

Project Manual – Volume 1 of 2

Project No. 20202.00

Northeast Metropolitan Regional Vocational High School

Wakefield, Massachusetts

**MSBA 60% CD SUBMISSION
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PROJECT MANUAL

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By CM/OPM

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A3-2-4	WALL SECTIONS
A3-2-5	WALL SECTIONS
A3-2-6	WALL SECTIONS
A3-2-7	WALL SECTIONS
A3-2-8	WALL SECTIONS
A3-2-9	WALL SECTIONS
A3-2-10	WALL SECTIONS
A3-2-11	WALL SECTIONS
A3-2-12	WALL SECTIONS
A3-2-13	WALL SECTIONS
A3-2-14	WALL SECTIONS
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A4-1-4	TOILET AND LOCKER ROOM PLANS
A4-1-5	TOILET AND LOCKER ROOM ELEVATIONS
A4-1-6	TOILET AND LOCKER ROOM ELEVATIONS
A4-1-7	LOCKER ROOM AND TOILET ELEVATIONS
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A4-1-9	LOCKER ROOM AND TOILET ELEVATIONS
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A5-2-1	INTERIOR PLAN DETAILS
A5-2-2	INTERIOR PLAN DETAILS
A5-3-1	ROOF DETAILS
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A5-3-3	ROOF DETAILS
A5-3-4	ROOF DETAILS
A6-2-1	DOOR SCHEDULE
A6-2-2	DOOR SCHEDULE
A6-2-3	DOOR SCHEDULE, FRAME & BORROWED LIGHT TYPES
A6-3-1	WINDOW, TRANSLUCENT WALL PANEL AND LOUVER TYPES

A6-3-2	CURTAIN WALL TYPES
A6-3-3	CURTAIN WALL TYPES
A6-3-4	CURTAIN WALL TYPES
A6-3-5	INTERIOR CURTAIN WALL TYPES
A6-3-6	STOREFRONT AND INTERIOR STOREFRONT TYPES
A6-3-7	INTERIOR STOREFRONT AND BORROWED LIGHT TYPES
A6-3-8	WINDOW & TRANSLUCENT WALL PANEL DETAILS
A6-3-9	CURTAIN WALL DETAILS
A6-3-10	CURTAIN WALL DETAILS
A7-1-1	STAIR PLANS
A7-1-2	STAIR SECTIONS
A7-1-3	STAIR PLANS & SECTIONS
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A7-1-7	STAIR PLANS & SECTIONS
A7-1-8	STAIR PLANS & SECTIONS
A7-1-9	ELEVATOR PLANS & SECTIONS
A7-1-10	STAIR DETAILS - ELEVATOR DETAILS, SPECIALTY DETAILS
A7-1-11	STAIR DETAILS
A7-1-12	LOADING RAMP PLAN, SECTION & DETAILS
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A8-1-0D	LOWER LEVEL REFLECTED CEILING PLAN - AREA D
A8-1-0MC	LOWER LEVEL MEZZANINE REFLECTED CEILING PLAN - AREA C
A8-1-0MD	LOWER LEVEL MEZZANINE REFLECTED CEILING PLAN - AREA D
A8-1-1A	FIRST FLOOR REFLECTED CEILING PLAN - AREA A
A8-1-1B	FIRST FLOOR REFLECTED CEILING PLAN - AREA B
A8-1-1C	FIRST FLOOR REFLECTED CEILING PLAN - AREA C
A8-1-1D	FIRST FLOOR REFLECTED CEILING PLAN - AREA D
A8-1-1MA	FIRST FLOOR MEZZANINE REFLECTED CEILING PLAN - AREA A
A8-1-1MB	FIRST FLOOR MEZZANINE REFLECTED CEILING PLAN - AREA B
A8-1-2A	SECOND FLOOR REFLECTED CEILING PLAN - AREA A
A8-1-2B	SECOND FLOOR REFLECTED CEILING PLAN - AREA B
A8-1-2C	SECOND FLOOR REFLECTED CEILING PLAN - AREA C
A8-1-2D	SECOND FLOOR REFLECTED CEILING PLAN - AREA D
A8-1-3A	THIRD FLOOR REFLECTED CEILING PLAN - AREA A
A8-1-3B	THIRD FLOOR REFLECTED CEILING PLAN - AREA B
A8-1-3C	THIRD FLOOR REFLECTED CEILING PLAN - AREA C
A8-1-3D	THIRD FLOOR REFLECTED CEILING PLAN - AREA D
A8-1-4A	FOURTH FLOOR REFLECTED CEILING PLAN - AREA A
A8-1-4B	FOURTH FLOOR REFLECTED CEILING PLAN - AREA B
A8-1-4C	FOURTH FLOOR REFLECTED CEILING PLAN - AREA C
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A9-1-1	MISCELLANEOUS DETAILS
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AC-1-1	TOILET AND CONCESSION BUILDING PLANS & ELEVATIONS
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AM-1-1	MAINTENANCE BUILDING DRAWINGS
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AF1-1-0C	LOWER LEVEL FLOOR FINISHES PLAN- AREA C
AF1-1-0D	LOWER LEVEL FLOOR FINISHES PLAN - AREA D
AF1-1-1A	FIRST LEVEL FLOOR FINISHES PLAN - AREA A
AF1-1-1B	FIRST LEVEL FLOOR FINISHES PLAN - AREA B
AF1-1-1C	FIRST LEVEL FLOOR FINISHES PLAN - AREA C
AF1-1-1D	FIRST LEVEL FLOOR FINISHES PLAN - AREA D
AF1-1-2A	SECOND LEVEL FLOOR FINISHES PLAN - AREA A
AF1-1-2B	SECOND LEVEL FLOOR FINISHES PLAN - AREA B
AF1-1-2C	SECOND LEVEL FLOOR FINISHES PLAN - AREA C
AF1-1-2D	SECOND LEVEL FLOOR FINISHES PLAN - AREA D
AF1-1-3A	THIRD LEVEL FLOOR FINISHES PLAN - AREA A
AF1-1-3B	THIRD LEVEL FLOOR FINISHES PLAN - AREA B
AF1-1-3C	THIRD LEVEL FLOOR FINISHES PLAN - AREA C
AF1-1-3D	THIRD LEVEL FLOOR FINISHES PLAN - AREA D
AF1-1-4A	FOURTH LEVEL FLOOR FINISHES PLAN - AREA A
AF1-1-4B	FOURTH LEVEL FLOOR FINISHES PLAN - AREA B
AF1-1-4C	FOURTH LEVEL FLOOR FINISHES PLAN - AREA C
AF1-1-4D	FOURTH LEVEL FLOOR FINISHES PLAN - AREA D
AF1-2-0C	LOWER LEVEL WALL FINISHES PLAN - AREA C
AF1-2-0D	LOWER LEVEL WALL FINISHES PLAN - AREA D
AF1-2-1A	FIRST LEVEL WALL FINISHES PLAN - AREA A
AF1-2-1B	FIRST LEVEL WALL FINISHES PLAN - AREA B
AF1-2-1C	FIRST LEVEL WALL FINISHES PLAN - AREA C
AF1-2-1D	FIRST LEVEL WALL FINISHES PLAN - AREA D
AF1-2-2A	SECOND LEVEL WALL FINISHES PLAN - AREA A
AF1-2-2B	SECOND LEVEL WALL FINISHES PLAN - AREA B
AF1-2-2C	SECOND LEVEL WALL FINISHES PLAN - AREA C
AF1-2-2D	SECOND LEVEL WALL FINISHES PLAN - AREA D
AF1-2-3A	THIRD LEVEL WALL FINISHES PLAN - AREA A
AF1-2-3B	THIRD LEVEL WALL FINISHES PLAN - AREA B
AF1-2-3C	THIRD LEVEL WALL FINISHES PLAN- AREA C
AF1-2-3D	THIRD LEVEL WALL FINISHES PLAN - AREA D
AF1-2-4A	FOURTH LEVEL WALL FINISHES PLAN - AREA A
AF1-2-4B	FOURTH LEVEL WALL FINISHES PLAN - AREA B
AF1-2-4C	FOURTH LEVEL WALL FINISHES PLAN - AREA C
AF1-2-4D	FOURTH LEVEL WALL FINISHES PLAN - AREA D
AF1-3-1	TRANSITION DETAILS
AF1-3-2	TRANSITION DETAILS
AF1-4-1	BASE DETAILS
AF1-4-2	BASE DETAILS
AF1-4-3	BASE DETAILS
AF1-5-1	DECORATIVE FABRIC METAL DETAILS
AF1-6-1	PHENOLIC RESIN PANEL DETAILS
AF1-7-1	INTERIOR WALL PANEL DETAILS
AF1-8-1	CERAMIC TILES PATTERN

ARCHITECTURAL SIGNAGE

SL1-1-1	CONCESSION BUILDING SIGNAGE PLAN
SL1-1-2	MAINTENANCE BUILDING SIGNAGE PLAN
SL1-1-3	LOCKER BUILDING FIRST FLOOR SIGNAGE PLAN
SL1-1-4	LOCKER BUILDING SECOND FLOOR SIGNAGE PLAN

SL1-1-5	LOWER LEVEL SIGNAGE PLAN
SL1-1-6	FIRST FLOOR SIGNAGE PLAN
SL1-1-7	SECOND FLOOR SIGNAGE PLAN
SL1-1-8	THIRD FLOOR SIGNAGE PLAN
SL1-1-9	FOURTH FLOOR SIGNAGE PLAN
SL1-1-10	SITE SIGNAGE PLAN

EQUIPMENT

EQ0.00	NOTES, SCHEDULES, AND ABBREVIATIONS
EQ1-1-0C	FF&E/CASEWORK LOWER LEVEL AREA C
EQ1.1-0D	FF&E/CASEWORK LOWER LEVEL AREA D
EQ1.1-1A	FF&E/CASEWORK FIRST FLOOR AREA A
EQ1.1-1B	FF&E/CASEWORK FIRST FLOOR AREA B
EQ1.1-1C	FF&E/CASEWORK FIRST FLOOR AREA C
EQ1.1-1D	FF&E/CASEWORK FIRST FLOOR AREA D
EQ1.1-2A	FF&E/CASEWORK SECOND FLOOR AREA A
EQ1.1-2B	FF&E/CASEWORK SECOND FLOOR AREA B
EQ1.1-2C	FF&E/CASEWORK SECOND FLOOR AREA C
EQ1.1-2D	FF&E/CASEWORK SECOND FLOOR AREA D
EQ1.1-3A	FF&E/CASEWORK THIRD FLOOR AREA A
EQ1.1-3B	FF&E/CASEWORK THIRD FLOOR AREA B
EQ1.1-4A	FF&E/CASEWORK FOURTH FLOOR AREA A
EQ1.1-4B	FF&E/CASEWORK FOURTH FLOOR AREA B
EQ2.1	METAL FABRICATION CASEWORK & EQUIPMENT
EQ2.2	AUTO COLLISION CASEWORK & EQUIPMENT
EQ2.3	AUTO TECHNOLOGY CASEWORK & EQUIPMENT
EQ2.4	HVAC TECH CASEWORK & EQUIPMENT
EQ2.5	CARPENTRY CASEWORK & EQUIPMENT
EQ2.6	PLUMBING / PIPEFITTING CASEWORK & EQUIPMENT
EQ2.7	ELECTRICAL TECHNOLOGY CASEWORK & EQUIPMENT
EQ2.8	DENTAL ASSISTING CASEWORK & EQUIPMENT
EQ2.9	ROBOTICS CASEWORK & EQUIPMENT
EQ2.10	DESIGN/VISUAL COM CASEWORK & EQUIPMENT
EQ2.11	DRAFTING / DESIGN CASEWORK & EQUIPMENT
EQ2.12	COSMOTOLOGY CASEWORK & EQUIPMENT
EQ2.13	MEDICAL ASSIST CASEWORK & EQUIPMENT
EQ2.14	HEALTH ASSIST CASEWORK & EQUIPMENT
EQ2.15	BIOTECH CASEWORK & EQUIPMENT
EQ3.1	CASEWORK ELEVATIONS
EQ3.2	CASEWORK ELEVATIONS
EQ3.3	CASEWORK ELEVATIONS

THEATRE EQUIPMENT

TR-1	THEATRE RIGGING PLAN
TR-2	THEATER RIGGING SECTION
TR-3	HOUSE AND WINDOW TRAVELER CURTAIN RIGGING
TE-1	THEATRE ELECTRICS POWER + DATA RISERS
TE-2.0	THEATRE ELECTICS DEVICE LOCATIONS
TE-2.1	THEATRE ELECTICS DEVICE LOCATIONS
TD-1	HOUSE AND WINDOW TRAVELER CURTAINS

FOOD SERVICE

FS1-1-1A	FOODSERVICE EQUIPMENT OVERALL PLAN
FS1-2-0	MAIN KITCHEN FOODSERVICE EQUIPMENT SCHEDULE
FS1-2-1	MAIN KITCHEN FOODSERVICE EQUIPMENT PLAN
FS1-3-0	CULINARY KITCHEN FOODSERVICE EQUIPMENT SCHEDULE
FS1-3-1	CULINARY KITCHEN FOODSERVICE EQUIPMENT PLAN
FS2-2-1	MAIN KITCHEN FOODSERVICE EQUIPMENT ROUGH-IN PLAN
FS2-3-1	CULINARY KITCHEN FOODSERVICE EQUIPMENT ROUGH-IN PLAN
FS3-2-1	MAIN KITCHEN FOODSERVICE EQUIPMENT VENTILATION ROUGH-IN PLAN
FS3-3-1	CULINARY KITCHEN FOODSERVICE EQUIPMENT VENTILATION ROUGH-IN PLAN
FS4-2-1	MAIN KITCHEN FOODSERVICE EQUIPMENT BUILDING CONDITIONS PLAN
FS4-3-1	CULINARY KITCHEN FOODSERVICE EQUIPMENT BUILDING CONDITIONS PLAN

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DRAWING LIST

01 – INFO DRAWING LIST

GEOTECHNICAL

GT-0-1	GEOTECHNICAL PLAN EAST
GT-0-2	GEOTECHNICAL PLAN WEST

PLUMBING

P0-0-1	PLUMBING LEGENDS, ABBREVIATIONS, AND GENERAL NOTES
P1-0-0A	PLUMBING FIRST FLOOR PLAN - AREA A BELOW SLAB
P1-0-0B	PLUMBING FIRST FLOOR PLAN - AREA B BELOW SLAB
P1-0-0C	PLUMBING LOWER LEVEL FLOOR PLAN - AREA C BELOW SLAB
P1-0-0D	PLUMBING LOWER LEVEL FLOOR PLAN - AREA D BELOW SLAB
P1-1-0C	PLUMBING LOWER LEVEL FLOOR PLAN - AREA C
P1-1-0D	PLUMBING LOWER LEVEL FLOOR PLAN - AREA D
P1-1-1A	PLUMBING FIRST FLOOR PLAN - AREA A
P1-1-1AB	PLUMBING FIRST FLOOR BELOW MEZZANINE PLAN – AREA A/B
P1-1-1B	PLUMBING FIRST FLOOR PLAN - AREA B
P1-1-1C	PLUMBING FIRST FLOOR PLAN - AREA C
P1-1-1D	PLUMBING FIRST FLOOR PLAN - AREA D
P1-1-2A	PLUMBING SECOND FLOOR PLAN - AREA A
P1-1-2B	PLUMBING SECOND FLOOR PLAN - AREA B
P1-1-2C	PLUMBING SECOND FLOOR PLAN - AREA C
P1-1-2D	PLUMBING SECOND FLOOR PLAN - AREA D
P1-1-3A	PLUMBING THIRD FLOOR PLAN - AREA A
P1-1-3B	PLUMBING THIRD FLOOR PLAN - AREA B
P1-1-3C	PLUMBING THIRD FLOOR PLAN - AREA C
P1-1-3D	PLUMBING THIRD FLOOR PLAN - AREA D
P1-1-4A	PLUMBING FOURTH FLOOR PLAN - AREA A
P1-1-4B	PLUMBING FOURTH FLOOR PLAN - AREA B
P1-1-4C	PLUMBING FOURTH FLOOR PLAN - AREA C
P1-1-4D	PLUMBING FOURTH FLOOR PLAN - AREA D

P1-2-1A	PLUMBING ROOF PLAN - AREA A
P1-2-1B	PLUMBING ROOF PLAN - AREA B
P1-2-1C	PLUMBING ROOF PLAN - AREA C
P1-2-1D	PLUMBING ROOF PLAN - AREA D
P2-0-0A	PLUMBING BELOW FLOOR ENLARGED PLANS
P2-1-1A	PLUMBING FIRST FLOOR ENLARGED PLANS
P3-0-1	PLUMBING DETAILS SHEET
P4-0-1	PLUMBING SCHEDULES SHEET
P5-0-1	PLUMBING RISER
P5-0-2	PLUMBING RISER
PC-1-1	PLUMBING - CONCESSIONS FLOOR LEVEL PLAN
PL-1-1	PLUMBING LOCKER BUILDING PLAN
PM-1-1	PLUMBING MAINTENANCE BUILDING PLAN

FIRE PROTECTION

FP0-0-1	FIRE PROTECTION COVER SHEET
FP1-1-0.5CD	FIRE PROTECTION UNDER MEZZANINE - AREAS C&D
FP1-1-0C	FIRE PROTECTION LOWER LEVEL FLOOR PLAN - AREA C
FP1-1-0D	FIRE PROTECTION LOWER LEVEL FLOOR PLAN - AREA D
FP1-1-1.5AB	FIRE PROTECTION FIRST FLOOR MEZZANINE LVL PLAN - AREA A
FP1-1-1A	FIRE PROTECTION FIRST FLOOR PLAN - AREA A
FP1-1-1B	FIRE PROTECTION FIRST FLOOR PLAN - AREA B
FP1-1-1C	FIRE PROTECTION FIRST FLOOR PLAN - AREA C
FP1-1-1D	FIRE PROTECTION FIRST FLOOR PLAN - AREA D
FP1-1-2A	FIRE PROTECTION SECOND FLOOR PLAN - AREA A
FP1-1-2B	FIRE PROTECTION SECOND FLOOR PLAN - AREA B
FP1-1-2C	FIRE PROTECTION SECOND FLOOR PLAN - AREA C
FP1-1-2D	FIRE PROTECTION SECOND FLOOR PLAN - AREA D
FP1-1-3A	FIRE PROTECTION THIRD FLOOR PLAN - AREA A
FP1-1-3B	FIRE PROTECTION THIRD FLOOR PLAN - AREA B
FP1-1-3C	FIRE PROTECTION THIRD FLOOR PLAN - AREA C
FP1-1-3D	FIRE PROTECTION THIRD FLOOR PLAN - AREA D
FP1-1-4A	FIRE PROTECTION FOURTH FLOOR PLAN - AREA A
FP1-1-4B	FIRE PROTECTION FOURTH FLOOR PLAN - AREA B
FP1-1-4C	FIRE PROTECTION FOURTH FLOOR PLAN - AREA C
FP1-1-4D	FIRE PROTECTION FOURTH FLOOR PLAN - AREA D
FP1-2-1-A	FIRE PROTECTION ROOF PLAN - AREA A
FP1-2-1-B	FIRE PROTECTION ROOF PLAN - AREA B
FP1-2-1-C	FIRE PROTECTION ROOF PLAN - AREA C
FP1-2-1-D	FIRE PROTECTION ROOF PLAN - AREA D
FP5-0-1	FIRE PROTECTION RISER DIAGRAM
FP6-0-1	FIRE PROTECTION DETAILS

MECHANICAL

M0-0-1	MECHANICAL LEGENDS AND ABBREVIATIONS
M0-0-2	MECHANICAL GENERAL NOTES
M0-0-3	MECHANICAL SCOPE OF WORK
M1-1-0C	MECHANICAL DUCTWORK LOWER LEVEL FLOOR PLAN - AREA C
M1-1-0D	MECHANICAL DUCTWORK LOWER LEVEL FLOOR PLAN - AREA D
M1-1-1A	MECHANICAL DUCTWORK FIRST FLOOR PLAN - AREA A
M1-1-1B	MECHANICAL DUCTWORK FIRST FLOOR PLAN - AREA B
M1-1-1C	MECHANICAL DUCTWORK FIRST FLOOR PLAN - AREA C

M1-1-1D	MECHANICAL DUCTWORK FIRST FLOOR PLAN - AREA D
M1-1-2A	MECHANICAL DUCTWORK SECOND FLOOR PLAN - AREA A
M1-1-2B	MECHANICAL DUCTWORK SECOND FLOOR PLAN - AREA B
M1-1-2C	MECHANICAL DUCTWORK SECOND FLOOR PLAN - AREA C
M1-1-2D	MECHANICAL DUCTWORK SECOND FLOOR PLAN - AREA D
M1-1-3A	MECHANICAL DUCTWORK THIRD FLOOR PLAN - AREA A
M1-1-3B	MECHANICAL DUCTWORK THIRD FLOOR PLAN - AREA B
M1-1-3C	MECHANICAL DUCTWORK THIRD FLOOR PLAN - AREA C
M1-1-3D	MECHANICAL DUCTWORK THIRD FLOOR PLAN - AREA D
M1-1-4A	MECHANICAL DUCTWORK FOURTH FLOOR PLAN - AREA A
M1-1-4B	MECHANICAL DUCTWORK FOURTH FLOOR PLAN - AREA B
M1-1-CB	MECHANICAL CONCESSION BUILDING PLAN
M1-1-LB	MECHANICAL LOCKER BUILDING PLAN
M1-1-MB	MECHANICAL MAINTENANCE BUILDING PLAN
M1-2-1A	MECHANICAL ROOF PLAN - AREA A
M1-2-1B	MECHANICAL ROOF PLAN - AREA B
M1-2-1C	MECHANICAL ROOF PLAN - AREA C
M1-2-1D	MECHANICAL ROOF PLAN - AREA D
M1-3-0C	MECHANICAL PIPING LOWER LEVEL FLOOR PLAN - AREA C
M1-3-0D	MECHANICAL PIPING LOWER LEVEL FLOOR PLAN - AREA D
M1-3-1A	MECHANICAL PIPING FIRST FLOOR PLAN - AREA A
M1-3-1B	MECHANICAL PIPING FIRST FLOOR PLAN - AREA B
M1-3-1C	MECHANICAL PIPING FIRST FLOOR PLAN - AREA C
M1-3-1D	MECHANICAL PIPING FIRST FLOOR PLAN - AREA D
M1-3-2A	MECHANICAL PIPING SECOND FLOOR PLAN - AREA A
M1-3-2B	MECHANICAL PIPING SECOND FLOOR PLAN - AREA B
M1-3-2C	MECHANICAL PIPING SECOND FLOOR PLAN - AREA C
M1-3-2D	MECHANICAL PIPING SECOND FLOOR PLAN - AREA D
M1-3-3A	MECHANICAL PIPING THIRD FLOOR PLAN - AREA A
M1-3-3B	MECHANICAL PIPING THIRD FLOOR PLAN - AREA B
M1-3-3C	MECHANICAL PIPING THIRD FLOOR PLAN - AREA C
M1-3-3D	MECHANICAL PIPING THIRD FLOOR PLAN - AREA D
M1-3-4A	MECHANICAL PIPING FOURTH FLOOR PLAN - AREA A
M1-3-4B	MECHANICAL PIPING FOURTH FLOOR PLAN - AREA B
M2-0-1	MECHANICAL ENLARGED PLANS
M2-0-2	MECHANICAL ENLARGED PLANS
M2-0-3	MECHANICAL ENLARGED PLANS
M3-0-1	MECHANICAL VRF SYSTEM DIAGRAMS SHEET #1
M3-0-2	MECHANICAL VRF SYSTEM DIAGRAMS SHEET #2
M3-0-3	MECHANICAL VRF SYSTEM DIAGRAMS SHEET #3
M3-0-4	MECHANICAL AIR RISER DIAGRAMS
M4-0-1	MECHANICAL DETAILS SHEET #1
M4-0-2	MECHANICAL DETAILS SHEET #2
M5-0-1	MECHANICAL SCHEDULES SHEET #1
M5-0-2	MECHANICAL SCHEDULES SHEET #2
M5-0-3	MECHANICAL SCHEDULE SHEET #3

FIRE ALARM

FAO-1	FIRE ALARM LEGENDS, ABBREVIATIONS, AND GENERAL NOTES
FA1-1-0C	FIRE ALARM LOWER LEVEL FLOOR PLAN - AREA C
FA1-1-0D	FIRE ALARM LOWER LEVEL FLOOR PLAN - AREA D
FA1-1-MC	FIRE ALARM LOWER LEVEL MEZZANINE PLAN - AREA C
FA1-1-1A	FIRE ALARM FIRST FLOOR PLAN - AREA A

FA1-1-1B	FIRE ALARM FIRST FLOOR PLAN - AREA B
FA1-1-1C	FIREALARM FIRST FLOOR PLAN - AREA C
FA1-1-1D	FIRE ALARM FIRST FLOOR PLAN - AREA D
FA1-1-MA	FIRE ALARM FIRST FLOOR MEZZANINE PLAN - AREA A
FA1-1-2A	FIRE ALARM SECOND FLOOR PLAN - AREA A
FA1-1-2B	FIRE ALARM SECOND FLOOR PLAN - AREA B
FA1-1-2C	FIRE ALARM SECOND FLOOR PLAN - AREA C
FA1-1-2D	FIRE ALARM SECOND FLOOR PLAN - AREA D
FA1-1-3A	FIRE ALARM THIRD FLOOR PLAN - AREA A
FA1-1-3B	FIRE ALARM THIRD FLOOR PLAN - AREA B
FA1-1-3C	FIRE ALARM THIRD FLOOR PLAN - AREA C
FA1-1-3D	FIRE ALARM THIRD FLOOR PLAN - AREA D
FA1-1-4A	FIRE ALARM FOURTH FLOOR PLAN - AREA A
FA1-1-4B	FIRE ALARM FOURTH FLOOR PLAN - AREA B
FA1-1-4C	FIRE ALARM FOURTH FLOOR PLAN - AREA C
FA1-1-4D	FIRE ALARM FOURTH FLOOR PLAN - AREA D
FA1-1-CB	FIRE ALARM CONCESSION BUILDING PLAN
FA1-1-LB	FIRE ALARM LOCKER BUILDING PLAN
FA1-1-MB	FIRE ALARM MAINTENANANCE BUILDING PLAN
FA2-1-A	FIRE ALARM ROOF PLAN - AREA A
FA2-1-B	FIRE ALARM ROOF PLAN - AREA B
FA2-1-C	FIRE ALARM ROOF PLAN - AREA C
FA2-1-D	FIRE ALARM ROOF PLAN - AREA D
FA4-0	FIRE ALARM HIGH SCHOOL BUILDING RISER DIAGRAM
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- A. The information listed in this Document is made available for reference purposes only. The listed information is not considered part of the Contract Documents.
- B. Available Reference Information includes the following:
 - 1. Geotechnical Report- Refer to Section 003100a
 - 2. Hazardous Material Summary Report – Refer to Section 003100b
 - 3. MSBA Compliant Sign – Refer to Section 015000 Temporary Facilities and Controls
 - 4. LEED Project Checklist – Refer to Section 018110 Sustainable Design Requirements
 - 5. Existing Building Drawings – Available for download at:
[Existing NEMT Building Drawings](#)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

Attachments:
Geotechnical Report
Hazardous Material Summary Report

END OF DOCUMENT

November 16, 2022

Mr. Vladimir Lyubetsky
Principal
Drummey Rosane Anderson, Inc.
Howard Clock Building
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Waltham, MA 02453
Phone: (617) 964-1700 x121
E-mail: vlyubetsky@draws.com

Re: **Geotechnical Report**
Proposed Northeast Metropolitan Regional Vocational Technical High School
Wakefield, Massachusetts
LGCI Project No. 2025

Dear Mr. Lyubetsky:

Lahlaf Geotechnical Consulting, Inc. (LGCI) has completed additional explorations at the site of the Proposed Northeast Metropolitan Regional Vocational Technical High School in Wakefield, Massachusetts as part of our Design Development (DD) Phase services. This report contains the results of our subsurface explorations to date, the results of the geophysical surveys, the recommendations of our rock specialist about rock cuts, and our foundation and construction recommendations.

The soil and rock samples from our explorations are currently stored at LGCI for further analysis, if requested. Unless notified otherwise, we will dispose of the soil samples three (3) months after the samples or rock cores are obtained.

Thank you for choosing LGCI as your geotechnical engineer.

Very truly yours,

Lahlaf Geotechnical Consulting, Inc.



Abdelmadjid M. Lahlaf, Ph.D., P.E.
Principal Engineer



LGC

Lahlaf Geotechnical Consulting, Inc.

**GEOTECHNICAL REPORT
PROPOSED NORTHEAST METROPOLITAN
REGIONAL VOCATIONAL TECHNICAL HIGH SCHOOL
WAKEFIELD, MASSACHUSETTS**

LGC Project No. 2025

November 16, 2022

Prepared for:

DRUMMEY ROSANE ANDERSON, INC.

Howard Clock Building

260 Charles Street, Studio 300

Waltham, MA 02453

Phone: (617) 964-1700

**GEOTECHNICAL REPORT
PROPOSED NORTHEAST METROPOLITAN
REGIONAL VOCATIONAL TECHNICAL HIGH SCHOOL
WAKEFIELD, MASSACHUSETTS**

LGCI Project No. 2025

November 16, 2022

Prepared for:

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Abdelmadjid M. Lahlaf, Ph.D., P.E.
Principal Engineer

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**Geotechnical Report
Proposed Northeast Metropolitan Regional Vocational Technical High School
Wakefield, Massachusetts
LGCI Project No. 2025**

1. PROJECT INFORMATION

1.1 Project Authorization

This geotechnical report presents the results of the subsurface explorations and a geotechnical evaluation performed by Lahlaf Geotechnical Consulting, Inc. (LGCI) for the proposed Northeast Metropolitan Regional Vocational Technical High School in Wakefield, Massachusetts. To date, we have performed services in four phases as follows:

- We performed a desk review in general accordance with the scope described in our proposal No. 20061 dated July 30, 2020. Mr. Vladimir Lyubetsky of Drummey Rosane Anderson, Inc. (DRA) authorized our desk review services by signing our proposal on July 30, 2020.
- We performed our Preferred Schematic Report (PSR) phase services in general accordance with the scope described in our proposal No. 20079 dated October 23, 2020. Mr. Vladimir Lyubetsky of DRA authorized our PSR phase services by signing our proposal on December 14, 2020.
- We performed our Schematic Design (SD) phase services in general accordance with the scope described in our proposal No. 21003-Rev. 2 dated January 29, 2021 and revised on February 19, 2021. Mr. Vladimir Lyubetsky of DRA authorized our SD phase services by signing our proposal on June 9, 2021.
- We performed our Design Development (DD) phase services in general accordance with the scope described in our proposal No. 21061-Rev. 3 dated February 28, 2022 and revised on April 7, 2022; our proposal No. 22095 dated July 20, 2022; and our proposal No. 22103-Rev. 1 dated August 10, 2022 and revised on August 19, 2022. Mr. Vladimir Lyubetsky of DRA authorized the services in our proposal No. 21061-Rev. 3 by signing the proposal on May 10, 2022, and authorized the services in our proposal No. 22095 in an e-mail dated June 28, 2022. Our proposal No. 22103-Rev. 1 was approved by the Owner Project Manager (OPM) in an e-mail August 23, 2022.
- We engaged Scarptec, Inc., a rock specialist, to perform a rock study and to provide recommendations about rock cuts in accordance with our proposal No. 22062-Rev. 1 dated May 2, 2022. Mr. Vladimir Lyubetsky of DRA approved our services in an e-mail dated May 23, 2022.

1.2 Purpose and Scope of Services

The purpose of our geotechnical services was to perform subsurface explorations at the site and to provide foundation design and construction recommendations. LGCI performed the following services:



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- Performed a desk review that included reviewing available information about the site, including the geologic data available from the U.S. Geological Survey and our field observations from the site visit.
- Coordinated our test pit and boring locations for the PSR, SD, and DD phases with DRA, Nitsch Engineering Inc., the project civil engineer, and with the school staff.
- Marked the test pit and boring locations for the PSR and SD phases at the site by measuring distances from the proposed building corners staked in the field by Nitsch. The DD phase explorations were staked in the field by Nitsch. LGCI notified Dig Safe Systems Inc. (Dig Safe) and the Town of Wakefield for utility clearance.
- Engaged a drilling subcontractor to advance twenty-nine (29) soil borings at the site, including four (4) borings as part of the PSR phase in 2020, six (6) borings as part of the SD phase in 2021, and nineteen (19) borings as part of the DD phase in 2022. Our drilling subcontractor installed seven (7) groundwater observation wells at the site, including two (2) groundwater observation wells as part of the PSR phase in 2020, two (2) groundwater observation wells as part of the SD phase in 2021, and three (3) groundwater observation wells as part of the DD phase in 2022. LGCI's scope includes three (3) borings located within the footprint of the existing building. These borings will be completed after the existing building is demolished.
- Engaged an excavation subcontractor to excavate forty-nine (49) test pits at the site, including eighteen (18) test pits as part of the PSR phase in 2020, thirteen (13) test pits as part of the SD phase in 2021, and eighteen (18) test pits as part of the DD phase in 2022.
- Provided an LGCI geotechnical engineer at the site to coordinate and observe the test pits and borings, describe the soil samples, and prepare field logs.
- Submitted twenty-four (24) soil samples for laboratory testing, including four (4) soil samples as part of the PSR phase in 2020, four (4) soil samples as part of the SD phase in 2021, and sixteen (16) soil samples as part of the DD phase in 2022. Submitted six (6) rock core samples for compressive strength of rock tests, including four (4) rock core samples as part of the SD phase in 2021, and two (2) rock core samples as part of the DD phase in 2022.
- Engaged a geophysical subcontractor to perform borehole logging with a televiwer in two (2) borings.
- Engaged a rock specialist to visit the site and observe rock outcrop features, perform a kinematic analysis of discontinuities in the rock, and provide a rock engineering design and recommendation report.



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- Obtained, at the request of the project landscape architect, four (4) soil samples from locations designated by the landscape architect and submitted them for loam analyses, including gradation tests, pH, and organic content.
- Prepared this geotechnical report containing the results of our subsurface explorations and our recommendations for foundation design and construction.

Following our 2020 desk review, LGCI submitted a preliminary geotechnical review services report dated August 7, 2020. Following our 2020 PSR phase test pits and borings, LGCI submitted a preliminary geotechnical report dated December 14, 2020, and following our 2021 and 2022 SD phase and DD phase test pits and borings, LGCI submitted an SD phase geotechnical report dated June 10, 2021, a draft DD phase geotechnical report, and a revised DD phase geotechnical report dated August 12, 2022. The present report includes the results of our desk review, our 2020 explorations, our 2021 and 2022 explorations, and supersedes the five (5) aforementioned reports.

LGCI's scope of services does not include an environmental assessment for the presence or absence of wetlands or analytical testing for hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site, or mold in the soil or in any structure at the site. Any statements regarding odors, colors, or unusual or suspicious items or conditions are strictly for the information of the client.

Our scope includes attending a meeting to discuss the results of our explorations. These services will be performed separately and are not included in this report. Our scope does not include performing field services. We will be pleased to perform these services for an additional fee. Recommendations for unsupported slopes, stormwater management, erosion control, pavement design, site specific liquefaction analysis, pile analysis and design, and detailed cost or quantity estimates are not included in our scope of work.

1.3 References

LGCI's understanding of the site is based on our observations at the site and on the following drawings and reports:

- Drawing S1 titled: "Typical Details and General Notes, Northeast Metropolitan Regional Vocational Technical School," (1969 Structural Details) prepared by Korslund, LeNormand & Quann, Inc., dated June 2, 1969, and provided to us by DRA on July 30, 2020.
- Drawing S3 titled: "Foundation and First Floor Plan – Unit A, Northeast Metropolitan Regional Vocational Technical School," (First Floor Plan – Unit A) prepared by Korslund, LeNormand & Quann, Inc., dated June 2, 1969, and provided to us by DRA on July 30, 2020.



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- Drawing S5 titled: “Foundation and First Floor Plan – Unit B, Northeast Metropolitan Regional Vocational Technical School,” (First Floor Plan – Unit B) prepared by Korslund, LeNormand & Quann, Inc., dated June 2, 1969, and provided to us by DRA on July 30, 2020.
- Drawing S7 titled: “Foundation and First Floor Plan – Unit C, Northeast Metropolitan Regional Vocational Technical School,” (First Floor Plan – Unit C) prepared by Korslund, LeNormand & Quann, Inc., dated June 2, 1969, and provided to us by Drummey Rosane Anderson, Inc. (DRA) on July 30, 2020.
- Drawing S9 titled: “Foundation and First Floor Plan – Unit D, Northeast Metropolitan Regional Vocational Technical School,” (First Floor Plan – Unit D) prepared by Korslund, LeNormand & Quann, Inc., dated June 2, 1969, and provided to us by DRA on July 30, 2020.
- Drawing S12 titled: “Foundation and First Floor Plan – Unit E, Northeast Metropolitan Regional Vocational Technical School,” (First Floor Plan – Unit E) prepared by Korslund, LeNormand & Quann, Inc., dated June 2, 1969, and provided to us by DRA on July 30, 2020.
- Drawing S14 titled: “Foundation and First Floor Plan – Unit F, Northeast Metropolitan Regional Vocational Technical School,” (First Floor Plan – Unit F) prepared by Korslund, LeNormand & Quann, Inc., dated June 2, 1969, and provided to us by DRA on July 30, 2020.
- “Custom Soil Resource Report for Essex County, Massachusetts, Southern Part; and Middlesex County, Massachusetts,” (Soil Survey Report) National Cooperative Soil Survey/National Resources Conservation Services, USDA (Map and soil description) printed November 15, 2019 <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>.
- “Surficial Materials Map of the Boston North, Massachusetts,” prepared by Stone, B.D. and DiGiacomo-Cohen, M.L. for U.S. Geological Survey, 2018, Scientific Investigation Map 3402, Quadrangle 125 – Boston North.
- Drawings L-401 to L-405 titled: “Grading Plan, Northeast Metro Technical High School, Wakefield, Massachusetts,” (Grading Plan) prepared by Warner Larson Landscape Architects, dated May 19, 2021, and provided to LGCI by Warner Larson Landscape Architects via e-mail on June 4, 2021.
- Drawings EX-1 to EX-13 titled: “Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA,” (Topographic Survey) prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.
- Drawings L401.1 and L402.1 titled: “Grading Plan, Northeast Metropolitan Regional Vocational High School,” (Landscape Drawings) prepared by Warner Larson Landscape Architects, dated February 15, 2022 and provided to us by Warner Larson Landscape Architects via e-mail on February 26, 2022.



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- Drawing EX-1 titled: “Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational School, 100 Hemlock Road, Wakefield, MA,” (Exhibit Plan) prepared by Nitsch, dated May 13, 2022, and provided to us by DRA via e-mail on June 3, 2022.
- Untitled site plan showing wetland buffer zones (Wetland Plan), prepared by Warner Larson Landscape Architects, undated, and provided to us by Warner Larson Landscape Architects via e-mail on April 21, 2022.
- Drawings C-300 to C-307 titled: “Utility Site Plan, MSBA Schematic Design Submittal,” (Civil Drawings) prepared by DRA, dated June 17, 2021, and provided to us by DRA via e-mail on February 14, 2022.
- Drawings S1-1-1A to S1-1-0D titled: “Lower Level and First Floor Foundation Plan, Northeast Metro Tech,” (Structural Drawings) prepared by EDG, dated June 17, 2021, and provided to us by DRA via e-mail on February 14, 2022.

1.4 Site Description

The site consists of the existing Northeast Metropolitan Regional Vocational Technical High School and the vacant land located south of it. The existing Northeast Metropolitan Regional Vocational Technical High School is located at 100 Hemlock Road, Wakefield, Massachusetts, as shown in Figure 1.

The site is bordered by the existing Wakefield High School on the western side, by the Saugus River on the northern side, by a utility easement on the eastern side, and by Farm Street on the southern side.

We have broken down our description of the site into two parts: 1) the existing Northeast Metropolitan Regional Vocational Technical High School where the proposed athletic fields will be constructed as described in Section 1.5, and 2) the vacant land located south of the Northeast Metropolitan Regional Vocational Technical High School where the proposed school will be constructed as described in Section 1.5.

Northeast Metropolitan Regional Vocational Technical High School – The existing Northeast Metropolitan Regional Vocational Technical High School consists of several interconnected buildings and includes an athletic practice field and a small, paved parking lot on the northern side; a football field and a baseball field on the western side; and a parking lot and a drop off loop on the southern side.

Based on the First Floor Plan (Unit A to F), the existing building is founded on conventional, shallow, spread, and continuous footings. Based on the 1969 Structural Details, the existing building footings were designed for allowable bearing capacities of 2 tons per square foot (tsf) for footings bearing on the natural soil or Structural Fill, and 15 tsf for footings bearing on bedrock.



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Based on the historical topo maps included in Appendix A, the grades appear to have been cut on the western side of the site in what is currently the football field.

Based on the Topographic Survey, the Landscape Drawings, and the Exhibit Plan, the existing grades vary at the site as described below.

- The grade drops from about El. 91 feet near the western end of the main access driveway (near the guard booth) to about El. 78 feet near the main entrance to the existing building. The grade continues dropping toward the southeastern corner of the existing building to about El. 75 feet then rises to about El. 90 feet near the northeastern corner of the building.
- The grade rises slightly to about El. 93 feet near the northwestern corner of the northern parking lot before it drops steeply to between about El. 58 feet and El. 62 feet at the northern practice field. The grade across the practice field continues dropping to about El. 58 feet near the northeastern corner of the field and gently rises to about El. 65 feet near the northwestern corner of the field.
- The driveway that loops around the building drops in elevation from about El. 93 feet near the northwestern corner of the site to about El. 80 feet on the southern side before it rises again to El. 85 feet where it joins the main driveway.
- On the western side, the site is terraced with tennis courts at about El. 102 feet, the football field at about El. 114 feet, and the baseball field at between El. 84 feet and El. 86 feet.

Vacant Land located south of the existing Northeast Metropolitan Regional Vocational Technical High School – The vacant land located south of the existing Northeast Metropolitan Regional Vocational Technical High School is wooded and is accessible through dirt paths. It extends from the southern side of the existing parking lot to Farm Street. The grades in the wooded area at the southern side of Hemlock Road are characterized by rolling terrain. The grade rises steeply from about El. 82 feet near the eastern side of Hemlock Road to over El. 110 feet over a former rock cut. The grade rises to about El. 207 feet near the western side of the wooded area, with frequent local highs and lows within the area. Rock outcrops and surficial boulders are present throughout the entire extent of the wooded area. Based on the Wetland Plan, wetlands are prominent near the southern side of the vacant land located near Farm Street. A dirt path that extends in a north-south direction across this portion of the site connects to Farm Road. The grade along the dirt path near Farm Road drops to about El. 128 feet.

1.5 Project Description

Our understanding of the proposed construction is based on our discussions with DRA, the Grading Plan, Civil Drawings, and Structural Drawings referenced in Section 1.3, and on the following drawing:



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- Drawing L-301 titled: “Northeast Metro Technical High School, Site Plan,” (Building Layout Plan) prepared by Warner Larson Landscape Architects, Inc., undated, and provided to LGCI by DRA, via e-mail on May 3, 2021.

The Town of Wakefield is proposing the wooded area located south of the existing Northeast Metropolitan Regional Vocational Technical High School as the site for the proposed high school.

The proposed construction will include a new high school building, paved driveways and parking lots, concrete walkways, and athletic fields. The proposed building will be constructed in the wooded area south of Hemlock Road. Based on the Building Layout Plan, Civil Drawings, and Structural Drawings, the proposed building will be somewhat rectangular in shape with a footprint of about 135,000 square feet. The proposed building will be accessible from Hemlock Road. We understand that the proposed building will consist of several underground levels. Based on the Grading Plan, the proposed building will be stepped with a lower ground floor on the northern side that will have a finished floor elevation (FFE) at El. 143.50 feet and higher ground floor elevation on the southern side with an FFE at El. 163.50 feet. Based on our conversations with the Structural Engineer, we understand that the perimeter walls for the proposed building will be designed as retaining walls with concrete buttresses. Based on the Grading Plan, cuts of up to 34 feet will be required to achieve the proposed FFE grade of the proposed building and the proposed paved areas around the proposed building.

The proposed main parking lot will be in the general area of the current southern parking lot. We understand that infiltration basins will be installed beneath the main parking lot to manage stormwater runoff and that the water will be discharged into the adjacent stream. Additional parking and a driveway loop will be provided around the proposed building. Based on the Grading Plan, the proposed grades along the proposed driveway loop will range between about El. 88 feet near Hemlock Road and El. 165 feet along the northern side of the proposed parking lot on the southern side (southern parking lot) of the proposed building. Cuts of up to 30 feet will be required to achieve the proposed grades on the western portion of the proposed driveway loop and fills of up to 20 feet will be required to achieve the proposed grades for the eastern portion of the proposed driveway loop. The grades within the proposed southern parking lot drop gently in a southerly direction to elevations ranging between El. 160 feet and El. 155 feet; thus, requiring up to 12-foot cuts on the northern side and fills of up to 13 feet on the southern side. The grade will drop from the southern side of the southern parking lot to meet the existing grades via a rip-rap slope currently designed as a 1H:1V slope. Other rip rap slopes are proposed in the fill areas along the eastern portion of the proposed driveway loop.

Based on the Grading Plan, the driveway connecting to Farm Street drops in elevation from El. 166 feet to about El. 135 feet where it connects to Farm Street. We understand that subsequent to our explorations along the proposed driveway connecting to Farm Street, the alignment of the proposed driveway shown in the Grading Plan listed in this report was shifted south. Based on the Grading Plan, the concrete walkways leading from the main parking lot to the northern edge of the proposed building will range in grade between El. 84 feet and El. 135 feet.



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A nearly vertical rock cut is proposed on the western side of the western portion of the proposed driveway loop. The cut will range up to 33 feet in height. A storm management swale is proposed along the bottom of the near-vertical rock cut, i.e., on the western side of the driveway loop. The proposed swale will be about 10 feet wide.

Based on the Grading Plan, athletic fields will also be provided, including one (1) combined soccer/baseball field, five (5) tennis courts, and one (1) combined football/soccer field with a track and stands. The proposed athletic fields will be constructed within the area of the existing building after the latter has been demolished. The proposed grades within the proposed combined soccer/baseball field range between El. 85.55 feet and El. 87.31 feet, requiring minor cuts and fills to achieve the proposed grades. The proposed grades within the proposed tennis courts will range between El. 85.15 feet and El. 86.15 feet; thus, requiring cuts of up to 9 feet to achieve the proposed grades. The proposed grades within the proposed combined football/soccer field with a track and stands range between El. 83.50 feet and El. 84 feet; thus, requiring cuts of up to 6 feet along the northern portion of the field, and fills of up to 7 feet along the southern portion of the field to achieve the proposed grades.

1.6 Elevation Datum

We understand that the elevations shown in the plans listed in Sections 1.3 and 1.5 are referenced to the North American Vertical Datum of 1988 (NAVD 88).



2. SITE AND SUBSURFACE CONDITIONS

2.1 Surficial Geology

Based on the Surficial Geological Map listed in Section 1.3, the natural soils in the general vicinity of the site mostly consist of the following:

- Thin Till – The thin till is described as non-sorted, non-stratified matrix of sand, some silt, and little clay that contains scattered pebbles, cobbles, and boulders. The thin till is generally less than 10 to 15 feet thick.
- Coarse Deposits – The coarse deposits consist of sand, sand and gravel, and gravel deposits as described below.

Sand Deposits – The sand deposits are comprised mostly of fine to coarse sand. Coarser layers may contain up to 25 percent gravel. Finer layers may contain very fine sand, silt, and clay.

Sand and Gravel Deposits – The sand and gravel deposits occur as a mixture of gravel and sand within individual layers and as alternating layers of sand and gravel. The sand and gravel layers range between 25 to 50 percent gravel and 50 to 75 percent sand.

Gravel Deposits – The gravel deposits are comprised of at least 50 percent gravel, cobbles, and boulders. Sand occurs within gravel beds and as separate layers within the gravel.

- Bedrock Outcrops – The Surficial Geological Map indicates the presence of abundant rock outcrops on the western and southern sides of the site.

The Surficial Geological Map of the site is shown in Figure 2.

2.2 Soil Survey Report

Based on the Soil Survey Report listed in Section 1.3, the soils at the site are classified primarily as follows:

- Charlton-Urban Land-Hollis Complex – Charlton soils are defined as well drained drumlin and ground moraines, and Hollis soils are defined as well drained ridges and hillslopes. Based on the Soil Survey Report, the Charlton soils are generally comprised of up to 5 inches of fine sandy loam, overlying up to 17 inches of sandy loam, overlying up to 43 inches of gravelly sandy loam. The groundwater table is typically deeper than 80 inches. The Hollis soils are generally comprised of up to 14 inches of fine sandy loam, overlying unweathered bedrock. The groundwater table is typically deeper than 80 inches.



- Urban Land – Urban Land is defined as excavated and filled land.
- Rock Outcrop-Hollis Complex – Rock outcrops are defined as granite and gneiss. Hollis soils are defined as well drained, friable, shallow loamy basal till over granite and gneiss. Based on the Soil Survey Report, the Hollis soils are generally comprised of up to 14 inches of fine sandy loam, overlying unweathered bedrock. The groundwater table is typically deeper than 80 inches.
- Charlton-Hollis-Rock Outcrop Complex – Charlton soils are defined as well drained, friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss. Based on the Soil Survey Report, the Charlton soils are generally comprised of up to 5 inches of fine sandy loam, overlying up to 17 inches of sandy loam, overlying up to 43 inches of gravelly sandy loam. The groundwater table is typically deeper than 80 inches. Hollis soils are defined as well drained, friable, shallow loamy basal till over granite and gneiss. Based on the Soil Survey Report, the Hollis soils are generally comprised of up to 14 inches of fine sandy loam, overlying unweathered bedrock. The groundwater table is typically deeper than 80 inches. Rock outcrops are defined as granite and gneiss.
- Swansea Muck – Swansea Muck is defined in the Soil Survey Report as “highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits.” Based on the Soil Survey Report, the Swansea Muck is generally comprised of up to 34 inches of muck, overlying up to 45 inches of coarse sand. The groundwater table typically ranges between 0 and 6 inches.
- Ridgebury Fine Sandy Loam – Ridgebury soils are defined as poorly drained depressions, drumlins, drainageways, hills, and ground moraines. Based on the Soil Survey Report, the Ridgebury soils are generally comprised of up to 1 inch of moderately decomposed plant material, overlying up to 5 inches of fine sandy loam, overlying up to 4 inches of sandy loam, overlying up to 56 inches of gravelly sandy loam. The groundwater table typically ranges between 0 and 6 inches.

A copy of the Soil Survey Report and Map are included in Appendix B.

2.3 LGCI’s Test Pits, Probes, and Borings

2.3.1 General

LGCI coordinated our PSR and SD exploration locations with DRA and marked the exploration locations in the field by taping distances from the proposed building corners staked by Nitsch. Our SD exploration locations were surveyed by Nitsch after completing our explorations to obtain ground surface elevations. Nitsch marked our DD exploration locations prior to performing our services. LGCI notified Dig Safe for utility clearance prior to starting our explorations at the site.



Unless notified otherwise, we will dispose of the soil and rock samples obtained during our explorations after three months.

2.3.2 LGCI's Explorations

2.3.2.1 Test Pits and Hand Probes

During the PSR phase, LGCI engaged Northern Drill Service, Inc. (NDS) of Northborough, Massachusetts to excavate eighteen (18) test pits (TP-1 to TP-18) at the site on December 3 and 4, 2020. The test pits were excavated with a Komatsu PC-120 excavator. The test pits extended to depths ranging between 0.7 and 10.5 feet beneath the ground surface. Upon completion, the test pit excavations were backfilled with the excavated material and tamped with the excavator bucket.

During the SD phase, LGCI engaged NDS to excavate thirteen (13) test pits (TP-101 to TP-111, TP-113, and TP-114) at the site between April 19 and 20, 2021. The test pits were excavated with a Kubota KX-080-4 excavator. The test pits extended to depths ranging between 1.8 and 5.5 feet beneath the ground surface. Upon completion, the test pit excavations were backfilled with the excavated material and tamped with the excavator bucket. Test pit TP-112 was skipped due to proximity to wetlands.

During the DD phase, LGCI engaged NDS to excavate an additional nine (9) test pits (TP-201 to TP-207, TP-B-205, and TP-B-206) at the site between April 26 and 27, 2022. The test pits were excavated with a Kubota KX-080-4 excavator. The test pits extended to depths ranging between 2.5 and 9 feet beneath the ground surface. Upon completion, the test pit excavations were backfilled with the excavated material and tamped with the excavator bucket.

During the DD phase, LGCI also performed four (4) hand probes (HP-TS-1 to HP-TS-4) at the site, at the request of the project landscape architect, on June 15, 2022 for the purpose of measuring the thickness of the topsoil. The hand probes were advanced using a hand auger. The hand probes extended to depths ranging between 1 and 1.3 feet beneath the ground surface. Upon completion, the hand probes were backfilled with the excavated material.

As part of the DD phase services, LGCI also engaged Saunders Construction to excavate an additional six (6) test pits (TP-208 to TP-213) at the site on July 22, 2022. The test pits were excavated with a Takeuchi TB-175 excavator. The test pits extended to depths ranging between 2.6 and 5.6 feet beneath the ground surface. Upon completion, the test pit excavations were backfilled with the excavated material in 12-inch to 18-inch lifts and tamped with the excavator bucket.

As part of the DD phase services, at the request of the project civil engineer, LGCI also engaged Saunders Construction to excavate three (3) test pits (TP-301 to TP-303)



within the existing baseball field on September 8, 2022. The test pits were excavated with a Kubota KX 080-3 excavator. The test pits extended to depths ranging between 3 and 7.5 feet beneath the ground surface. Upon completion, the test pit excavations were backfilled with the excavated material in 18-inch to 24-inch lifts and tamped with the excavator bucket.

An LGCI geotechnical engineer observed and logged the test pits and hand probes in the field.

To explore the subsurface conditions at greater depths, soil borings were also advanced at the site as described in Section 2.3.2.2 below.

2.3.2.2 Soil Borings

During the PSR phase, LGCI engaged NDS to advance four (4) borings (B-1-OW to B-4) at the site on December 10 and 11, 2020. The borings were advanced with a Mobile B-48 track-mounted drill rig using drive and wash techniques with a 4-inch casing. The borings extended to depths ranging between 0.5 feet and 18 feet beneath the ground surface. Upon completion, the boreholes were backfilled with the soil cuttings. Two (2) groundwater observation wells were installed in borings B-1-OW and B-3-OW.

During the SD phase, LGCI engaged NDS to advance six (6) borings (B-101-OW to B-106) at the site between April 26 and May 14, 2021. The borings were advanced with a Mobile B-48 track-mounted drill rig and a Diedrich D-25 track-mounted drill rig using drive and wash techniques with 3-inch and 4-inch casings. The borings extended to depths ranging between 11.5 and 36 feet beneath the ground surface. Upon completion, the boreholes were backfilled with the soil cuttings. Two (2) groundwater observation wells were installed in borings B-101-OW and B-104-OW.

During the DD phase, LGCI engaged NDS to advance an additional nineteen (19) borings (B-201 to B-204-OW, B-206 to B-214, B-216 to B-217, and B-220-OW to B-223) at the site between April 26 and May 11, 2022. The borings were advanced with a Mobile B-48 track-mounted drill rig using drive and wash techniques with 3-inch and 4-inch casings. The borings extended to depths ranging between 4 and 37 feet beneath the ground surface. Upon completion, the boreholes were backfilled with the soil cuttings and gravel. In paved areas, the ground surface was restored using asphalt cold patch. Three (3) groundwater observation wells were installed in borings B-204-OW, B-208-OW, and B-220-OW.

NDS performed Standard Penetration Tests (SPT) during drilling and obtained split spoon samples in the borings with an automatic hammer at typical depth intervals of 2 feet or 5 feet as noted on the boring logs in general accordance with ASTM D-1586.



Rock was cored in borings B-1-OW, B-3-OW, B-101-OW to B-106, B-201 to B-204-OW, B-206 to B-209, B-216, and B-220-OW.

An LGCI geotechnical engineer observed and logged the borings in the field.

2.3.2.3 Test Pit, Hand Probe, and Soil Boring Logs and Locations

The test pit, hand probe, and boring locations are shown in Figures 3A to 3D. Appendix C contains LGCI's test pit and hand probe logs. Appendix D contains LGCI's boring logs, the groundwater observation well installation reports, and photographs of the rock cores. Tables 1 and 2 include summaries of LGCI's test pits and hand probes, and borings, respectively.

2.4 Subsurface Conditions

The subsurface description in this report is based on a limited number of test pits, hand probes, and borings and is intended to highlight the major soil strata encountered during our test pits, hand probes, and borings. The subsurface conditions are known only at the actual test pit, hand probe, and boring locations. Variations may occur and should be expected between test pit, hand probe, and boring locations. The test pit, hand probe, and boring logs represent conditions that we observed at the time of our test pits, hand probes, and borings, and were edited, as appropriate, based on the results of the laboratory test data and inspection of the soil samples in the laboratory. The strata boundaries shown in our test pit, hand probe, and boring logs are based on our interpretations and the actual transitions may be gradual. Graphic soil symbols are for illustration only.

The soil strata encountered in the test pits, hand probes, and borings were as follows, starting at the ground surface.

Topsoil/Forest Mat – A layer of surficial topsoil/forest mat was encountered at the ground surface in all hand probes, test pits except in test pit TP-210, and borings except in borings B-210, B-212 to B-214, B-216 to B-217, and B-220-OW to B-223. The topsoil/forest mat extended to depths ranging between 0.1 and 2.3 feet beneath the ground surface. Refusal was encountered in this layer on apparent rock in test pits TP-7, TP-14, and TP-108 and in boring B-2 at depths of 2.0, 0.7, 2.3 and 0.5 feet beneath the ground surface, respectively. Rock outcrops were observed at the ground surface near the locations of the test pits and borings.

Asphalt – A layer of asphalt was encountered at the ground surface in borings B-210, B-212 to B-214, B-216 to B-217, and B-220-OW to B-223. The thickness of the asphalt ranged between 0.2 and 0.5 feet.

Fill – Existing fill was encountered beneath the asphalt or surficial topsoil/forest mat in borings B-210 to B-214, B-216 to B-217, and B-220-OW to B-223, in test pits TP-201 and TP-301 to TP-303, and in hand probes HP-TS-1 to HP-TS-3. These explorations were performed in the



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grass areas, in the paved areas around the existing building, and within the existing baseball field. The fill extended to depths ranging between 0.8 and 4.8 feet beneath the ground surface. Hand probes HP-TS-1 to HP-TS-3 were terminated in the fill layer at depths of 1.3, 1.1, and 1.0 feet beneath the ground surface, respectively.

The samples in this layer were mostly described as silty sand, well graded sand, and poorly graded sand. Four (4) samples were described as well graded gravel. The fines content in the fill layer ranged between 0 and 25 percent, and the gravel content ranged up to 45 percent. When described as gravel, the sand content in the fill ranged between 20 and 45 percent. The fill contained traces of organic soil, roots, wood, brick, and asphalt.

The standard penetration test (SPT) N-values in the fill ranged between 5 blows per foot (bpf) and refusal, with most values higher than 20 bpf, indicating medium dense to very dense material. The higher SPT N-values in the fill may be due to obstructions in the fill and may not represent the true density of the fill. The excavation effort within the fill layer was described as easy.

Subsoil – A layer of subsoil was encountered beneath the surficial topsoil/forest mat or fill in the test pits and borings except in test pits TP-7, TP-14, TP-108, TP-113, TP-114, and TP-201, and in borings B-2, B-101-OW, B-103, B-104-OW, B-106, B-206, B-209 to B-214, B-216 to B-217, and B-221 to B-223. The subsoil extended to depths ranging between 1.5 and 5.0 feet beneath the ground surface. Refusal was encountered in this layer on apparent rock in test pits TP-3, TP-4, TP-101, TP-105, TP-106, TP-110, TP-203, TP-205, TP-208, and TP-B-206, and in borings B-1-OW, B-3-OW, and B-102 at depths of 2.0, 1.5, 3.5, 1.8, 3.2, 2.7, 2.5, 2.5, 2.6, 2.6, 2.5, 2.2, and 2.7 feet, respectively.

The samples in this layer were mostly described as silty sand. Eight (8) samples were described as silt with sand or sandy silt, one (1) sample was described as silty gravel, and one (1) sample was described as well graded gravel. The fines content in the subsoil ranged between 20 and 45 percent, and the gravel content ranged up to 35 percent. The fines in the subsoil were occasionally described as slightly plastic. When described as silt, the sand content ranged between 25 and 30 percent. This layer contained traces of organic soil, roots, and wood. The subsoil also contained between 5 and 30 percent cobbles and boulders.

The SPT N-values in the subsoil ranged between 1 bpf and refusal, with most values lower than 10 bpf, indicating very loose to loose soil. The excavation effort within the subsoil was described as easy to very difficult.

Buried Organic Soil – A layer of buried organic soil was encountered beneath the fill in test pit TP-210 and extended to a depth of 2.0 feet below the ground surface. The buried organic soil was described as silty sand. The fines content ranged between 25 and 30 percent, and the soil contained trace of roots.



Sand and Gravel – A layer of sand and gravel was encountered beneath the surficial topsoil/forest mat, the subsoil, or fill in test pits TP-1, TP-5, TP-6, TP-8 to TP-10, TP-12, TP-13, TP-15 to TP-18, TP-102 to TP-104, TP-107, TP-109, TP-111, TP-113, TP-114, TP-202, TP-204, TP-206, TP-207, TP-209 to TP-213, TP-B-205, and TP-301 to TP-303; and in borings B-4, B-105, B-201, B-204-OW, B-207, B-210 to B-214, B-217, and B-220-OW to B-223. Where encountered, this layer extended to the bottom of the explorations or to refusal. Refusal was encountered in this layer on apparent rock at depths ranging between 1.9 and 10.5 feet beneath the ground surface.

The samples in this layer were mostly described as silty sand and well or poorly graded gravel. Eight (8) samples were described as well graded sand, and seven (7) samples were described as poorly graded sand. The fines content in the sand and gravel ranged between 0 and 50 percent, and the gravel content ranged up to 40 percent. When described as gravel, the sand content ranged between 0 and 45 percent. A few samples in this layer contained traces of organic soil and roots. The sand and gravel also contained between 5 and 50 percent cobbles and boulders up to 44 inches in diameter.

The SPT N-values in the sand and gravel ranged between 7 bpf and refusal, with most values ranging between 11 and 66 bpf indicating mostly medium dense to very dense sand. The excavation effort within the sand and gravel was described as easy to very difficult.

Weathered Rock – Weathered rock was encountered beneath the subsoil or fill in test pits TP-2, TP-11, and TP-201 at depths of 3.5, 2, and 2 feet beneath the ground surface, respectively. The weathered rock broke into a well graded gravel and silty gravel soil matrix.

Rock – Excavation refusal and split spoon refusal were encountered in the test pits and borings, except in borings B-211, B-212, and B-223, at depths ranging between 0.1 and 19.1 feet beneath the ground surface.

To confirm and characterize the rock, rock was cored in borings B-1-OW, B-3-OW, B-101-OW to B-106, B-201 to B-204-OW, B-206 to B-209, B-216, and B-220-OW. The rock generally consisted of hard to very hard, moderately weathered to fresh, extremely fractured to sound, fine-grained to medium-grained, gray to blue, Rhyolite. The rock core recoveries ranged between 81 and 100 percent and the Rock Quality Designation (RQD) ranged between 11.67 and 100 percent. The coring rate was generally less than 20 minutes per foot (min./ft.). However, in borings B-103, B-106, and B-203, coring rates up to 211 min./ft. were recorded, indicating very hard rock.

2.5 Groundwater

Groundwater was encountered in test pits TP-1, TP-2, TP-8, TP-9, TP-15 to TP-17, TP-101, TP-103, TP-107, TP-108, TP-110, TP-111, TP-114, TP-202, TP-204, TP-B-205, and TP-B-206, and in borings B-1-OW, B-4, B-101-OW to B-106, B-201 to B-204-OW, B-206 to B-208, B-210 to B-212, B-216 to B-217, and B-220-OW to B-221 at depths ranging between 0 feet (at the ground



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surface) and 10.0 feet beneath the ground surface as shown in Tables 1 and 2 and in the test pit and hand probe logs, and boring logs.

Ten (10) groundwater level readings were obtained in groundwater observation wells B-1-OW and B-3-OW, six (6) groundwater level readings were obtained in groundwater observation wells B-101-OW and B-104-OW, four (4) groundwater level readings were obtained in groundwater observation wells B-204-OW and B-208-OW, three (3) groundwater level readings were obtained in boring B-206, and one (1) groundwater level reading was obtained in groundwater observation well B-220-OW between the dates of December 11, 2020, and May 11, 2022. The groundwater level readings ranged between 2.5 and 30.1 feet beneath the ground surface as shown in the tables below.

	B-1-OW G.S. El. = 184.5 ft.	B-3-OW G.S. El. = 170.5 ft.	B-101-OW G.S. El. = 172.6 ft.	B-104-OW G.S. El. = 180.9 ft.
Date	Depth / Elevation (ft.)	Depth / Elevation (ft.)	Depth / Elevation (ft.)	Depth / Elevation (ft.)
12/11/2020	10.0 / 174.5	4.9 / 165.6	- / -	- / -
2/1/2021	10.0 / 174.5	8.7 / 161.8	- / -	- / -
3/3/2021	9.4 / 175.1	5.3 / 165.2	- / -	- / -
3/24/2021	9.5 / 175.0	7.8 / 162.7	- / -	- / -
5/13/2021	7.6 / 176.9	8.0 / 162.5	12.5 / 160.1	6.1 / 174.8
6/3/2021	7.9 / 176.6	8.1 / 162.4	23.9 / 148.7	17.1 / 163.8
6/29/2021	11.0 / 173.5	14.1 / 156.4	30.1 / 142.5	24.4 / 156.5
4/26/2022	8.7 / 175.8	7.4 / 163.1	18.4 / 154.2	17.3 / 163.6
5/5/2022	- / -	- / -	- / -	- / -
5/6/2022	10.0 / 174.5	9.4 / 161.1	23.7 / 148.9	19.5 / 161.4
5/9/2022	10.2 / 174.3	10.1 / 160.4	23.5 / 149.1	19.9 / 161.0
5/11/2022	- / -	- / -	- / -	- / -

	B-204-OW G.S. El. = 162.0 ft.	B-206 G.S. El. = 181.0 ft.	B-208-OW G.S. El. = 193.0 ft.	B-220-OW G.S. El. = 88.0 ft.
Date	Depth / Elevation (ft.)	Depth / Elevation (ft.)	Depth / Elevation (ft.)	Depth / Elevation (ft.)
12/11/2020	- / -	- / -	- / -	- / -
2/1/2021	- / -	- / -	- / -	- / -
3/3/2021	- / -	- / -	- / -	- / -
3/24/2021	- / -	- / -	- / -	- / -



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5/13/2021	- / -	- / -	- / -	- / -
6/3/2021	- / -	- / -	- / -	- / -
6/29/2021	- / -	- / -	- / -	- / -
4/26/2022	2.5 / 159.5	15.5 / 165.5	20.0 / 173.0	- / -
5/5/2022	2.5 / 159.5	15.5 / 165.5	20.0 / 173.0	- / -
5/6/2022	2.8 / 159.2	16.0 / 165.0	22.0 / 171.0	- / -
5/9/2022	3.0 / 159.0	- / -	23.7 / 169.3	- / -
5/11/2022	- / -	- / -	- / -	10.7 / 77.3

Groundwater flowed out of the borehole at boring B-102 upon completion of drilling for 24 hours before the borehole was sealed, possibly indicating an artesian condition. Boring B-102 extended to El. 135.2 feet. This condition was not observed in other borings.

The groundwater information reported herein is based on observations made during or shortly after the completion of drilling and excavation and may not represent the actual groundwater conditions. Furthermore, the drilling procedure introduced water into the boreholes; therefore, additional time may be required for the groundwater levels to stabilize. The groundwater information presented in this report only represents the conditions encountered at the time and location of the explorations. Seasonal fluctuation should be anticipated.

2.6 Borehole Geophysical Logging

LGCI engaged Hager Richter Geoscience, Inc. (HRGI) of Salem New Hampshire on May 5, 2022 to perform borehole geophysical logging in two (2) borings (B-206 and B-208). HRGI lowered a televiwer into the core holes and recorded discontinuities in the rock. The purpose of the borehole logging was to provide data about the rock discontinuities to Scarptec, Inc. who performed a kinematic analysis of discontinuities in the rock, and provided a rock engineering design and recommendation report described in Section 3.7. The results of the borehole logging are included in Appendix E.

2.7 Ground Penetrating Radar Geophysical Survey

LGCI engaged Hager Geoscience of Woburn, Massachusetts to perform a bedrock depth investigation using ground penetrating radar on July 14 and 15, 2022. Hager Geoscience submitted its report on July 22, 2022. The report includes the profile of inferred rock along two (2) lines: one line that extends on the western side of the proposed building, and the second line extending along the eastern side of the proposed building. Hager Geoscience's report is included in Appendix F.

2.8 Laboratory Test Data

LGCI submitted twenty-four (24) soil samples collected from the test pits and borings for grain-size analysis. The results of the grain-size analyses are provided in the test data sheets included in Appendix G and are summarized in the table below.



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Grain-Size Analysis Test Results

Exploration No.	Sample No.	Stratum	Sample depth (ft.)	Percent Gravel	Percent Sand	Percent Fines
TP-1	Grab	Subsoil	0.7 – 3.5	10.3	38.1	51.6
TP-5	Grab	Subsoil	0.5 – 3.5	18.9	45.2	35.9
TP-6	Grab	Subsoil	0.5 – 3.0	2.6	39.4	58.0
TP-9	Grab	Natural	1.9 – 6.2	23.2	54.3	22.5
TP-104	Grab	Subsoil	0.5 – 2.5	56.2	22.0	21.8
TP-106	Grab	Subsoil	0.5 – 3.2	8.3	54.4	37.3
TP-107	Grab	Natural	2.1 – 3.1	7.4	51.1	41.5
TP-113	Grab	Natural	0.5 – 3.0	31.6	55.9	12.5
B-201	S3	Natural	4.0 – 6.0	10.0	49.2	40.8
B-202	S1 Bot. 2"	Subsoil	0.3 – 1.8	30.5	36.2	33.3
B-203	S1 Bot. 3"	Subsoil	0.2 – 2.0	17.2	48.4	34.4
B-204-OW	S1 Bot. 6"	Subsoil	0.3 – 2.0	0.5	29.1	70.4
B-204-OW	S2 Bot. 8"	Natural	2.7 – 4.0	49.4	41.2	9.4
B-204-OW	S3	Natural	4.0 – 4.3	37.6	46.0	16.4
B-210	S2	Fill	2.0 – 4.0	18.5	59.1	22.4
TP-201	Grab	Fill	1.0 – 2.0	37.4	43.8	18.8
TP-202	Grab	Subsoil	2.0 – 2.5	9.8	59.4	30.8
TP-204	Grab	Subsoil	0.5 – 3.0	34.5	40.6	24.9
TP-207	Grab	Subsoil	0.5 – 3.0	15.1	45.0	39.9
TP-B-205	Grab	Subsoil	0.5 – 1.5	0.6	28.2	71.2
B-220-OW	S2	Subsoil	2.0 – 4.0	21.4	42.5	36.1
B-220-OW	S3	Natural	4.0 – 5.3	69.1	20.3	10.6
TP-103	Grab	Natural	2.4 – 5.5	15.1	37.4	47.5
TP-207	Grab	Natural	3.0 – 3.5	18.5	58.7	22.8

LGCI submitted six (6) rock specimens to a laboratory for compressive strength tests, including four (4) specimens during the SD phase and two (2) specimens during the DD phase. One (1) sample broke during testing. The results, included in Appendix H, indicate compressive strengths ranging between 17,340 psi and 42,395 psi.

LGCI also submitted four (4) topsoil samples collected from locations selected by the landscape architect for loam analyses. The results are included in Appendix I.



3. EVALUATION AND RECOMMENDATIONS

3.1 General

Based on our understanding of the proposed construction, our observation of the test pits and borings, and the results of our laboratory testing, there are a few issues that we would like to highlight for consideration and discussion.

We anticipate that the major considerations during design and construction will be the removal of the subsoil, the blasting of rock, the stability of the proposed near-vertical rock cuts, the onsite processing of blasted rock to produce rip rap and other fill materials, and under-slab drainage as described below.

3.1.1 Surficial Topsoil, Forest Mat, Subsoil, and Existing Fill

The surficial topsoil and forest mat extended to depths of up to 2.3 feet and subsoil extended to depths of up to 5 feet. Existing fill was encountered in a few explorations performed around the existing building and extended to depths of up to 4.8 feet beneath the ground surface. The existing fill could be deeper at locations not explored by LGCI. The topsoil, forest mat, subsoil, and existing fill should be handled as follows:

- The topsoil, forest mat, subsoil, and existing fill, if any, are not suitable to support the proposed building and should be entirely removed from within the footprint of the proposed building, and under retaining wall and bleacher footings. The removal should extend outside the limits of the proposed building a distance equal to the distance between the bottom of the footings and the bottom of the topsoil, forest mat, subsoil, and existing fill, if any, or 5 feet, whichever is greater.
- The topsoil and the forest mat should be entirely removed within the proposed paved areas.
- In paved areas, we recommend removing the subsoil to the top of the natural sand, or to a minimum depth of 18 inches beneath the bottom of the proposed pavement, whichever occurs first. Where subsoil is encountered and extends to depths greater than 18 inches beneath the bottom of the proposed pavement, the subsoil deeper than 18 inches beneath the bottom of the proposed pavement may remain in place provided that it is improved in accordance with the recommendations in Section 4.1.
- The removal of the topsoil and subsoil should extend laterally 5 feet outside the limits of the proposed paved area.
- The existing fill should be improved within the proposed paved areas in accordance with the requirements of Section 4.1.



- The topsoil, forest mat, subsoil, and existing fill, if any, should be removed within the proposed athletic fields in accordance with the requirements of the project landscape architect.

3.1.2 Rock Blasting

- Significant cuts are anticipated in order to achieve the proposed grades. Based on the test pits and borings, the majority of cuts will be in rock and will require rock blasting.
- To facilitate rock removal and the preparation of the subgrade of footings and slabs, we recommend that blasting extend at least 12 inches below the bottom of the footings over the entire building footprint.
- Care should be exercised by the blasting contractor not to overblast. Overblasted and heaved rock should be removed and replaced with Structural Fill.
- Where a near-vertical rock face is desired for esthetics, pre-splitting may be considered.
- For safety reasons, we recommend providing a catchment area at least 15 feet wide separating the bottom of the near-vertical rock cut and the nearest walkway or driveway. The drainage swale proposed on the western side of the western portion of the proposed driveway loop may be considered part of the catchment area.
- Based on our discussions with the project Civil Engineer, we understand that utilities will come into the building on all sides. Accordingly, rock blasting should be performed beyond the limits of the proposed building to allow for a safe space to install the utilities.
- Due to construction sequencing, rock blasting may not be feasible everywhere, especially for shallow utilities. Therefore, we recommend that the project include a contingency amount for hoe-ramming.

Additional recommendations for rock blasting are provided in Section 4.5.

3.1.3 Stability of the Near-Vertical Rock Cuts

- On the western side of the western portion of the proposed driveway loop, an almost 33-foot-high rock cut is proposed. We recommend that the cut be performed in accordance with the recommendations in Section 3.7.
- We would like to highlight that rock faces sloped at 1H:8V may not be feasible if rock discontinuities dip into the excavations. Depending on the number, type, and the orientation of discontinuities in the rock, flatter slopes and/or rock bolts may be required to maintain stable rock faces.



- Typically, the rock faces are inspected after rock blasting is completed during the excavation of the blasted rock. At that time, it may become evident that the rock requires local treatment/reinforcement by means of nets or rock bolts. We recommend that the cost estimate include a contingency for rock bolting and/or netting to support and protect the rock faces.

3.1.4 Shallow Foundations and Slabs-on-Grade

- After the surficial topsoil, forest mat, subsoil, and existing fill are entirely removed from within the proposed building footprint and from under the proposed retaining walls, if any, and other structure footings, the proposed building, retaining walls, and footings may be supported on shallow footings bearing in Structural Fill placed directly on the natural sand and gravel or on top of rock. Due to the susceptibility of the natural sand to disturbance, we recommend placing footings on a minimum of 6 inches of Structural Fill.
- The proposed slab may be designed as a slab-on-grade supported on Structural Fill placed directly on top of the natural sand.

3.1.5 Under-Slab Drainage System

Based on the groundwater levels observed in the groundwater observation wells, we believe that an under-slab drainage system is required beneath the proposed slab-on-grade. We anticipate that the under-slab drainage system will generate a considerable volume of water. We recommend that the system be designed to flow by gravity. Based on our discussions with the project Civil Engineer, we understand that the water from the under-slab drainage system may be channeled to one of the infiltration systems under the proposed main parking lot and from there the overflow will be discharged into the Saugus River on the northern side of the site. Our recommendations for the under-slab drainage system are presented in Section 3.4.

3.1.6 Silt Content

The natural soil is silty. Silty soils are very susceptible to disturbance when exposed to moisture. Care should be exercised during construction to maintain a dry working subgrade and to provide working mats, e.g., crushed stone or concrete mud mats, to reduce the potential for disturbance of the foundation subgrade and to improve working conditions.

3.1.7 Reuse of Onsite Materials

The onsite materials are not suitable for reuse as Structural Fill.

The contractor may consider mobilizing a rock crusher to the site. Existing cobble and boulders, and blasted rock can be processed by blending them with the natural soil and crushing them to produce a well graded material. Processed material obtained by crushing



blasted rock, boulders, and soil should meet the gradation requirements of Ordinary Fill and Structural Fill. Material produced by the crushing operation should be well graded so as to reduce the potential for formation of honeycombs during its placement and compaction.

Additional recommendations for fill materials and reuse of onsite materials are presented in Sections 4.3 and 4.4, respectively.

Our recommendations for footing design are presented in Section 3.2.1. Our estimates for settlement are presented in Section 3.2.2. Our concrete slab considerations are presented in Section 3.3 and the lateral earth pressure recommendations are presented in Section 3.6. Section 4.1 provides recommendations for preparation of subgrades.

3.2 Foundation Recommendations

3.2.1 Footing Design

- For footings supported on a minimum of 6 inches of Structural Fill placed directly over the natural sand and gravel or on rock after removing the surficial topsoil and the subsoil, we recommend a net allowable bearing pressure of 4 kips per square foot (ksf) for footings bearing in the natural sand or in deep Structural Fill thicker than 4 feet, and 10 ksf for footings bearing on a leveling layer of crushed stone or Structural Fill placed on rock.
- Footing subgrades should be prepared in accordance with the recommendations in Section 4.1.
- All foundations should be designed in accordance with *The Commonwealth of Massachusetts State Building Code 780 CMR, ninth Edition* (MSBC 9th Edition).
- Exterior footings and footings in unheated areas should be placed at a minimum depth of 4 feet below the final exterior grade to provide adequate frost protection. Interior footings in heated areas may be designed and constructed at a minimum depth of 2 feet below finished floor grades.
- Wall footings should be designed and constructed with continuous, longitudinal steel reinforcement for greater bending strength to span across small areas of loose or soft soils that may go undetected during construction.
- A representative of LGCI should be engaged to observe that the subgrade has been prepared in accordance with our recommendations.

3.2.2 Settlement Estimate

For footings designed using the net allowable bearing pressure recommended above, we anticipate that the settlement will be about 1 inch and that the differential settlement of the



footings will be 3/4 inch or less, over 25 feet. Total and differential settlements of these magnitudes are usually considered tolerable for the anticipated construction. As the design progresses and the settlement estimates are refined, the tolerance of the proposed structure to the predicted total and differential settlements should be assessed by the structural engineer.

3.3 Concrete Slab Considerations

- Floor slabs can be constructed as slabs-on-grade bearing on a minimum of 12 inches of Structural Fill placed directly on top of the natural sand. The subgrade of the slabs should be prepared as described in Section 4.1.
- To reduce the potential for dampness in the proposed floor slabs, the project architect may consider placing a vapor barrier beneath the floor slabs. The vapor barrier should be protected from puncture during construction of the slabs.
- For the design of the floor slabs bearing on the materials described above, we recommend using a modulus of subgrade reaction, k_{s1} , of 100 tons per cubic foot (tcf). Please note that the values of k_{s1} are for a 1 x 1 square foot area. These values should be adjusted for larger areas using the following expression:

$$\text{Modulus of Subgrade Reaction } (k_s) = k_{s1} * \left(\frac{B+1}{2B} \right)^2$$

where:

- k_s = Coefficient of vertical subgrade reaction for loaded area,
- k_{s1} = Coefficient of vertical subgrade reaction for 1 x 1 square foot area, and
- B = Width of area loaded, in feet.

Please note that cracking of slabs-on-grade can occur as a result of heaving or compression of the underlying soil, but also as a result of concrete curing stresses. To reduce the potential for cracking, the precautions listed below should be closely followed for construction of all slabs-on-grade:

- Construction joints should be provided between the floor slab and the walls and columns in accordance with the American Concrete Institute (ACI) requirements, or other applicable code.
- Backfill in interior utility trenches should be properly compacted.
- In order for the movement of exterior slabs not to be transmitted to the building foundation or superstructure, exterior slabs should be isolated from the building superstructure.



3.4 Under-Slab Drains

Based on the current groundwater levels observed in the explorations, we anticipate that an under-slab drainage system will be required under the proposed building.

We anticipate that the under-slab drainage system will generate considerable quantities of water. Accordingly, we recommend that the under-slab drainage system consist of 1) a minimum of 12 inches of $\frac{3}{4}$ -inch crushed stone placed below the slab, and 2) 6-inch-diameter slotted PVC pipes installed with their inverts at least 15 inches below the bottom of the slab. The pipes should be installed in trenches placed at 10 to 15 inches apart. The trenches should be at least 18 inches wide and 9 inches deep (below the bottom of the 12 inches of crushed stone) to allow placing crushed stone around the PVC pipe. The slotted PVC pipes should connect to a 6-inch solid PVC header pipe that collects and channels the collected water out of the building. We recommend at least three (3) exit points from the building for the groundwater collected by the under-slab drainage system.

A non-woven geotextile fabric should be installed between the crushed stone and the underlying soil or rock for separation. The slots on the PVC pipes should be placed facing downward to allow for entry of water at the bottom of the pipe. Clean-outs should be included at the end of the perforated pipes, at changes in directions, and at about 100-foot intervals.

We recommend channeling the water from the under-slab drainage system to flow by gravity to a discharge area or to an infiltration system. The owner should apply for a discharge permit and should perform analytical tests as required by the permits.

3.5 Seismic Design

In accordance with Section 1613 of MSBC 9th Edition and International Building Code (2015 IBC) and based on the boring data, the seismic criteria for the site are as follows:

- | | |
|---|---------|
| • Site Class: | C |
| • Spectral Response Acceleration at short period (S_s): | 0.232g |
| • Spectral Response Acceleration at 1 sec. (S_1): | 0.072g |
| • Site Coefficient F_a (Table 1613.5.3(1)): | 1.2 |
| • Site Coefficient F_v (Table 1613.5.3(2)): | 1.7 |
| • Adjusted spectral response S_{MS} : | 0.278 g |
| • Adjusted spectral responses S_{M1} : | 0.122 g |

Based on the boring information, we believe the site soils are not susceptible to liquefaction.



3.6 Lateral Pressures for Wall Design

3.6.1 Lateral Earth Pressures

Lateral earth pressures recommended for design of below-ground building walls, including the wall separating the ground floor (FFE of El. 143.5 feet) and the main floor (FFE of El. 163.5 feet), perimeter walls that are below ground, and site retaining walls, if any, are provided below.

Coefficient of Active Earth Pressure, K_A :	0.33 (see note below)
Coefficient of At-Rest Earth Pressure, K_o :	0.50
Coefficient of Passive Earth Pressure, K_p :	3.0
Total Unit Weight γ :	125 pcf

Note: The values in the table are based on a friction angle for the backfill of 30 degrees and neglecting friction between the backfill and the wall. The design active and passive coefficients are based on horizontal surfaces (non-sloping backfill) on both the active and passive sides, and a vertical wall face.

- Exterior walls of below-ground spaces and retaining walls braced at the top to restrain movement/rotation, such as the perimeter walls of the proposed building and the wall separating the two levels, should be designed using the “at-rest” pressure coefficient.
- We recommend placing free-draining material within the 3 feet immediately behind the retaining wall.
- We recommend providing weep holes in site walls to promote drainage where possible, or a pipe should be placed at the base of the walls to collect the groundwater. Groundwater collected by the wall drains should be discharged in a lower area if gravity flow is possible.
- Passive earth pressures should only be used at the toe of the wall where special measures or provisions are taken to prevent disturbance or future removal of the soil on the passive side of the wall, or in areas where the wall design includes a key. In any case, the passive pressures should be neglected in the top 2 feet.
- Where a permanent vertical uniform load will be applied on the active side immediately adjacent to the wall, a horizontal surcharge load equal to half of the uniform vertical load should be applied over the height of the wall. At a minimum, a temporary construction surcharge of 100 psf should be applied uniformly over the height of the wall.
- We recommend using an ultimate friction factor of 0.50 between the natural sand and the bottom of the wall. Below-ground walls should be designed for minimum factors of safety of 1.5 for sliding and 2.0 for overturning.



3.6.2 Seismic Pressures

In accordance with MSBC 9th Edition, Section 1610, a lateral earthquake force equal to $0.100 \cdot (S_s) \cdot (F_a) \cdot \gamma \cdot H^2$ should be included in the design of walls (for horizontal backfill), where S_s is the maximum considered earthquake spectral response acceleration (defined in Section 3.5), F_a is the site coefficient (defined in Section 3.5), γ is the total unit weight of the soil backfill, and H is the height of the wall.

The earthquake force should be distributed as an inverted triangle over the height of the wall. In accordance with MSBC 9th Edition, Section 1610.2, a load factor of 1.43 shall be applied to the earthquake force for wall strength design.

Temporary surcharges should not be included when designing for earthquake loads. Surcharge loads applied for extended periods of time shall be included in the total static lateral soil pressure and their earthquake lateral force shall be computed and added to the force determined above.

3.6.3 Wall Drains

- We recommend that free-draining material be placed within 3 feet of the below-ground spaces such the perimeter walls of the proposed building, and the wall separating the ground floor and the main floor. To reduce the potential for dampness in below-ground spaces, perimeter walls of the proposed below-ground spaces, if any, should be damp-proofed.
- We recommend that drains be provided behind walls of below-ground spaces and behind site retaining walls. The drains should consist of 6-inch perforated PVC pipes installed with the slots facing down. Perimeter drains should be installed at the bottom of the wall in 18 inches of crushed stone wrapped in a geotextile fabric for separation and filtration. Site retaining walls may be designed with weep holes discharging near the bottom of the face of the walls.
- Groundwater collected by the wall drains could be discharged in a lower area if gravity flow is possible. Alternatively, it should be discharged into the street drains. A permit would be required for discharge into street drains.
- Perimeter walls and the wall separating the two ground floors should be waterproofed.

3.7 Rock Cuts

Rock cuts up to 33 feet will be required on the western side of the proposed building. In its report dated July 25, 2022, Scarptec, Inc. made the following recommendations:

- The slope angle of the rock cut should not be steeper than 3V:1H.



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- To the extent possible, the alignment of the rock cut should be performed to reduce the potential for outwardly concave curves. Scarptec, Inc. suggested an alignment for the rock cut.
- The rock cut should be observed after the rock is blasted and removed to assess the need for reinforcement of loose zones and zones where a fault is exposed.
- Rock dowels may be needed locally. The project should include a contingency for rock dowels.
- The project should also include a contingency for 10- to 20-foot-long drains drilled into the rock at a slope of 4H:1V (with upward batter).
- Presplitting and perimeter control will be required. Scarptec, Inc. recommended using less explosives during presplitting.
- Scaling of the slope should be performed after the rock cut is completed. Scarptec, Inc. recommended removing vegetation within 15 feet of the crest of the slope and cutting the overburden at 2H:1V or flatter.
- The minimum dimension of the ditch (catchment area) at the bottom of the rock cut should be 12 feet. The ditch should be cut at a slope of 4H:1V.
- Signage should be provided at the top of the slope to warn against falling hazard.
- There should be a program of periodic (long term) maintenance of the slope performed, including scaling and possibly additional rock reinforcement.

The recommendations above represent a short summary of the Scarptec, Inc. recommendations. Scarptec, Inc.'s report, included in Appendix J, should be read in its entirety for a full understanding of the recommendations.

3.8 Slope Stability

3.8.1 General

LGCI performed limit equilibrium analyses to evaluate the global stability of the proposed 20-foot-high, fill, rip rapped slope on the eastern side of the proposed building along the eastern side of the proposed access road. LGCI performed stability analyses using the slope stability program PCSTABL5M to calculate the factor of safety, FS, for a sliding failure using the Simplified Bishop Method of slices for circular failure surfaces. For this project, we defined critical failure surfaces as those surfaces that start on the upper side of the proposed rip rap slope on the access road and extend to the lower side of the proposed slope, i.e., surfaces that entirely encompass the existing slope (global failure surfaces).



3.8.2 Slope Geometry and Loads

Our understanding of the proposed slope is based on the Landscape Drawings listed in Section 1.3.

For our analyses, we assumed a 1H:1V slope starting at El. 150 feet and dropping to about El. 130 feet. We assumed a 2-foot-thick rip rap layer at the top of the slope. We assumed that the slope will be filled with Ordinary Fill. We assumed a surcharge load equivalent to 2 feet of soil, i.e., 240 pounds per square foot (psf), to account for vehicular traffic.

3.8.3 Soil Parameters

LGCI estimated the friction angles of the onsite soils, including the existing fill, and the natural sand and gravel layer, based on SPT data from the borings.

The table below shows the soil parameters we used in our slope stability analyses.

Soil Layer	Total Unit Weight (pcf)	Saturated Unit Weight (pcf)	Friction Angle (degrees)
Ordinary Fill	120	125	34
Natural Sand and Gravel	125	130	42
Rip Rap	140	140	42

For rock, we assigned high strength values to force the failure surfaces into the overlying sand and gravel.

3.8.4 Results of Slope Stability Analyses

The results of our analyses, included in Appendix K, indicated a factor of safety, FS, less than the target FS of 1.5.

To improve the stability of the slope, LGCI performed slope stability analyses assuming that the slope is reinforced with geogrids. To achieve a factor of safety, FS, of 1.5, we estimate that the geogrid reinforcements should extend at least 10 feet into the slope from the back of the rip rap.

The design of reinforced slopes is a delegated design and is typically performed by a registered professional engineer engaged by the contractor. LGCI should be engaged to review the design and update our slope stability analyses using the actual reinforced slope geometry.

3.9 Radon Mitigation System

We understand that a radon mitigation system will be installed at the site. The radon mitigation system should consist of 6-inch solid PVC pipes connected to the crushed stone installed under



the proposed slab as part of the under-slab drainage system. The pipes should be installed vertically with one open end in the crushed stone and the other end daylighting on the roof of the proposed building. The system could be installed to operate passively. However, the pipes should be outfitted to be ready to install extraction fans.

We recommend at least one (1) stack per 10,000 square feet of building.

3.10 Pavement Considerations

3.10.1 General

The subsurface conditions encountered at the site are generally suitable to support the proposed driveway after preparation of the subgrade as described in Section 4.1.

- We recommend entirely removing the topsoil and forest mat from within the footprint of the proposed paved areas.
- The subsoil should be removed in accordance with the recommendations in Sections 3.1.1 and 4.1.
- The existing fill should be improved in accordance with the recommendations in Sections 4.1.
- Cobbles and boulders should be removed to at least 18 inches below the bottom of the pavement.

3.10.2 Exterior Slabs

- Exterior slabs such as sidewalks/walkways and surface pads should be placed on a minimum of 12 inches of Structural Fill with less than 5 percent fines.
- To reduce the potential for heave caused by surface water penetrating under the concrete panels of the proposed sidewalks/walkways, the joints between the concrete sections should be sealed with a waterproof compound. The exterior slabs should be sloped away from the building or other vertical surfaces to promote flow of water. To the extent possible, roof leaders should not discharge onto exterior slab surfaces.
- Based on the groundwater levels measured during our explorations, we do not believe that sidewalk drains are needed. LGCI will update this recommendation after additional explorations are performed and more groundwater observation wells are installed at the site.



3.10.3 Pavement Sections

The proposed driveways and parking areas should be constructed with minimum asphalt and subbase thicknesses in accordance with the recommendations and details prepared by the project Civil Engineer. At a minimum, the following typical pavement sections should be used.

A typical, minimum, standard-duty pavement section that could be used for parking areas is as follows:

- 1.5" Asphalt "Top Course"
- 2.0" Asphalt "Base Course"
- 8" Processed Gravel for Sub-Base (MassDOT M1.03.1)

A typical, minimum, heavy-duty pavement section that could be used for driveways and areas of heavy truck traffic is as follows:

- 2.0" Asphalt "Top Course"
- 2.5" Asphalt "Base Course"
- 12" Processed Gravel for Sub-Base (MassDOT M1.03.1)

Other than in parking spaces, the heavy-duty section should be used in all paved areas.

The pavement sections shown above represent minimum thicknesses representative of typical local construction practices for similar use. Periodic maintenance should be anticipated.

Pavement material types and construction procedures should conform to specifications of the "Standard Specifications for Highways and Bridges," prepared by the Commonwealth of Massachusetts Department of Public Works and dated 1988 (with the latest Supplemental Specifications).



4. CONSTRUCTION CONSIDERATIONS

4.1 Subgrade Preparation

- The topsoil, subsoil, organic materials, abandoned utilities, if any, and other below-ground structures, if any, should be entirely removed from within the footprint of the proposed building and site structures, including site retaining walls and exterior stairs, if any, before the start of foundation work.
- Tree stumps, root balls, and roots larger than ½ inch in diameter should be removed and the cavities filled with suitable material and compacted per Section 4.3 of this report.
- Topsoil, root balls, organic material, and other deleterious material should be entirely removed from within the proposed paved areas.
- The site contractor should note that the surficial materials at the site may contain large boulders.
- Cobbles and boulders should be removed at least 6 inches from beneath footings, 24 inches beneath the bottom of proposed slabs, 24 inches beneath the bottom of the asphalt in paved areas, and 24 inches beneath the base material of the turf in the proposed athletic fields. The resulting excavations should be backfilled with compacted Structural Fill within the proposed building and with Ordinary Fill under the subbase of paved areas and under the base material in athletic fields.
- The base material of athletic fields should conform to the gradation and placement requirements of the Landscape Architect or the manufacturer/installer of synthetic turf.
- Due to the high susceptibility of the natural sand and gravel for disturbance under foot and vehicular traffic, we recommend placing a minimum of 6 inches of Structural Fill at the bottom of the excavation or 4 inches of lean concrete to serve as a working mat.
- The bottom of the excavation resulting from the removal of the topsoil and subsoil in areas where the excavation terminates in the natural sand and gravel should be compacted with a dynamic vibratory compactor imparting a minimum of 40 kips of force to the subgrade.
- The base of the footing excavations terminating in granular soil should be compacted with a dynamic vibratory compactor weighing at least 200 pounds and imparting a minimum of 4 kips of force to the subgrade before placing the required 6 inches of Structural Fill.
- The subgrade of the slabs should be compacted using a vibratory roller compactor imparting a minimum of 10 kips of force to the subgrade before placing Structural Fill.



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- Where soft zones are revealed during the preparation of the subgrade, the soft materials or buried organic soil should be removed and replaced with Structural Fill within the building footprint and with Ordinary Fill beneath the subbase of paved areas.
- The subgrade in rock should be prepared in accordance with the recommendations in Section 4.5.
- To reduce the potential of increasing lateral pressures on the retaining walls, fill placed within 3 feet of the walls, if any, should be compacted using a small plate compactor imparting a maximum dynamic effort of 4 kips. The fill within 3 feet of the walls should be placed in maximum 8-inch loose lifts.
- After the surficial topsoil and forest mat are entirely removed and after the subsoil is removed from within the proposed paved areas in accordance with the recommendations in Section 3.1.1, the existing subsoil deeper than 18 inches beneath the bottom of the proposed pavement should be improved by compacting the exposed surface with at least eight (8) passes (4 passes in each direction) of a vibratory roller compactor imparting a dynamic effort of at least 40 kips. Where soft zones of soil are observed, the soft soil should be removed, and the grade should be restored using Ordinary Fill to the bottom of the proposed subbase layer. If pumping of the subsoil deeper than 18 inches beneath the bottom of the proposed grade is observed, the compactor should be switched to static mode and the soft material should be removed and replaced with Ordinary Fill.
- In paved areas, the existing fill should be improved by compacting the exposed surface of the existing fill with a minimum of eight (8) overlapping passes of a vibratory roller compactor imparting a dynamic effort of at least 40 kips. Where soft zones of soil or pumping are observed, the soft/pumping soil should be removed, and the grade should be restored using Ordinary Fill to the bottom of the proposed subbase layer.
- After the topsoil and forest mat are removed from within the proposed athletic fields, the exposed subsoil or natural soil should be proofrolled with a loaded rubber tire truck or with a large vibratory roller compactor imparting a minimum dynamic effort of 40 kips. Where soft zones are indicated by the proofrolling, the soft zones should be removed and the grades should be restored using Ordinary Fill to the bottom of the base material of the proposed turf designed by the Landscape Architect or the manufacturer/installer of synthetic turf, if any. The preparation of the subgrade before the placement of the turf subbase should follow the recommendations of the Landscape Architect.
- Fill placed within the footprint of the proposed building should meet the gradation and compaction requirements of Structural Fill shown in Section 4.3.1.
- Fill placed under the subbase of paved areas, should meet the gradation and compaction requirements of Ordinary Fill shown in Section 4.3.2.



- Fill placed in the top 12 inches beneath exterior slabs should consist of Structural Fill with less than 5 percent fines.
- When crushed stone is required in the drawings or it is used for the convenience of the contractor, it should be wrapped in a geotextile fabric for separation. The geotextile fabric should not be used under retaining walls as it promotes a plane of sliding such as under retaining wall footings.
- An LGCI geotechnical representative should observe the subgrades of footings and slabs prior to fill and concrete placement to verify that the exposed bearing materials are suitable for the design soil bearing pressure. If soft or loose pockets are encountered in the footing excavations, the soft or loose materials should be removed, and the bottom of the footing should be placed at a lower elevation on firm soil, or the resulting excavation should be backfilled with Structural Fill or crushed stone wrapped in geotextile for separation. The LGCI representative should also observe the improvement of the existing subsoil if any, and/or fill within the proposed paved areas.

4.2 Subgrade Protection

The site soils are frost susceptible. If construction takes place during freezing weather, special measures should be taken to prevent the subgrade from freezing. Such measures should include the use of heat blankets or excavating the final six inches of soil just before pouring concrete. Footings should be backfilled as soon as possible after footing construction. Soil used as backfill should be free of frozen material, as should the ground on which it is placed. Filling operations should be halted during freezing weather.

Materials with high fines contents are typically difficult to handle when wet as they are sensitive to moisture content variations. Subgrade support capacities may deteriorate when such soils become wet and/or disturbed. The contractor should keep exposed subgrades properly drained and free of ponded water. Subgrades should be protected from machine and foot traffic to reduce disturbance.

4.3 Fill Materials

Structural Fill and Ordinary Fill should consist of inert, hard, durable sand and gravel, free from organic matter, clay, surface coatings and deleterious materials, and should conform to the gradation requirements shown below.

4.3.1 Structural Fill

The Structural Fill should have a plasticity index of less than 6 and should meet the gradation requirements shown below. Structural Fill should be compacted in maximum 9-inch loose lifts to at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557), with moisture contents within ± 2 percentage points of optimum moisture content.



Sieve Size Percent	Passing by Weight
3 inches	100
1 ½ inch	80-100
½ inch	50-100
No. 4	30-85
No. 20	15-60
No. 60	5-35
No. 200*	0-10

* 0 – 5 Under sidewalks, unheated slabs, exterior stairs, ramps, and pads, and walkways

4.3.2 Ordinary Fill

Ordinary Fill should have a plasticity index of less than 6 and should meet the gradation requirements shown below. Ordinary Fill should be compacted in maximum 9-inch loose lifts to at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557), with moisture contents within ± 2 percentage points of optimum moisture content.

Sieve Size Percent	Passing by Weight
6 inches	100
1 inch	50-100
No. 4	20-100
No. 20	10-70
No. 60	5-45
No. 200	0-20

4.4 Reuse and Processing of Onsite Materials

Based on our field observations and the results of the grain-size analyses, the natural soils at the site are not suitable for reuse as Structural Fill or Ordinary Fill.

The contractor should avoid mixing the existing soils with suitable imported material. Should reusable materials be encountered during excavation, they should be excavated and stockpiled separately for compliance testing.

Soils with 20 percent or greater fines content are generally very sensitive to moisture content variations and are susceptible to frost. Such soils are very difficult to compact at moisture contents that are much higher or much lower than the optimum moisture content determined from the laboratory compaction test. Therefore, strict moisture control should be implemented during compaction of onsite soils with fines contents of 20 percent or greater. The contractor should be prepared to remove and replace such soils if pumping occurs.



The contractor may consider mobilizing a rock crusher to the site. Boulders and blasted rock can be processed with the natural soil and crushed to produce granular fill that is lower in fines if blended with a sufficient proportion of rock. Processed material obtained by crushing blasted rock, boulders, and soil should meet the gradation requirements of Ordinary Fill and Structural Fill. Material produced by the crushing operation should be well graded so as to reduce the potential for formation of honeycombs during its placement and compaction. The site contractor should be prepared to produce batches of material processed using different blending ratios at the start of the earthwork operations. LGCI will review the results of grain-size analyses performed on the processed material and provide an opinion about the blending ratio to maintain throughout construction.

All materials to be used as fill, including blended materials, should first be tested for compliance with the applicable gradation specifications.

4.5 Rock Blasting Considerations

4.5.1 Rock Removal

Deep rock cuts will be required to achieve the proposed FFE of the proposed building and the proposed grades of the paved areas.

Minor rock cuts (less than one foot) over short distances may be achieved using hoe-rams or using other non-blasting techniques. For the majority of the cuts, we anticipate that rock blasting will be required.

- Rock should be cut to at least 12 inches beneath footings and to a minimum of 24 inches beneath the bottom of the proposed slabs. To facilitate rock excavation and backfilling, we recommend that the blasting extend to an elevation corresponding to 12 inches beneath the bottom of the deepest footings under the entire building footprint.
- The rock should be cut laterally at least one foot beyond each side of the footing. For retaining wall footings, the rock should be cut laterally at least 3 feet from the outside face of the wall to allow for placement of the formwork. Where utilities are installed around the perimeter of the proposed building, the rock should be cut at least 3 feet from the nearest utility.
- The rock surface should be cut as level as possible. The surface of rock should not be steeper than 12H:1V.
- Structural Fill should not be placed directly on rock surfaces that are fractured. The fractures should be covered with a geotextile fabric for separation before placing Structural Fill on the fractured rock.



- Rock should be cut at least 18 inches beneath the bottom of paved areas and the ground surface of athletic fields.
- Under utility pipes, manholes, and catch basins, rock should be cut a minimum of 12 inches beneath the pipe or structure.
- Laterally, rock should be cut a minimum of 12 inches outside utility structures and a minimum of 18 inches on each side of utility pipes.
- To reduce overblasting and the potential for heaved rock, drill holes for blasting should not extend more than 2 feet beneath the minimum depths shown above.
- Rock blasting should be controlled to reduce vibrations and airblast overpressure to below thresholds established in the Earth Moving Specifications.
- Pre-splitting or controlled blasting may be desirable to reduce the amount of over-blast.
- To reduce the potential for blasted rock intended for crushing mixing with organic soil, we recommend that the topsoil, roots, tree stumps, and vegetation be removed before blasting. The remainder of the overburden soils and excavatable weathered rock should not be removed before blasting.
- To help obtain information about the top of the rock for rock quantity estimating purposes, we recommend that the Earth Moving Specifications include a requirement for the contractor to perform rock probes at the site in a grid pattern before the start of blasting. The results of the probes should include at a minimum the ground surface elevation and the elevation of the top of the rock. The probes should extend at least 10 feet beyond the perceived top of rock to make sure that the perceived top of rock is not a boulder.

4.5.2 Ground Vibration Monitoring

Rock blasting operations will generate ground vibrations that may result in minor cracks and cosmetic damage to nearby structures. To protect the adjacent structures from potential damage, construction blasting should be carefully controlled and monitored. We recommend monitoring vibrations at the ground surface and at nearby structures before and during the rock blasting operations. We recommend a peak particle velocity (PPV) of 2 inches per second (ips) for concrete foundations and 1 ips for masonry foundations.

4.5.3 Public Notification

The human perception threshold to vibration is very low, i.e., people are far more sensitive to vibrations than are the structures they occupy. Various studies have indicated that the sound effects are noticeable at PPV values of 0.02 ips and complaints and claims of damage are



likely at PPV values of 0.2 to 0.3 ips. These vibration intensities are well below the intensities that would cause structural damage to buildings. For these reasons, we recommend that the owner implement a proactive program of public notification and education of neighbors on the physical characteristics of blasting effects before the start of blasting.

4.5.4 Pre-Construction Condition Survey

We recommend that the Owner perform a pre-construction condition survey of structures located within 250 feet of the nearest blasting operation to document the existing conditions of the structures. The Owner may also consider using crack monitoring gauges to monitor large cracks identified during the pre-construction surveys.

4.6 Groundwater Control Procedures

Based on the groundwater levels encountered in our explorations, we anticipate that groundwater control procedures will be needed during removal of the subsoil and after rock blasting. We anticipate that significant quantities of water will be generated at the bottom of the rock excavation. Accordingly, we recommend that a groundwater control plan be designed and implemented that disposes of the groundwater by gravity. We anticipate that filtered sump pumps installed in pits located at least three feet below the bottom of the excavation may be sufficient to handle surface runoff that may enter shallow excavation. The contractor should be prepared to install multiple deep sump pumps to maintain a dry subgrade. Also, where deep trenches are required for utilities, multiple sump pumps would be required to maintain a dry excavation subgrade.

The contractor should be permitted to employ whatever commonly accepted means and practices as necessary to maintain the groundwater level below the bottom of the excavation and to maintain a dry excavation during wet weather. Groundwater levels should be maintained at a minimum of 1-foot below the bottom of excavations during construction. Placement of reinforcing steel or concrete in standing water should not be permitted.

Proper permits should be obtained from authorities having jurisdiction over the work. At a minimum, the water collected from excavations should be filtered for fines in sedimentation basins before being discharged. The sedimentation basins could be constructed of hay bales wrapped in a geotextile fabric.

To reduce the potential for sinkholes developing over sump pump pits after the sump pumps are removed, the crushed stone placed in the sump pump pits should be wrapped in a geotextile for separation. Alternatively, the crushed stone should be entirely removed after the sump pump is no longer in use and the sump pump pit should be restored with suitable backfill.



4.7 Temporary Excavations

All excavations to receive human traffic should be constructed in accordance with the OSHA guidelines.

The site soils should generally be considered Type “C” and should have a maximum allowable slope of 1.5 Horizontal to 1 Vertical (1.5H:1V) for excavations less than 20 feet deep. Deeper excavations, if needed, should have shoring designed by a professional engineer.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of the excavation sides and bottom and to protect existing structures.

The contractor should engage a design professional to inspect the rock cuts where workers will be working near the bottom of the cuts. Where the rock is deemed unstable, it should be cut to render the slope stable.



5. RECOMMENDATIONS FOR FUTURE WORK

As part of our current scope, LGCI will prepare Earth Moving Specifications and will review the geotechnical aspect of the SD Foundation and Civil Drawing.

We recommend engaging LGCI to perform the following services:

- Review the geotechnical aspects of contractor submittals and requests for information (RFIs).
- Observe the rock probes performed by the contractor before the start of blasting.
- Observe the excavation of rock and observe the exposed rock surfaces.
- Observe rock bolting, if needed.
- Observe the processing of onsite soils and blasted rock; and
- Provide a field representative during construction to observe the subgrade of foundations and slabs.



6. REPORT LIMITATIONS

Our analysis and recommendations are based on project information provided to us at the time of this report. If changes to the type, size, and location of the proposed structures or to the site grading are made, the recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the conclusions and recommendations modified in writing by LGCI. LGCI cannot accept responsibility for designs based on our recommendations unless we are engaged to review the final plans and specifications to determine whether any changes in the project affect the validity of our recommendations and whether our recommendations have been properly implemented in the design.

It is not part of our scope to perform a more detailed site history; therefore, we have not explored for or researched the locations of buried utilities or other structures in the area of the proposed construction. Our scope did not include environmental services or services related to moisture, mold, or other biological contaminants in or around the site.

The recommendations in this report are based in part on the data obtained from the subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations from anticipated conditions are encountered, it may be necessary to revise the recommendations in this report. We cannot accept responsibility for designs based on recommendations in this report unless we are engaged to 1) make site visits during construction to check that the subsurface conditions exposed during construction are in general conformance with our design assumptions and 2) ascertain that, in general, the work is being performed in compliance with the contract documents.

Our report has been prepared in accordance with generally accepted engineering practices and in accordance with the terms and conditions set forth in our agreement. No other warranty, expressed or implied, is made. This report has been prepared for the exclusive use of Drummey Rosane Anderson, Inc. for the specific application to the Proposed Northeast Metropolitan Regional Vocational Technical High School in Wakefield, Massachusetts as conceived at this time.



7. REFERENCES

In addition to the references included in the text of the report, we used the following references:

The Commonwealth of Massachusetts (2015), “The Massachusetts State Building Code, Ninth Edition,” comprised of the International Building Code (IBC-2015) and 780 CMR: Massachusetts Amendments to IBC-2015.

The Department of Labor, Occupational Safety and Health Administration (1989), “Occupational Safety and Health Standards - Excavations; Final Rule,” 20 CFR Part 1926, Subpart P.

USGS Wakefield, MA topographic map from <http://mapserver.mytopo.com>.



Table 1 - Summary of LGCI's Test Pits and Probes
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Test Pit No.	Ground Surface Elevation (ft.) ^{1,2}	Groundwater ³ Depth / El. (ft.)	Bottom of Forest Mat / Topsoil Depth / El. (ft.)	Bottom of Subsoil / Fill Depth / El. (ft.)	Bottom of Sand and Gravel Depth / El. (ft.)	Top of Possible Weathered Rock / Rock Depth / El. (ft.)	Bottom of Test Pit Depth / El. (ft.)
2020 Test Pits							
TP-1	156.2	2.0 / 154.2	0.7 / 155.5	3.5 / 152.7	9.0 / 147.2	- / -	9.0 / 147.2
TP-2	165.0	4.0 / 161.0	0.8 / 164.2	3.5 / 161.5	- / -	3.5 / 161.5	4.3 / 160.7
TP-3	180.6	- / -	1.0 / 179.6	2.0 / 178.6	- / -	2.0 / 178.6	2.0 / 178.6
TP-4	171.3	- / -	0.5 / 170.8	1.5 / 169.8	- / -	1.5 / 169.8	1.5 / 169.8
TP-5	173.2	- / -	0.5 / 172.7	3.5 / 169.7	5.0 / 168.2	5.0 / 168.2	5.0 / 168.2
TP-6	138.7	- / -	0.5 / 138.2	3.0 / 135.7	4.5 / 134.2	4.5 / 134.2	4.5 / 134.2
TP-7	158.1	- / -	2.0 / 156.1	- / -	- / -	2.0 / 156.1	2.0 / 156.1
TP-8	130.0	2.0 / 128.0	1.0 / 129.0	3.0 / 127.0	9.0 / 121.0	9.0 ⁵ / 121.0	9.0 / 121.0
TP-9	162.9	3.6 / 159.3	0.4 / 162.5	1.9 / 161.0	6.2 / 156.7	6.2 ⁵ / 156.7	6.2 / 156.7
TP-10	187.9	- / -	0.3 / 187.6	2.1 / 185.8	2.7 / 185.2	2.7 / 185.2	2.7 / 185.2
TP-11	181.1	- / -	0.5 / 180.6	2.0 / 179.1	- / -	2.0 / 179.1	3.2 / 177.9
TP-12	136.0	- / -	1.0 / 135.0	4.0 / 132.0	7.0 / 129.0	7.0 / 129.0	7.0 / 129.0
TP-13	162.2	- / -	0.4 / 161.8	2.3 / 159.9	4.8 / 157.4	4.8 / 157.4	4.8 / 157.4
TP-14	164.9	- / -	0.7 / 164.2	- / -	- / -	0.7 / 164.2	0.7 / 164.2
TP-15	162.0	2.5 / 159.5	0.5 / 161.5	4.0 / 158.0	5.0 / 157.0	5.0 / 157.0	5.0 / 157.0
TP-16	143.7	3.5 / 140.2	1.0 / 142.7	5.0 / 138.7	10.5 / 133.2	10.5 / 133.2	10.5 / 133.2
TP-17	139.5	1.5 / 138.0	0.2 / 139.3	1.9 / 137.6	3.1 / 136.4	3.1 ⁵ / 136.4	3.1 / 136.4
TP-18	132.0	- / -	0.3 / 131.7	2.8 / 129.2	3.9 / 128.1	3.9 / 128.1	3.9 / 128.1
2021 Test Pits							
TP-101	126.5	3.5 / 123.0	1.0 / 125.5	3.5 / 123.0	- / -	3.5 / 123.0	3.5 / 123.0
TP-102	126.4	- / -	0.7 / 125.7	2.9 / 123.5	3.7 / 122.7	3.7 / 122.7	3.7 / 122.7
TP-103	135.0	1.3 / 133.7	0.8 / 134.2	2.4 / 132.6	5.5 / 129.5	5.5 / 129.5	5.5 / 129.5
TP-104	180.0	- / -	0.5 / 179.5	2.5 / 177.5	3.0 / 177.0	3.0 / 177.0	3.0 / 177.0
TP-105	180.1	- / -	0.5 / 179.6	1.8 / 178.3	- / -	1.8 / 178.3	1.8 / 178.3
TP-106	161.0	- / -	0.5 / 160.5	3.2 / 157.8	- / -	3.2 / 157.8	3.2 / 157.8
TP-107	168.1	3.0 / 165.1	0.3 / 167.8	2.1 / 166.0	3.1 / 165.0	3.1 / 165.0	3.1 / 165.0
TP-108	180.4	2.3 / 178.1	2.3 / 178.1	- / -	- / -	2.3 / 178.1	2.3 / 178.1
TP-109	171.2	- / -	0.5 / 170.7	3.0 / 168.2	4.6 / 166.6	4.6 / 166.6	4.6 / 166.6
TP-110	168.1	2.5 / 165.6	0.5 / 167.6	2.7 / 165.4	- / -	2.7 / 165.4	2.7 / 165.4
TP-111	156.3	5.0 / 151.3	0.5 / 155.8	3.5 / 152.8	5.0 / 151.3	5.0 / 151.3	5.0 / 151.3
TP-113	143.6	- / -	0.5 / 143.1	- / -	3.0 / 140.6	3.0 / 140.6	3.0 / 140.6
TP-114	147.4	1.9 / 145.5	0.3 / 147.1	- / -	1.9 / 145.5	1.9 / 145.5	1.9 / 145.5
2022 Test Pits							
TP-201	84.0	- / -	1.0 / 83.0	2.0 / 82.0	- / -	2.0 / 82.0	4.5 / 79.5
TP-202	120.0	2.0 / 118.0	0.3 / 119.7	2.0 / 118.0	4.5 / 115.5	4.5 / 115.5	4.5 / 115.5
TP-203	129.0	- / -	0.3 / 128.7	2.5 / 126.5	- / -	2.5 / 126.5	2.5 / 126.5
TP-204	155.0	6.0 / 149.0	0.5 / 154.5	3.0 / 152.0	8.7 / 146.3	8.7 / 146.3	8.7 / 146.3
TP-205	181.0	- / -	0.5 / 180.5	2.5 / 178.5	- / -	2.5 / 178.5	2.5 / 178.5
TP-206	159.0	- / -	1.0 / 158.0	3.0 / 156.0	6.5 / 152.5	6.5 / 152.5	6.5 / 152.5
TP-207	153.0	- / -	0.5 / 152.5	3.0 / 150.0	3.5 / 149.5	3.5 / 149.5	3.5 / 149.5
TP-208	165.0	- / -	0.9 / 164.1	2.6 / 162.4	- / -	2.6 / 162.4	2.6 / 162.4
TP-209	137.0	- / -	1.4 / 135.6	2.5 / 134.5	4.2 / 132.8	4.2 / 132.8	4.2 / 132.8
TP-210	133.0	- / -	- / -	1.2 / 131.8	4.6 ^{10,11} / 128.4	4.6 / 128.4	4.6 / 128.4
TP-211	129.0	- / -	1.7 / 127.3	2.5 / 126.5	5.6 / 123.4	5.6 / 123.4	5.6 / 123.4
TP-212	133.0	- / -	0.9 / 132.1	3.0 / 130.0	4.9 / 128.1	4.9 / 128.1	4.9 / 128.1
TP-213	136.0	- / -	0.3 / 135.7	2.3 / 133.7	3.3 / 132.7	3.3 / 132.7	3.3 / 132.7
TP-B-205	134.0	3.0 / 131.0	0.5 / 133.5	1.5 / 132.5	9.0 / 125.0	9.0 / 125.0	9.0 / 125.0
TP-B-206	151.0	2.6 / 148.4	0.4 / 150.6	2.6 / 148.4	- / -	2.6 / 148.4	2.6 / 148.4
TP-301	86.0	- / -	0.5 / 85.5	1.5 / 84.5	3.0 / 83.0	3.0 / 83.0	3.0 / 83.0
TP-302	86.0	- / -	0.5 / 85.5	1.7 / 84.3	7.5 / 78.5	7.5 / 78.5	7.5 / 78.5
TP-303	86.0	- / -	0.7 / 85.3	1.1 / 84.9	5.2 / 80.8	5.2 / 80.8	5.2 / 80.8
2022 Probes							
HP-TS-1	86.0	- / -	0.8 / 85.2	1.3 ⁹ / 84.7	- / -	- / -	1.3 / 84.7
HP-TS-2	85.0	- / -	0.8 / 84.2	1.1 ⁹ / 83.9	- / -	- / -	1.1 / 83.9
HP-TS-3	65.0	- / -	0.8 / 64.2	1.0 ⁹ / 64.0	- / -	- / -	1.0 / 64.0
HP-TS-4	58.0	- / -	1.2 ⁸ / 56.8	- / -	- / -	- / -	1.2 / 56.8

SEE NOTES ON NEXT PAGE

Notes:

1. The ground surface elevations for the 2020 and 2021 test pits were surveyed by Nitsch Engineering, Inc. (Nitsch) and were obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.
2. The ground surface elevations for the 2022 test pits and probes were interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to LGCI by DRA via e-mail on June 3, 2022.
3. Groundwater depths based on level observed during excavation.
4. "-" means groundwater or layer was not encountered.
5. Refusal encountered on cobbles and boulders.
6. TP-112 was not performed.
7. The probes were performed while obtaining samples for loam analysis.
8. Probe terminated in the forest mat.
9. Probe terminated in the fill.
10. A layer of buried organic soil was encountered between depths of 1.2 feet and 2.0 feet beneath the ground surface.
11. A layer of buried subsoil was encountered between depths of 2.0 feet and 3.0 feet beneath the ground surface.

Table 2 - Summary of LGCI's Borings
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Wakefield, Massachusetts
LGCI Project No. 2025

Boring No.	Ground Surface Elevation (ft.) ^{1,2}	Groundwater ³ Depth / El. (ft.)	Bottom of Asphalt Depth / El. (ft.)	Bottom of Forest Mat/ Topsoil Depth / El. (ft.)	Bottom of Fill Depth / El. (ft.)	Bottom of Subsoil Depth / El. (ft.)	Bottom of Sand and Gravel Depth / El. (ft.)	Top of Rock Depth / El. (ft.)	Bottom of Boring Depth / El. (ft.)
2020 Boring Logs									
B-1-OW	184.5	10.0 / 174.5	- / -	0.3 / 184.2	- / -	2.5 / 182.0	- / -	2.5 / 182.0	14.0 / 170.5
B-2	166.5	- / -	- / -	0.5 / 166.0	- / -	- / -	- / -	0.5 / 166.0	0.5 / 166.0
B-3-OW	170.5	- / -	- / -	0.3 / 170.2	- / -	2.2 / 168.3	- / -	2.2 / 168.3	18.0 / 152.5
B-4	180.7	0.8 / 179.9	- / -	0.3 / 180.4	- / -	2.6 / 178.1	6.0 / 174.7	6.0 / 174.7	8.0 / 172.7
2021 Boring Logs									
B-101-OW	172.6	5.2 / 167.4	- / -	0.1 / 172.5	- / -	- / -	- / -	0.1 / 172.5	36.0 / 136.6
B-102	158.7	2.5 / 156.2	- / -	0.5 / 158.2	- / -	2.7 / 156.0	- / -	2.7 / 156.0	23.5 / 135.2
B-103	174.6	0.1 / 174.5	- / -	1.8 / 172.8	- / -	- / -	- / -	1.8 / 172.8	23.5 / 151.1
B-104-OW	180.9	0.0 / 180.9	- / -	0.7 / 180.2	- / -	- / -	- / -	0.7 / 180.2	27.0 / 153.9
B-105	161.5	2.0 / 159.5	- / -	0.3 / 161.2	- / -	2.0 / 159.5	3.5 / 158.0	3.5 / 158.0	17.0 / 144.5
B-106	161.9	1.0 / 160.9	- / -	1.4 / 160.5	- / -	- / -	- / -	1.4 / 160.5	11.5 / 150.4
2022 Boring Logs									
B-201	167.0	2.0 / 165.0	- / -	2.0 / 165.0	- / -	3.0 / 164.0	19.1 ⁴ / 147.9	19.1 / 147.9	24.5 / 142.5
B-202	176.0	5.2 / 170.8	- / -	0.3 / 175.7	- / -	1.8 / 174.2	- / -	1.8 / 174.2	22.5 / 153.5
B-203	167.0	1.0 / 166.0	- / -	0.2 / 166.8	- / -	2.0 / 165.0	- / -	2.0 / 165.0	11.5 / 155.5
B-204-OW	162.0	1.0 / 161.0	- / -	0.3 / 161.7	- / -	2.7 / 159.3	4.4 / 157.6	4.4 / 157.6	25.2 / 136.8
B-206	181.0	4.5 / 176.5	- / -	1.3 / 179.7	- / -	- / -	- / -	1.3 / 179.7	21.5 / 159.5
B-207	139.0	2.0 / 137.0	- / -	0.3 / 138.7	- / -	2.5 / 136.5	2.9 / 136.1	2.9 / 136.1	13.0 / 126.0
B-208-OW	193.0	7.0 / 186.0	- / -	0.3 / 192.7	- / -	1.5 / 191.5	- / -	1.5 / 191.5	37.0 / 156.0
B-209	152.0	- / -	- / -	0.5 / 151.5	- / -	- / -	- / -	0.5 / 151.5	5.5 / 146.5
B-210	80.0	1.0 / 79.0	0.3 / 79.7	- / -	4.8 / 75.2	- / -	8.0 / 72.0	8.0 / 72.0	10.0 / 70.0
B-211	79.0	6.1 / 72.9	- / -	0.5 / 78.5	2.4 / 76.6	- / -	20.1 / 58.9	- / -	20.1 / 58.9
B-212	83.0	3.5 / 79.5	0.5 / 82.5	- / -	4.0 / 79.0	- / -	11.0 / 72.0	- / -	11.0 / 72.0
B-213	85.0	- / -	0.2 / 84.8	- / -	2.3 / 82.7	- / -	2.6 / 82.4	2.6 / 82.4	4.0 / 81.0
B-214	201.0	- / -	0.3 / 200.7	- / -	0.8 / 200.2	- / -	7.0 / 194.0	7.0 / 194.0	8.0 / 193.0
B-216	89.0	4.9 / 84.1	0.3 / 88.7	- / -	3.3 / 85.7	- / -	- / -	3.3 / 85.7	8.5 / 80.5
B-217	89.0	2.0 / 87.0	0.3 / 88.7	- / -	1.0 / 88.0	- / -	3.5 / 85.5	3.5 / 85.5	4.0 / 85.0
B-220-OW	88.0	4.0 / 84.0	0.3 / 87.7	- / -	2.0 / 86.0	4.0 / 84.0	5.3 / 82.7	5.3 / 82.7	11.0 / 77.0
B-221	79.0	4.0 / 75.0	0.3 / 78.7	- / -	4.0 / 75.0	- / -	19.0 / 60.0	19.0 / 60.0	21.0 / 58.0
B-222	76.0	- / -	0.3 / 75.7	- / -	0.8 / 75.2	- / -	5.1 / 70.9	5.1 / 70.9	7.0 / 69.0
B-223	78.0	3.5 / 74.5	0.4 / 77.6	- / -	2.3 / 75.7	- / -	13.5 / 64.5	- / -	13.5 / 64.5

- The ground surface elevations for the 2020 and 2021 borings were surveyed by Nitsch Engineering, Inc. (Nitsch) and were obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to LGCI by Nitsch via e-mail on June 4, 2021.
- The ground surface elevations for the 2022 borings were interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to LGCI by DRA via e-mail on June 3, 2022.
- Groundwater depths based on sample moisture or level at the end of drilling, whichever is shallower.
- Possible weathered rock encountered at depth of 10.5 feet beneath the ground surface.
- "-" means groundwater or layer was not encountered.

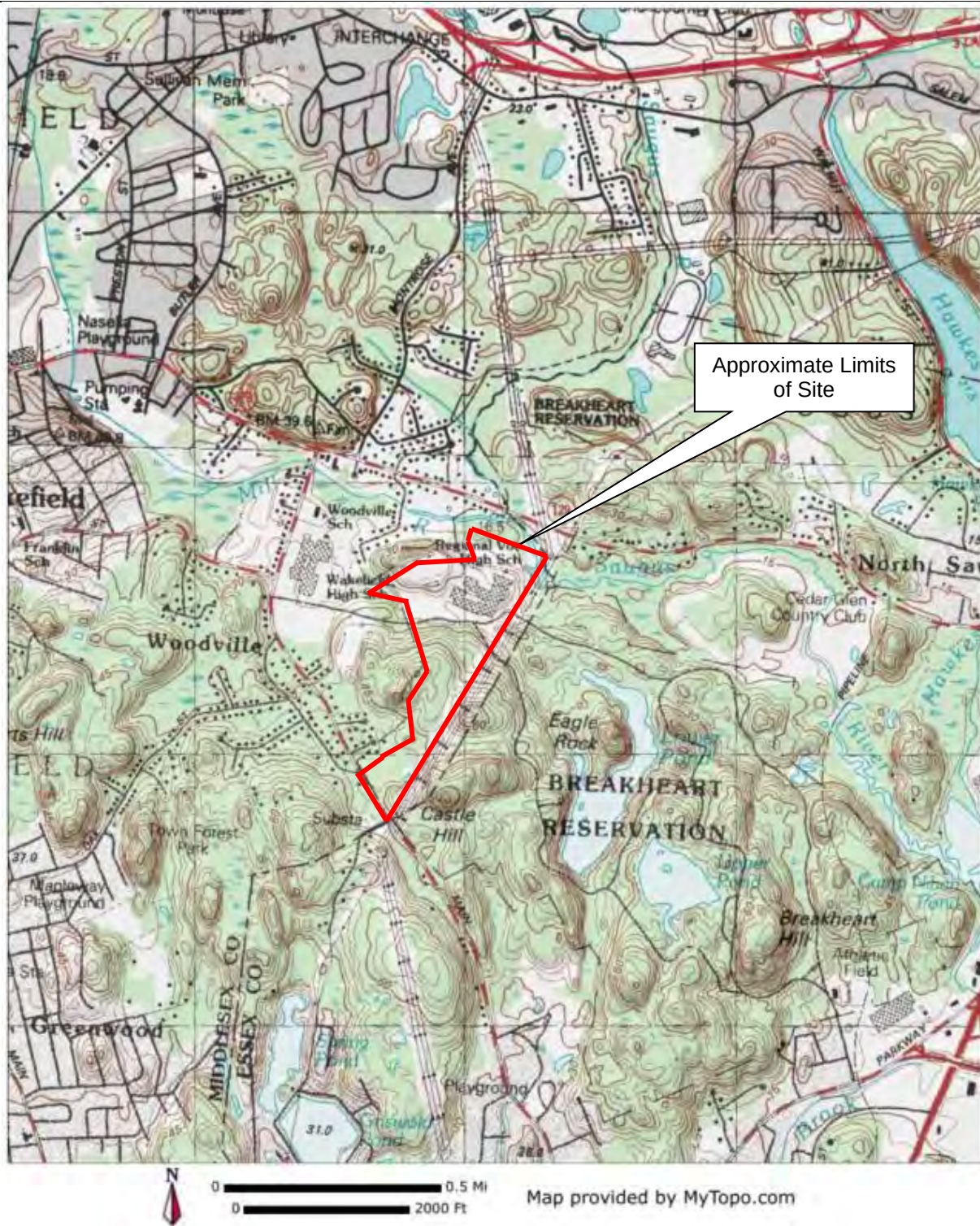
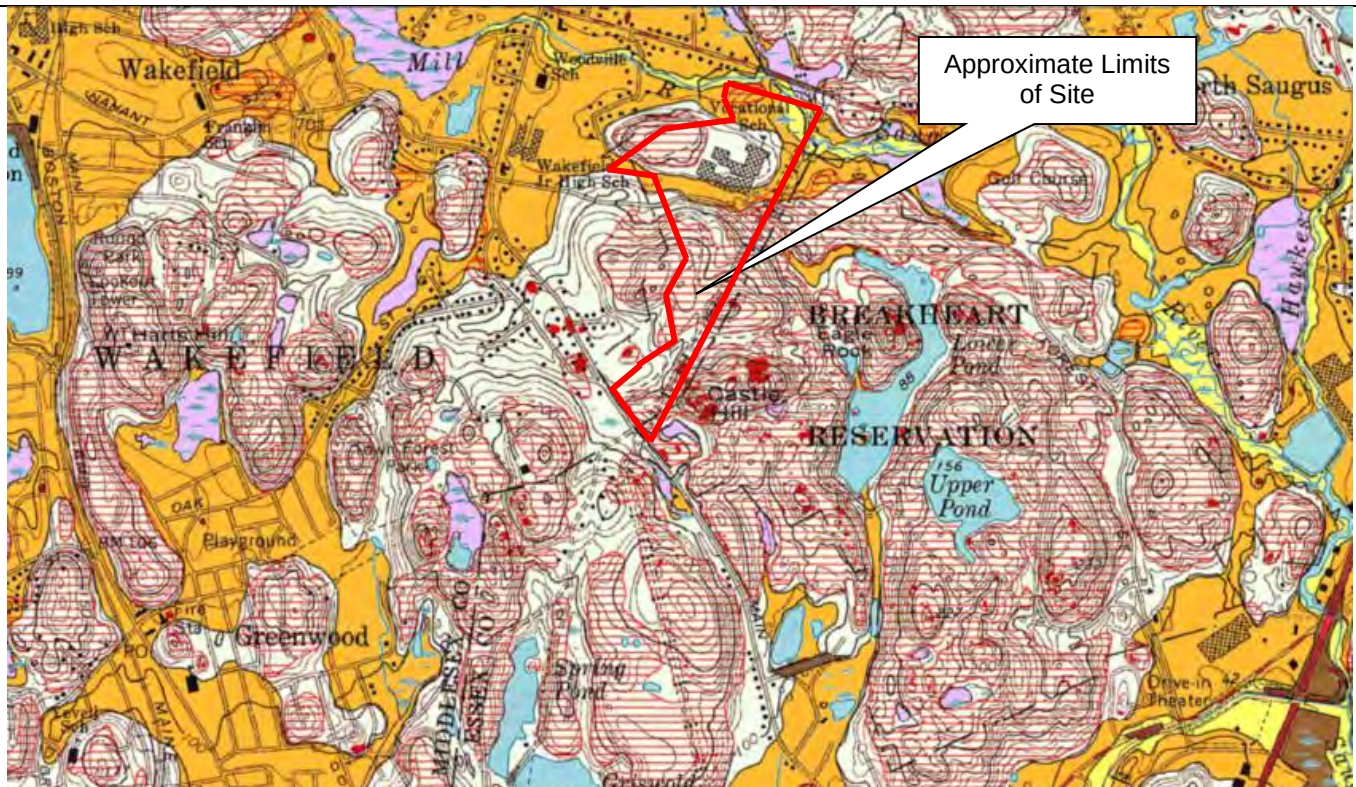


Figure based on USGS topographic map of Wakefield, MA obtained from www.mytopo.com

Client: Drummey Rosane Anderson, Inc.	Project: Prop. Northeast Metro Regional Vocational Technical H.S.	Figure 1 – Site Location Map	
 LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Wakefield, MA	LGCI Project No.: 2025	Date: Nov. 2022



Thin till—Nonsorted, nonstratified matrix of sand, some silt, and little clay containing scattered pebble, cobble, and boulder clasts; large surface boulders are common; unit was mapped where till is generally less than 10 to 15 ft thick including areas of shallow bedrock. Predominantly consists of upper till of the last glaciation; loose to moderately compact, generally sandy, commonly stony. Two facies are present in some places: a looser, coarser grained ablation facies, melted out from supraglacial position; and an underlying more compact, finer grained lodgement facies deposited subglacially. In general, both ablation and lodgement facies of upper till derived from fine-grained bedrock are finer grained, more compact, less stony and have fewer surface boulders than upper till derived from coarse-grained crystalline rocks. Across Massachusetts, fine-grained bedrock sources include the red Mesozoic sedimentary rocks of the Connecticut Valley lowland, marble in the western river valleys, and fine-grained schists in upland areas



Coarse deposits consist of *gravel deposits*, *sand and gravel deposits*, and *sand deposits*, not differentiated in this report. *Gravel deposits* are composed of at least 50 percent gravel-size clasts; cobbles and boulders predominate; minor amounts of sand occur within gravel beds, and sand comprises a few separate layers. Gravel layers generally are poorly sorted, and bedding commonly is distorted and faulted due to postdepositional collapse related to melting of ice. *Sand and gravel deposits* occur as mixtures of gravel and sand within individual layers and as layers of sand alternating with layers of gravel. Sand and gravel layers generally range between 25 and 50 percent gravel particles and between 50 and 75 percent sand particles. Layers are well sorted to poorly sorted; bedding may be distorted and faulted due to postdepositional collapse. *Sand deposits* are composed mainly of very coarse to fine sand, commonly in well-sorted layers. Coarser layers may contain up to 25 percent gravel particles, generally granules and pebbles; finer layers may contain some very fine sand, silt, and clay



Bedrock outcrops and areas of abundant outcrop or shallow bedrock—Solid color shows extent of individual bedrock outcrops; horizontal-line pattern indicates areas of shallow bedrock or areas where small outcrops are too numerous to map individually; in areas of shallow bedrock, surficial materials are less than 5 to 10 ft thick. These units were not mapped consistently among all quadrangles; see note at beginning of appendix 1 for information on bedrock outcrop mapping by quadrangle

Figure based on map titled: "Surficial Materials Map of the Boston North, Massachusetts," prepared by Stone, B.D. and DiGiacomo-Cohen, M.L. for U.S. Geological Survey, 2018, Scientific Investigation Map 3402, Quadrangle 125 – Boston North.

Client: Drummey Rosane Anderson, Inc.	Project: Prop. Northeast Metro Regional Vocational Technical H.S.	Figure 2 – Surficial Geologic Map	
 LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Wakefield, MA	LGCI Project No.: 2025	Date: Nov. 2022

Legend

 Approximate location of test pit excavated by Saunders Construction on July 26th, 2022, and observed by LGCI.

 Approximate location of test pit excavated by NDS between December 3 and 4, 2020, and observed by LGCI.

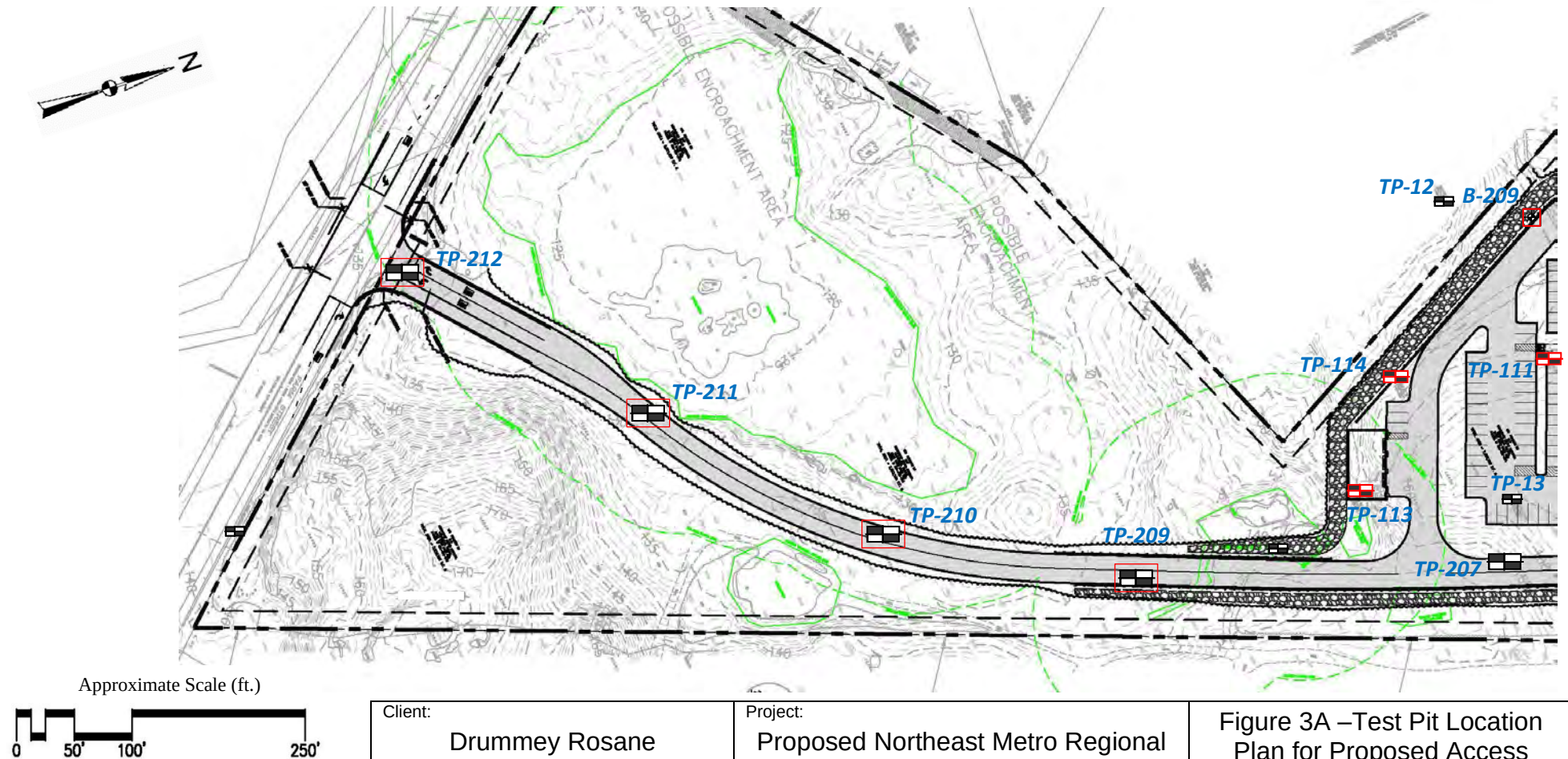
 Approximate location of test pit excavated by NDS between April 26 and 27, 2022, and observed by LGCI.

 Approximate location of test pit excavated by NDS between April 19 and 20, 2021, and observed by LGCI.

 Approximate location of boring advanced by NDS between April 26, 2022, and May 11, 2022, and observed by LGCI.

IMPORTANT

Subsequent to our test pits TP209 to TP-212, the alignment of the proposed driveway was shifted south. No subsurface explorations were performed along the new alignment. However, based on the surficial geology map and our field observations, the new alignment will likely require rock cuts to achieve the proposed grades.



Note

Figure based on untitled drawing provided to LGCI by Warner Larson via e-mail on April 21, 2022.

Client:

Drumme Rosane
Anderson, Inc.



LGCI
Lahlaf Geotechnical Consulting, Inc.

Project:

Proposed Northeast Metro Regional
Vocational Technical High School

Project Location:

Wakefield, MA

Figure 3A –Test Pit Location
Plan for Proposed Access
Road from Farm Street

LGCI Project No.:

2025

Date:

Nov. 2022

Legend

 Approximate location of boring advanced by Northern Drill Service, Inc. (NDS) of Northborough, MA between December 10 and 11, 2020, and observed by Lahlaf Geotechnical Consulting, Inc. (LGCI).

 Approximate location of boring advanced by NDS between April 26, 2021, and May 14, 2021, and observed by LGCI.

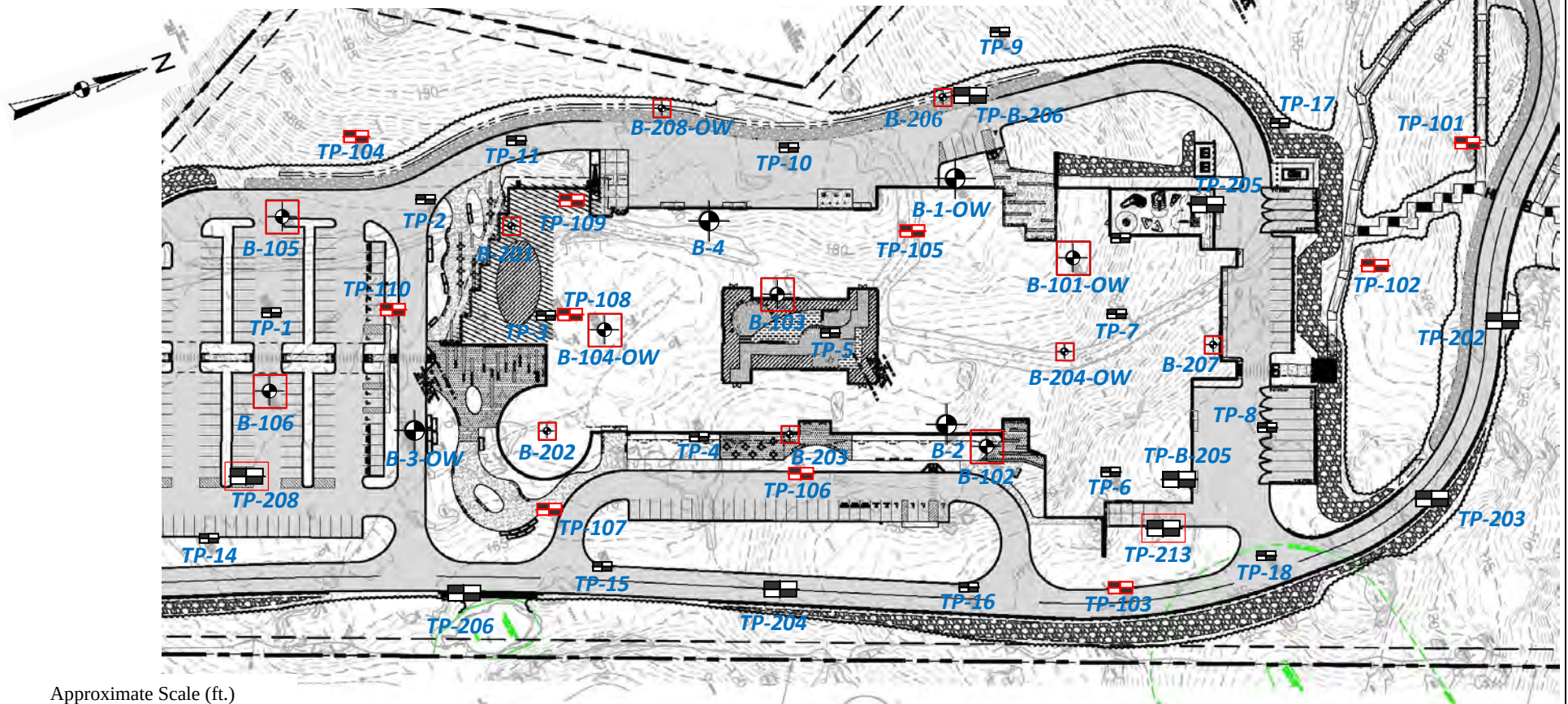
 Approximate location of boring advanced by NDS between April 26, 2022, and May 11, 2022, and observed by LGCI.

 Approximate location of test pit excavated by Saunders Construction on July 26th, 2022, and observed by LGCI.

 Approximate location of test pit excavated by NDS between December 3 and 4, 2020, and observed by LGCI.

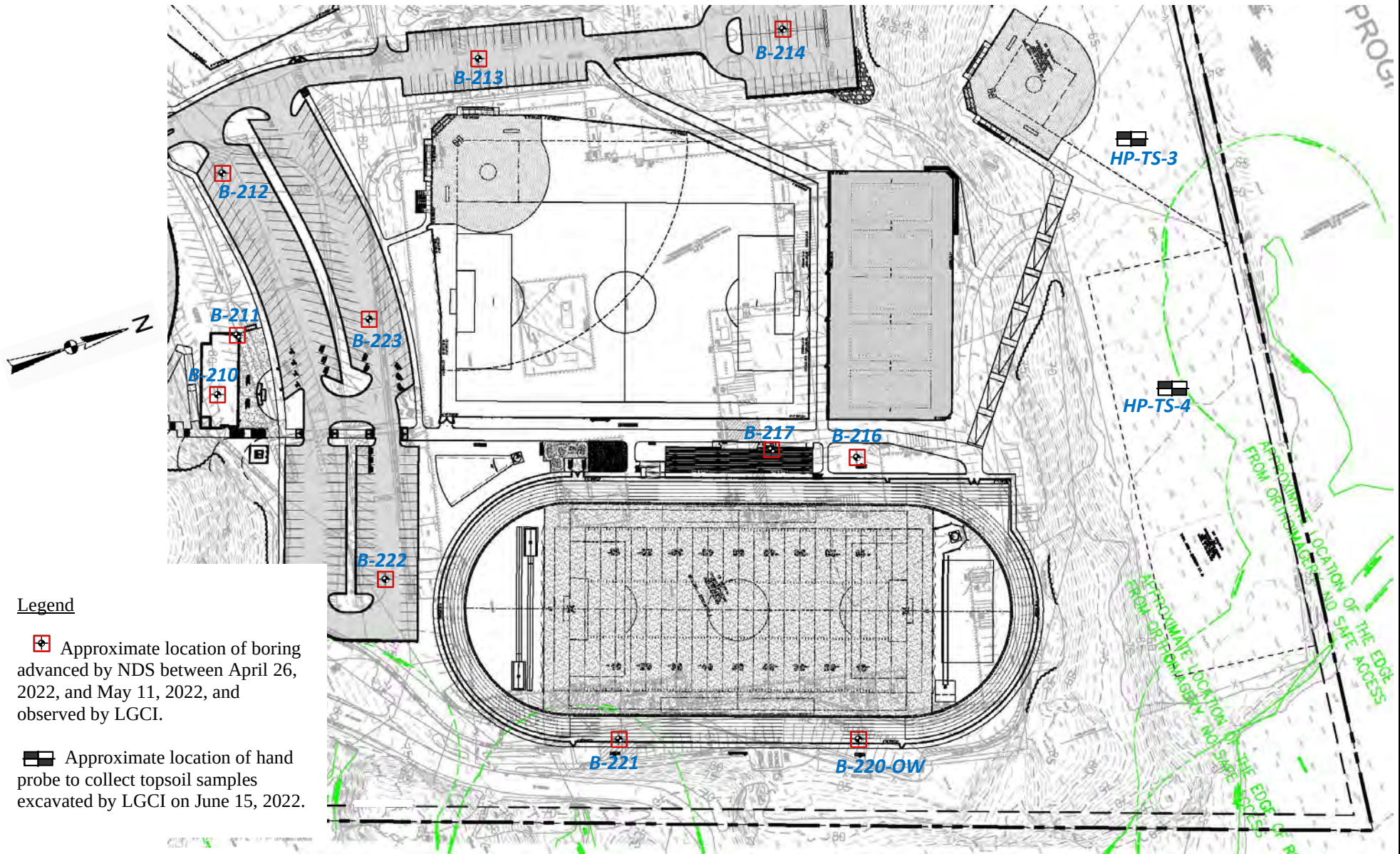
 Approximate location of test pit excavated by NDS between April 19 and 20, 2021, and observed by LGCI.

 Approximate location of test pit excavated by NDS between April 26 and 27, 2022, and observed by LGCI.



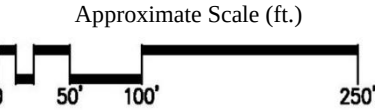
Note
Figure based on untitled drawing provided to LGCI by Warner Larson via e-mail on April 21, 2022.

Client: Drummey Rosane Anderson, Inc.	Project: Proposed Northeast Metro Regional Vocational Technical High School	Figure 3B –Test Pit and Boring Location Plan for Proposed Building	
 LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Wakefield, MA	LGCI Project No.: 2025	Date: Nov. 2022



Legend

- Approximate location of boring advanced by NDS between April 26, 2022, and May 11, 2022, and observed by LGCI.
- Approximate location of hand probe to collect topsoil samples excavated by LGCI on June 15, 2022.



Note
Figure based on untitled drawing provided to LGCI by Warner Larson via e-mail on April 21, 2022.

Client: Drummey Rosane Anderson, Inc.	Project: Proposed Northeast Metro Regional Vocational Technical High School	Figure 3C – Test Pit, Hand Probe, and Boring Location Plan for Prop. Athletic Fields	
 LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Wakefield, MA	LGCI Project No.: 2025	Date: Nov. 2022

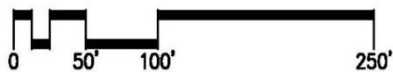
Legend

 Approximate location of hand probe to collect topsoil samples excavated by LGCI on June 15, 2022.

 Approximate location of test pit excavated by Saunders Construction of Reading, Massachusetts on September 8, 2022, and observed by LGCI.



Approximate Scale (ft.)



Note

Figure based on untitled drawing provided to LGCI by Warner Larson via e-mail on April 21, 2022.

Client:

Drummey Rosane
Anderson, Inc.



LGCI

Lahlaf Geotechnical Consulting, Inc.

Project:

Proposed Northeast Metro Regional
Vocational Technical High School

Project Location:

Wakefield, MA

Figure 3D – Exploration
Location Plan for Western
Baseball Field

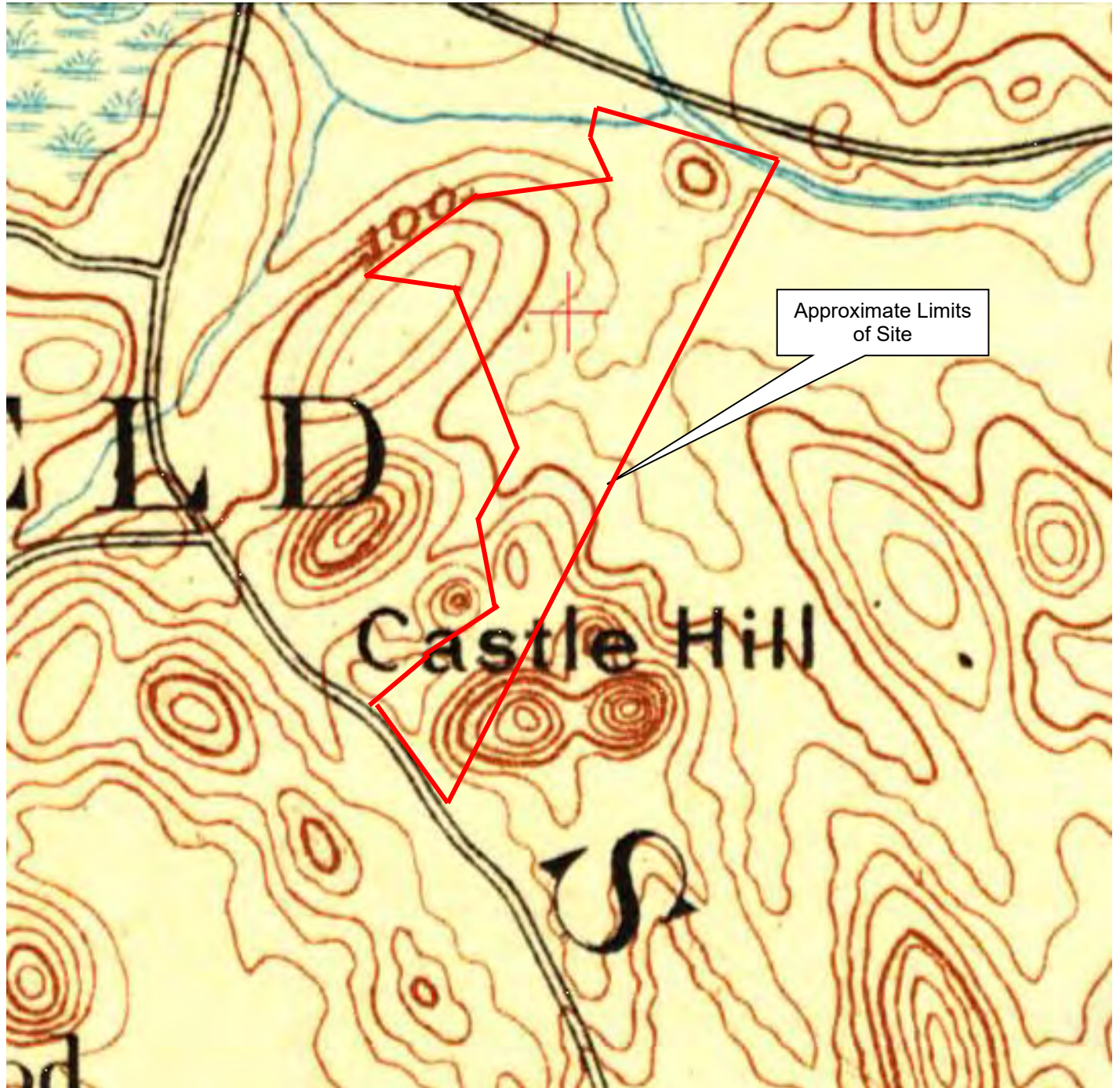
LGCI Project No.:

2025

Date:

Nov. 2022

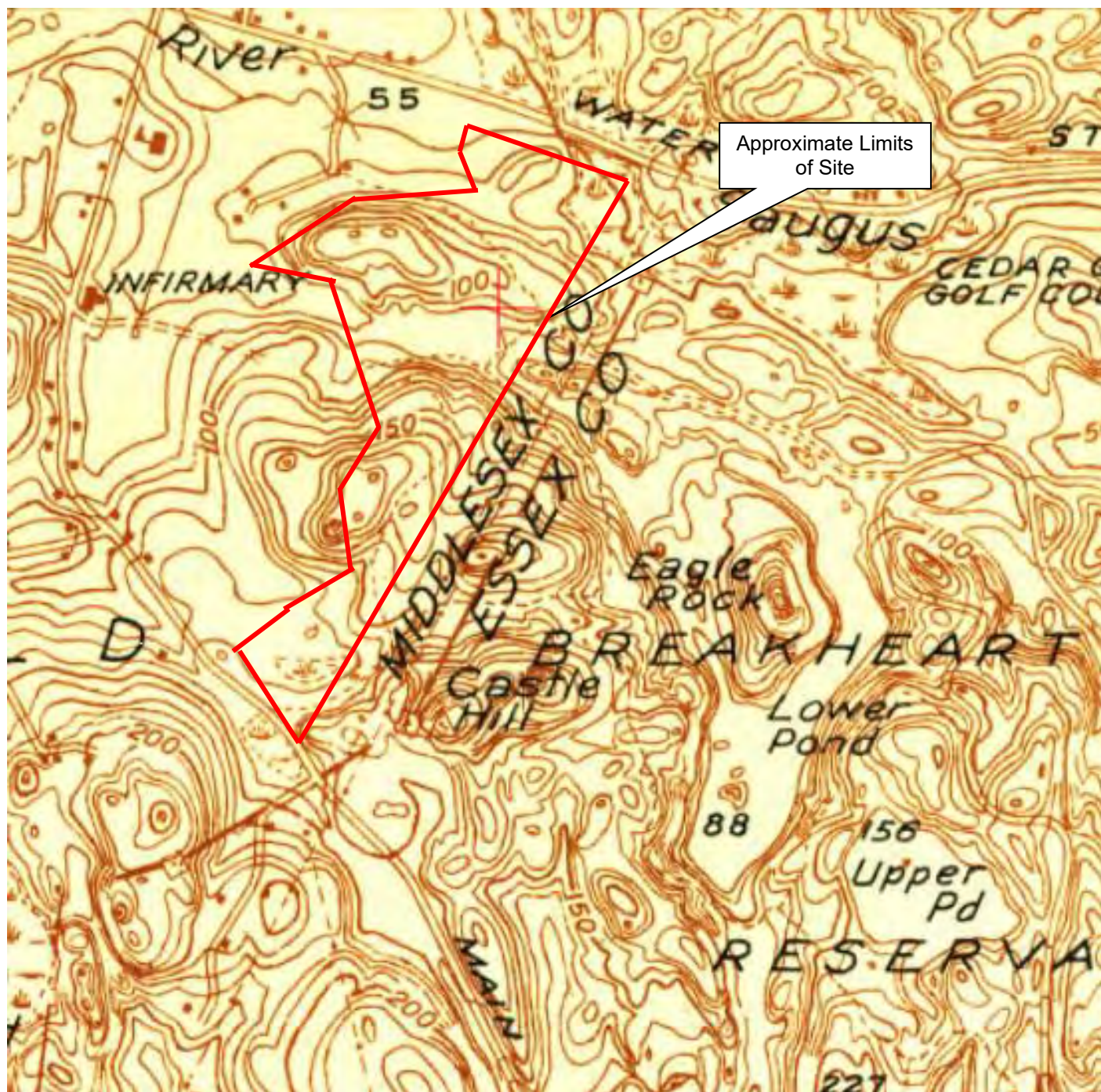
APPENDIX A – Historical Topo Maps



Contour Intervals: 20 feet

Figure based on USGS topographic map of Wakefield, MA obtained from <https://livingatlas.arcgis.com/topoexplorer/index.html>

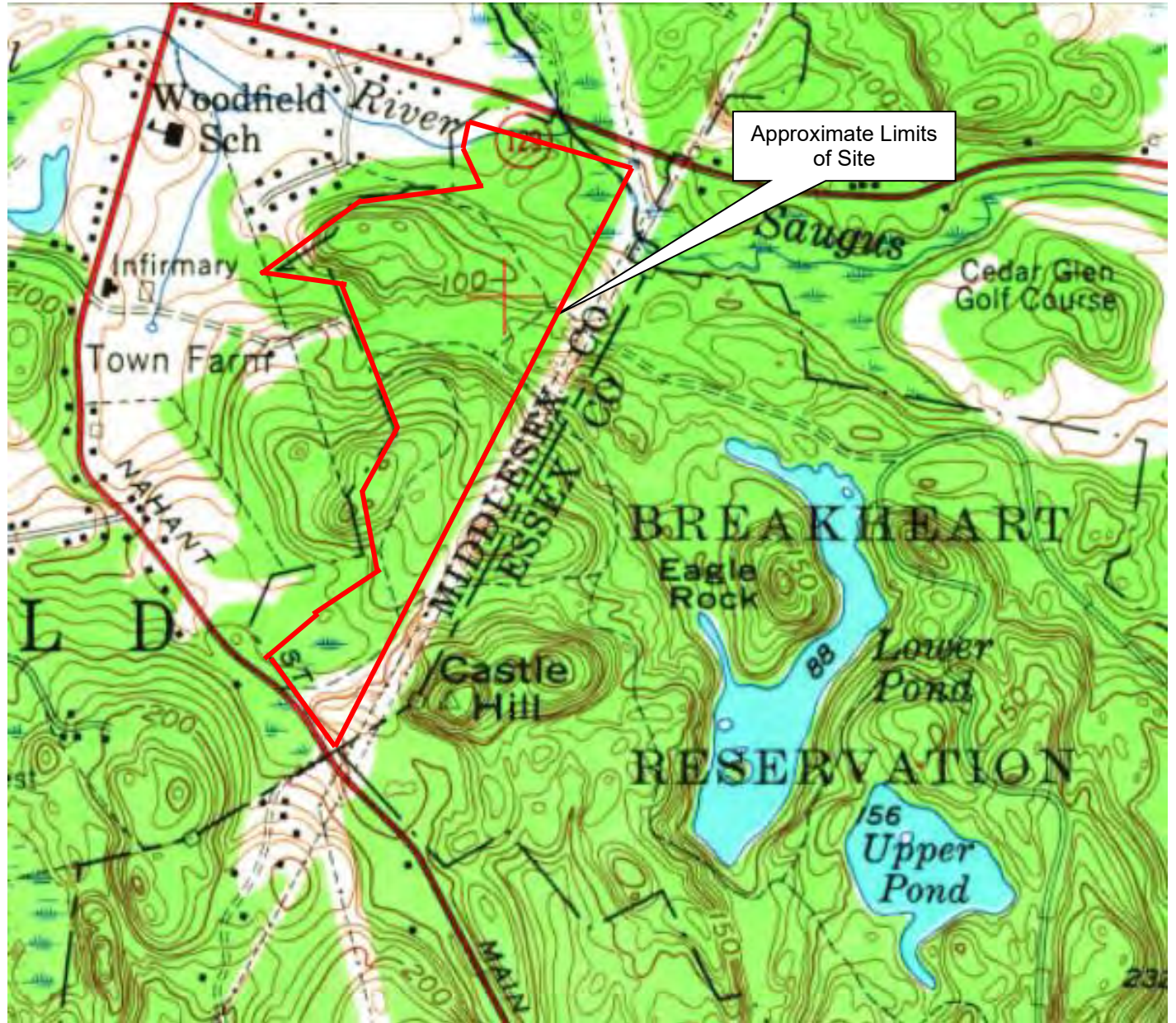
Client: Drummey Rosane Anderson, Inc.	Project: Proposed Northeast Metropolitan Regional Vocational High School	Figure A1 – 1893 Historical Topo Map	
 LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Wakefield, MA	LGCI Project No.: 2025	Date: June 2021



Contour Intervals: 10 feet

Figure based on USGS topographic map of Wakefield, MA obtained from <https://livingatlas.arcgis.com/topoexplorer/index.html>

Client: Drummey Rosane Anderson, Inc.	Project: Proposed Northeast Metropolitan Regional Vocational High School	Figure A2 – 1943 Historical Topo Map	
 LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Wakefield, MA	LGCI Project No.: 2025	Date: June 2021



Contour Intervals: 10 feet

Figure based on USGS topographic map of Wakefield, MA obtained from <https://livingatlas.arcgis.com/topoexplorer/index.html>

Client:

Drummey Rosane Anderson,
Inc.

Project:

Proposed Northeast Metropolitan
Regional Vocational High School

Figure A3 – 1956
Historical Topo Map



LGCI

Lahlef Geotechnical Consulting, Inc.

Project Location:

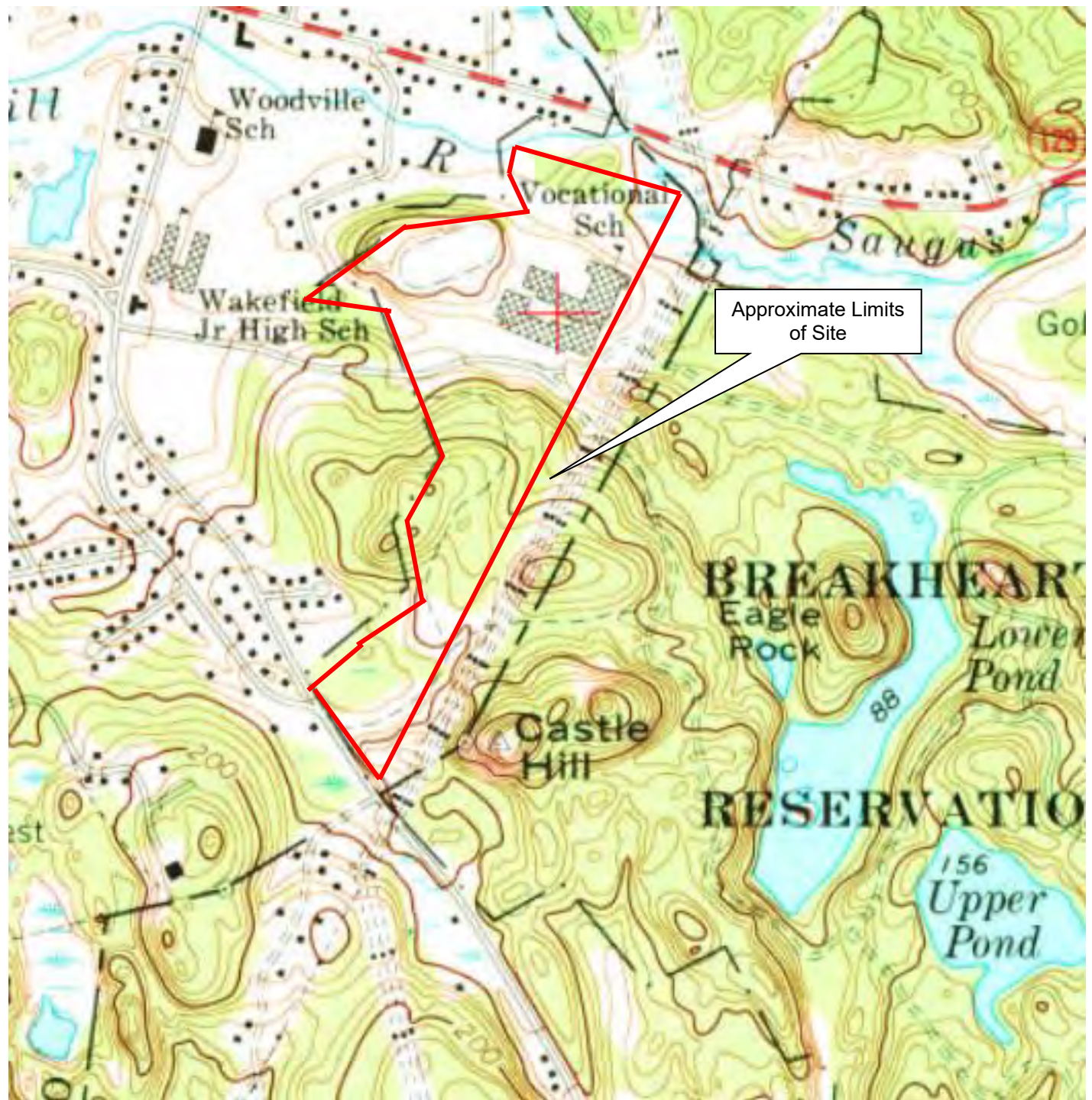
Wakefield, MA

LGCI Project No.:

2025

Date:

June 2021



Contour Intervals: 10 feet

Figure based on USGS topographic map of Wakefield, MA obtained from <https://livingatlas.arcgis.com/topoexplorer/index.html>

Client: Drummey Rosane Anderson, Inc.	Project: Proposed Northeast Metropolitan Regional Vocational High School	Figure A4 – 1971 Historical Topo Map	
 LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Wakefield, MA	LGCI Project No.: 2025	Date: June 2021



Contour Intervals: 3 meters

Figure based on USGS topographic map of Wakefield, MA obtained from <https://livingatlas.arcgis.com/topoexplorer/index.html>

Client:

Drummey Rosane Anderson,
Inc.

Project:

Proposed Northeast Metropolitan
Regional Vocational High School

Figure A5 – 1985
Historical Topo Map



LGCI

Lahlaf Geotechnical Consulting, Inc.

Project Location:

Wakefield, MA

LGCI Project No.:

2025

Date:

June 2021

APPENDIX B – Soil Survey Report and Map



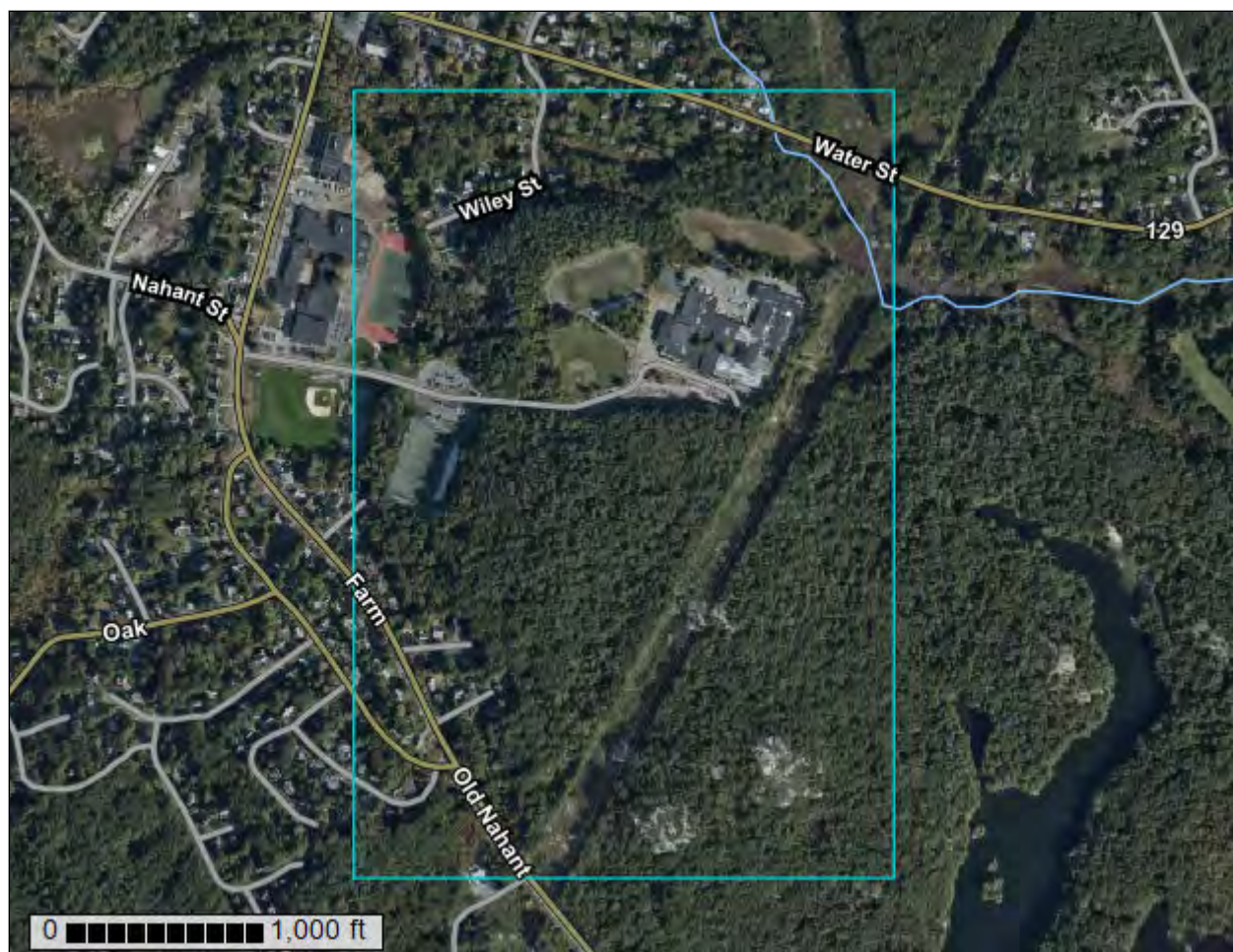
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Essex County, Massachusetts, Southern Part; and Middlesex County, Massachusetts



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



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MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,800 to 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Southern Part
Survey Area Data: Version 17, Jun 9, 2020

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

MAP LEGEND

MAP INFORMATION

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 13, 2019—Oct 5, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
102C	Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes	13.4	5.3%
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	1.2	0.5%
105D	Rock outcrop-Hollis complex, 3 to 25 percent slopes	39.7	15.7%
242B	Hinckley gravelly fine sandy loam, 3 to 8 percent slopes	1.7	0.7%
616A	Fluvaquents, frequently flooded, 0 to 3 percent slopes	4.7	1.8%
Subtotals for Soil Survey Area		60.6	24.0%
Totals for Area of Interest		252.2	100.0%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	4.6	1.8%
52A	Freetown muck, 0 to 1 percent slopes	10.0	4.0%
53A	Freetown muck, ponded, 0 to 1 percent slopes	3.8	1.5%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	6.8	2.7%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	8.3	3.3%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	3.0	1.2%
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	4.6	1.8%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes	6.4	2.6%
105E	Rock outcrop-Hollis complex, 3 to 35 percent slopes	58.2	23.1%
253B	Hinckley loamy sand, 3 to 8 percent slopes	2.9	1.2%
602	Urban land	11.7	4.6%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	39.8	15.8%

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Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
655	Udorthents, wet substratum	15.7	6.2%
656	Udorthents-Urban land complex	15.7	6.2%
Subtotals for Soil Survey Area		191.6	76.0%
Totals for Area of Interest		252.2	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Essex County, Massachusetts, Southern Part

102C—Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w69g
Elevation: 0 to 1,540 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Chatfield, extremely stony, and similar soils: 39 percent
Hollis, extremely stony, and similar soils: 26 percent
Rock outcrop: 17 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chatfield, Extremely Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 2 inches: fine sandy loam
Bw - 2 to 30 inches: gravelly fine sandy loam
2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 41 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands

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Hydric soil rating: No

Description of Hollis, Extremely Stony

Setting

Landform: Ridges, hills

Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Nose slope, crest, side slope

Down-slope shape: Convex

Across-slope shape: Linear, convex

Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material

A - 2 to 7 inches: gravelly fine sandy loam

Bw - 7 to 16 inches: gravelly fine sandy loam

2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 8 to 23 inches to lithic bedrock

Drainage class: Somewhat excessively drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D

Ecological site: F144AY033MA - Shallow Dry Till Uplands

Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Igneous and metamorphic rock

Properties and qualities

Slope: 0 to 15 percent

Depth to restrictive feature: 0 inches to lithic bedrock

Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8

Hydrologic Soil Group: D

Hydric soil rating: No

Minor Components

Charlton, extremely stony

Percent of map unit: 12 percent

Landform: Hills, ridges

Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Crest, side slope

Down-slope shape: Linear, convex

Across-slope shape: Convex

Hydric soil rating: No

Sutton, extremely stony

Percent of map unit: 3 percent

Landform: Ground moraines, hills

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave

Across-slope shape: Linear

Hydric soil rating: No

Paxton, extremely stony

Percent of map unit: 2 percent

Landform: Drumlins, hills, ground moraines

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex, linear

Across-slope shape: Linear, convex

Hydric soil rating: No

Leicester, extremely stony

Percent of map unit: 1 percent

Landform: Depressions, drainageways, hills, ground moraines

Landform position (two-dimensional): Toeslope, footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Linear, concave

Across-slope shape: Concave

Hydric soil rating: Yes

102E—Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2w69h

Elevation: 0 to 1,540 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Chatfield, extremely stony, and similar soils: 35 percent

Hollis, extremely stony, and similar soils: 30 percent

Rock outcrop: 20 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chatfield, Extremely Stony

Setting

Landform: Ridges, hills

Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Crest, side slope, nose slope

Down-slope shape: Convex

Across-slope shape: Convex, linear

Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material

A - 1 to 2 inches: fine sandy loam

Bw - 2 to 30 inches: gravelly fine sandy loam

2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 20 to 41 inches to lithic bedrock

Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: B

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Description of Hollis, Extremely Stony

Setting

Landform: Hills, ridges

Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Side slope, nose slope, crest

Down-slope shape: Convex

Across-slope shape: Linear, convex

Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

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Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills, ridges
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Charlton, extremely stony

Percent of map unit: 7 percent
Landform: Hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope

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Down-slope shape: Linear, convex

Across-slope shape: Convex

Hydric soil rating: No

Leicester, extremely stony

Percent of map unit: 4 percent

Landform: Depressions, drainageways, hills, ground moraines

Landform position (two-dimensional): Toeslope, footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Linear, concave

Across-slope shape: Concave

Hydric soil rating: Yes

Sutton, extremely stony

Percent of map unit: 2 percent

Landform: Hills, ground moraines

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave

Across-slope shape: Linear

Hydric soil rating: No

Paxton, extremely stony

Percent of map unit: 2 percent

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear, convex

Across-slope shape: Convex, linear

Hydric soil rating: No

105D—Rock outcrop-Hollis complex, 3 to 25 percent slopes

Map Unit Setting

National map unit symbol: vkcq

Elevation: 0 to 280 feet

Mean annual precipitation: 45 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Rock outcrop: 65 percent

Hollis and similar soils: 20 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Outcrop

Setting

Parent material: Granite

Properties and qualities

Slope: 25 to 35 percent

Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8s

Hydric soil rating: Unranked

Description of Hollis

Setting

Landform: Ridges, hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Friable, shallow loamy basal till derived from granite and gneiss over granite

Typical profile

O - 0 to 2 inches: muck

H2 - 2 to 4 inches: fine sandy loam

H3 - 4 to 17 inches: gravelly fine sandy loam

H4 - 17 to 19 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 35 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 10 to 20 inches to lithic bedrock

Drainage class: Somewhat excessively drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D

Ecological site: F144AY033MA - Shallow Dry Till Uplands

Hydric soil rating: No

Minor Components

Chatfield

Percent of map unit: 15 percent

Hydric soil rating: No

242B—Hinckley gravelly fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vk5l

Elevation: 0 to 1,000 feet

Mean annual precipitation: 45 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Flood plains

Landform position (two-dimensional): Shoulder

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Friable sandy and gravelly glaciofluvial deposits derived from granite and gneiss

Typical profile

H1 - 0 to 8 inches: gravelly fine sandy loam

H2 - 8 to 17 inches: gravelly loamy sand

H3 - 17 to 60 inches: stratified cobbly coarse sand to very gravelly loamy fine sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: A

Ecological site: F144AY022MA - Dry Outwash

Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 10 percent
Hydric soil rating: No

Sudbury

Percent of map unit: 3 percent
Hydric soil rating: No

Wareham

Percent of map unit: 1 percent
Landform: Terraces
Hydric soil rating: Yes

Swansea

Percent of map unit: 1 percent
Landform: Bogs
Hydric soil rating: Yes

616A—Fluvaquents, frequently flooded, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vk56
Elevation: 0 to 100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Fluvaquents and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents

Setting

Landform: Alluvial flats
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy alluvium over friable sandy eolian deposits

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Depth to water table: About 0 to 12 inches
Frequency of flooding: NoneFrequent

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Frequency of ponding: None

Minor Components

Swansea

Percent of map unit: 10 percent

Landform: Bogs

Hydric soil rating: Yes

Unnamed soils

Percent of map unit: 5 percent

Hydric soil rating: No

Middlesex County, Massachusetts

51A—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2
Elevation: 0 to 1,140 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Swansea and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Swansea

Setting

Landform: Swamps, bogs
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck
Oa2 - 24 to 34 inches: muck
Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Bogs, swamps

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Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Depressions, depressions, bogs, marshes, kettles, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Custom Soil Resource Report

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 5 percent
Landform: Kettles, depressions, depressions, marshes, swamps, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

53A—Freetown muck, ponded, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2qc
Elevation: 0 to 1,140 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown, ponded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown, Ponded

Setting

Landform: Marshes, kettles, swamps, bogs, depressions, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Whitman, ponded

Percent of map unit: 5 percent
Landform: Depressions on ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea, ponded

Percent of map unit: 5 percent
Landform: Kettles, depressions, depressions, marshes, swamps, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

71B—Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w69c
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Ridgebury, extremely stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ridgebury, Extremely Stony

Setting

Landform: Depressions, drumlins, drainageways, hills, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope

Custom Soil Resource Report

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material

A - 1 to 6 inches: fine sandy loam

Bw - 6 to 10 inches: sandy loam

Bg - 10 to 19 inches: gravelly sandy loam

Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 15 to 35 inches to densic material

Drainage class: Poorly drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: About 0 to 6 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D

Ecological site: F144AY009CT - Wet Till Depressions

Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony

Percent of map unit: 10 percent

Landform: Drumlins, hills, ground moraines

Landform position (two-dimensional): Footslope, summit, backslope

Landform position (three-dimensional): Crest, side slope

Down-slope shape: Convex

Across-slope shape: Linear

Hydric soil rating: No

Whitman, extremely stony

Percent of map unit: 8 percent

Landform: Depressions

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Paxton, extremely stony

Percent of map unit: 2 percent

Landform: Drumlins, hills, ground moraines

Landform position (two-dimensional): Shoulder, summit, backslope

Landform position (three-dimensional): Crest, side slope

Down-slope shape: Linear, convex

Custom Soil Resource Report

Across-slope shape: Convex, linear
Hydric soil rating: No

103B—Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 98yc
Elevation: 0 to 1,490 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 50 percent
Hollis and similar soils: 25 percent
Rock outcrop: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Ground moraines, drumlins
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 22 inches: sandy loam
H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Custom Soil Resource Report

Hydrologic Soil Group: A

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Description of Hollis

Setting

Landform: Ridges, hills

Landform position (two-dimensional): Shoulder, summit

Landform position (three-dimensional): Crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam

H2 - 2 to 14 inches: fine sandy loam

H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 8 to 20 inches to lithic bedrock

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: D

Ecological site: F144AY033MA - Shallow Dry Till Uplands

Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Ledges

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Head slope

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Granite and gneiss

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8s

Minor Components

Canton

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Head slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, toeslope, summit
Landform position (three-dimensional): Head slope, base slope, nose slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Scituate

Percent of map unit: 2 percent
Landform: Hillslopes, depressions
Landform position (two-dimensional): Toeslope, summit
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Narragansett

Percent of map unit: 2 percent
Landform: Ridges, hills
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent

Montauk

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Head slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

103C—Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2wzp1

Elevation: 0 to 1,390 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Charlton, extremely stony, and similar soils: 50 percent

Hollis, extremely stony, and similar soils: 20 percent

Rock outcrop: 10 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Extremely Stony

Setting

Landform: Hills, ridges

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear, convex

Across-slope shape: Convex

Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material

A - 2 to 4 inches: fine sandy loam

Bw - 4 to 27 inches: gravelly fine sandy loam

C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.14 to 14.17 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Hollis, Extremely Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills, ridges
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Custom Soil Resource Report

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8

Hydrologic Soil Group: D

Hydric soil rating: No

Minor Components

Woodbridge, extremely stony

Percent of map unit: 8 percent

Landform: Drumlins, hills, ground moraines

Landform position (two-dimensional): Backslope, footslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Linear

Hydric soil rating: No

Canton, extremely stony

Percent of map unit: 5 percent

Landform: Moraines, ridges, hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Chatfield, extremely stony

Percent of map unit: 5 percent

Landform: Hills, ridges

Landform position (two-dimensional): Summit, backslope, shoulder

Landform position (three-dimensional): Crest, side slope, nose slope

Down-slope shape: Convex

Across-slope shape: Linear, convex

Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 2 percent

Landform: Hills, ground moraines, depressions, drumlins, drainageways

Landform position (two-dimensional): Toeslope, footslope

Landform position (three-dimensional): Base slope, head slope

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

104C—Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w69p

Elevation: 0 to 1,270 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Hollis, extremely stony, and similar soils: 35 percent

Charlton, extremely stony, and similar soils: 25 percent

Rock outcrop: 25 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis, Extremely Stony

Setting

Landform: Hills, ridges

Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Crest, side slope, nose slope

Down-slope shape: Convex

Across-slope shape: Linear, convex

Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material

A - 2 to 7 inches: gravelly fine sandy loam

Bw - 7 to 16 inches: gravelly fine sandy loam

2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 8 to 23 inches to lithic bedrock

Drainage class: Somewhat excessively drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Charlton, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills, ridges
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Custom Soil Resource Report

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8

Hydrologic Soil Group: D

Hydric soil rating: No

Minor Components

Canton, extremely stony

Percent of map unit: 7 percent

Landform: Hills, moraines, ridges

Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Chatfield, extremely stony

Percent of map unit: 6 percent

Landform: Hills, ridges

Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Crest, side slope, nose slope

Down-slope shape: Convex

Across-slope shape: Linear, convex

Hydric soil rating: No

Montauk, extremely stony

Percent of map unit: 1 percent

Landform: Recessionial moraines, hills, drumlins, ground moraines

Landform position (two-dimensional): Summit, backslope, shoulder

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Linear, convex

Across-slope shape: Convex

Hydric soil rating: No

Scituate, extremely stony

Percent of map unit: 1 percent

Landform: Drumlins, hills, ground moraines

Landform position (two-dimensional): Footslope, backslope, summit

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Linear, convex

Across-slope shape: Convex

Hydric soil rating: No

104D—Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 98yh
Elevation: 0 to 1,530 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 35 percent
Rock outcrop: 30 percent
Charlton and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Crest, head slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Custom Soil Resource Report

Hydrologic Soil Group: D

Ecological site: F144AY033MA - Shallow Dry Till Uplands

Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Granite and gneiss

Properties and qualities

Slope: 15 to 25 percent

Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8s

Description of Charlton

Setting

Landform: Hills

Landform position (two-dimensional): Shoulder, summit

Landform position (three-dimensional): Side slope, base slope

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam

H2 - 5 to 22 inches: sandy loam

H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 15 to 25 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Minor Components

Canton

Percent of map unit: 10 percent

Landform: Hills

Landform position (two-dimensional): Shoulder, summit

Custom Soil Resource Report

Landform position (three-dimensional): Head slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Montauk

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Nose slope, head slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 2 percent

105E—Rock outcrop-Hollis complex, 3 to 35 percent slopes

Map Unit Setting

National map unit symbol: 98yj
Elevation: 0 to 2,100 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Rock outcrop: 50 percent
Hollis and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Outcrop

Setting

Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Granite and gneiss

Properties and qualities

Slope: 5 to 20 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified

Custom Soil Resource Report

Land capability classification (nonirrigated): 8s

Description of Hollis

Setting

Landform: Ridges, hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam

H2 - 2 to 14 inches: fine sandy loam

H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 35 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 8 to 20 inches to lithic bedrock

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: D

Ecological site: F144AY033MA - Shallow Dry Till Uplands

Hydric soil rating: No

Minor Components

Whitman

Percent of map unit: 3 percent

Landform: Depressions, drainageways

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Swansea

Percent of map unit: 1 percent

Landform: Bogs, depressions

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Dip

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Unnamed

Percent of map unit: 1 percent

253B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svm8

Elevation: 0 to 1,430 feet

Mean annual precipitation: 36 to 53 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 250 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash terraces, outwash deltas, outwash plains, eskers, moraines, kame terraces, kames

Landform position (two-dimensional): Summit, shoulder, backslope, footslope

Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread

Down-slope shape: Linear, convex, concave

Across-slope shape: Convex, linear, concave

Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material

A - 1 to 8 inches: loamy sand

Bw1 - 8 to 11 inches: gravelly loamy sand

Bw2 - 11 to 16 inches: gravelly loamy sand

BC - 16 to 19 inches: very gravelly loamy sand

C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water capacity: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: A

Ecological site: F144AY022MA - Dry Outwash

Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 8 percent

Landform: Moraines, outwash terraces, outwash deltas, kame terraces, outwash plains, kames, eskers

Landform position (two-dimensional): Summit, shoulder, backslope, footslope

Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread

Down-slope shape: Linear, convex, concave

Across-slope shape: Convex, linear, concave

Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent

Landform: Kame terraces, outwash plains, moraines, outwash terraces, outwash deltas

Landform position (two-dimensional): Backslope, footslope

Landform position (three-dimensional): Side slope, base slope, head slope, tread

Down-slope shape: Concave, linear

Across-slope shape: Linear, concave

Hydric soil rating: No

Agawam

Percent of map unit: 2 percent

Landform: Outwash deltas, kame terraces, outwash plains, kames, eskers, moraines, outwash terraces

Landform position (two-dimensional): Summit, shoulder, backslope, footslope

Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread

Down-slope shape: Linear, convex, concave

Across-slope shape: Convex, linear, concave

Hydric soil rating: No

602—Urban land

Map Unit Setting

National map unit symbol: 9950

Elevation: 0 to 3,000 feet

Mean annual precipitation: 32 to 50 inches

Mean annual air temperature: 45 to 50 degrees F

Frost-free period: 110 to 200 days

Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Excavated and filled land

Minor Components

Rock outcrop

Percent of map unit: 5 percent

Landform: Ledges

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Head slope

Down-slope shape: Concave

Across-slope shape: Concave

Udorthents, wet substratum

Percent of map unit: 5 percent

Hydric soil rating: No

Udorthents, loamy

Percent of map unit: 5 percent

Hydric soil rating: No

631C—Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky

Map Unit Setting

National map unit symbol: vr1g

Elevation: 0 to 1,000 feet

Mean annual precipitation: 32 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 110 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 45 percent

Urban land: 35 percent

Hollis and similar soils: 10 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Drumlins, ground moraines

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam

H2 - 5 to 22 inches: sandy loam

H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 15 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: A

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Excavated and filled land

Description of Hollis

Setting

Landform: Ridges, hillslopes

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam

H2 - 2 to 14 inches: fine sandy loam

H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Minor Components

Canton

Percent of map unit: 4 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Udorthents, loamy

Percent of map unit: 2 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 2 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Scituate

Percent of map unit: 1 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, summit
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Montauk

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Nose slope, head slope
Down-slope shape: Convex

Across-slope shape: Convex
Hydric soil rating: No

655—Udorthents, wet substratum

Map Unit Setting

National map unit symbol: vr1n
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, wet substratum, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Wet Substratum

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Urban land

Percent of map unit: 8 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Freetown

Percent of map unit: 4 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave

Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent

Landform: Bogs, depressions

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Dip

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

656—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 995k

Elevation: 0 to 3,000 feet

Mean annual precipitation: 32 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 110 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 45 percent

Urban land: 35 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 15 percent

Depth to restrictive feature: More than 80 inches

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Excavated and filled land

Minor Components

Canton

Percent of map unit: 10 percent

Landform: Hills

Landform position (two-dimensional): Backslope, toeslope

Landform position (three-dimensional): Side slope, base slope

Down-slope shape: Linear

Across-slope shape: Convex

Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent

Landform: Plains, terraces

Landform position (two-dimensional): Shoulder

Landform position (three-dimensional): Tread, rise

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

Paxton

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Backslope, summit

Landform position (three-dimensional): Head slope, side slope

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

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APPENDIX C – LGCI's Test Pit and Hand Probe Logs



TEST PIT LOG

TP-1
PAGE 1 OF 1

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

PROJECT LOCATION: Wakefield, MA

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Dave Edilberti

EXCAVATOR TYPE/MODEL: Komatsu PC 120

WEATHER: 40's / Sunny

TEST PIT DIMENSIONS: 13.0' x 4.5'

LOGGED BY: SD CHECKED BY: TG

▼ AT END OF EXCAVATION: 2.0 ft. / El. 154.2 ft.

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
		E		Topsoil	0 ft. - 0.7 ft.: Topsoil
	155.0	E		Subsoil	0.7 ft. - 3.5 ft.: Sandy SILT (ML), slightly plastic, 35-40% fine sand, 10-15% fine subrounded gravel, trace of organic soil, trace of roots, trace of wood, 5-10% boulders, brown, wet
2.5					
	152.5	E		Sand and Gravel	3.5 ft. - 9 ft.: Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 30-35% fine to coarse subrounded gravel, 15-20% cobbles, light brown, wet (natural)
5.0					
	150.0				
7.5		D	1		
	147.5				
					REMARK 1: Excavator refusal encountered on possible rock at depth of 9.0'. Bottom of test pit at 9.0 feet. Backfilled excavation with excavated material.

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

TP-2

PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 12/4/20 DATE COMPLETED: 12/4/20

TEST PIT LOCATION: Along western side of prop. building

COORDINATES: NA

SURFACE EL.: 165.0 ft. (see note 1) TOTAL DEPTH: 4.3 ft.

GROUNDWATER LEVELS:

▽ DURING EXCAVATION: -

▽ AT END OF EXCAVATION: 4.0 ft. / El. 161.0 ft.

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Dave Edilberti

EXCAVATOR TYPE/MODEL: Komatsu PC 120

WEATHER: 50's / Sunny

TEST PIT DIMENSIONS: 10.0' x 5.0'

LOGGED BY: TG

CHECKED BY: SD

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Topsoil	0.8	0 ft. - 0.8 ft.: Topsoil
		E		Subsoil	164.2	0.8 ft. - 3.5 ft.: SILT (ML), slightly plastic, 5-10% fine sand, trace of organic soil, trace of roots, 15-20% cobbles and boulders, brown, moist
2.5	162.5				3.5	
		M		Weathered Rock	4.3	3.5 ft. - 4.3 ft.: Well Graded GRAVEL with Silt (GW-GM), fine to coarse, subangular, 5-10% fines, 10-15% fine to coarse sand, wet (weathered rock)
		D	1			REMARK 1: Excavator refusal encountered on possible rock at depth of 4.3'. Bottom of test pit at 4.3 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M - Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



TEST PIT LOG

TP-3

PAGE 1 OF 1

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

PROJECT LOCATION: Wakefield, MA

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Dave Edilberti

EXCAVATOR TYPE/MODEL: Komatsu PC 120

WEATHER: 40's / Sunny

TEST PIT DIMENSIONS: 13.0' x 3.5'

▽ DURING EXCAVATION: -

LOGGED BY: SD CHECKED BY: TG

▼ AT END OF EXCAVATION: Not encountered

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
	180.0	E		Topsoil	0 ft. - 1 ft.: Topsoil
		D		Subsoil	1 ft. - 2 ft.: Silty SAND (SM), fine to medium, trace coarse, 30-35% fines, 10-15% coarse subrounded gravel, trace of organic soil, trace of roots, trace of wood, brown, wet
			1		REMARK 1: Excavator refusal encountered on possible rock at depth of 2.0'. Bottom of test pit at 2.0 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M - Moderate, D = Difficult, V = Very Difficult

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.LGCI PROJECT NUMBER: 2025PROJECT LOCATION: Wakefield, MADATE STARTED: 12/3/20 DATE COMPLETED: 12/3/20TEST PIT LOCATION: Along SE side of prop. buildingCOORDINATES: NASURFACE EL.: 171.3 ft. (see note 1) TOTAL DEPTH: 1.5 ft.**GROUNDWATER LEVELS:**▽ DURING EXCAVATION: -▼ AT END OF EXCAVATION: Not encounteredEXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.EXCAVATION FOREMAN: Dave EdilbertiEXCAVATOR TYPE/MODEL: Komatsu PC 120WEATHER: 40's / SunnyTEST PIT DIMENSIONS: 12.0' x 4.0'LOGGED BY: SD CHECKED BY: TG

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Topsoil	0.5	0 ft. - 0.5 ft.: Topsoil
	170.0	D		Subsoil	1.5	0.5 ft. - 1.5 ft.: Silty SAND (SM), fine to medium, trace coarse, 30-35% fines, ~10% fine to coarse subrounded gravel, trace of organic soil, trace of roots, 15-20% cobbles, brown, moist
REMARK 1: Excavator refusal encountered on possible rock at depth of 1.5'. Bottom of test pit at 1.5 feet. Backfilled excavation with excavated material.						

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

TP-5

PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 12/3/20 **DATE COMPLETED:** 12/3/20

TEST PIT LOCATION: Within footprint of prop. building

COORDINATES: NA

SURFACE EL.: 173.2 ft. (see note 1) **TOTAL DEPTH:** 5 ft.

GROUNDWATER LEVELS:

▽ **DURING EXCAVATION:** -

▽ **AT END OF EXCAVATION:** Not encountered

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Dave Edilberti

EXCAVATOR TYPE/MODEL: Komatsu PC 120

WEATHER: 40's / Sunny

TEST PIT DIMENSIONS: 11.0' x 6.0'

LOGGED BY: SD **CHECKED BY:** TG

Depth (ft)	El. (ft)	Excavation Effort	Strata	Material Description
		E	Topsoil	0 ft. - 0.5 ft.: Topsoil
	172.5			
		E	Subsoil	0.5 ft. - 3.5 ft.: Silty SAND with Gravel (SM), fine to coarse, 35-40% fines, 15-20% fine to coarse subrounded gravel, trace of organic soil, trace of roots, 25-30% cobbles and boulders, light brown, wet
2.5				
	170.0			
		D	Sand and Gravel	3.5 ft. - 5 ft.: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 10-15% fines, 30-35% fine to coarse subrounded gravel, 45-50% cobbles and boulders, gray, wet
5.0				
REMARK 1: Excavator refusal encountered on possible rock at depth of 5.0'. Bottom of test pit at 5.0 feet. Backfilled excavation with excavated material.				

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



PAGE 1 OF 1

PROJECT LOCATION: Wakefield, MA

▼ AT END OF EXCAVATION: Not encountered

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



TEST PIT LOG

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PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

PROJECT LOCATION: Wakefield, MA

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Dave Edilberti

EXCAVATOR TYPE/MODEL: Komatsu PC 120

WEATHER: 40's / Sunny

TEST PIT DIMENSIONS: 11.0' x 5.0'

▽ DURING EXCAVATION: -

LOGGED BY: SD CHECKED BY: TG

▼ AT END OF EXCAVATION: Not encountered

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
	157.5	E			0 ft. - 2 ft.: Topsoil
		D			
			1		2.0 REMARK 1: Excavator refusal encountered on possible rock at depth of 2.0'. Bottom of test pit at 2.0 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M - Moderate, D = Difficult, V = Very Difficult

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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Fax: (978) 330-5056**TEST PIT LOG****TP-8**

PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.**PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.**LGCI PROJECT NUMBER:** 2025**PROJECT LOCATION:** Wakefield, MA**DATE STARTED:** 12/3/20**DATE COMPLETED:** 12/3/20**TEST PIT LOCATION:** Within prop. parking lot north of prop. building**COORDINATES:** NA**SURFACE EL.:** 130.0 ft. (see note 1) **TOTAL DEPTH:** 9 ft.**GROUNDWATER LEVELS:**▽ **DURING EXCAVATION:** -▽ **AT END OF EXCAVATION:** 2.0 ft. / El. 128.0 ft.**EXCAVATION SUBCONTRACTOR:** Northern Drill Service, Inc.**EXCAVATION FOREMAN:** Dave Edilberti**EXCAVATOR TYPE/MODEL:** Komatsu PC 120**WEATHER:** 40's / Sunny**TEST PIT DIMENSIONS:** 8.5' x 4.5'**LOGGED BY:** SD**CHECKED BY:** TG

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
		E		Topsoil	0 ft. - 1 ft.: Topsoil
		E		Subsoil	1 ft. - 3 ft.: Silty SAND with Gravel (SM), fine to medium, trace coarse, ~30% fines, 15-20% fine to coarse subrounded gravel, trace of organic soil, trace of roots, light brown, wet
2.5	127.5				
		E			3 ft. - 9 ft.: Silty SAND with Gravel (SM), fine to coarse, 20-25% fines, 15-20% fine to coarse subrounded gravel, gray, wet
5.0	125.0				
		M			
7.5	122.5				
		D			
			1		REMARK 1: Excavator refusal encountered on cobbles and boulders at depth of 9.0' (possible weathered rock). Bottom of test pit at 9.0 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 12/4/20 **DATE COMPLETED:** 12/4/20

TEST PIT LOCATION: Near NW corner of prop. building

COORDINATES: NA

SURFACE EL.: 162.9 ft. (see note 1) **TOTAL DEPTH:** 6.2 ft.

GROUNDWATER LEVELS:

▽ **DURING EXCAVATION:** -

▽ **AT END OF EXCAVATION:** 3.6 ft. / El. 159.3 ft.

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Dave Edilberti

EXCAVATOR TYPE/MODEL: Komatsu PC 120

WEATHER: 50's / Sunny

TEST PIT DIMENSIONS: 13.0' x 4.0'

LOGGED BY: TG

CHECKED BY: SD

Depth (ft)	El. (ft)	Excavation Effort	Strata	Material Description
	162.5	E	Topsoil	0 ft. - 0.4 ft.: Topsoil
		E	Subsoil	0.4 ft. - 1.9 ft.: Silty SAND (SM), fine to medium, 35-40% fines, 5-10% fine to coarse subrounded gravel, trace of organic soil, trace of roots, brown, moist
2.5	160.0	E	Sand and Gravel	1.9 ft. - 6.2 ft.: Silty SAND with Gravel (SM), fine to coarse, 20-25% fines, 20-25% fine to coarse subrounded gravel, 5-10% cobbles and boulders, gray, moist
5.0	157.5	M		
		D		
				REMARK 1: Excavator refusal encountered on cobbles and boulders at depths ranging between 4.0' and 6.2' (possible weathered rock). Bottom of test pit at 6.2 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.1.



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TEST PIT LOG

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 12/4/20 DATE COMPLETED: 12/4/20

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

TEST PIT LOCATION: West of prop. building

EXCAVATION FOREMAN: Dave Edilberti

COORDINATES: NA

EXCAVATOR TYPE/MODEL: Komatsu PC 120

SURFACE EL.: 187.9 ft. (see note 1) TOTAL DEPTH: 2.7 ft.

WEATHER: 50's / Sunny

GROUNDWATER LEVELS:

TEST PIT DIMENSIONS: 14.0' x 4.0'

▽ DURING EXCAVATION: -

LOGGED BY: TG CHECKED BY: SD

▼ AT END OF EXCAVATION: Not encountered

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
	187.5	E		Topsoil	0.3	0 ft. - 0.3 ft.: Topsoil
		E		Subsoil	187.6	0.3 ft. - 2.1 ft.: Silty SAND (SM), fine to medium, 35-40% fines, trace of organic soil, trace of roots, brown, moist
2.5		D	1	Sand and Gravel	2.1	2.1 ft. - 2.7 ft.: Silty SAND with Gravel (SM), fine to coarse, 25-30% fines, 20-25% fine to coarse subrounded to subangular gravel, trace of roots, gray, moist
					2.7	REMARK 1: Excavator refusal encountered on possible rock at depth of 2.7'. Bottom of test pit at 2.7 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 12/4/20 DATE COMPLETED: 12/4/20

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

TEST PIT LOCATION: West of prop. building

EXCAVATION FOREMAN: Dave Edilberti

COORDINATES: NA

EXCAVATOR TYPE/MODEL: Komatsu PC 120

SURFACE EL.: 181.1 ft. (see note 1) TOTAL DEPTH: 3.2 ft.

WEATHER: 50's / Sunny

GROUNDWATER LEVELS:

TEST PIT DIMENSIONS: 9.0' x 5.0'

▽ DURING EXCAVATION: -

LOGGED BY: TG CHECKED BY: SD

▽ AT END OF EXCAVATION: Not encountered

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Topsoil	0.5	0 ft. - 0.5 ft.: Topsoil
	180.0	E		Subsoil	180.6	0.5 ft. - 2 ft.: Silty SAND (SM), fine to medium, 35-40% fines, trace of organic soil, trace of roots, 20-25% cobbles and boulders, brown, moist
2.5		M	1	Weathered Rock	2.0 179.1	2 ft. - 3.2 ft.: Silty GRAVEL with Sand (GM), fine to coarse, subangular to angular, 15-20% fines, 15-20% fine to coarse sand, trace of roots, moist (weathered rock) REMARK 1: Encountered two boulders about 2.0' x 1.0'.
		D	2		3.2	REMARK 2: Excavator refusal encountered on possible rock at depth of 3.2'. Bottom of test pit at 3.2 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M - Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.**PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.**LGCI PROJECT NUMBER:** 2025**PROJECT LOCATION:** Wakefield, MA**DATE STARTED:** 12/3/20**DATE COMPLETED:** 12/3/20**TEST PIT LOCATION:** South of prop. building**COORDINATES:** NA**SURFACE EL.:** 136.0 ft. (see note 1) **TOTAL DEPTH:** 7 ft.**GROUNDWATER LEVELS:**▽ **DURING EXCAVATION:** -▽ **AT END OF EXCAVATION:** Not encountered**EXCAVATION SUBCONTRACTOR:** Northern Drill Service, Inc.**EXCAVATION FOREMAN:** Dave Edilberti**EXCAVATOR TYPE/MODEL:** Komatsu PC 120**WEATHER:** 40's / Sunny**TEST PIT DIMENSIONS:** 13.5' x 5.0'**LOGGED BY:** SD**CHECKED BY:** TG

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El. (ft.)	Material Description
		E		Topsoil	0 ft. - 1 ft.:	Topsoil
135.0					1.0	
		E		Subsoil	1 ft. - 4 ft.:	Silty SAND with Gravel (SM), fine to medium, trace coarse, 30-35% fines, 15-20% fine subrounded gravel, trace of organic soil, trace of roots, 10-15% boulders, light brown, moist
2.5					135.0	
		E			4.0	
132.5					132.0	
		E		Sand and Gravel	4 ft. - 7 ft.:	Poorly Graded SAND with Silt and Gravel (SP-SM), medium to coarse, trace fine, 10-15% fines, 30-35% fine to coarse subrounded to subangular gravel, 15-20% cobbles, dark brown, moist
5.0					130.0	
		D			7.0	
130.0			1			
						REMARK 1: Excavator refusal encountered on possible rock at depth of 7.0'. Bottom of test pit at 7.0 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



PAGE 1 OF 1

PROJECT LOCATION: Wakefield, MA

▼ **AT END OF EXCAVATION:** Not encountered

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



TEST PIT LOG

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PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

PROJECT LOCATION: Wakefield, MA

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Dave Edilberti

EXCAVATOR TYPE/MODEL: Komatsu PC 120

WEATHER: 50's / Sunny

TEST PIT DIMENSIONS: 11.0' x 4.0'

▽ DURING EXCAVATION: -

LOGGED BY: SD / TG **CHECKED BY:** TG

▼ **AT END OF EXCAVATION:** Not encountered

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
-	-	D	1	Topsoil	0 ft. - 0.7 ft.: Topsoil
					REMARK 1: Excavator refusal encountered on possible rock at depth of 0.7'. Bottom of test pit at 0.7 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M - Moderate, D = Difficult, V = Very Difficult

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 12/3/20 **DATE COMPLETED:** 12/3/20

TEST PIT LOCATION: East of prop. building

COORDINATES: NA

SURFACE EL.: 162.0 ft. (see note 1) **TOTAL DEPTH:** 5 ft.

GROUNDWATER LEVELS:

▽ **DURING EXCAVATION:** -

▽ **AT END OF EXCAVATION:** 2.5 ft. / El. 159.5 ft.

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Dave Edilberti

EXCAVATOR TYPE/MODEL: Komatsu PC 120

WEATHER: 40's / Sunny

TEST PIT DIMENSIONS: 13.5' x 4.5'

LOGGED BY: SD

CHECKED BY: TG

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Topsoil	0.5	0 ft. - 0.5 ft.: Topsoil
					161.5	
	160.0	E		Subsoil		0.5 ft. - 4 ft.: Silty SAND (SM), fine to medium, trace coarse, 25-30% fines, 10-15% fine to coarse subangular gravel, trace of organic soil, trace of roots, 15-20% cobbles, brown, wet
2.5						
		M				
					4.0	
	157.5	D		Sand and Gravel		4 ft. - 5 ft.: Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 25-30% fine to coarse subrounded to subangular gravel, 25-30% cobbles, gray, wet
5.0			1		5.0	
REMARK 1: Excavator refusal encountered on possible rock at depth of 5.0'. Bottom of test pit at 5.0 feet. Backfilled excavation with excavated material.						

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 12/3/20 DATE COMPLETED: 12/3/20

TEST PIT LOCATION: East of prop. building

COORDINATES: NA

SURFACE EL.: 143.7 ft. (see note 1) TOTAL DEPTH: 10.5 ft.

GROUNDWATER LEVELS:

▽ DURING EXCAVATION: -

▽ AT END OF EXCAVATION: 3.5 ft. / El. 140.2 ft.

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Dave Edilberti

EXCAVATOR TYPE/MODEL: Komatsu PC 120

WEATHER: 40's / Sunny

TEST PIT DIMENSIONS: 12.5' x 4.5'

LOGGED BY: SD

CHECKED BY: TG

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
		E		Topsoil	0 ft. - 1 ft.: Topsoil
	142.5				
2.5		E		Subsoil	1 ft. - 5 ft.: Silty SAND (SM), fine to medium, trace coarse, 25-30% fines, 10-15% fine subrounded gravel, trace of organic soil, trace of roots, ~15% cobbles and boulders, light brown, wet
	140.0				
5.0					
	137.5	E		Sand and Gravel	5 ft. - 10.5 ft.: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 15-20% fine to coarse subrounded to subangular gravel, 25-30% cobbles and boulders, gray, moist
7.5					
	135.0				
10.0		D			
	10.5		1		REMARK 1: Excavator refusal encountered on possible rock at depth of 10.5'. Bottom of test pit at 10.5 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



TEST PIT LOG

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PAGE 1 OF 1

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

PROJECT LOCATION: Wakefield, MA

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Dave Edilberti

EXCAVATOR TYPE/MODEL: Komatsu PC 120

WEATHER: 50's / Sunny

TEST PIT DIMENSIONS: 22.0' x 3.0'

▽ DURING EXCAVATION: -

LOGGED BY: TG CHECKED BY: SD

▼ AT END OF EXCAVATION: 1.5 ft. / El. 138.0 ft.

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
		E		Topsoil	0 ft. - 0.2 ft.: Topsoil
		E		Subsoil	0.2 ft. - 1.9 ft.: Silty SAND (SM), fine to medium, 35-40% fines, 0-5% fine subrounded gravel, trace of organic soil, trace of roots, brown, moist
2.5	137.5	M		Sand and Gravel	1.9 ft. - 3.1 ft.: Silty SAND with Gravel (SM), fine to coarse, 25-30% fines, 15-20% fine to coarse subrounded gravel, trace of roots, gray, wet
			1		REMARK 1: Excavator refusal encountered on cobbles and boulders at depths ranging between 0.2' and 3.1'. Bottom of test pit at 3.1 feet. Backfilled excavation with excavated material.

GENERAL COMMENTS: E = Easy, M - Moderate, D = Difficult, V = Very Difficult

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.LGCI PROJECT NUMBER: 2025PROJECT LOCATION: Wakefield, MADATE STARTED: 12/4/20DATE COMPLETED: 12/4/20TEST PIT LOCATION: Near driveway NE of prop. buildingCOORDINATES: NASURFACE EL.: 132.0 ft. (see note 1) TOTAL DEPTH: 3.9 ft.**GROUNDWATER LEVELS:**▽ DURING EXCAVATION: -▽ AT END OF EXCAVATION: Not encounteredEXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.EXCAVATION FOREMAN: Dave EdilbertiEXCAVATOR TYPE/MODEL: Komatsu PC 120WEATHER: 50's / SunnyTEST PIT DIMENSIONS: 14.0' x 3.0'LOGGED BY: TGCHECKED BY: SD

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El. (ft.)	Material Description
		E		Topsoil	0.3	0 ft. - 0.3 ft.: Topsoil
		E		Subsoil	131.7	0.3 ft. - 2.8 ft.: Silty SAND (SM), fine to medium, 30-35% fines, trace fine subangular gravel, trace of organic soil, trace of roots, brown, moist
130.0						
2.5						
		D		Sand and Gravel	2.8	2.8 ft. - 3.9 ft.: Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 15-20% fine to coarse subrounded gravel, trace of roots, light brown, moist
			1		129.2	
					3.9	
REMARK 1: Excavator refusal encountered on possible rock at depth of 3.9'. Bottom of test pit at 3.9 feet. Backfilled excavation with excavated material.						

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 4/19/21

DATE COMPLETED: 4/19/21

TEST PIT LOCATION: Wooded area north of prop. building

COORDINATES: NA

SURFACE EL.: 126.5 ft. (see note 1) TOTAL DEPTH: 3.5 ft.

GROUNDWATER LEVELS:

▽ DURING EXCAVATION: -

▼ AT END OF EXCAVATION: 3.5 ft. / El. 123.0 ft.

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Justin Stevens

EXCAVATOR TYPE/MODEL: Kubota KX 080-4

WEATHER: 60's / Sunny

TEST PIT DIMENSIONS: 13.0' x 7.0'

LOGGED BY: NP

CHECKED BY: AML

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		M/D	1	Forest Mat		0 ft. - 1 ft.: Forest Mat REMARK 1: Several rock outcrops observed at the ground surface.
	125.0	D/V			1.0 125.5	1 ft. - 3.5 ft.: Silty SAND (SM), fine, 25-30% fines, 0-5% cobbles up to 8" in diameter, trace of organic soil, trace of roots, brown, moist to wet
2.5		V		Subsoil		
		V	2		3.5	REMARK 2: Excavator refusal encountered on possible rock at depth of 3.5'. Bottom of test pit at 3.5 feet. Backfilled excavation with excavated material and tamped with the excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.LGCI PROJECT NUMBER: 2025PROJECT LOCATION: Wakefield, MADATE STARTED: 4/20/21 DATE COMPLETED: 4/20/21TEST PIT LOCATION: Near prop. driveway north of prop. buildingCOORDINATES: NASURFACE EL.: 126.4 ft. (see note 1) TOTAL DEPTH: 3.7 ft.**GROUNDWATER LEVELS:**▽ DURING EXCAVATION: -▽ AT END OF EXCAVATION: Not encounteredEXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.EXCAVATION FOREMAN: Justin StevensEXCAVATOR TYPE/MODEL: Kubota KX 080-4WEATHER: 70's / SunnyTEST PIT DIMENSIONS: 11.0' x 6.5'LOGGED BY: TGCHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Forest Mat	0.7	0 ft. - 0.7 ft.: Forest Mat
	125.0	E	1	Subsoil	125.7	0.7 ft. - 2.9 ft.: Silty SAND (SM), fine, 40-45% slightly plastic fines, trace of organic soil, trace of roots, brown, moist to wet REMARK 1: Excavator refusal encountered on possible rock at depths ranging between 1' and 3.7'.
2.5		M			2.9	
		V		Sand and Gravel	3.7	2.9 ft. - 3.7 ft.: Silty SAND (SM), fine to coarse, 30-35% fines, 5-10% fine to coarse subangular gravel, gray, moist
						Bottom of test pit at 3.7 feet. Backfilled excavation with excavated material and tamped with the excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.**PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.**LGCI PROJECT NUMBER:** 2025**PROJECT LOCATION:** Wakefield, MA**DATE STARTED:** 4/20/21 **DATE COMPLETED:** 4/20/21**TEST PIT LOCATION:** Near prop. driveway NW of prop. building**COORDINATES:** NA**SURFACE EL.:** 135.0 ft. (see note 1) **TOTAL DEPTH:** 5.5 ft.**GROUNDWATER LEVELS:**▽ **DURING EXCAVATION:** -▽ **AT END OF EXCAVATION:** 1.3 ft. / El. 133.7 ft.**EXCAVATION SUBCONTRACTOR:** Northern Drill Service, Inc.**EXCAVATION FOREMAN:** Justin Stevens**EXCAVATOR TYPE/MODEL:** Kubota KX 080-4**WEATHER:** 70's / Sunny**TEST PIT DIMENSIONS:** 9.0' x 4.0'**LOGGED BY:** TG**CHECKED BY:** NP

Depth (ft)	El. (ft)	Excavation Effort	Strata	Material Description
		M	Forest Mat	0 ft. - 0.8 ft.: Forest Mat
		M	Subsoil	0.8 ft. - 2.4 ft.: Sandy SILT (ML), slightly plastic, ~40% fine sand, trace of organic soil, trace of roots, brown, wet
2.5	132.5	D		
		D	Sand and Gravel	2.4 ft. - 5.5 ft.: Silty SAND with Gravel (SM), fine to coarse, 45-50% fines, 15-20% fine subangular gravel, light brown, wet
5.0	130.0	V		
				REMARK 1: Excavator refusal encountered on possible rock at depth of 5.5'. Bottom of test pit at 5.5 feet. Backfilled excavation with excavated material and tamped with the excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.**PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.**LGCI PROJECT NUMBER:** 2025**PROJECT LOCATION:** Wakefield, MA**DATE STARTED:** 4/19/21 **DATE COMPLETED:** 4/19/21**TEST PIT LOCATION:** Near prop. parking lot west of prop. building**COORDINATES:** NA**SURFACE EL.:** 180.0 ft. (see note 1) **TOTAL DEPTH:** 3 ft.**GROUNDWATER LEVELS:**▽ **DURING EXCAVATION:** -▽ **AT END OF EXCAVATION:** Not encountered**EXCAVATION SUBCONTRACTOR:** Northern Drill Service, Inc.**EXCAVATION FOREMAN:** Justin Stevens**EXCAVATOR TYPE/MODEL:** Kubota KX 080-4**WEATHER:** 60's / Sunny**TEST PIT DIMENSIONS:** 11.0' x 6.0'**LOGGED BY:** NP**CHECKED BY:** AML

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		D	1	Forest Mat	0.5	0 ft. - 0.5 ft.: Forest Mat
		D/V		Subsoil	179.5	REMARK 1: Several rock outcrops observed at the ground surface.
						0.5 ft. - 2.5 ft.: Silty GRAVEL with Sand (GM), fine to coarse, 20-25% fines, 20-25% fine to coarse sand, 10-15% cobbles and boulders up to 2' in diameter, trace of organic soil, trace of roots, brown, moist
2.5	177.5				2.5	
		V	2	Sand and Gravel	3.0	2.5 ft. - 3 ft.: Silty SAND with Gravel (SM), fine to medium, ~20% fines, 25-30% fine subangular to subrounded gravel, trace of organic soil, trace of weathered rock, light brown, moist
						REMARK 2: Excavator refusal encountered on possible rock at depth of 3'.
						Bottom of test pit at 3.0 feet. Backfilled with excavation with excavated material and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

TP-105

PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 4/19/21 DATE COMPLETED: 4/19/21

TEST PIT LOCATION: Near NW portion of prop. building

COORDINATES: NA

SURFACE EL.: 180.1 ft. (see note 1) TOTAL DEPTH: 1.8 ft.

GROUNDWATER LEVELS:

▽ DURING EXCAVATION: -

▽ AT END OF EXCAVATION: Not encountered

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Justin Stevens

EXCAVATOR TYPE/MODEL: Kubota KX 080-4

WEATHER: 60's / Sunny

TEST PIT DIMENSIONS: 13.0' x 12.0'

LOGGED BY: NP

CHECKED BY: AML

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		D/V	1	Forest Mat	0.5 179.6	0 ft. - 0.5 ft.: Forest Mat REMARK 1: Several rock outcrops observed at the ground surface.
		V		Subsoil		0.5 ft. - 1.8 ft.: Silty SAND (SM), fine, 35-40% slightly plastic fines, trace of organic soil, trace of roots, brown, moist
			2		1.8	REMARK 2: Excavator refusal encountered on possible rock at depth of 1.8'. Bottom of test pit at 1.8 feet. Backfilled with excavation with excavated material and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

TP-106

PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 4/20/21 **DATE COMPLETED:** 4/20/21

TEST PIT LOCATION: Near prop. parking lot west of prop. building

COORDINATES: NA

SURFACE EL.: 161.0 ft. (see note 1) **TOTAL DEPTH:** 3.2 ft.

GROUNDWATER LEVELS:

▽ **DURING EXCAVATION:** -

▽ **AT END OF EXCAVATION:** Not encountered.

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Justin Stevens

EXCAVATOR TYPE/MODEL: Kubota KX 080-4

WEATHER: 70's / Sunny

TEST PIT DIMENSIONS: 12.0' x 3.0'

LOGGED BY: TG

CHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		M		Forest Mat	0.5	0 ft. - 0.5 ft.: Forest Mat
	160.0	D			160.5	0.5 ft. - 3.2 ft.: Silty SAND (SM), fine to coarse, 35-40% fines, 5-10% fine gravel, trace of organic soil, trace of roots, brown, moist
			1	Subsoil		REMARK 1: Excavator refusal encountered on possible rock at depths ranging between 2.0' and 3.2'.
2.5		V				
					3.2	Bottom of test pit at 3.2 feet. Backfilled with excavation with excavated material and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M - Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.LGCI PROJECT NUMBER: 2025PROJECT LOCATION: Wakefield, MADATE STARTED: 4/20/21 DATE COMPLETED: 4/20/21TEST PIT LOCATION: Near prop. parking lot west of prop. buildingCOORDINATES: NASURFACE EL.: 168.1 ft. (see note 1) TOTAL DEPTH: 3.1 ft.**GROUNDWATER LEVELS:**▽ DURING EXCAVATION: -▽ AT END OF EXCAVATION: 3.0 ft. / El. 165.1 ft.EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.EXCAVATION FOREMAN: Justin StevensEXCAVATOR TYPE/MODEL: Kubota KX 080-4WEATHER: 70's / SunnyTEST PIT DIMENSIONS: 10.0' x 3.5'LOGGED BY: TGCHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Forest Mat	0.3 167.8	0 ft. - 0.3 ft.: Forest Mat
	167.5	M		Subsoil		0.3 ft. - 2.1 ft.: Silty SAND (SM), fine, 40-45% slightly plastic fines, trace of organic soil, trace of roots, brown, moist
					2.1	
2.5		V		Sand and Gravel		2.1 ft. - 3.1 ft.: Silty SAND (SM), fine to coarse, 40-45% fines, 5-10% fine subrounded to subangular gravel, gray, moist to wet
	165.0		1		3.1	REMARK 1: Excavator refusal encountered on possible rock at depth of 3.1'. Bottom of test pit at 3.1 feet. Backfilled with excavation with excavated material and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 4/20/21 **DATE COMPLETED:** 4/20/21

TEST PIT LOCATION: Near eastern side of prop. building

COORDINATES: NA

SURFACE EL.: 180.4 ft. (see note 1) **TOTAL DEPTH:** 2.3 ft.

GROUNDWATER LEVELS:

▽ **DURING EXCAVATION:** -

▼ **AT END OF EXCAVATION:** 2.3 ft. / El. 178.1 ft.

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Justin Stevens

EXCAVATOR TYPE/MODEL: Kubota KX 080-4

WEATHER: 70's / Sunny

TEST PIT DIMENSIONS: 13.0' x 3.0'

LOGGED BY: TG

CHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
	180.0	E	1	Forest Mat	0 ft. - 2.3 ft.: Forest Mat, 0-5% cobbles and boulders up to 1' in diameter
		D			REMARK 1: Excavator refusal encountered on possible rock at depths ranging between 0.5' and 2.3'.
		V			2.3 ▼ Bottom of test pit at 2.3 feet. Backfilled with excavation with excavated material and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.**PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.**LGCI PROJECT NUMBER:** 2025**PROJECT LOCATION:** Wakefield, MA**DATE STARTED:** 4/19/21 **DATE COMPLETED:** 4/20/21**TEST PIT LOCATION:** Near western side of prop. building**COORDINATES:** NA**SURFACE EL.:** 171.2 ft. (see note 1) **TOTAL DEPTH:** 4.6 ft.**GROUNDWATER LEVELS:**▽ **DURING EXCAVATION:** -▽ **AT END OF EXCAVATION:** Not encountered**EXCAVATION SUBCONTRACTOR:** Northern Drill Service, Inc.**EXCAVATION FOREMAN:** Justin Stevens**EXCAVATOR TYPE/MODEL:** Kubota KX 080-4**WEATHER:** 60's / Sunny**TEST PIT DIMENSIONS:** 10.0' x 3.0'**LOGGED BY:** TG**CHECKED BY:** NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		M	1	Forest Mat	0.5	0 ft. - 0.5 ft.: Forest Mat
	170.0	M/D			170.7	REMARK 1: Several rock outcrops observed at the ground surface.
				Subsoil		0.5 ft. - 3 ft.: Silty SAND (SM), fine, ~40% slightly plastic fines, trace of organic soil, trace of roots, brown, moist
2.5		D			3.0	
	167.5	D		Sand and Gravel	168.2	3 ft. - 4.6 ft.: Silty SAND with Gravel (SM), fine to coarse, ~20% fines, ~30% fine to coarse subangular to angular gravel, 5-10% cobbles and boulders up to 2' in diameter, light brown, moist
		V	2			REMARK 2: Excavator blew hydraulic line at depth of 4' on 4/19/2021. The excavator bucket was left at the bottom of the excavation and the excavation was taped off with caution tape. Test pit continued on 4/20/2021.
			3		4.6	REMARK 3: Excavator refusal encountered on possible rock at depth of 4.6'. Bottom of test pit at 4.6 feet. Backfilled with excavation with excavated material and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 4/19/21 DATE COMPLETED: 4/19/21

TEST PIT LOCATION: South of prop. building

COORDINATES: NA

SURFACE EL.: 168.1 ft. (see note 1) TOTAL DEPTH: 2.7 ft.

GROUNDWATER LEVELS:

▽ DURING EXCAVATION: -

▽ AT END OF EXCAVATION: 2.5 ft. / El. 165.6 ft.

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Justin Stevens

EXCAVATOR TYPE/MODEL: Kubota KX 080-4

WEATHER: 60's / Sunny

TEST PIT DIMENSIONS: 14.0' x 6.0'

LOGGED BY: NP

CHECKED BY: AML

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
	167.5	M	1	Forest Mat	0.5 167.6	0 ft. - 0.5 ft.: Forest Mat REMARK 1: Several rock outcrops observed at the ground surface.
		D		Subsoil		0.5 ft. - 2.7 ft.: Silty SAND (SM), fine, 35-40% slightly plastic fines, trace fine gravel, trace of organic soil, trace of roots, brown, moist to wet
2.5		V	2		2.7	REMARK 2: Excavator refusal encountered on possible rock at depth of 2.7'. Bottom of test pit at 2.7 feet. Backfilled with excavation with excavated material and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M - Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 4/19/21 **DATE COMPLETED:** 4/19/21

TEST PIT LOCATION: Prop. parking lot south of prop. building

COORDINATES: NA

SURFACE EL.: 156.3 ft. (see note 1) **TOTAL DEPTH:** 5 ft.

GROUNDWATER LEVELS:

▽ **DURING EXCAVATION:** -

▽ **AT END OF EXCAVATION:** 5.0 ft. / El. 151.3 ft.

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Justin Stevens

EXCAVATOR TYPE/MODEL: Kubota KX 080-4

WEATHER: 60's / Sunny

TEST PIT DIMENSIONS: 13.0' x 7.0'

LOGGED BY: NP

CHECKED BY: AML

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El. (ft.)	Material Description
		M	1	Forest Mat	0.5	0 ft. - 0.5 ft.: Forest Mat
	155.0	D			155.8	REMARK 1: Several rock outcrops observed at the ground surface.
						0.5 ft. - 3.5 ft.: Silty SAND (SM), fine, 35-40% fines, trace fine gravel, trace of organic soil, trace of roots, brown, moist
2.5		D/V		Subsoil		
		V			3.5	
	152.5				152.8	3.5 ft. - 5 ft.: Silty SAND with Gravel (SM), fine, trace medium, 15-20% fines, 15-20% fine subrounded gravel, trace of roots, light brown, moist to wet
5.0		V	2	Sand and Gravel	5.0	REMARK 2: Excavator refusal encountered on possible rock at depth of 5'. Bottom of test pit at 5.0 feet. Backfilled with excavation with excavated material and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.LGCI PROJECT NUMBER: 2025PROJECT LOCATION: Wakefield, MADATE STARTED: 4/19/21 DATE COMPLETED: 4/19/21TEST PIT LOCATION: Wooded area SW of prop. buildingCOORDINATES: NASURFACE EL.: 143.6 ft. (see note 1) TOTAL DEPTH: 3 ft.**GROUNDWATER LEVELS:**▽ DURING EXCAVATION: -▽ AT END OF EXCAVATION: Not encountered.EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.EXCAVATION FOREMAN: Justin StevensEXCAVATOR TYPE/MODEL: Kubota KX 080-4WEATHER: 60's / SunnyTEST PIT DIMENSIONS: 12.0' x 6.0'LOGGED BY: NPCHECKED BY: AML

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		D	1	Forest Mat	0.5	0 ft. - 0.5 ft.: Forest mat
	142.5	V		Sand and Gravel	143.1	REMARK 1: Several rock outcrops observed at the ground surface.
						0.5 ft. - 3 ft.: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 10-15% fines, 30-35% fine to coarse subrounded gravel, trace of roots, light brown
2.5		V				
			2		3.0	REMARK 2: Excavator refusal encountered on possible rock at depth of 3'. Bottom of test pit at 3.0 feet. Backfilled with excavation with excavated material and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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TEST PIT LOG

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 4/19/21 DATE COMPLETED: 4/19/21

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

TEST PIT LOCATION: Prop. parking lot south of the prop. building

EXCAVATION FOREMAN: Justin Stevens

COORDINATES: NA

EXCAVATOR TYPE/MODEL: Kubota KX 080-4

SURFACE EL.: 147.4 ft. (see note 1) TOTAL DEPTH: 1.9 ft.

WEATHER: 60's / Sunny

GROUNDWATER LEVELS:

TEST PIT DIMENSIONS: 12.0' x 5.0'

▽ DURING EXCAVATION: -

LOGGED BY: NP CHECKED BY: AML

▽ AT END OF EXCAVATION: 1.9 ft. / El. 145.5 ft.

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		D/V	1	Forest Mat	0.3 147.1	0 ft. - 0.3 ft.: Forest Mat REMARK 1: Several rock outcrops observed at the ground surface.
		V		Sand and Gravel		0.3 ft. - 1.9 ft.: Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, subrounded, 10-15% fines, 25-30% fine to coarse sand, trace of roots, light brown, moist to wet
			2		1.9	REMARK 2: Excavator refusal encountered on possible rock at depth of 1.9'. Bottom of test pit at 1.9 feet. Backfilled with excavation with excavated material and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.LGCI PROJECT NUMBER: 2025PROJECT LOCATION: Wakefield, MADATE STARTED: 4/27/22 DATE COMPLETED: 4/27/22TEST PIT LOCATION: Prop. roadway NW of prop. buildingCOORDINATES: NASURFACE EL.: 84 ft. (see note 1) TOTAL DEPTH: 4.5 ft.**GROUNDWATER LEVELS:**▽ DURING EXCAVATION: -▼ AT END OF EXCAVATION: Not encountered.EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.EXCAVATION FOREMAN: Justin RaymondEXCAVATOR TYPE/MODEL: Kubota KX 080-4WEATHER: 50's / CloudyTEST PIT DIMENSIONS: 8.5' x 3.5'LOGGED BY: HOCHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Topsoil		0 ft. - 1 ft.: Topsoil
	82.5	E		Fill	1.0	1 ft. - 2 ft.: Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 35-40% fine to coarse subrounded gravel, trace of organic soil, trace of roots, brown, moist
2.5		M		Weathered Rock	2.0 82.0	2 ft. - 4.5 ft.: Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, angular, 5-10% fines, 20-25% coarse sand, 15-20% boulder up to 22" in diameter, brown, moist
	80.0	D	1		4.5	REMARK 1: Excavator refusal encountered on possible rock at depth 4.5 feet.
						Bottom of test pit at 4.5 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.



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TEST PIT LOG

TP-202

PAGE 1 OF 1

CLIENT: Drumme Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 4/27/22

DATE COMPLETED: 4/27/22

TEST PIT LOCATION: Prop. roadway north of prop. building

COORDINATES: NA

SURFACE EL.: 120 ft. (see note 1) TOTAL DEPTH: 4.5 ft.

GROUNDWATER LEVELS:

▽ DURING EXCAVATION: -

▽ AT END OF EXCAVATION: 2.0 ft. / El. 118.0 ft.

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Justin Reymond

EXCAVATOR TYPE/MODEL: Kubota KX 080-4

WEATHER: 50's / Cloudy

TEST PIT DIMENSIONS: 15.5' x 4'

LOGGED BY: HO

CHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Forest Mat	0.3	0 ft. - 0.3 ft.: Forest Mat
		E		Subsoil	119.7	0.3 ft. - 2 ft.: Silty SAND (SM), fine to medium, 35-40% fines, trace of organic soil, trace of roots, brown, moist
2.5	117.5	D			2.0	2 ft. - 2.5 ft.: Silty SAND (SM), fine to medium, trace coarse, 30-35% fines, 5-10% fine to coarse subangular gravel, trace of roots, gray, wet
		D		Sand and Gravel	118.0	2.5 ft. - 4.5 ft.: Similar to G3
		V	1		4.5	REMARK 1: Excavator refusal encountered on possible rock at depth of 4.5 feet.
						Bottom of test pit at 4.5 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.**PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.**LGCI PROJECT NUMBER:** 2025**PROJECT LOCATION:** Wakefield, MA**DATE STARTED:** 4/27/22**DATE COMPLETED:** 4/27/22**TEST PIT LOCATION:** Prop. roadway north of prop. building**COORDINATES:** NA**SURFACE EL.:** 129 ft. (see note 1) **TOTAL DEPTH:** 2.5 ft.**GROUNDWATER LEVELS:**▽ **DURING EXCAVATION:** -▼ **AT END OF EXCAVATION:** Not encountered**EXCAVATION SUBCONTRACTOR:** Northern Drill Service, Inc.**EXCAVATION FOREMAN:** Justin Reymond**EXCAVATOR TYPE/MODEL:** Kubota KX 080-4**WEATHER:** 50's / Cloudy**TEST PIT DIMENSIONS:** 11' x 5'**LOGGED BY:** HO**CHECKED BY:** NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Forest Mat	0.3	0 ft. - 0.3 ft.: Forest Mat
		E			128.7	0.3 ft. - 2.5 ft.: Silty SAND (SM), fine to medium, 30-35% fines, 5-10% coarse subangular gravel, 5-10% cobbles up to 9" in diameter, trace of organic soil, trace of roots, brown, moist
	127.5	M		Subsoil		
2.5		V	1		2.5	REMARK 1: Excavation refusal encountered on possible rock at depth of 2.5 feet. Bottom of test pit at 2.5 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.LGCI PROJECT NUMBER: 2025PROJECT LOCATION: Wakefield, MADATE STARTED: 4/26/22DATE COMPLETED: 4/26/22TEST PIT LOCATION: Prop. roadway east of prop. buildingCOORDINATES: NASURFACE EL.: 155 ft. (see note 1) TOTAL DEPTH: 8.7 ft.

GROUNDWATER LEVELS:

▽ DURING EXCAVATION: -▽ AT END OF EXCAVATION: 6.0 ft. / El. 149.0 ft.EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.EXCAVATION FOREMAN: Justin RaymondEXCAVATOR TYPE/MODEL: Kubota KX 080-4WEATHER: 50's / CloudyTEST PIT DIMENSIONS: 13' x 4.5'LOGGED BY: HOCHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Forest Mat	0.5	0 ft. - 0.5 ft.: Forest Mat
		E		Subsoil	154.5	0.5 ft. - 3 ft.: Silty SAND with Gravel (SM), fine to coarse, 20-25% fines, 30-35% fine to coarse subrounded gravel, 5-10% cobbles up to 6" in diameter, trace of roots, light brown, moist
2.5	152.5					
		M			3.0	3 ft. - 6 ft.: Silty SAND with Gravel (SM), fine to coarse, ~20% fines, 15-20% fine to coarse angular gravel, gray, moist
5.0	150.0				152.0	
		D		Sand and Gravel		6 ft. - 8.7 ft.: Similar to G3, 5-10% cobbles up to 8" in diameter, wet
7.5	147.5					
		V				
			1		8.7	REMARK 1: Excavator refusal encountered on possible rock at depth of 8.7 feet. Bottom of test pit at 8.7 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.LGCI PROJECT NUMBER: 2025PROJECT LOCATION: Wakefield, MADATE STARTED: 4/26/22DATE COMPLETED: 4/26/22TEST PIT LOCATION: Near NW corner of prop. buildingCOORDINATES: NASURFACE EL.: 181 ft. (see note 1) TOTAL DEPTH: 2.5 ft.

GROUNDWATER LEVELS:

▽ DURING EXCAVATION: -▼ AT END OF EXCAVATION: Not encounteredEXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.EXCAVATION FOREMAN: Justin ReymondEXCAVATOR TYPE/MODEL: Kubota KX 080-4WEATHER: 50's / CloudyTEST PIT DIMENSIONS: 10' x 3.5'LOGGED BY: HOCHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Forest Mat	0.5	0 ft. - 0.5 ft.: Forest Mat
	180.0	E			180.5	0.5 ft. - 2.5 ft.: Silty SAND with Gravel (SM), fine to medium, 30-35% fines, 15-20% coarse subangular gravel, trace of organic soil, trace of roots, brown, moist
		M		Subsoil		
2.5		V	1		2.5	REMARK 1: Excavator refusal encountered on possible rock at depth of 2.5 feet. Bottom of test pit at 2.5 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.



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TEST PIT LOG

TP-206

PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 4/26/22

DATE COMPLETED: 4/26/22

TEST PIT LOCATION: Prop. roadway SE of prop. building

COORDINATES: NA

SURFACE EL.: 159 ft. (see note 1) **TOTAL DEPTH:** 6.5 ft.

GROUNDWATER LEVELS:

▽ **DURING EXCAVATION:** -

▽ **AT END OF EXCAVATION:** Not encountered

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

EXCAVATION FOREMAN: Justin Reymond

EXCAVATOR TYPE/MODEL: Kubota KX 080-4

WEATHER: 50's / Cloudy

TEST PIT DIMENSIONS: 14' x 4'

LOGGED BY: HO

CHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
		E		Forest Mat	0 ft. - 1 ft.: Forest Mat
	157.5	M		Subsoil	1 ft. - 3 ft.: Silty SAND (SM), 35-40% fines, 5-10% fine to coarse subangular gravel, 0-5% cobbles up to 8" in diameter, trace of organic soil, trace of roots, brown, moist
2.5					
	155.0	D		Sand and Gravel	3 ft. - 6.5 ft.: Silty SAND with Gravel (SM), fine to medium, trace coarse, 15-20% fines, ~30% fine to coarse angular gravel, 5-10% cobbles up to 9" in diameter, gray, moist
5.0					
	152.5	V	1		REMARK 1: Excavator refusal encountered on possible rock at depth of 6.5 feet. Bottom of test pit at 6.5 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.**PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.**LGCI PROJECT NUMBER:** 2025**PROJECT LOCATION:** Wakefield, MA**DATE STARTED:** 4/26/22**DATE COMPLETED:** 4/26/22**TEST PIT LOCATION:** Prop. roadway SE of prop. building**COORDINATES:** NA**SURFACE EL.:** 153 ft. (see note 1) **TOTAL DEPTH:** 3.5 ft.**GROUNDWATER LEVELS:**▽ **DURING EXCAVATION:** -▽ **AT END OF EXCAVATION:** Not encountered**EXCAVATION SUBCONTRACTOR:** Northern Drill Service, Inc.**EXCAVATION FOREMAN:** Justin Raymond**EXCAVATOR TYPE/MODEL:** Kubota KX 080-4**WEATHER:** 50's / Cloudy**TEST PIT DIMENSIONS:** 10' x 4.5'**LOGGED BY:** HO**CHECKED BY:** NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
	152.5	E		Forest Mat	0.5	0 ft. - 0.5 ft.: Forest Mat
		E			152.5	
		M		Subsoil		0.5 ft. - 3 ft.: Silty SAND with Gravel (SM), fine to coarse, 35-40% fines, 15-20% fine to coarse subrounded gravel, 5-10% cobbles up to 8" in diameter, trace of organic soil, trace of roots, orange brown, moist
2.5						
	150.0				3.0	
		V	1	Sand and Gravel	3.5	3 ft. - 3.5 ft.: Silty SAND with Gravel (SM), fine to medium, 20-25% fines, 15-20% fine to coarse subangular gravel, 10-15% cobbles up to 44" in diameter, light brown, moist
						REMARK 1: Excavator refusal encountered on possible rock at depth of 3.5 feet.
						Bottom of test pit at 3.5 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.LGCI PROJECT NUMBER: 2025PROJECT LOCATION: Wakefield, MADATE STARTED: 7/22/22DATE COMPLETED: 7/22/22TEST PIT LOCATION: Near prop. parking lot south of prop. buildingCOORDINATES: NASURFACE EL.: 165 ft. (see note 1) TOTAL DEPTH: 2.6 ft.

GROUNDWATER LEVELS:

▽ DURING EXCAVATION: -▼ AT END OF EXCAVATION: Not encounteredEXCAVATION SUBCONTRACTOR: Saunders ConstructionEXCAVATION FOREMAN: Chris SaundersEXCAVATOR TYPE/MODEL: Takeuchi TB-175WEATHER: 90's / SunnyTEST PIT DIMENSIONS: 13.0' x 6.5'LOGGED BY: TGCHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Forest Mat	0.9	0 ft. - 0.9 ft.: Forest Mat
		M		Subsoil	164.1	0.9 ft. - 2.6 ft.: Silty SAND (SM), fine to medium, 30-35% fines, 10-15% fine to coarse subrounded gravel, trace of organic soil, trace of roots, light brown, moist
2.5	162.5	V	1		2.6	REMARK 1: Excavator refusal encountered at depth of 2.6' on rock. Bottom of test pit at 2.6 feet. Backfilled the excavation with excavated material in 12" to 18" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.



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TEST PIT LOG

TP-209

PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 7/22/22 **DATE COMPLETED:** 7/22/22

TEST PIT LOCATION: Near northern side of prop. driveway

COORDINATES: NA

SURFACE EL.: 137 ft. (see note 1) **TOTAL DEPTH:** 4.2 ft.

GROUNDWATER LEVELS:

▽ **DURING EXCAVATION:** -

▽ **AT END OF EXCAVATION:** Not encountered

EXCAVATION SUBCONTRACTOR: Saunders Construction

EXCAVATION FOREMAN: Chris Saunders

EXCAVATOR TYPE/MODEL: Takeuchi TB-175

WEATHER: 90's / Sunny

TEST PIT DIMENSIONS: 13.0' x 8.0'

LOGGED BY: TG

CHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Strata	Material Description
		E	Forest Mat	0 ft. - 1.4 ft.: Forest Mat
	135.0	E	Subsoil	1.4 ft. - 2.5 ft.: Silty SAND (SM), fine to medium, 25-30% fines, ~5% fine to coarse subrounded gravel, 0-5% cobbles and boulders up to 16" in diameter, trace of organic soil, trace of roots, brown, moist
2.5		E		2.5 ft. - 4.2 ft.: Silty SAND (SM), fine to medium, trace of coarse, 30-35% fines, 5-10% fine to coarse subrounded gravel, trace of roots, light brown to gray, moist
		M	Sand and Gravel	
		V		
REMARK 1: Excavator refusal encountered at depth of 4.2' on rock. Bottom of test pit at 4.2 feet. Backfilled the excavation with excavated material in 12" to 18" lifts and tamped with excavator bucket. Ground surface restored with excavated Forest Mat. Area raked and straw placed for erosion control.				

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.**PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.**LGCI PROJECT NUMBER:** 2025**PROJECT LOCATION:** Wakefield, MA**DATE STARTED:** 7/22/22 **DATE COMPLETED:** 7/22/22**TEST PIT LOCATION:** Near northern side of prop. driveway**COORDINATES:** NA**SURFACE EL.:** 133 ft. (see note 1) **TOTAL DEPTH:** 4.6 ft.**GROUNDWATER LEVELS:**▽ **DURING EXCAVATION:** -▽ **AT END OF EXCAVATION:** Not encountered**EXCAVATION SUBCONTRACTOR:** Saunders Construction**EXCAVATION FOREMAN:** Chris Saunders**EXCAVATOR TYPE/MODEL:** Takeuchi TB-175**WEATHER:** 90's / Sunny**TEST PIT DIMENSIONS:** 11.0' x 5.0'**LOGGED BY:** TG**CHECKED BY:** NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El. (ft.)	Material Description
	132.5	M		Fill		0 ft. - 1.2 ft.: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 10-15% fines, 25-30% fine to coarse subrounded gravel, 5-10% cobbles and boulders up to 12" in diameter, light brown, moist
		E			1.2	
		E		Buried Organic Soil	2.0	1.2 ft. - 2 ft.: Silty SAND (SM), fine, 25-30% fines, trace of organic soil, trace of roots, black, moist
2.5		M		Buried Subsoil	3.0	2 ft. - 3 ft.: Silty SAND (SM), fine to medium, 25-30% fines, 5-10% fine to coarse subrounded gravel, trace of organic soil, trace of roots, orange-brown, moist
	130.0				130.0	
		D		Sand and Gravel		3 ft. - 4.6 ft.: Silty SAND with Gravel (SM), fine to medium, trace of coarse, 20-25% fines, 20-25% fine to coarse subangular gravel, 5-10% cobbles up to 8" in diameter, trace of roots, light brown, moist
		V			4.6	
			1			REMARK 1: Excavator refusal encountered at depth of 4.6' on rock. Bottom of test pit at 4.6 feet. Backfilled the excavation with excavated material in 12" to 18" lifts and tamped with excavator bucket. Ground surface restored with excavated Forest Mat. Area raked and straw placed for erosion control.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

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PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.**PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.**LGCI PROJECT NUMBER:** 2025**PROJECT LOCATION:** Wakefield, MA**DATE STARTED:** 7/22/22 **DATE COMPLETED:** 7/22/22**TEST PIT LOCATION:** Near southern side of prop. driveway**COORDINATES:** NA**SURFACE EL.:** 129 ft. (see note 1) **TOTAL DEPTH:** 5.6 ft.**GROUNDWATER LEVELS:**▽ **DURING EXCAVATION:** -▽ **AT END OF EXCAVATION:** Not encountered**EXCAVATION SUBCONTRACTOR:** Saunders Construction**EXCAVATION FOREMAN:** Chris Saunders**EXCAVATOR TYPE/MODEL:** Takeuchi TB-175**WEATHER:** 90's / Sunny**TEST PIT DIMENSIONS:** 12.0' x 7.0'**LOGGED BY:** TG**CHECKED BY:** NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
		M	1	Forest Mat	0 ft. - 1.7 ft.: Forest Mat with ~8" layer of Silty SAND (SM), fine to medium, 20-25% fines, 10-15% fine to coarse angular gravel, ~10% cobbles and boulders up to 18" in diameter, brown, moist REMARK 1: Thin layer of fill encountered on northern side of test pit between depths of 0' and 0.7'.
	127.5	D			
		D		Subsoil	1.7 ft. - 2.5 ft.: Silty SAND (SM), fine to medium, 25-30% fines, ~10% fine to coarse subangular gravel, trace of organic soil, trace of roots, brown, moist
2.5		D			
		M		Sand and Gravel	2.5 ft. - 5.6 ft.: Silty SAND with Gravel (SM), fine to medium, 20-25% fines, 15-20% fine to coarse subangular gravel, ~10% cobbles and boulders up to 16" in diameter, trace of roots, gray, moist
	125.0				
5.0		V			
			2		REMARK 2: Excavator refusal encountered at depth of 5.6' on rock. Bottom of test pit at 5.6 feet. Backfilled the excavation with excavated material in 12" to 18" lifts and tamped with excavator bucket. Ground surface restored with excavated Forest Mat. Area raked and straw placed for erosion control.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

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PAGE 1 OF 1

CLIENT: Drummeys Rosane Anderson, Inc.PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.LGCI PROJECT NUMBER: 2025PROJECT LOCATION: Wakefield, MADATE STARTED: 7/22/22DATE COMPLETED: 7/22/22TEST PIT LOCATION: Near prop. entrance at Farm RoadCOORDINATES: NASURFACE EL.: 133 ft. (see note 1) TOTAL DEPTH: 4.9 ft.**GROUNDWATER LEVELS:**▽ DURING EXCAVATION: -▽ AT END OF EXCAVATION: Not encounteredEXCAVATION SUBCONTRACTOR: Saunders ConstructionEXCAVATION FOREMAN: Chris SaundersEXCAVATOR TYPE/MODEL: Takeuchi TB-175WEATHER: 90's / SunnyTEST PIT DIMENSIONS: 13.0' x 6.0'LOGGED BY: TGCHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
	132.5	E	1	Forest Mat		0 ft. - 0.9 ft.: Forest Mat REMARK 1: Boulder about 5' in diameter observed at ground surface.
		E			0.9 132.1	
				Subsoil		0.9 ft. - 3 ft.: Silty SAND (SM), fine to medium, 20-25% fines, 5-10% fine to coarse subrounded gravel, trace of organic soil, trace of roots, orange-brown, moist
2.5		M				
	130.0				3.0 130.0	
		M		Sand and Gravel		3 ft. - 4.9 ft.: Poorly Graded SAND with Silt (SP-SM), fine. 10-15% fines, 5-10% fine subangular gravel, trace of roots, gray, moist
		V				
			2		4.9	REMARK 2: Excavator refusal encountered at depth of 4.9' on rock.
						Bottom of test pit at 4.9 feet. Backfilled the excavation with excavated material in 12" to 18" lifts and tamped with excavator bucket. Ground surface restored with excavated Forest Mat. Area raked and straw placed for erosion control.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.



LGCI

Lahlaif Geotechnical Consulting, Inc.

100 Chelmsford Road, Suite 2
Billerica, MA 01862
Telephone: (978) 330-5912
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TEST PIT LOG

TP-213

PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 7/22/22

DATE COMPLETED: 7/22/22

TEST PIT LOCATION: Near prop. parking lot north of prop. building

COORDINATES: NA

SURFACE EL.: 136 ft. (see note 1) **TOTAL DEPTH:** 3.3 ft.

GROUNDWATER LEVELS:

▽ **DURING EXCAVATION:** -

▽ **AT END OF EXCAVATION:** Not encountered

EXCAVATION SUBCONTRACTOR: Saunders Construction

EXCAVATION FOREMAN: Chris Saunders

EXCAVATOR TYPE/MODEL: Takeuchi TB-175

WEATHER: 90's / Sunny

TEST PIT DIMENSIONS: 10.0' x 7.0'

LOGGED BY: TG

CHECKED BY: NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Forest Mat	0.3	0 ft. - 0.3 ft.: Forest Mat
	135.0	E			135.7	0.3 ft. - 2.3 ft.: Silty SAND (SM), fine to medium, 25-30% fines, 10-15% fine to coarse subrounded gravel, trace of organic soil, trace of roots, brown, moist
		M		Subsoil		
2.5		D			2.3	
		D		Sand and Gravel		2.3 ft. - 3.3 ft.: Poorly Graded SAND with Silt (SP-SM), fine, trace of medium, 10-15% fines, 5-10% cobbles up to 10" in diameter, trace of roots, light brown, moist
		V	1		3.3	REMARK 1: Excavator refusal encountered at depth of 3.3' on rock. Bottom of test pit at 3.3 feet. Backfilled the excavation with excavated material in 12" to 18" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.



LGCI

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TEST PIT LOG

TP-B-205

PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 4/27/22 **DATE COMPLETED:** 4/27/22

EXCAVATION SUBCONTRACTOR: Northern Drill Service, Inc.

TEST PIT LOCATION: Near NE corner of prop. building

EXCAVATION FOREMAN: Justin Raymond

COORDINATES: NA

EXCAVATOR TYPE/MODEL: Kubota KX 080-4

SURFACE EL.: 134 ft. (see note 1) **TOTAL DEPTH:** 9 ft.

WEATHER: 50's / Cloudy

GROUNDWATER LEVELS:

TEST PIT DIMENSIONS: 11.5' x 4.5'

▽ **DURING EXCAVATION:** -

LOGGED BY: HO **CHECKED BY:** NP

▽ **AT END OF EXCAVATION:** 3.0 ft. / El. 131.0 ft.

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Forest Mat	0.5	0 ft. - 0.5 ft.: Forest Mat
	132.5	E		Subsoil	1.5	0.5 ft. - 1.5 ft.: SILT with Sand (ML), slightly plastic, 25-30% fine to medium sand, trace coarse sand, trace fine subrounded gravel, trace of roots, trace of organic soil, brown, moist
2.5		E		Sand and Gravel	132.5	1.5 ft. - 3 ft.: Silty SAND with Gravel (SM), fine to coarse, ~20% fines, 15-20% fine to coarse subangular gravel, 5-10% cobbles up to 8" in diameter, gray, moist
	130.0	E				3 ft. - 9 ft.: Similar to G3, 20-25% fines, wet
5.0						
	127.5	M				
7.5						
	125.0	D			9.0	
REMARK 1: Excavator refusal encountered on possible rock at depth of 9 feet. Bottom of test pit at 9.0 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.						

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

**LGCI**

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Telephone: (978) 330-5912
Fax: (978) 330-5056**TEST PIT LOG****TP-B-206**

PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.**PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.**LGCI PROJECT NUMBER:** 2025**PROJECT LOCATION:** Wakefield, MA**DATE STARTED:** 4/27/22**DATE COMPLETED:** 4/27/22**TEST PIT LOCATION:** Near west of prop. building**COORDINATES:** NA**SURFACE EL.:** 151 ft. (see note 1) **TOTAL DEPTH:** 2.6 ft.**GROUNDWATER LEVELS:**▽ **DURING EXCAVATION:** -▼ **AT END OF EXCAVATION:** 2.6 ft. / El. 148.4 ft.**EXCAVATION SUBCONTRACTOR:** Northern Drill Service, Inc.**EXCAVATION FOREMAN:** Justin Reymond**EXCAVATOR TYPE/MODEL:** Kubota KX 080-4**WEATHER:** 50's / Cloudy**TEST PIT DIMENSIONS:** 10.5' x 5.0'**LOGGED BY:** HO**CHECKED BY:** NP

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Depth El.(ft.)	Material Description
		E		Forest Mat	0.4	0 ft. - 0.4 ft.: Forest Mat
	150.0	E			150.6	0.4 ft. - 2.6 ft.: Silty SAND with Gravel (SM), fine to medium, ~40% fines, 15-20% fine to coarse subangular gravel, 15-20% boulders up to 55" in diameter, trace of organic soil, trace of roots, brown, moist
		V		Subsoil		
2.5			1		2.6	REMARK 1: Excavator refusal encountered on possible rock at depth of 2.6 feet. Bottom of test pit at 2.6 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.



TEST PIT LOG

TP-301

PAGE 1 OF 1

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 9/8/22 DATE COMPLETED: 9/8/22

EXCAVATION SUBCONTRACTOR: Saunders Construction

TEST PIT LOCATION: Near northern side of prop. athletic field

EXCAVATION FOREMAN: Keith Webb

COORDINATES: NA

EXCAVATOR TYPE/MODEL: Kubota KX 080-3

SURFACE EL.: 86 ft. (see note 1) **TOTAL DEPTH:** 3 ft.

WEATHER: 70's / Sunny

GROUNDWATER LEVELS:

TEST PIT DIMENSIONS: 8.0' x 4.0'

 DURING EXCAVATION: Not encountered

LOGGED BY: HO CHECKED BY: TG

▼ AT END OF EXCAVATION: Not encountered

Depth (ft)	El. (ft)	Excavation Effort	Remark	Strata	Material Description
		E		Topsoil	0 ft. - 0.5 ft.: Topsoil
	85.0	E		Fill	0.5 ft. - 1.5 ft.: Poorly Graded SAND with Silt (SP-SM), fine, 5-10% fines, brown, moist
		E		Sand and Gravel	1.5 ft. - 3 ft.: Silty SAND with Gravel (SM), fine to medium, 15-20% fines, 35-40% fine to coarse subangular gravel, brown, moist
2.5		D			
			1		REMARK 1: Excavator refusal encountered at depth of 3 feet on possible rock. Bottom of test pit at 3.0 feet. Backfilled the excavation with excavated material in 18" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M - Moderate, D = Difficult, V = Very Difficult

1. The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeys Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u>
DATE STARTED: <u>9/8/22</u> DATE COMPLETED: <u>9/8/22</u> TEST PIT LOCATION: <u>Near center of prop. athletic field</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>86 ft. (see note 1)</u> TOTAL DEPTH: <u>7.5 ft.</u> GROUNDWATER LEVELS: ▽ DURING EXCAVATION: <u>Not encountered</u> ▽ AT END OF EXCAVATION: <u>Not encountered</u>	EXCAVATION SUBCONTRACTOR: <u>Saunders Construction</u> EXCAVATION FOREMAN: <u>Keith Webb</u> EXCAVATOR TYPE/MODEL: <u>Kubota KX 080-3</u> WEATHER: <u>70's / Sunny</u> TEST PIT DIMENSIONS: <u>10.0' x 4.0'</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>TG</u>

Depth (ft)	El. (ft)	Excavation Effort	Strata	Material Description
		E	Topsoil	0 ft. - 0.5 ft.: Topsoil
	85.0	E	Fill	0.5 ft. - 1.7 ft.: Poorly Graded SAND with Silt (SP-SM), fine to medium, ~5% fines, light brown, moist
		E		1.7 ft. - 7.5 ft.: Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, angular, 5-10% fines, 15-20% fine to medium sand, 45-50% cobbles and boulders up to about 28" in size, light brown, moist
2.5				
	82.5	M		
5.0				
	80.0			
		D		
7.5				
REMARK 1: Excavator refusal encountered at depth of 7.5 feet on possible rock. Bottom of test pit at 7.5 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.				

GENERAL COMMENTS: E = Easy, M = Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: Drummey Rosane Anderson, Inc.

PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.

LGCI PROJECT NUMBER: 2025

PROJECT LOCATION: Wakefield, MA

DATE STARTED: 9/8/22 **DATE COMPLETED:** 9/8/22

TEST PIT LOCATION: Near southern side of prop. athletic field

COORDINATES: NA

SURFACE EL.: 86 ft. (see note 1) **TOTAL DEPTH:** 5.2 ft.

GROUNDWATER LEVELS:

 ▽ **DURING EXCAVATION:** Not encountered

 ▼ **AT END OF EXCAVATION:** Not encountered

EXCAVATION SUBCONTRACTOR: Saunders Construction

EXCAVATION FOREMAN: Keith Webb

EXCAVATOR TYPE/MODEL: Kubota KX 080-3

WEATHER: 70's / Sunny

TEST PIT DIMENSIONS: 10.0' x 4.5'

LOGGED BY: HO

CHECKED BY: TG

Depth (ft)	El. (ft)	Excavation Effort	Strata	Material Description
		E	Topsoil	0 ft. - 0.7 ft.: Topsoil
	85.0	E	Fill	0.7 ft. - 1.1 ft.: Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, 5-10% fine to coarse subangular gravel, trace of roots, brown, moist
		E		1.1 ft. - 2 ft.: Silty SAND with Gravel (SM), fine to medium, 15-20% fines, 15-20% fine to coarse subrounded gravel, 15-20% cobbles up to 8" in size, trace of organic soil, trace of roots, dark brown, moist
2.5		M	Sand and Gravel	2 ft. - 3.5 ft.: Silty SAND with Gravel (SM), fine to medium, 15-20% fines, 20-25% fine to coarse subangular gravel, 25-30% cobbles and boulders up to about 17" in size, brown, moist
	82.5	M		3.5 ft. - 5.2 ft.: Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, 5-10% fines, 20-25% fine to coarse subangular gravel, 35-40% cobbles and boulders up to about 17" in size, light brown, moist
		D		
5.0				
				REMARK 1: Excavator refusal encountered at depth of 5.2 feet on possible rock.
				Bottom of test pit at 5.2 feet. Backfilled the excavation with excavated material in 18" to 24" lifts and tamped with excavator bucket.

GENERAL COMMENTS: E = Easy, M - Moderate, D = Difficult, V = Very Difficult

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

**APPENDIX D – LGCI's Boring Logs, Groundwater Observation Well Installation
Reports, and Photographs of the Rock Cores**

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>12/10/20</u> DATE COMPLETED: <u>12/10/20</u> BORING LOCATION: <u>Near NW corner of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>184.5 ft. (see note 1)</u> TOTAL DEPTH: <u>14 ft.</u> WEATHER: <u>30's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>10.0 ft. / El. 174.5 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>TG</u> CHECKED BY: <u>SD</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Topsoil	S1 - Top 3": Topsoil
		2	S1	1-1-8 (2)	24/11		Subsoil	Bot. 8": Silty SAND with Gravel (SM), fine to medium, 30-35% fines, 15-20% fine to coarse subrounded to angular gravel, trace of organic soil, trace of roots, brown, moist
		2.5	S2	43	6/5			S2 - Similar to S1 Bot. 8", 25-30% fine to coarse subangular to angular gravel, gray
		4						REMARK 1: Split spoon refusal encountered on rock at depth of 2.5'. Advanced button bit about 1.5' to depth of 4'.
5	180.0		C1					C1 - min/ft: 12.6, 5.7, 3.5, 6.3, 7.5 REC=95%, RQD= 66% Very hard, slightly weathered to fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE
10	175.0		C2					C2 - min/ft: 6.6, 3.3, 2.0, 3.1, 4.0 REC=98%, RQD=92% Very hard, fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE
15	170.0							Bottom of borehole at 14.0 feet. Installed groundwater observation well in borehole.
20	165.0							
25	160.0							

GENERAL NOTES:

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

CLIENT: <u>Drummeys Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u>
DATE STARTED: <u>12/11/20</u> DATE COMPLETED: <u>12/11/20</u> BORING LOCATION: <u>Near NE corner of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>166.5 ft. (see note 1)</u> TOTAL DEPTH: <u>0.5 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>Not encountered</u> ▽ AT END OF DRILLING: <u>Not encountered</u> ▽ OTHER: <u>-</u>	DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>TG</u> CHECKED BY: <u>SD</u>

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El. (ft.)	Material Description
0		0.5	S1	42	6/4	1	Topsoil	0.5	S1 - Topsoil
165.0						2			REMARK 1: Split spoon sampler refusal encountered on possible rock at depth of 0.5'. REMARK 2: Moved borehole 18' south and encountered refusal at 0.5'. Exposed a 1' x 2' area of rock with a shovel. Bottom of borehole at 0.5 feet. Backfilled borehole with drill cuttings.
5									
160.0									
10									
155.0									
15									
150.0									
20									
145.0									
25									

GENERAL NOTES:

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u>
DATE STARTED: <u>12/10/20</u> DATE COMPLETED: <u>12/11/20</u> BORING LOCATION: <u>Near SE corner of prop. building</u> COORDINATES: <u>NA</u> SURFACE EI.: <u>170.5 ft. (see note 1)</u> TOTAL DEPTH: <u>18 ft.</u> WEATHER: <u>30's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>Not encountered</u> ▽ OTHER: <u>-</u>	DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>TG</u> CHECKED BY: <u>SD</u>

Depth (ft.)	EI. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
	170.0	0					Topsoil	0.3 170.2
			S1	0-0-1-11 (1)	24/6			
		2					Subsoil	2.2 168.3
		2.2	S2	38/2"	2/1	1		
		3						
5	165.0		C1		60/58			
8								
10	160.0		C2		60/60		Rock	
13								
15	155.0		C3		60/58			
18						2		
20	150.0							
25								

S1 - Top 4": Topsoil
 Bot. 2": SILT with Sand (ML), slightly plastic, ~15% fine sand, trace of organic soil, trace of roots, brownish orange, moist

S2 - Similar to S1 Bot. 2", 10-15% fine subangular to angular gravel
 REMARK 1: Split spoon sampler refusal encountered on rock at depth of 2.2'.
 Advanced button bit about 0.8' to depth of 3'.
 C1 - min/ft: 3.4, 3.4, 2.7, 5.3, 3.8
 REC=97%, RQD=69%
 Very hard, slightly weathered to fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE

C2 - min/ft: 4.6, 3.5, 5.1, 4.3, 5.6
 REC=100%, RQD=51%
 Hard to very hard, slightly weathered to fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE

C3 - min/ft: 5.9, 5.6, 7.7, 11.7, 16.9
 REC=97%, RQD=88%
 Very hard, fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE

REMARK 2: Broke a button bit clearing out the borehole after coring.

Bottom of borehole at 18.0 feet. Installed groundwater observation well in borehole

GENERAL NOTES:

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

CLIENT: <u>Drumme Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u>
DATE STARTED: <u>12/10/20</u> DATE COMPLETED: <u>12/10/20</u> BORING LOCATION: <u>Along western side of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>180.7 ft. (see note 1)</u> TOTAL DEPTH: <u>8 ft.</u> WEATHER: <u>30's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>0.8 ft. / El. 179.9 ft.</u> ▽ OTHER: <u>-</u>	DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>TG</u> CHECKED BY: <u>SD</u>

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
	180.0	0					Topsoil	S1 - Top 3": Topsoil
			S1	2-1-2-1 (3)	24/7		Subsoil	Bot. 4": Silty SAND (SM), fine to medium, 35-40% fines, 0-5% fine subrounded to angular gravel, trace of organic soil, trace of roots, brownish orange, moist
		2						S2 - Top 7": Similar to S1 Bot. 4", 10-15% fine to coarse subrounded to angular gravel
			S2	2-2-9-12 (11)	24/13			Bot. 6": Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, ~20% fine to coarse subrounded to subangular gravel, light brown, moist (natural)
		4					Sand and Gravel	S3 - Similar to S2 Bot. 6", 20-25% fine to coarse subrounded to subangular gravel
5	175.0		S3	15-16-18-27 (34)	24/13			
		6				1		REMARK 1: Split spoon sampler refusal encountered on rock at depth of 6'.
						2	Rock	REMARK 2: Advanced button bit for 10 minutes. Advanced button bit from depth of 6' to 8' into rock.
								Bottom of borehole at 8.0 feet. Backfilled borehole with drill cuttings and 1.5 bags of gravel.
10	170.0							
15	165.0							
20	160.0							
25								

GENERAL NOTES:

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/10/21</u> DATE COMPLETED: <u>5/11/21</u> BORING LOCATION: <u>Near NW corner of prop. building</u> COORDINATES: <u>NA</u> SURFACE EI.: <u>172.6 ft. (see note 1)</u> TOTAL DEPTH: <u>36 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>5.2 ft. / El. 167.4 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 3-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>TG</u> CHECKED BY: <u>NP</u>
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Depth (ft.)	EI. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0	S1		0.1/0.1		Forest Mat	S1 - Forest Mat
1		1				1		REMARK 1: Spun casing to a depth of 1'. C1 - min/ft: 7.3, 8.1, 12.2, 11.2, 14.7 REC = 97%, RQD = 73% Very hard, slightly weathered to fresh, slightly fractured to sound, gray with white and green mottles, fine-grained to medium-grained, RHYOLITE
5	170.0		C1		60/58			
6								
6	165.0		C2		60/60	2		C2 - min/ft: 19.5, 12.3, 12.8, 16.1, 15.1 REC = 100%, RQD = 46% Very hard, slightly weathered to fresh, extremely fractured to slightly fractured, gray, fine-grained, RHYOLITE REMARK 2: Rock core sampler jammed at depth of 7.8'.
10								
11	160.0		C3		60/60	3	Rock	C3 - min/ft: 11.1, 10.0, 11.1, 6.1, 5.5 REC = 100%, RQD = 63% Very hard, fresh, extremely fractured to sound, gray with white mottles, fine-grained to medium-grained, RHYOLITE REMARK 3: Lost water at depth of 14' through end of boring.
15								
16	155.0		C4		60/60			C4 - min/ft: 3.5, 3.0, 4.6, 4.6, 3.3 REC = 100%, RQD = 80% Hard to very hard, slightly weathered to fresh, extremely fractured to sound, gray with white mottles and green banding, medium-grained, RHYOLITE
20								
21	150.0		C5		60/60			C5 - min/ft: 7.3, 8.1, 12.2, 11.2, 14.7 REC = 97%, RQD = 73% Very hard, slightly weathered to fresh, slightly fractured to sound, gray with white mottles and green banding, medium-grained, RHYOLITE
25								

GENERAL NOTES:

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

CLIENT: Drummeys Rosane Anderson, Inc.
PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.
LGCI PROJECT NUMBER: 2025
PROJECT LOCATION: Wakefield, MA

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
21								
26								
145.0								
30			C6		60/60		Rock	C6 - min/ft: 9.0, 8.8, 14.6, 19.1, 2.7 REC = 100%, RQD = 91% Very hard, slightly weathered to fresh, moderately fractured to sound, gray with white mottles and green banding, medium-grained, RHYOLITE
31								
140.0			C7		60/60			C7 - min/ft: 2.3, 4.7, 5.2, 6.3, 6.5 REC = 100%, RQD = 100% Very hard, slightly weathered to fresh, moderately fractured to sound, gray with white mottles and green banding, fine-grained to medium-grained, RHYOLITE
35								
36								
135.0								Bottom of borehole at 36.0 feet. Backfilled borehole with drill cuttings. Installed groundwater observation well.
40								
130.0								
45								
125.0								
50								
120.0								
55								
115.0								
60								

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/10/21</u> DATE COMPLETED: <u>5/10/21</u> BORING LOCATION: <u>Near NE corner of prop. building</u> COORDINATES: <u>NA</u> SURFACE EI.: <u>158.7 ft. (see note 1)</u> TOTAL DEPTH: <u>23.5 ft.</u> WEATHER: <u>50's / Cloudy</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>2.5 ft. / El. 156.2 ft. Based on sample moisture.</u> ▽ AT END OF DRILLING: <u>-</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>QV</u> CHECKED BY: <u>NP</u>
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Depth (ft.)	EI. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Forest Mat	S1 - Top 5": Forest Mat
		2	S1	1-1-1-12 (2)	24/12		Subsoil	Bot 7": Silty SAND (SM), fine, trace medium, 35-40% fines, trace of organic soil, trace of roots, brown, moist
		2.7	S2	22-100/2"	8/4			S2 - Well Graded GRAVEL (GW), subangular to angular, ~5% fines, 5-10% medium to coarse sand, light brown, wet
5	155.0	3.5	C1		60/59.5			C1 - min/ft: 8.9, 7.3, 8.0, 8.8, 8.2 REC = 99%, RQD = 95% Very hard, slightly weathered to fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE
10	150.0	8.5	C2		60/55			C2 - min/ft: 10.1, 10.5, 10.7, 18.8, 2.8 REC = 91.7%, RQD = 71.7% Very hard, slightly weathered to fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE
15	145.0	13.5	C3		60/60		Rock	C3 - min/ft: 5.7, 6.7, 2.8, 3.7, 6.1 REC = 100%, RQD = 90% Hard, slightly weathered to fresh, moderately fractured to sound, gray with green mottles, medium-grained to coarse-grained, RHYOLITE
20	140.0	18.5	C4		60/60			C4 - min/ft: 3.9, 3.8, 6.8, 6.6, 7.3 REC = 100%, RQD = 96.7% Hard, slightly weathered to fresh, moderately fractured to sound, gray with green and white mottles, medium-grained, RHYOLITE
25	135.0	23.5						Bottom of borehole at 23.5 feet. Backfilled borehole with drill cuttings.

GENERAL NOTES:

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u>
DATE STARTED: <u>5/7/21</u> DATE COMPLETED: <u>5/14/21</u> BORING LOCATION: <u>Near NW portion of prop. building</u> COORDINATES: <u>NA</u> SURFACE EI.: <u>174.6 ft. (see note 1)</u> TOTAL DEPTH: <u>23.5 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>0.1 ft. / El. 174.5 ft.</u> ▽ OTHER: <u>-</u>	DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 3-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>NP / FR</u> CHECKED BY: <u>AML</u>

Depth (ft.)	EI. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0						
			S1	1-1-2-100/4" (3)	22/7		Forest Mat	S1 - Top 4": Forest Mat, trace of organic soil, trace of roots Bottom 3": Silty SAND (SM), fine to coarse, 20-25% fines, trace of roots, trace of organic soil, trace of pine needles, brown, moist
		1.8				1		REMARK 1: Split spoon sampler refusal encountered on rock at depth of 1.8'. Advanced to 3.5' to seat casing and started coring. Drilled used series 10 bit to make coring faster.
		3.5						C1 - min/ft: 19.0, 55.0, 33.0, 7.0, 44.0 REC = 85%, RQD = 40% Hard, slightly weathered to fresh, extremely fractured to slightly fractured, gray, medium-grained, RHYOLITE
5	170.0		C1		60/55			
		8.5				2		C2 - min/ft: 25.0, 34.5, 14.5, 42.1, 145.0 REC = 90%, RQD = 63.3% Very hard, slightly weathered to fresh, extremely fractured to slightly fractured, gray, medium-grained, RHYOLITE REMARK 2: Rock core sampler jammed at depth of 10'.
10	165.0		C2		60/54			
		13.5				3	Rock	REMARK 3: Rock core sampler jammed at depth of 12.7'
15	160.0		C3		60/60			C3 - min/ft: 130.0, 8.0, 6.0, 8.5, 22.0 REC = 100%, RQD = 83.3% Very hard, fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE REMARK 4: Rock became softer and faster to core at depth of 15.5'.
		18.5				4		C4 - min/ft: 18.0, 15.0, 25.0, 8.0, 11.0 REC = 95%, RQD = 88.3% Very hard, slightly weathered to fresh, extremely fractured to sound, gray, medium-grained, RHYOLITE
20	155.0		C4		60/57			
		23.5						Bottom of borehole at 23.5 feet. Backfilled borehole with drill cuttings.
25	150.0							

GENERAL NOTES:

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

CLIENT: <u>Drummeys Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u>
DATE STARTED: <u>5/12/21</u> DATE COMPLETED: <u>5/12/21</u> BORING LOCATION: <u>Near southern portion of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>180.9 ft. (see note 1)</u> TOTAL DEPTH: <u>27 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>0.0 ft. / El. 180.9 ft.</u> ▽ OTHER: <u>-</u>	DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 3-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>NP / FR</u> CHECKED BY: <u>AML</u>

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
	180.0	0.7	S1	1-100/2"	8/1	1	Forest Mat	S1 - Forest Mat REMARK 1: Split spoon sampler refusal encountered at depth of 8" on rock.
2								
5	175.0		C1	60/60				C1 - min/ft: 5.2, 5.1, 4.1, 3.1, 3.1 REC = 100%, RQD = 76.7% Hard to very hard, slightly weathered to fresh, moderately fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
7								
10	170.0		C2	60/59				C2 - min/ft: 2.6, 2.5, 2.5, 2.9, 3.1 REC = 98.3, RQD = 67.5% Hard to very hard, moderately weathered to fresh, moderately fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
12								
15	165.0		C3	60/60			Rock	C3 - min/ft: 2.7, 2.5, 2.3, 2.7, 3.2 REC = 100%, RQD = 81.7% Hard to very hard, slightly weathered to fresh, moderately fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
17								
20	160.0		C4	60/60				C4 - min/ft: 5.2, 5.7, 3.5, 6.0, 7.1 REC = 100%, RQD = 93.3% Hard to very hard, fresh, moderately fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
22								
25			C5	60/60				C5 - min/ft: 5.5, 4.5, 5.3, 4.2, 4.5 REC = 100%, RQD = 84.2% Hard to very hard, fresh, moderately fractured to sound, gray, fine-grained to medium-grained, RHYOLITE

GENERAL NOTES:

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

CLIENT: <u>Drummeys Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u>
DATE STARTED: <u>4/26/21</u> DATE COMPLETED: <u>4/26/21</u> BORING LOCATION: <u>Near SW corner of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>161.5 ft. (see note 1)</u> TOTAL DEPTH: <u>17 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>2.0 ft. / El. 159.5 ft.</u> ▽ OTHER: <u>-</u>	DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Diedrich D-25 Track Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>NP</u> CHECKED BY: <u>AML</u>

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Forest Mat	
	160.0		S1	1-3-2-3 (5)	24/12		Subsoil	S1 - Top 4": Forest Mat Bot 8": Silty SAND (SM), fine to medium, 30-35% fines, 5-10% fine subrounded gravel, trace of organic soil, trace of roots, brown, moist
		2						
		3.5	S2	4-33-67	18/11		Sand	S2 - Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, trace coarse, ~10% fines, ~25% fine to coarse subrounded gravel, light brown, moist (natural)
5								
	155.0							
		7						
			C1		60/57		Rock	C1 - min/ft: 3.5, 5.1, 10.5, 31.2, 32.1 REC = 95%, RQD = 95% Hard to very hard, slightly weathered to fresh, slightly fractured to sound, gray with brown mottles, fine-grained to medium-grained, RHYOLITE
10								
	150.0							
		12				1		REMARK 1: Switched to series 6 turbo rock core bit from a series 4 rock core bit at depth of 12'. C2 - min/ft: 8.1, 8.5, 15.2, 18.1, 19.2 REC = 90%, RQD = 86.7% Hard to very hard, fresh, moderately fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
15			C2		60/54			
	145.0							
		17						Bottom of borehole at 17.0 feet. Backfilled borehole with drill cuttings.
20								
	140.0							
25								

GENERAL NOTES:

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>4/27/21</u> DATE COMPLETED: <u>5/14/21</u> BORING LOCATION: <u>Near SE corner of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>161.9 ft. (see note 1)</u> TOTAL DEPTH: <u>11.5 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>1.0 ft. / El. 160.9 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Deidrich D-25 Track Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>NP / FR</u> CHECKED BY: <u>AML</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0						
		1.3	S1	1-3-100/3"	15/4		Forest Mat	S1 - Forest Mat
160.0						1		REMARK 1: Split spoon sampler refusal encountered on rock at depth of 1.4'.
		3.5						
5			C1		36/29.5			C1 - min/ft: 32.9, 65.1, 42.0 REC = 82%, RQD = 75% Hard to very hard, fresh, moderately fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
155.0		6.5					Rock	
			C2		60/56			C2 - min/ft: 5.5, 5.0, 6.0, 2.5, 6.5 REC = 93%, RQD = 75% Hard to very hard, fresh, extremely fractured to sound, blue, fine-grained to medium-grained, RHYOLITE
10								
150.0		11.5						Bottom of borehole at 11.5 feet. Backfilled borehole with drill cuttings.
15								
145.0								
20								
140.0								
25								

GENERAL NOTES:

- The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.

CLIENT: <u>Drummeys Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u>
DATE STARTED: <u>4/28/22</u> DATE COMPLETED: <u>4/28/22</u> BORING LOCATION: <u>Near SW corner of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>167 ft. (see note 1)</u> TOTAL DEPTH: <u>24.5 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>3.0 ft. / El. 164.0 ft. Based on sample moisture</u> ▽ AT END OF DRILLING: <u>2.0 ft. / El. 165.0 ft.</u> ▽ OTHER: <u>-</u>	DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>NP</u> CHECKED BY: <u>HH</u>

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0						S1 - Forest Mat
	165.0	2	S1	0-0-1-1 (1)	24/8		Forest Mat	
								2.0
								3.0
								164.0
			S2	1-1-1-2 (2)	24/22		Subsoil	S2 - Top 12": Silty SAND (SM), fine, 40-45% slightly plastic fines, trace of organic soil, trace of roots, brown, moist
								Bot. 10": Silty SAND (SM), fine, 30-35% fines, trace of organic soil, trace of roots, light brown, wet
5		4	S3	9-28-42-34 (70)	24/12		Sand and Gravel	S3 - Silty SAND (SM), mostly fine, 40-45% fines, 10-15% fine subrounded gravel, light brown, wet
		6	S4	28-42-44-100/3" (86)	21/19			S4 - Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 20-25% fine subrounded gravel, light brown, wet
	160.0	7.8				1		REMARK 1: Split spoon refusal encountered at 7.8' on possible boulder.
		8.3	S5	100/3"	3/2			S5 - Silty SAND with Gravel (SM), fine to coarse, 20-25% fines, 20-25% fine subangular gravel, light brown, wet
						2	Boulder	REMARK 2: Split spoon refusal encountered at 8.3' on boulder. Drilled to 10.5' through boulder.
10		10.5						10.5
			S6	52-65-63-81 (128)	24/17			156.5
	155.0	12.5						S6 - Similar to S5, 15-20% fines (possible weathered rock)
		14	S7	39-56-92-100/3" (148)	21/11		Sand and Gravel	S7 - Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, ~35% fine to coarse subangular gravel, light brown, wet (possible weathered rock)
15		15.8						
	150.0							
		19	S8	100/1"	1/1			19.1
20		19.3				3		147.9
								S8 - Similar to S7
								REMARK 3: Split spoon refusal encountered at 19.1' on rock. Drilled to 19.5' and began rock core.
								C1 - min/ft: 3.0, 3.0, 3.5, 2.5, 2.5
								REC = 91.67%, RQD = 11.67%
								Soft to Hard, moderately weathered to slightly weathered, extremely fractured to lightly fractured, medium-grained, gray, RHYOLITE
	145.0		C1		60/55		Rock	
								24.5
25		24.5						Bottom of borehole at 24.5 feet. Backfilled borehole with drill cuttings.

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>4/27/22</u> DATE COMPLETED: <u>4/28/22</u> BORING LOCATION: <u>Near SE corner of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>176 ft. (see note 1)</u> TOTAL DEPTH: <u>22.5 ft.</u> WEATHER: <u>50's/ Cloudy</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>5.2 ft. / El. 170.8 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>NP</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
								Depth El. (ft.) S1 - Top 4": Forest Mat Bot. 2": Silty SAND with Gravel (SM), fine to coarse, 30-35% fines, 30-35% fine to coarse subrounded gravel, brown to dark brown, moist REMARK 1: Split spoon refusal at 1.8' on rock. Drilled to 2.5' and began rock core C1 - min/ft: 4.7, 3.2, 3.0, 3.7, 4.8 REC = 100%, RQD = 58.3% Hard, moderately weathered to fresh, extremely fractured to slightly fractured, gray, medium-grained, RHYOLITE
175.0	175.0	0	S1	0-0-1-100/3" (1)	21/6		Forest Mat	
		1.8				1	Subsoil	
2.5	174.2	2.5						
5			C1		60/60			
170.0								
		7.5						
10			C2		60/60			
165.0								
		12.5					Rock	
15			C3		60/60			
160.0								
		17.5						
20			C4		60/60			
155.0								
		22.5						
22.5								Bottom of borehole at 22.5 feet. Backfilled borehole with drill cuttings and 2 bags of asphalt.
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeys Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/2/22</u> DATE COMPLETED: <u>5/6/22</u> BORING LOCATION: <u>Near eastern side of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>167 ft. (see note 1)</u> TOTAL DEPTH: <u>11.5 ft.</u> WEATHER: <u>50's / Cloudy</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>1.0 ft. / El. 166.0 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>NP / HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Forest Mat	
			S1	0-2-3-100 (5)	24/5		Subsoil	S1 - Top 2": Forest Mat ▼ Bot. 3": Silty SAND with Gravel (SM), fine to coarse, 30-35% fines, 15-20% fine subrounded gravel, dark brown, moist
165.0		2						
		2.5						
5			C1		60/60	1		C1 - min/ft: 8.5, 60, 104.9, 211, 16.3 REC = 100%, RQD = 83.33% Very hard, moderately weathered to fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE
160.0		7.5				2	Rock	REMARK 1: Consumed 9 tanks (2900) gallons of water during coring from 5.5' to 6.5'. C2 - min/ft: 10.2, 14.1, 32.7, 49.6 REC = 97.92%, RQD = 46.88% Very hard, moderately weathered, moderately fractured to slightly fractured, gray, fine-grained to medium-grained, RHYOLITE REMARK 2: Rock core barrel jammed at 7.7' due to core fracure.
10			C2		48/47			
155.0		11.5						Bottom of borehole at 11.5 feet. Backfilled borehole with drill cuttings and 2 bags of gravel.
15								
150.0								
20								
145.0								
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/4/22</u> DATE COMPLETED: <u>5/4/22</u> BORING LOCATION: <u>Near center of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>162 ft. (see note 1)</u> TOTAL DEPTH: <u>25.5 ft.</u> WEATHER: <u>50's / Rain</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>4.0 ft. / El. 158.0 ft. Based on Sample Moisture</u> ▽ AT END OF DRILLING: <u>1.0 ft. / El. 161.0 ft.</u> ▽ OTHER: <u>3.0 ft. / El. 159.0 ft. Monitored on 5/5</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch then 3-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Forest Mat	S1 - Top 4": Forest Mat
	160.0	2	S1	1-1-1-2 (2)	24/10		Subsoil	▼ Bot. 6": SILT with Sand (ML), non-plastic, 25-30% fine to medium sand, trace coarse sand, 0-5% fine subrounded gravel, brown, moist
			S2	3-14-22-28 (36)	24/16			S2 - Top 8": Similar to S1 Bot. 6"
		4	S3	100/4"	4/4		Sand and Gravel	▼ Bot. 8": Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, angular, 5-10% fines, 40-45% fine to coarse sand, brown to gray, moist
5		4.3						▼ S3 - Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 35-40% fine to coarse subrounded gravel, light brown, wet
	155.0	5.5	C1			1		C1 - min/ft: 10.2, 7.1, 3.6, 3.1, 6.4 REC = 96.67%, RQD = 25.83% Hard, moderately weathered, extremely fractured to slightly fractured, gray to olive, fine-grained to medium-grained, RHYOLITE REMARK 1: Rock core barrel jammed at depth 6.5' due to core fracture
10		10.5	C2			2		REMARK 2: Rock core barrel jammed at depth 9' due to core fracture
	150.0							C2 - min/ft: 2.8, 3.3, 3.5, 4.3, 5.4 REC = 100%, RQD = 38.33% Hard to very hard, moderately weathered, moderately fractured to slightly fractured, gray to olive, fine-grained to medium-grained, RHYOLITE
15		15.5	C3				Rock	C3 - min/ft: 5.0, 4.8, 5.0, 7.7, 11.5 REC = 100%, RQD = 82.5% Hard, moderately weathered to fresh, moderately fractured to sound, gray to olive, fine-grained to medium-grained, RHYOLITE
	145.0							
20		20.5	C4					C4 - min/ft: 12.2, 9.2, 12.0, 16.7, 17.4 REC = 100%, RQD = 69.17% Hard, moderately weathered to slightly weathered, moderately fractured to sound, gray to olive, fine-grained to medium-grained, RHYOLITE
	140.0							
25						3		REMARK 3: Rock core barrel jammed at depth 24' due to core fracture

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: Drummeys Rosane Anderson, Inc. **PROJECT NAME:** Prop. Northeast Metro Reg. Vocational Tech. H.S.
LGCI PROJECT NUMBER: 2025 **PROJECT LOCATION:** Wakefield, MA

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		20.5 25.5	11				Rock	Bottom of borehole at 25.5 feet. Installed groundwater observation well.
135.0								
30								
130.0								
35								
125.0								
40								
120.0								
45								
115.0								
50								
110.0								
55								
105.0								
60								

CLIENT: <u>Drummeys Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>4/28/22</u> DATE COMPLETED: <u>4/29/22</u> BORING LOCATION: <u>Near NW corner of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>181 ft. (see note 1)</u> TOTAL DEPTH: <u>21.5 ft.</u> WEATHER: <u>40's/ Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>4.5 ft. / El. 176.5 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>HO / NP</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
	180.0	0	S1	1-1-100/4"	16/4		Forest Mat	S1 - Forest Mat
		1.3						
			C1		60/60			C1 - min/ft: 4.0, 4.2, 3.6, 7.3, 8.1 REC = 100%, RQD = 41.67% Hard to very hard, moderately weathered to fresh, extremely fractured to sound, gray, fine-grained to medium-grained, RHYOLITE REMARK 1: Rock core barrel jammed at 3' due to core fracture ▼ REMARK 2: Rock core barrel jammed at 4.5' due to core fracture
5								
	175.0	6.5	C2		60/60			C2 - min/ft: 3.6, 3.5, 3.7, 4.3, 4.4 REC = 100%, RQD = 77.5% Hard to very hard, slightly weathered to fresh, moderately fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
10								
	170.0	11.5	C3		60/60		Rock	C3 - min/ft: 4.3, 4.4, 4.3, 6.7, 7.5 REC = 100%, RQD = 86.67% Hard to very hard, slightly weathered to fresh, moderately fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
15								
	165.0	16.5	C4		60/60			C4 - min/ft: 5.1, 4.6, 4.5, 5.7, 7.0 REC = 100%, RQD = 95.83% Hard to very hard, slightly weathered to fresh, moderately fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
20								
	160.0	21.5						
25								Bottom of borehole at 21.5 feet. Backfilled borehole with drill cuttings and 4 bags of gravel.

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/5/22</u> DATE COMPLETED: <u>5/5/22</u> BORING LOCATION: <u>Near northern side of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>139 ft. (see note 1)</u> TOTAL DEPTH: <u>13 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>2.0 ft. / El. 137.0 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Forest Mat	S1 - Top 4": Forest Mat
			S1	1-1-2-3 (3)	24/10		Subsoil	Bot. 6": Silty SAND (SM), fine, 25-30% fines, dark brown, moist
		2						S2 - Top 6": Similar to S1 Bot. 6"
		2.9	S2	6-100/5"	11/10		Sand and Gravel	Bot. 4": Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, angular, 5-10% fines, 20-25% fine to coarse sand, gray to brown, moist
135.0		3						C1 - min/ft: 5.1, 4.7, 7.2, 3.4, 5.2 REC = 100%, RQD = 45% Hard to very hard, moderately weathered, moderately fractured to slightly fractured, gray, fine-grained to medium-grained, RHYOLITE REMARK 1: Rock core barrel jammed at 5.7' due to core fracture
5			C1		60/60	1	Rock	
		8						C2 - min/ft: 2.5, 4.8, 5.6, 8.1, 9.7 REC = 95%, RQD = 90% Very hard, moderately weathered to fresh, extremely fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
130.0			C2		60/57			
10								
		13						Bottom of borehole at 13.0 feet. Backfilled borehole with drill cuttings and 2 bags of gravel.
125.0								
15								
120.0								
20								
115.0								
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>4/26/22</u> DATE COMPLETED: <u>4/27/22</u> BORING LOCATION: <u>Near western side of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>193 ft. (see note 1)</u> TOTAL DEPTH: <u>37 ft.</u> WEATHER: <u>50's / Cloudy</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>7.0 ft. / El. 186.0 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>NP</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0						
		1.5	S1	1-1-100	18/7		Forest Mat	S1 - Top 3": Forest Mat
		2				1	Subsoil	Bot. 4": Silty SAND (SM), fine, 25-30% fines, trace organic soil, trace of roots, brown to dark brown, moist REMARK 1: Split spoon refusal encountered at 1.5' on rock. Drilled to 2' and began rock core
5	190.0		C1		60/56			C1 - min/ft: 2.8, 2.8, 3.5, 3.7, 4.2 REC = 93.33%, RQD = 74.16% Hard to very hard, slightly weathered to fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE
7	185.0		C2		60/60			C2 - min/ft: 3.5, 3.9, 5.5, 4.5, 4.5 REC = 100%, RQD = 93.33% Very hard, fresh, slightly fractured to sound, gray, medium-grained, RHYOLITE
10								
12	180.0		C3		60/60		Rock	C3 - min/ft: 3.6, 3.0, 3.2, 3.9, 5.5 REC = 100%, RQD = 86% Very hard, slightly weathered to fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE
15								
17	175.0		C4		60/60			C4 - min/ft: 4.5, 3.7, 4.7, 5.7, 4.2 REC = 100%, RQD = 100% Very hard, fresh, slightly fractured to sound, gray, medium-grained, RHYOLITE
20								
22	170.0		C5		60/58			C5 - min/ft: 5.2, 5.0, 6.5, 5.1, 7.2 REC = 96.67%, RQD = 80% Hard to very hard, slightly weathered to fresh, extremely fractured to sound, gray, medium-grained, RHYOLITE
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: Drummey Rosane Anderson, Inc.
PROJECT NAME: Prop. Northeast Metro Reg. Vocational Tech. H.S.
LGCI PROJECT NUMBER: 2025
PROJECT LOCATION: Wakefield, MA

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
22								Depth El. (ft.) 191.5
27	165.0							
30			C6		60/60		Rock	C6 - min/ft: 4.5, 3.9, 3.7, 6.5, 6.1 REC = 100%, RQD = 87.5% Hard to very hard, slightly weathered to fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE
32	160.0							
35			C7		60/56			C7 - min/ft: 5.8, 4.9, 5.2, 5.0, 5.3 REC = 93.33%, RQD = 88.33% Hard to very hard, slightly weathered to fresh, moderately fractured to sound, gray, medium-grained, RHYOLITE
37	155.0							37.0 Bottom of borehole at 37.0 feet. Installed groundwater observation well.
40								
	150.0							
45								
	145.0							
50								
	140.0							
55								
	135.0							
60								

CLIENT: <u>Drumme Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>4/29/22</u> DATE COMPLETED: <u>4/29/22</u> BORING LOCATION: <u>Near southern side of prop. building</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>152 ft. (see note 1)</u> TOTAL DEPTH: <u>5.5 ft.</u> WEATHER: <u>40's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>Not encountered</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0						
		0.5	S1	100	6/6		Forest Mat	S1 - Forest Mat
150.0								
			C1		60/52		Rock	C1 - min/ft: 3.1, 3.9, 5.1, 5.7, 5.3, REC = 86.67%, RQD = 86.67% Very hard, fresh, slightly fractured to sound, gray, fine-grained to medium-grained, RHYOLITE
5		5.5						
								Bottom of borehole at 5.5 feet. Backfilled borehole with drill cuttings and 1 bag of gravel.
145.0								
10								
140.0								
15								
135.0								
20								
130.0								
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/9/22</u> DATE COMPLETED: <u>5/9/22</u> BORING LOCATION: <u>Near SE side of prop. soccer field</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>80 ft. (see note 1)</u> TOTAL DEPTH: <u>10 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>1.0 ft. / El. 79.0 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NA</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Asphalt	S1 - Top 3": Asphalt
			S1	15-11-9-8 (20)	24/11			▼ Bot. 8": Silty SAND with Gravel (SM), fine to medium, ~15% fines, 30-35% fine to coarse subangular gravel, brown, moist
		2					Fill	S2 - Silty SAND with Gravel (SM), fine to coarse, 20-25% fines, 15-20% fine to coarse subangular gravel, trace of bricks, brown to orange, moist
		4						S3 - Top 10": Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 15-20% fine to coarse subangular gravel, trace of brick, brown, moist
5	75.0		S2	14-17-10-12 (27)	24/11			Bot. 9": Similar to S3 Top 10", 25-30% fine to coarse subangular gravel
			S3	12-29-37-49 (66)	24/19		Sand and Gravel	REMARK 1: Drill rig chattering from 6' to 7' on possible cobbles
		6					Rock	REMARK 2: Casing refusal at 8'
10	70.0							REMARK 3: Advanced roller bit from 8' to 10' to confirm presence of rock
								Bottom of borehole at 10.0 feet. Backfilled borehole with drill cuttings and 1 bag of gravel. Ground surface restored with asphalt cold patch.
15	65.0							
20	60.0							
25	55.0							

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: Drummey Rosane Anderson, Inc.

[illegible]

GENERAL NOTES:

1. The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/9/22</u> DATE COMPLETED: <u>5/9/22</u> BORING LOCATION: <u>Near SW side of prop. soccer field</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>83 ft. (see note 1)</u> TOTAL DEPTH: <u>11 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>9.0 ft. / El. 74.0 ft. Based on sample moisture</u> ▽ AT END OF DRILLING: <u>3.5 ft. / El. 79.5 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NA</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Asphalt	S1 - Top 6": Asphalt
		2	S1	64-12-22-24 (34)	24/17		Fill	Bot. 6": Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, angular, 5-10% fines, 20-25% fine to medium sand, brown, moist
	80.0		S2	20-10-5-15 (15)	24/7			S2 - Similar to S1 Bot. 6", 40-45% fine to coarse sand, trace of asphalt
		4						▽
5			S3	18-17-18-16 (35)	24/10			S3 - Silty SAND with Gravel (SM), fine to medium, ~15% fines, 30-35 fine to coarse subangular gravel, brown, moist
		6						
	75.0		S4	20-27-39-39 (66)	24/15		Sand and Gravel	S4 - Top 7": Silty SAND (SM), fine to coarse, 15-20% fines, 0-5% fine subrounded gravel, brown, moist
		8						Bot. 8": Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 30-35% fine to coarse angular gravel, brown, moist
		9						▽
10		9.8	S5	56-100/4"	10/7	1		S5 - Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, angular to subangular, 5-10% fines, 30-35% fine to coarse sand, brown, wet
								REMARK 1: Advanced roller bit from 9.8' to 11' to confirm presence of Sand and Gravel Strata
								Bottom of borehole at 11.0 feet. Backfilled borehole with drill cuttings. Ground surface restored with asphalt cold patch.
	70.0							
15								
	65.0							
20								
	60.0							
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/9/22</u> DATE COMPLETED: <u>5/9/22</u> BORING LOCATION: <u>Near western side of prop. soccer field</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>85 ft. (see note 1)</u> TOTAL DEPTH: <u>4 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>Not encountered</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NA</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Asphalt	Depth El. (ft.) 0.2 84.8
			S1	12-11-16-21 (27)	24/11		Fill	S1 - Top 2": Asphalt Bot. 9": Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, 5-10% fines, 40-45% fine to coarse subangular gravel, brown, moist
		2						2.3 84.5
		2.6	S2	70-100/1"	7/7		Sand and Gravel	S2 - Top 4": Well Graded SAND with Silt, (SW-SM), fine to coarse, 5-10% fines, 10-15% fine angular gravel, brown, moist
						1	Rock	Bot. 3": Well Graded GRAVEL with Sand (GW), fine to coarse, angular, 0-5% fines, 20-25% fine to medium sand, white, moist
5	80.0							4.0 82.4
								REMARK 1: Advanced roller bit from 2.7' to 4' to confirm presence of rock Bottom of borehole at 4.0 feet. Backfilled borehole with drill cuttings and 0.5 bags of gravel. Ground surface restored with asphalt cold patch.
10	75.0							
15	70.0							
20	65.0							
25	60.0							

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/10/22</u> DATE COMPLETED: <u>5/10/22</u> BORING LOCATION: <u>Near NW side of prop. soccer field</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>201 ft. (see note 1)</u> TOTAL DEPTH: <u>8 ft.</u> WEATHER: <u>50's /Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>Not encountered</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NA</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
	200.0	0					Asphalt	0.3 S1 - Top 3": Asphalt
			S1	21-10-11-15 (21)	24/12		Fill	0.8 Mid. 6": Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 20-25% coarse subangular to subrounded gravel, trace of asphalt, brown, moist
		2						200.2 Bot. 3": Well Graded GRAVEL with Sand (GW), fine to coarse, angular, 0-5% fines, 30-35% fine to coarse sand, weathered rock, gray, moist
			S2	15-16-16-27 (32)	24/10			S2 - Similar to S1 Bot. 3", 25-30% fine to coarse sand
		4					Sand and Gravel	
5			S3	25-24-16-16 (40)	24/9			S3 - Similar to S1 Bot. 3", 20-25% medium to coarse sand
195.0		6						
							1 Rock	7.0 REMARK 1: Casing refusal at 7'
							2	8.0 REMARK 2: Advanced roller bit from 7' to 8' to confirm presence of rock
								Bottom of borehole at 8.0 feet. Backfilled borehole with drill cuttings. Ground surface restored with asphalt cold patch.
10								
190.0								
15								
185.0								
20								
180.0								
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drumme Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/10/22</u> DATE COMPLETED: <u>5/10/22</u> BORING LOCATION: <u>Near NE side of prop. soccer field</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>89 ft. (see note 1)</u> TOTAL DEPTH: <u>8.5 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>4.9 ft. / El. 84.1 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Asphalt	0.3 88.7
			S1	21-10-11-27 (21)	24/13			
		2					Fill	
			S2	52-60-40/4"	16/12			3.3 85.7
	85.0	3.3						
5							Rock	
			C1		60/56	1		
	80.0	8.5						
10								
	75.0							
15								
	70.0							
20								
	65.0							
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/10/22</u> DATE COMPLETED: <u>5/10/22</u> BORING LOCATION: <u>Near eastern side of prop. soccer field</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>89 ft. (see note 1)</u> TOTAL DEPTH: <u>4 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>2.0 ft. / El. 87.0 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NA</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Asphalt	0.3 S1 - Top 3": Asphalt
			S1	23-13-20-64 (33)	24/13		Fill	1.0 Mid. 9": Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, 5-10% fines, 15-20% fine subangular gravel, brown, moist
		2					Sand and Gravel	88.0 ▼ Bot. 1": Well Graded GRAVEL with Sand (GW), fine to coarse, angular, 0-5% fines, 20-25% fine to coarse sand, weathered rock, gray, moist
		3.3	S2	34-51-51/3"	15/7			S2 - Similar to S1 Bot. 1"
85.0						1	Rock	3.5 REMARK 1: Casing refusal at 3.5'
5						2		4.0 REMARK 2: Advanced roller bit from 3.5' to 4' to confirm presence of rock
								Bottom of borehole at 4.0 feet. Backfilled borehole with drill cuttings. Ground surface restored with asphalt cold patch.
80.0								
10								
75.0								
15								
70.0								
20								
65.0								
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeys Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/10/22</u> DATE COMPLETED: <u>5/11/22</u> BORING LOCATION: <u>Near NE side of prop. football field</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>88 ft. (see note 1)</u> TOTAL DEPTH: <u>11 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>4.0 ft. / El. 84.0 ft. Based on sample moisture</u> ▽ AT END OF DRILLING: <u>10.7 ft. / El. 77.3 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NX</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Asphalt	S1 - Top 3": Asphalt
			S1	19-14-15-17 (29)	24/13		Fill	Bot. 10": Well Graded SAND with Gravel (SW), fine to medium, 0-5% fines, 15-20% fine to coarse angular gravel, brown, moist
	85.0	2	S2	14-6-4-5 (10)	24/11		Subsoil	S2 - Silty SAND with Gravel (SM), fine to medium, trace coarse, 35-40% fines, 20-25% mostly fine subangular gravel, trace of organic soil, brown, moist
		4	S3	11-11-90/4"	16/7		Sand and Gravel	S3 - Poorly Graded GRAVEL with Silt and Sand (GP-GM), mostly coarse, angular, 10-15% fines, 20-25% fine to coarse sand, trace of weathered rock, light brown, wet
5		5.3						
		6						
	80.0		C1		60/59	1	Rock	C1 - min/ft: 4.2, 2.5, 6.3, 2.5, 2.1 REC = 98.33%, RQD = 15% Hard, moderately weathered, extremely fractured to slightly fractured, gray, fine-grained, RHYOLITE REMARK 1: Rock core barrel jammed at 6.5' due to core fracture REMARK 2: Rock core barrel jammed at 8.5' due to core fracture
10						2		
		11						
	75.0							Bottom of borehole at 11.0 feet. Installed groundwater observation well.
15								
	70.0							
20								
	65.0							
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/11/22</u> DATE COMPLETED: <u>5/11/22</u> BORING LOCATION: <u>Near SE side of prop. football field</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>79 ft. (see note 1)</u> TOTAL DEPTH: <u>21 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>4.0 ft. / El. 75.0 ft. Based on sample moisture</u> ▼ AT END OF DRILLING: <u>11.6 ft. / El. 67.4 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NA</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Asphalt	S1 - Top 3": Asphalt
		2	S1	31-17-25-21 (42)	24/13		Fill	Mid. 9": Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, 5-10% fines, 15-20% fine to coarse angular gravel, brown, moist
		4	S2	30-24-20-15 (44)	24/12			Bot. 1": Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, angular, 5-10% fines, 25-30% fine to coarse sand, brown, moist
75.0		4				1		REMARK 1: Drilled 3" spoon from 4' to 8'
5		6	S3	5-4-3-3 (7)	24/4		Sand and Gravel	S3 - Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, angular, 5-10% fines, ~15% fine to coarse sand, brown, wet
		8	S4	4-7-9-12 (16)	24/4			S4 - Similar to S3 3" spoon sample from 4' to 8': similar to S3, 20-25% fine to coarse sand
70.0		10	S5	3-3-6-17 (9)	24/3			S5 - Similar to S3, 20-25% fine to coarse sand
10		12	S6	13-10-8-6 (18)	24/7			S6 - Similar to S3, 25-30% fine to coarse sand
65.0		14						
15		16	S7	12-8-6-5 (14)	24/2			S7 - Well Graded GRAVEL (GW), fine to coarse, subangular to subrounded, 0-5% fines, 5-10% medium to coarse sand, brown, wet
		18	S8	10-14-9-17 (23)	24/15			S8 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, brown, wet
60.0		19	S9	100/0"	0/0	2	Rock	REMARK 2: Advanced roller bit from 19' to 21' to confirm presence of rock
20								S9 - No recovery
								Bottom of borehole at 21.0 feet. Backfilled borehole with drill cuttings and 2 bags of gravel. Ground surface restored with asphalt cold patch.
55.0								
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeys Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/11/22</u> DATE COMPLETED: <u>5/11/22</u> BORING LOCATION: <u>Near southern side of prop. football field</u> COORDINATES: <u>NA</u> SURFACE EL.: <u>76 ft. (see note 1)</u> TOTAL DEPTH: <u>7 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>-</u> ▽ AT END OF DRILLING: <u>Not encountered</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NA</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
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Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
	75.0	0	S1	49-24-32-35 (56)	24/13		Asphalt	S1 - Top 4": Asphalt
		2	S2	33-15-18-12 (33)	24/6		Fill	Mid. 6": Well Graded Sand with Silt and Gravel (SW-SM), fine to coarse, 10-15% fines, 20-25% fine to coarse subangular gravel, brown, moist
		4	S3	28-43-100/1"	13/5		Sand and Gravel	Bot. 3": Well Graded SAND with Gravel (SW), fine to coarse, 0-5% fines, 30-35% fine to coarse angular gravel, white, moist S2 - Well Graded GRAVEL with Sand (GW), fine to coarse, angular, 0-5% fines 20-25% fine to coarse sand, white, moist
5		5.1				1	Rock	S3 - Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, angular, 5-10% fines, ~15% fine to coarse sand, brown, moist REMARK 1: Split spoon refusal encountered at 5.1'
	70.0					1		REMARK 1: Advanced roller bit from 5.1' to 7' to confirm presence of rock Bottom of borehole at 7.0 feet. Backfilled borehole with 2 bags of gravel. Ground surface restored with asphalt cold patch.
10								
	65.0							
15								
	60.0							
20								
	55.0							
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.

CLIENT: <u>Drummeey Rosane Anderson, Inc.</u> LGCI PROJECT NUMBER: <u>2025</u> DATE STARTED: <u>5/10/22</u> DATE COMPLETED: <u>5/10/22</u> BORING LOCATION: <u>Near southern side of prop. soccer field</u> COORDINATES: <u>NA</u> SURFACE EI.: <u>78 ft. (see note 1)</u> TOTAL DEPTH: <u>13.5 ft.</u> WEATHER: <u>50's / Sunny</u> GROUNDWATER LEVELS: ▽ DURING DRILLING: <u>3.5 ft. / El. 74.5 ft. Based on Sample Moisture</u> ▽ AT END OF DRILLING: <u>10.0 ft. / El. 68.0 ft.</u> ▽ OTHER: <u>-</u>	PROJECT NAME: <u>Prop. Northeast Metro Reg. Vocational Tech. H.S.</u> PROJECT LOCATION: <u>Wakefield, MA</u> DRILLING SUBCONTRACTOR: <u>Northern Drill Service, Inc.</u> DRILLING FOREMAN: <u>Jon Beirholm</u> DRILLING METHOD: <u>Drive and wash with 4-inch casing</u> DRILL RIG TYPE/MODEL: <u>Mobile Drill B-48 ATV Rig</u> HAMMER TYPE: <u>Automatic</u> HAMMER WEIGHT: <u>140 lb.</u> HAMMER DROP: <u>30 in.</u> SPLIT SPOON DIA.: <u>1.375 in. I.D., 2 in. O.D.</u> CORE BARREL SIZE: <u>NA</u> LOGGED BY: <u>HO</u> CHECKED BY: <u>HH</u>
--	--

Depth (ft.)	EI. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		0					Asphalt	S1 - Top 5": Asphalt
			S1	22-10-10-15 (20)	24/7		Fill	Bot. 2": Silty SAND (SM), fine to coarse ~15% fines, 10-15% fine subangular gravel, trace of asphalt, brown, moist
	75.0	2	S2	24-68-12	18/8			S2 - Top 4": Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, 10-15% fine to coarse subangular gravel, trace of asphalt, brown, moist
		3.5	S3	7-6-6-10 (12)	24/3	1		Bot. 4": Well Graded GRAVEL with Sand (GW), fine to coarse, angular, 0-5% fines, 30-35% fine to coarse sand, brown to gray moist REMARK 1: Drove 3" split spoon from 3.5' to 7.5' to obtain sample S3 - Similar to S2 Bot. 4", 15-20% coarse sand, wet
5		5.5	S4	15-4-9-4 (13)	24/4			S4 - Well Graded GRAVEL with Silt (GW-GM), fine to coarse, angular, 5-10% fines, 10-15% fine to coarse sand, brown to gray, wet 3" spoon sample from 3.5' to 7.5': Similar to S4, 5-10% fine to medium sand
	70.0	7.5	S5	9-5-4-4 (9)	24/4	2	Sand and Gravel	REMARK 2: Drove 3" split spoon from 7.5' to 11.5' to obtain sample S5 - Well Graded GRAVEL (GW), fine to coarse, angular, 10-15% coarse sand, gray, wet
10		9.5	S6	5-11-6-4 (17)	24/3			▼ S6 - Similar to S5, 0-5% fines, 20-25% fine to coarse sand 3" spoon sample from 7.5' to 11': Well Graded GRAVEL (GW), fine to coarse, angular, 0-5% fines, 0-5% coarse sand, gray, wet
	65.0	11.5	S7	5-7-7-9 (14)	24/8			S7 - Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, 5-10% fines, 25-30% fine to coarse angular gravel, brown, moist
	13.5							Bottom of borehole at 13.5 feet. Backfilled borehole with drill cuttings. Ground surface restored with asphalt cold patch.
15								
	60.0							
20								
	55.0							
25								

GENERAL NOTES:

- The ground surface elevation was interpolated to the nearest foot from drawing titled: "Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by DRA via e-mail on June 3, 2022.



LGCI

Lahlaf Geotechnical Consulting, Inc.

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Boring No. : **B-1-OW**

Page 1/1

Project Name: Proposed Northeast Metro Regional Vocational Technical High School, Wakefield, MA	
LGCI Project Number: 2025	
Client: Drummey Rosane Anderson, Inc.	
Drilling Subcontractor: Northern Drill Services, Inc.	Date Started: 12/10/20
Drilling Foreman: Jon Beirholm	Date Completed: 12/10/20
LGCI Engineer: Tom Greenwood	Location: Near NW corner of proposed building
Ground Surface Elevation: 184.5 feet	Total Depth of Boring: 14 feet
Groundwater Depth: 10 feet below ground surface	Drill Rig Type: Mobile Drill B-48
	Drilling Method: Drive and wash with 4-inch casing

GENERAL SOIL CONDITIONS (not to scale)		Riser Stickup 3.1 feet above ground surface	
Topsoil 0.3 feet		THICKNESS OF SURFACE SEAL	1 foot
		TYPE OF SURFACE SEAL	Concrete
Subsoil 2.5 feet		TYPE OF SURFACE CASING	Riser pipe
		ID OF SURFACE CASING	4 inch
		DEPTH TO BOTTOM OF CASING	1.0 foot
		ID OF RISER PIPE	2 inch
		TYPE OF RISER PIPE	Schedule 40 PVC
		TYPE OF BACKFILL AROUND RISER PIPE	Filter sand
		DEPTH TO TOP OF SEAL	2.0 feet
		TYPE OF SEAL	Bentonite
		DEPTH TO BOTTOM OF SEAL	3.0 feet
		DEPTH TO TOP OF PERVIOUS SECTION	4.0 feet
		TYPE OF PERVIOUS SECTION	Schedule 40 PVC
		DESCRIBE OPENINGS	0.01 inch slots
		ID OF PERVIOUS SECTION	2 inch
		TYPE OF BACKFILL AROUND PERVIOUS SECTION	Filter sand (Holliston sand)
		DEPTH TO BOTTOM OF PERVIOUS SECTION	14.0 feet
		DEPTH TO BOTTOM OF SAND COLUMN	14.0 feet
		TYPE OF BACKFILL BELOW PERVIOUS SECTION	Filter sand (Holliston sand)
		DIAMETER OF BOREHOLE	4 inch
		DEPTH TO BOTTOM OF BOREHOLE	14.0 feet
Rock 14.0 feet			

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Boring No. : **B-3-OW**

Page 1/1

Project Name: Proposed Northeast Metro Regional Vocational Technical High School, Wakefield, MA	
LGCI Project Number: 2025	
Client: Drummey Rosane Anderson, Inc.	
Drilling Subcontractor: Northern Drill Services, Inc.	Date Started: 12/10/20
Drilling Foreman: Jon Beirholm	Date Completed: 12/11/20
LGCI Engineer: Tom Greenwood	Location: Near SE corner of proposed building
Ground Surface Elevation: 170.5 feet	Total Depth of Boring: 18 feet
Groundwater Depth: 4.9 feet below ground surface	Drill Rig Type: Mobile Drill B-48
	Drilling Method: Drive and wash with 4-inch casing

GENERAL SOIL CONDITIONS (not to scale)		Riser Stickup 3.1 feet above ground surface	
Topsoil 0.3 feet		THICKNESS OF SURFACE SEAL	1 foot
		TYPE OF SURFACE SEAL	Concrete
Subsoil 2.2 feet		TYPE OF SURFACE CASING	Riser pipe
		ID OF SURFACE CASING	4 inch
		DEPTH TO BOTTOM OF CASING	1.0 foot
		ID OF RISER PIPE	2 inch
		TYPE OF RISER PIPE	Schedule 40 PVC
		TYPE OF BACKFILL AROUND RISER PIPE	Filter sand
		DEPTH TO TOP OF SEAL	4.0 feet
		TYPE OF SEAL	Bentonite
		DEPTH TO BOTTOM OF SEAL	6.0 feet
		DEPTH TO TOP OF PERVIOUS SECTION	8.0 feet
		TYPE OF PERVIOUS SECTION	Schedule 40 PVC
		DESCRIBE OPENINGS	0.01 inch slots
		ID OF PERVIOUS SECTION	2 inch
		TYPE OF BACKFILL AROUND PERVIOUS SECTION	Filter sand (Holliston sand)
		DEPTH TO BOTTOM OF PERVIOUS SECTION	18.0 feet
		DEPTH TO BOTTOM OF SAND COLUMN	18.0 feet
		TYPE OF BACKFILL BELOW PERVIOUS SECTION	Filter sand (Holliston sand)
		DIAMETER OF BOREHOLE	4 inch
		DEPTH TO BOTTOM OF BOREHOLE	18.0 feet
Rock 18.0 feet			

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Boring No. : **B-101-OW**

Page 1/1

Project Name: Proposed Northeast Metro Regional Vocational Technical High School, Wakefield, MA	
LGCI Project Number: 2025	
Client: Drummeys Rosane Anderson, Inc.	
Drilling Subcontractor: Northern Drill Services, Inc.	Date Started: 5/10/21
Drilling Foreman: Jon Beirholm	Date Completed: 5/11/21
LGCI Engineer: Tom Greenwood	Location: Near NW corner of proposed building
Ground Surface Elevation: 172.6 feet	Total Depth of Boring: 36 feet
Groundwater Depth: 5.2 feet below ground surface	Drill Rig Type: Mobile Drill B-48
	Drilling Method: Drive and wash with 3-inch casing

GENERAL SOIL CONDITIONS (not to scale)		Riser Stickup 3.8 feet above ground surface	
	THICKNESS OF SURFACE SEAL	1 foot	
	TYPE OF SURFACE SEAL	Concrete	
	TYPE OF SURFACE CASING	Riser pipe	
	ID OF SURFACE CASING	4 inch	
	DEPTH TO BOTTOM OF CASING	1.0 foot	
	ID OF RISER PIPE	2 inch	
	TYPE OF RISER PIPE	Schedule 40 PVC	
	TYPE OF BACKFILL AROUND RISER PIPE	Filter sand	
	DEPTH TO TOP OF SEAL	1.0 foot	
	TYPE OF SEAL	Bentonite	
	DEPTH TO BOTTOM OF SEAL	2.0 feet	
	DEPTH TO TOP OF PERVIOUS SECTION	16.0 feet	
	TYPE OF PERVIOUS SECTION	Schedule 40 PVC	
	DESCRIBE OPENINGS	0.01 inch slots	
	ID OF PERVIOUS SECTION	2 inch	
TYPE OF BACKFILL AROUND PERVIOUS SECTION	Filter sand (Holliston sand)		
DEPTH TO BOTTOM OF PERVIOUS SECTION	36.0 feet		
DEPTH TO BOTTOM OF SAND COLUMN	36.0 feet		
TYPE OF BACKFILL BELOW PERVIOUS SECTION	Filter sand (Holliston sand)		
DIAMETER OF BOREHOLE	3 inch		
DEPTH TO BOTTOM OF BOREHOLE	36.0 feet		

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



**GROUNDWATER OBSERVATION WELL
INSTALLATION REPORT**

Boring No. : **B-104-OW**

Page 1/1

Project Name: Proposed Northeast Metro Regional Vocational Technical High School, Wakefield, MA	
LGCI Project Number: 2025	
Client: Drummeys Rosane Anderson, Inc.	
Drilling Subcontractor: Northern Drill Services, Inc.	Date Started: 5/12/21
Drilling Foreman: Jon Beirholm	Date Completed: 5/12/21
LGCI Engineer: Nicholas Proulx	Location: Southern portion of proposed building
Ground Surface Elevation: 180.9 feet	Total Depth of Boring: 27 feet
Groundwater Depth: 0.0 feet below ground surface	Drill Rig Type: Mobile Drill B-48
	Drilling Method: Drive and wash with 3-inch casing

GENERAL SOIL CONDITIONS (not to scale)		Riser Stickup 4.2 feet above ground surface	
Forest Mat 0.7 feet		THICKNESS OF SURFACE SEAL	1 foot
		TYPE OF SURFACE SEAL	Concrete
		TYPE OF SURFACE CASING	Riser pipe
		ID OF SURFACE CASING	4 inch
		DEPTH TO BOTTOM OF CASING	1.0 foot
		ID OF RISER PIPE	2 inch
		TYPE OF RISER PIPE	Schedule 40 PVC
		TYPE OF BACKFILL AROUND RISER PIPE	Filter sand
		DEPTH TO TOP OF SEAL	1.0 foot
		TYPE OF SEAL	Bentonite
		DEPTH TO BOTTOM OF SEAL	2.0 feet
		DEPTH TO TOP OF PERVIOUS SECTION	7.0 feet
		TYPE OF PERVIOUS SECTION	Schedule 40 PVC
		DESCRIBE OPENINGS	0.01 inch slots
		ID OF PERVIOUS SECTION	2 inch
		TYPE OF BACKFILL AROUND PERVIOUS SECTION	Filter sand (Holliston sand)
		DEPTH TO BOTTOM OF PERVIOUS SECTION	27.0 feet
		DEPTH TO BOTTOM OF SAND COLUMN	27.0 feet
		TYPE OF BACKFILL BELOW PERVIOUS SECTION	Filter sand (Holliston sand)
		DIAMETER OF BOREHOLE	3 inch
		DEPTH TO BOTTOM OF BOREHOLE	27.0 feet
Rock			
27.0 feet			

1. The ground surface elevation was surveyed by Nitsch Engineering, Inc. (Nitsch) and was obtained by LGCI from drawings EX-1 to EX-13 titled: "Topographic Survey, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to us by Nitsch via e-mail on June 4, 2021.



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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Boring No. : **B- 204-OW**

Page 1/1

Project Name: Prop. Northeast Metro Regional Vocational Technical High School, Wakefield, MA	
LGCI Project Number: 2025	
Client: Drummeys Rosane Anderson, Inc.	
Drilling Subcontractor: Northern Drill Services, Inc.	Date Started: 5/4/22
Drilling Foreman: Jon Beirholm	Date Completed: 5/4/22
LGCI Engineer: Husham Osman	Location: Near center of proposed building
Ground Surface Elevation: 162.0 feet	Total Depth of Boring: 25.5 feet
Groundwater Depth: 1.0 feet below ground surface	Drill Rig Type: Mobile Drill ATV B-48
Drilling Method: Drive and wash with 4-inch then 3-inch casing	

		Riser Stickup 2.9 feet above ground surface	
GENERAL SOIL CONDITIONS (not to scale)		THICKNESS OF SURFACE SEAL	1 foot
		TYPE OF SURFACE SEAL	Concrete
Forest Mat 0.3 feet		TYPE OF SURFACE CASING	Riser Pipe
		ID OF SURFACE CASING	4 inch
Subsoil 2.7 feet		DEPTH TO BOTTOM OF CASING	1.0 foot
		ID OF RISER PIPE	2 inch
		TYPE OF RISER PIPE	Schedule 40 PVC
Sand and Gravel 4.4 feet		TYPE OF BACKFILL AROUND RISER PIPE	Filter sand (Holliston sand)
		DEPTH TO TOP OF SEAL	11.0 feet
		TYPE OF SEAL	Bentonite Chips
		DEPTH TO BOTTOM OF SEAL	13.0 feet
		DEPTH TO TOP OF PERVIOUS SECTION	15.5 feet
		TYPE OF PERVIOUS SECTION	Schedule 40 PVC
		DESCRIBE OPENINGS	0.01 inch slots
		ID OF PERVIOUS SECTION	2 inch
		TYPE OF BACKFILL AROUND PERVIOUS SECTION	Filter sand (Holliston sand)
		DEPTH TO BOTTOM OF PERVIOUS SECTION	25.5 feet
		DEPTH TO BOTTOM OF SAND COLUMN	25.5 feet
		TYPE OF BACKFILL BELOW PERVIOUS SECTION	Filter sand (Holliston sand)
		DIAMETER OF BOREHOLE	4 inch
		DEPTH TO BOTTOM OF BOREHOLE	25.5 feet
Rock 25.5 feet			

NOTES: The ground surface elevation was interpolated to the nearest foot from drawing titled: " Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to LGCI by DRA via e-mail on June 3, 2022.



LGCI

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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Boring No. : **B- 208-OW**

Page 1/1

Project Name: Prop. Northeast Metro Regional Vocational Technical High School, Wakefield, MA	
LGCI Project Number: 2025	
Client: Drummeys Rosane Anderson, Inc.	
Drilling Subcontractor: Northern Drill Services, Inc.	Date Started: 4/26/22
Drilling Foreman: Jon Beirholm	Date Completed: 4/27/22
LGCI Engineer: Husham Osman	Location: Near western side of proposed building
Ground Surface Elevation: 193.0 feet	Total Depth of Boring: 37.0 feet
Groundwater Depth: 7.0 feet below ground surface	Drill Rig Type: Mobile Drill ATV B-48
	Drilling Method: Drive and wash with 4-inch casing

		Riser Stickup 3.4 feet above ground surface	
GENERAL SOIL CONDITIONS (not to scale)		THICKNESS OF SURFACE SEAL	1 foot
		TYPE OF SURFACE SEAL	Concrete
Topsoil 0.3 feet		TYPE OF SURFACE CASING	Riser Pipe
		ID OF SURFACE CASING	4 inch
Subsoil 1.5 feet		DEPTH TO BOTTOM OF CASING	1.0 foot
		ID OF RISER PIPE	2 inch
		TYPE OF RISER PIPE	Schedule 40 PVC
		TYPE OF BACKFILL AROUND RISER PIPE	Filter sand (Holliston sand)
		DEPTH TO TOP OF SEAL	5.0 feet
		TYPE OF SEAL	Bentonite Chips
		DEPTH TO BOTTOM OF SEAL	7.0 feet
		DEPTH TO TOP OF PERVIOUS SECTION	16.2 feet
		TYPE OF PERVIOUS SECTION	Schedule 40 PVC
		DESCRIBE OPENINGS	0.01 inch slots
		ID OF PERVIOUS SECTION	2 inch
		TYPE OF BACKFILL AROUND PERVIOUS SECTION	Filter sand (Holliston sand)
		DEPTH TO BOTTOM OF PERVIOUS SECTION	36.2 feet
		DEPTH TO BOTTOM OF SAND COLUMN	37.0 feet
		TYPE OF BACKFILL BELOW PERVIOUS SECTION	Filter sand (Holliston sand)
		DIAMETER OF BOREHOLE	4 inch
		DEPTH TO BOTTOM OF BOREHOLE	37.0 feet
Rock			
37.0 feet			

NOTES: The ground surface elevation was interpolated to the nearest foot from drawing titled: " Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to LGCI by DRA via e-mail on June 3, 2022.



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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Boring No. : **B- 220-OW**

Page 1/1

Project Name: Prop. Northeast Metro Regional Vocational Technical High School, Wakefield, MA	
LGCI Project Number: 2025	
Client: Drummeys Rosane Anderson, Inc.	
Drilling Subcontractor: Northern Drill Services, Inc. Drilling Foreman: Jon Beirholm LGCI Engineer: Husham Osman	Date Started: 5/10/22 Date Completed: 5/11/22 Location: Near NE side of proposed football field
Ground Surface Elevation: 88.0 feet Groundwater Depth: 4.0 feet below ground surface	Total Depth of Boring: 11.0 feet Drill Rig Type: Mobile Drill ATV B-48 Drilling Method: Drive and wash with 4-inch casing

		Riser Stickup 0.0 feet above ground surface	
GENERAL SOIL CONDITIONS (not to scale)		THICKNESS OF SURFACE SEAL	1 foot
Asphalt 0.3 feet		TYPE OF SURFACE SEAL	Concrete
Fill 2.0 feet		TYPE OF SURFACE CASING	Roadway Box
Subsoil 4.0 feet		ID OF SURFACE CASING	4 inch
Sand and Gravel 5.3 feet		DEPTH TO BOTTOM OF CASING	1.0 foot
		ID OF RISER PIPE	2 inch
		TYPE OF RISER PIPE	Schedule 40 PVC
		TYPE OF BACKFILL AROUND RISER PIPE	Filter sand
		DEPTH TO TOP OF SEAL	2.0 feet
		TYPE OF SEAL	Bentonite Chips
		DEPTH TO BOTTOM OF SEAL	3.0 feet
		DEPTH TO TOP OF PERVIOUS SECTION	4.0 feet
		TYPE OF PERVIOUS SECTION	Schedule 40 PVC
		DESCRIBE OPENINGS	0.01 inch slots
		ID OF PERVIOUS SECTION	2 inch
		TYPE OF BACKFILL AROUND PERVIOUS SECTION	Filter sand (Holliston sand)
		DEPTH TO BOTTOM OF PERVIOUS SECTION	11.0 feet
		DEPTH TO BOTTOM OF SAND COLUMN	11.0 feet
		TYPE OF BACKFILL BELOW PERVIOUS SECTION	Filter sand (Holliston sand)
		DIAMETER OF BOREHOLE	4 inch
		DEPTH TO BOTTOM OF BOREHOLE	11.0 feet
Rock 11.0 feet			

NOTES: The ground surface elevation was interpolated to the nearest foot from drawing titled: " Explorations Exhibit Plan, Northeast Metropolitan Regional Vocational High School, 100 Hemlock Road, Wakefield, MA," prepared by Nitsch and provided to LGCI by DRA via e-mail on June 3, 2022.



Core Photos (from top): B-1-C1, B-1-C2, B-3-C1, B-3-C2



Core Photos (from top): B-1-C1, B-1-C2, B-3-C1, B-3-C2



Core Photos (from top): B-104-OW-C1 to C4



Core Photos (from top): B-105-C1, B-105-C2, B-106-C1



Core Photos: B-206-C1 to C4



Core Photos (from top): B-203-C2, B-216-C1, and B-220-OW-C1



Core Photos (from top): B-208-C1 to C4



Core Photos (from top): B-208-C5 to C7, B-202-C1

APPENDIX E – Borehole Geophysical Logging - Data Report

**BOREHOLE GEOPHYSICAL LOGGING - DATA REPORT
BOREHOLES B-206 & B-208
NORTHEAST METRO TECH HIGH SCHOOL
WAKEFIELD, MASSACHUSETTS**

Prepared for:

Lahlaf Geotechnical Consulting, Inc.
100 Chelmsford Road, Suite 2
Billerica, Massachusetts 01862

Prepared by:

Hager-Richter Geoscience, Inc.
8 Industrial Way - D10
Salem, New Hampshire 03079

File 22RG48
June 2022

Tadpole	Structure Category (Symbol Color)	Description
	Fracture Rank 1 (Light Blue)	Minor Fracture - not distinct and may not be continuous around the borehole
	Fracture Rank 2 (Blue)	Intermediate Fracture - distinct and continuous around the borehole with little or no apparent aperture
	Fracture Rank 3 (Light Green)	Intermediate Fracture - distinct and continuous around the borehole with some apparent aperture
	Fracture Rank 4 (Red)	Major Fracture - distinct with continuous apparent aperture around the borehole
	Foliation or Vein (Orange)	Planar geologic feature interpreted as foliation or a vein

Figure 1. Key to bedrock structure categories.

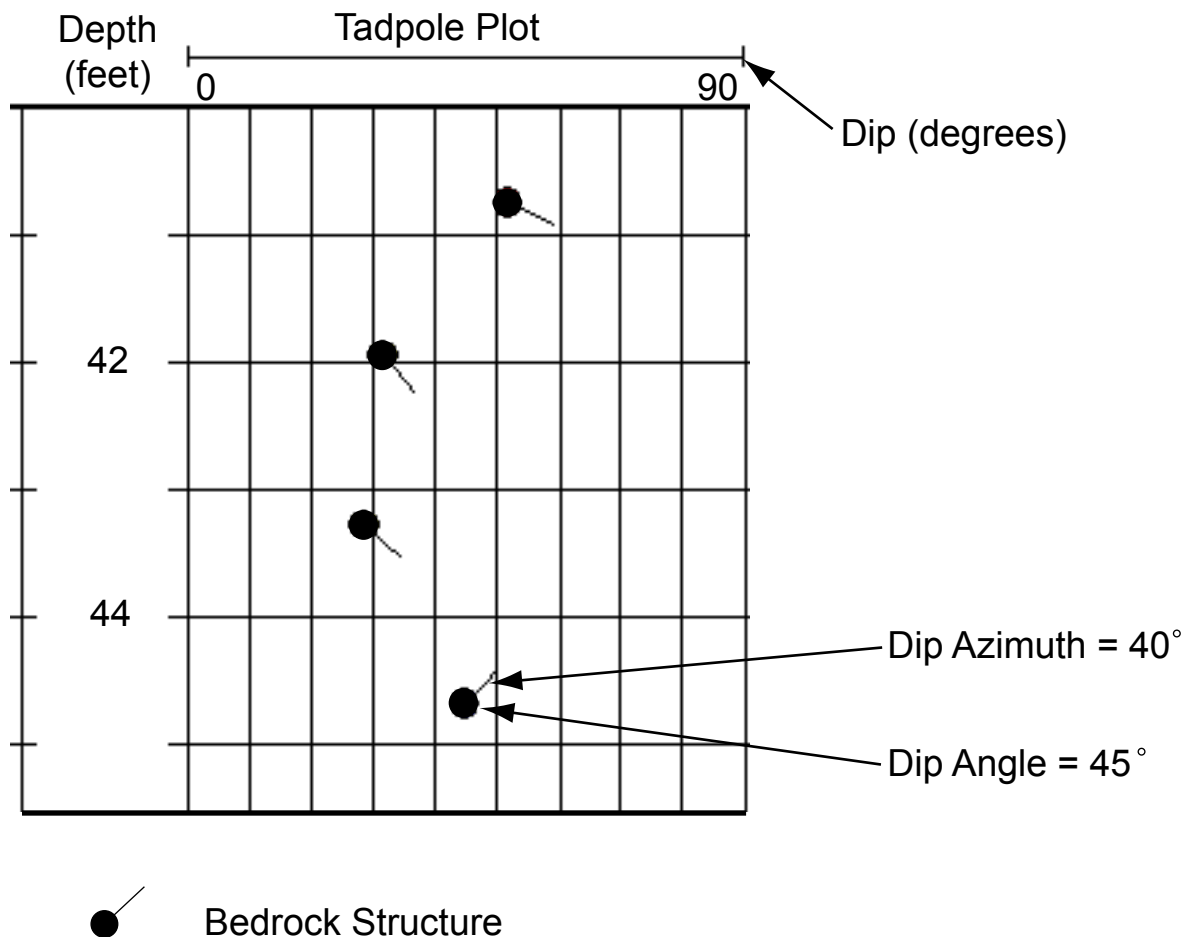


Figure 2. Tadpole plot explanation. The orientation of the bedrock structures is graphically displayed by a tadpole consisting of a circle, the head, and a line, the tail. The position of the head, left to right on the tadpole plot, gives the dip angle of the structure. The left side of the track indicates a dip angle of 0°, and the right side of the track indicates a dip angle of 90° from horizontal. The orientation of the tail gives the dip azimuth of the structure and can be read like a compass. The tail pointing directly up is 0°, north.

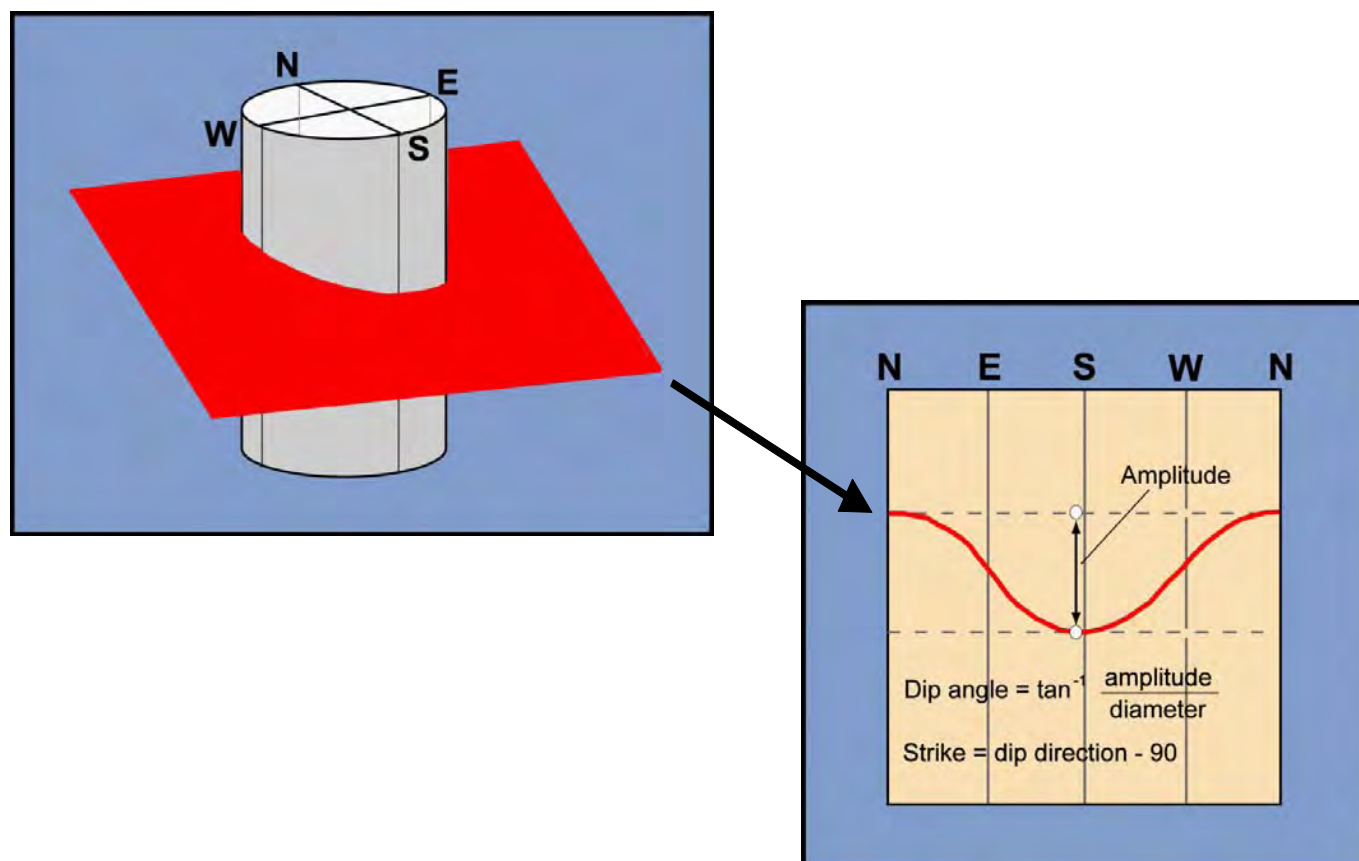


Figure 3. Televiewer Explanation Figure. The image on the left depicts a planar structure in red, such as a fracture or bedding plane, intersected by a borehole. The image on the right depicts the same structure unwrapped as it would be displayed in an optical televiewer (OTV) or acoustic televiewer (ATV) log.

Figure modified from: Garfield, R.L., Day-Lewis, F.D., Gray, M.B., Johnson, C.D., Williams, J.H. and Day-Lewis, A.D.F., 2003, Fractured-Rock Aquifer Characterization within a Regional Geologic Context: Results from the Bucknell University Hydrogeophysics Test Site, GSA Northeastern Section, 38th Annual Meeting, Paper No. 25-19.

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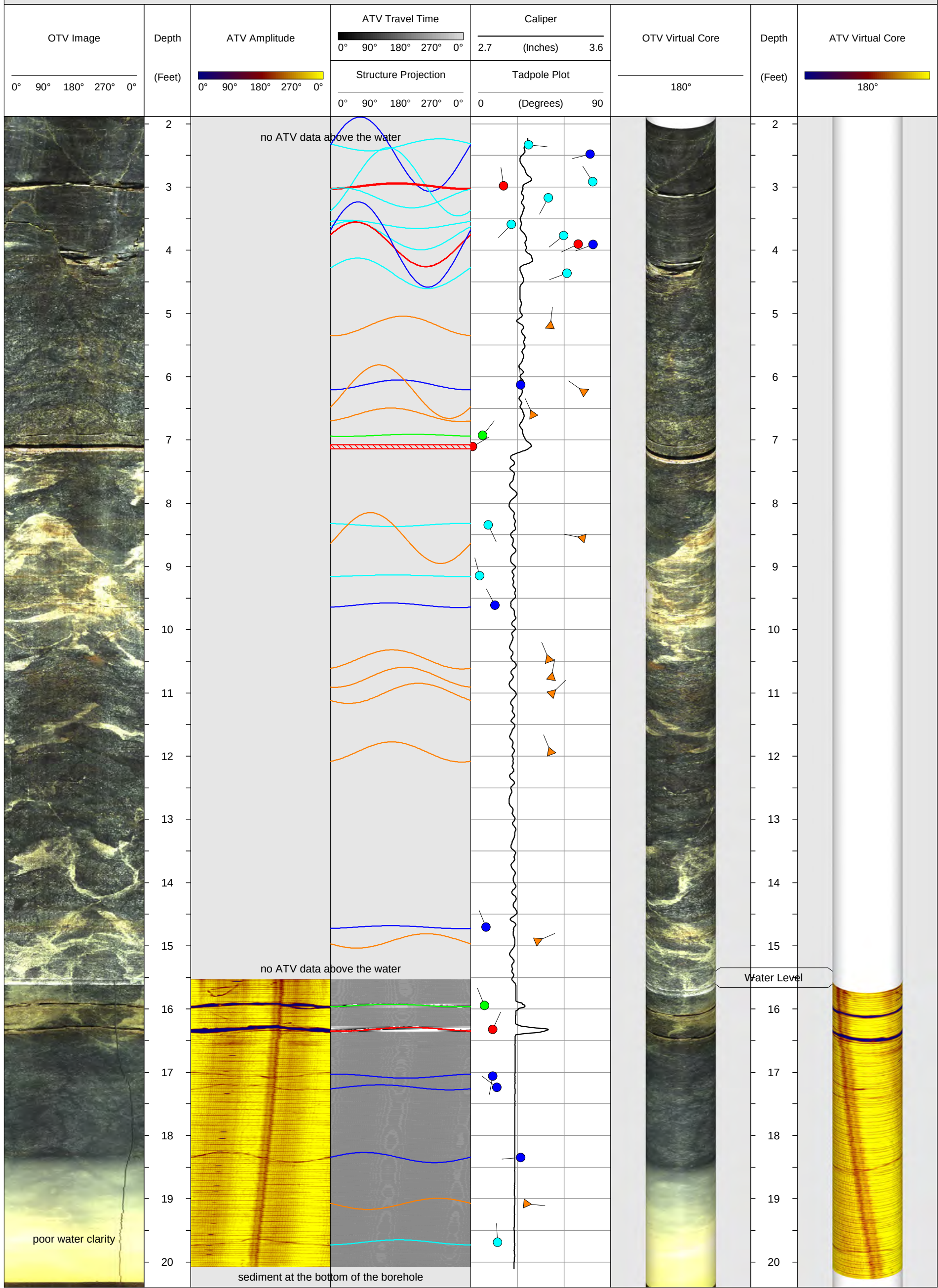
Fords, New Jersey
Tel: 732.661.0555

DATE(S) LOGGED: May 5, 2022

HRGS FILE:	22RG48
LOG DATUM:	Ground Surface
ORIENTATION REFERENCE:	True North (Magnetic Declination = 14.3° West)
BOREHOLE DIAMETER:	3 Inches
LOGS PROCESSED BY:	Robert Garfield, P.G. & Nick DeCristofaro

 Fracture Rank 1
 Fracture Rank 2
 Fracture Rank 3
 Fracture Rank 4
 Foliation / Vein

NOTES: ATV and acoustic caliper data can only be acquired in the water-filled portion of the borehole. The caliper data plotted in the logs below are 3-arm caliper data in the air-filled portion of the borehole and acoustic caliper data in the water-filled portion of the borehole.



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Fords, New Jersey
Tel: 732.661.0555

B-208 - BOREHOLE GEOPHYSICAL LOGS

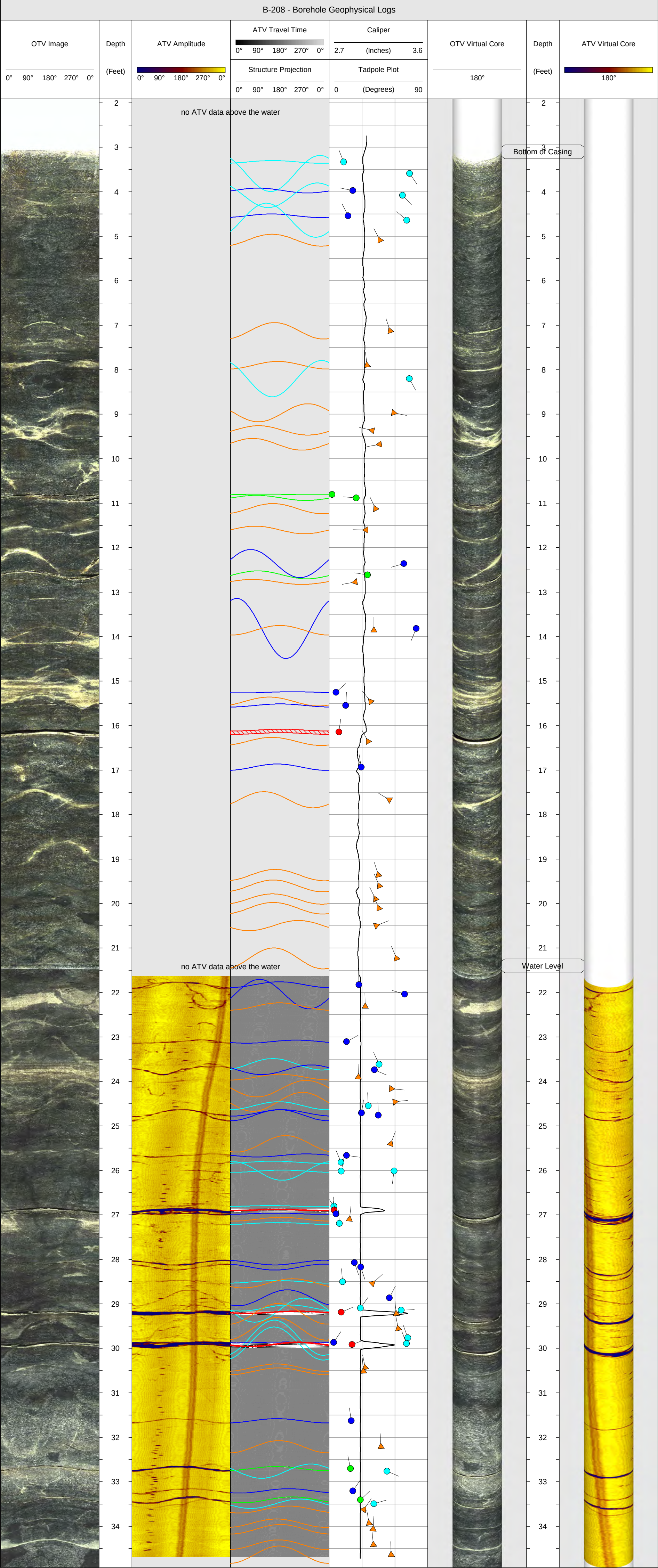
DATE(S) LOGGED: May 5, 2022

CLIENT:	Lahlaf Geotechnical Consulting, Inc.	HRGS FILE:	22RG48
PROJECT:	Northeast Metro Tech High School	LOG DATUM:	Ground Surface
LOCATION:	Wakefield, Massachusetts	ORIENTATION REFERENCE:	True North (Magnetic Declination = 14.3° West)
LOGGING GEOPHYSICIST(S):	Nick DeCristofaro & Justin Covert	BOREHOLE DIAMETER:	3 Inches
PROJECT REP(S) ON-SITE:	Husham Osman	LOGS PROCESSED BY:	Robert Garfield, P.G. & Nick DeCristofaro

STRUCTURE LEGEND

Fracture Rank 1Fracture Rank 2Fracture Rank 3Fracture Rank 4Foliation / Vein

NOTES: ATV and acoustic caliper data can only be acquired in the water-filled portion of the borehole. The caliper data plotted in the logs below are 3-arm caliper data in the air-filled portion of the borehole and acoustic caliper data in the water-filled portion of the borehole.



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Tel: 732.661.0555

B-206 & B-208 - BEDROCK STRUCTURE STATISTICS PLOTS WITH CONTOURED STEREOGRAMS

DATE(S) LOGGED: May 5, 2022

CLIENT: Lahlaf Geotechnical Consulting, Inc.

HRGS FILE: 22RG48

PROJECT: Northeast Metro Tech High School

ORIENTATION REFERENCE: True North

LOCATION: Wakefield, Massachusetts

MAGNETIC DECLINATION: 14.3° West

STRUCTURE LEGEND

● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ▲ Foliation / Vein

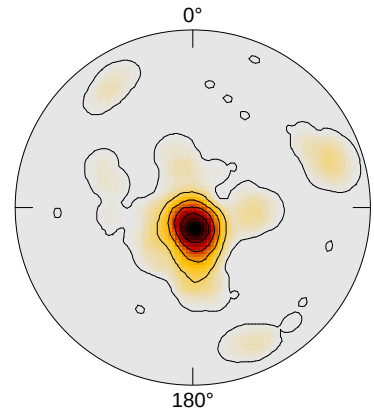
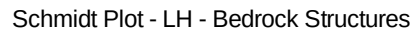
Dip Azimuth Rose Diagram of Bedrock Fractures

Dip Angle Histogram of Bedrock Fractures

Stereogram - Lower Hemisphere
of Foliation & Veins

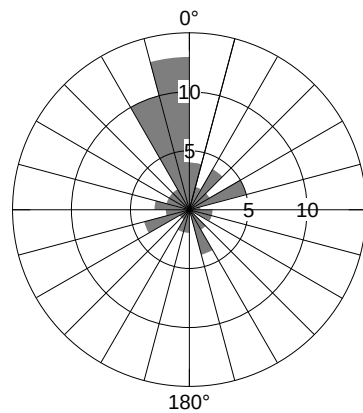
Dip Azimuth Rose Diagram of Foliation & Veins

Dip Angle Histogram of Foliation & Veins



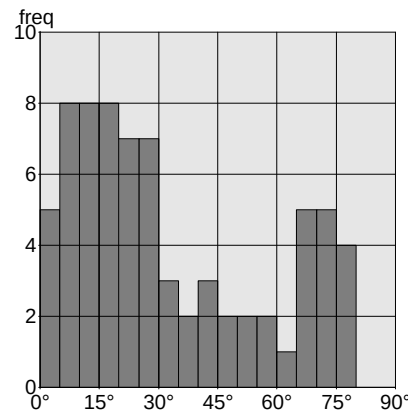
	Counts	Dip[deg]	Azi[deg]
Mean	72	32.26	351.87
	28	41.64	355.22
	29	30.97	342.76
	8	18.08	24.85
	7	18.12	331.94

Azimuth - Absolute (Count)



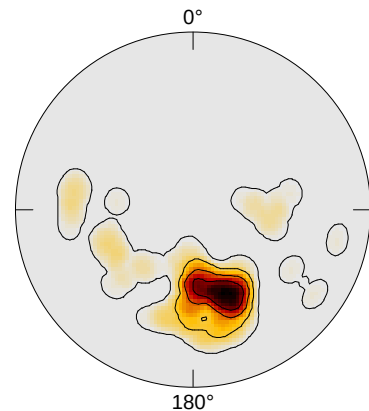
Components:	Azimuth
Counts:	72.00
Mean (2D):	351.87
Std.Dev.:	82.20
Min:	3.06
Max:	358.99

Dip Histogram (Count)



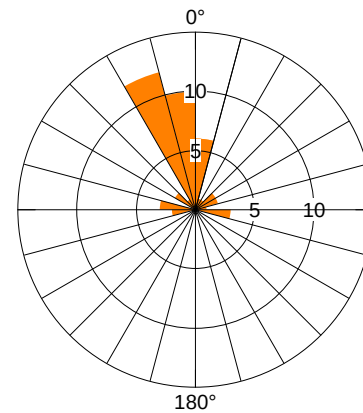
Counts:	72.00
Mean (2D):	32.26
Std.Dev.:	24.30
Min:	1.18
Max:	79.54

Schmidt Plot - LH - Bedrock Structures



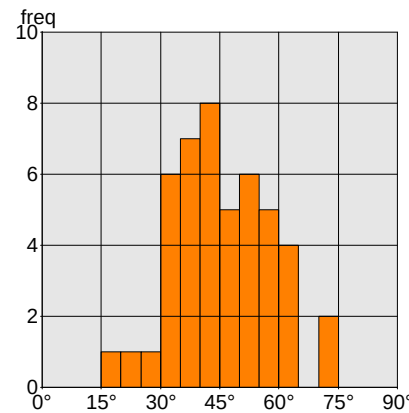
	Counts	Dip[deg]	Azi[deg]
Mean	46	45.28	352.24
▶	46	45.28	352.24

Azimuth - Absolute (Count)



Components:	Azimuth
Counts:	46.00
Mean (2D):	352.24
Std.Dev.:	47.27
Min:	0.43
Max:	358.62

Dip Histogram (Count)



Counts:	46.00
Mean (2D):	45.28
Std.Dev.:	11.83
Min:	18.54
Max:	72.76

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B-206 - BEDROCK STRUCTURE STATISTICS PLOTS

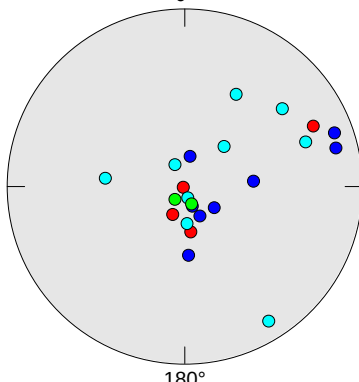
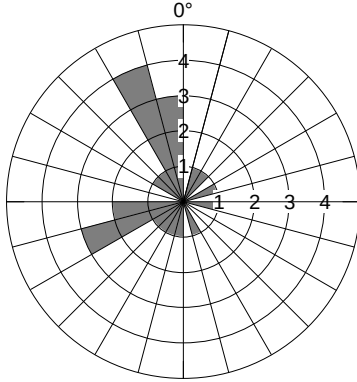
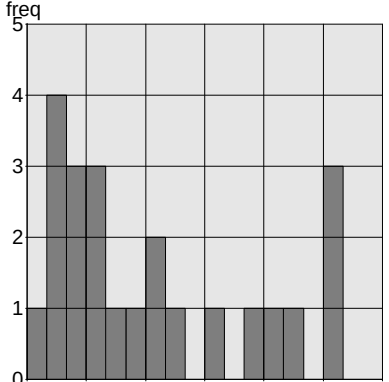
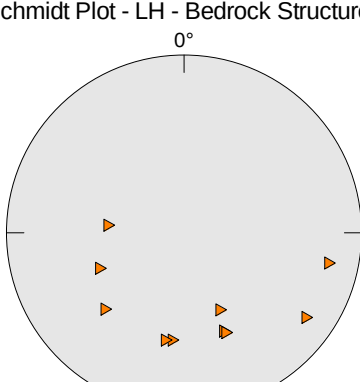
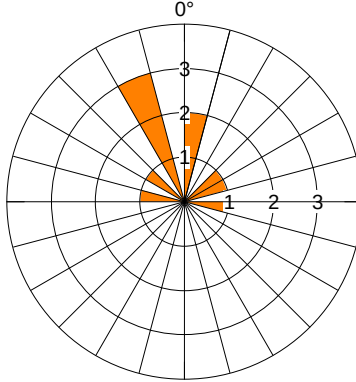
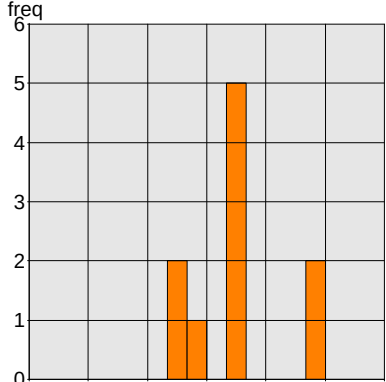
DATE(S) LOGGED: May 5, 2022

CLIENT: Lahlaf Geotechnical Consulting, Inc.
PROJECT: Northeast Metro Tech High School
LOCATION: Wakefield, Massachusetts

HRGS FILE: 22RG48
ORIENTATION REFERENCE: True North
MAGNETIC DECLINATION: 14.3° West

STRUCTURE LEGEND

Fracture Rank 1 Fracture Rank 2 Fracture Rank 3 Fracture Rank 4 Foliation / Vein

Stereogram - Lower Hemisphere of Bedrock Fractures	Dip Azimuth Rose Diagram of Bedrock Fractures	Dip Angle Histogram of Bedrock Fractures	Stereogram - Lower Hemisphere of Foliation & Veins	Dip Azimuth Rose Diagram of Foliation & Veins	Dip Angle Histogram of Foliation & Veins																																																																																
Schmidt Plot - LH - Bedrock Structures  <table><tr><th></th><th>Counts</th><th>Dip[deg]</th><th>Azi[deg]</th></tr><tr><td>Mean</td><td>23</td><td>31.82</td><td>304.99</td></tr><tr><td></td><td>9</td><td>38.50</td><td>252.15</td></tr><tr><td></td><td>8</td><td>33.67</td><td>290.08</td></tr><tr><td></td><td>4</td><td>25.57</td><td>6.93</td></tr><tr><td></td><td>2</td><td>8.32</td><td>8.09</td></tr></table>		Counts	Dip[deg]	Azi[deg]	Mean	23	31.82	304.99		9	38.50	252.15		8	33.67	290.08		4	25.57	6.93		2	8.32	8.09	Azimuth - Absolute (Count)  <table><tr><th>Components:</th><th>Azimuth</th></tr><tr><td>Counts:</td><td>23.00</td></tr><tr><td>Mean (2D):</td><td>304.99</td></tr><tr><td>Std.Dev.:</td><td>82.50</td></tr><tr><td>Min:</td><td>24.36</td></tr><tr><td>Max:</td><td>356.53</td></tr></table>	Components:	Azimuth	Counts:	23.00	Mean (2D):	304.99	Std.Dev.:	82.50	Min:	24.36	Max:	356.53	Dip Histogram (Count)  <table><tr><th>Counts:</th><th>23.00</th></tr><tr><th>Mean (2D):</th><th>31.82</th></tr><tr><th>Std.Dev.:</th><th>25.68</th></tr><tr><th>Min:</th><th>1.18</th></tr><tr><th>Max:</th><th>78.66</th></tr></table>	Counts:	23.00	Mean (2D):	31.82	Std.Dev.:	25.68	Min:	1.18	Max:	78.66	Schmidt Plot - LH - Bedrock Structures  <table><tr><th></th><th>Counts</th><th>Dip[deg]</th><th>Azi[deg]</th></tr><tr><td>Mean</td><td>10</td><td>51.96</td><td>359.58</td></tr><tr><td></td><td>10</td><td>51.96</td><td>359.58</td></tr></table>		Counts	Dip[deg]	Azi[deg]	Mean	10	51.96	359.58		10	51.96	359.58	Azimuth - Absolute (Count)  <table><tr><th>Components:</th><th>Azimuth</th></tr><tr><td>Counts:</td><td>10.00</td></tr><tr><td>Mean (2D):</td><td>359.58</td></tr><tr><td>Std.Dev.:</td><td>53.19</td></tr><tr><td>Min:</td><td>6.68</td></tr><tr><td>Max:</td><td>338.10</td></tr></table>	Components:	Azimuth	Counts:	10.00	Mean (2D):	359.58	Std.Dev.:	53.19	Min:	6.68	Max:	338.10	Dip Histogram (Count)  <table><tr><th>Counts:</th><th>10.00</th></tr><tr><th>Mean (2D):</th><th>51.96</th></tr><tr><th>Std.Dev.:</th><th>11.52</th></tr><tr><th>Min:</th><th>35.80</th></tr><tr><th>Max:</th><th>72.76</th></tr></table>	Counts:	10.00	Mean (2D):	51.96	Std.Dev.:	11.52	Min:	35.80	Max:	72.76
	Counts	Dip[deg]	Azi[deg]																																																																																		
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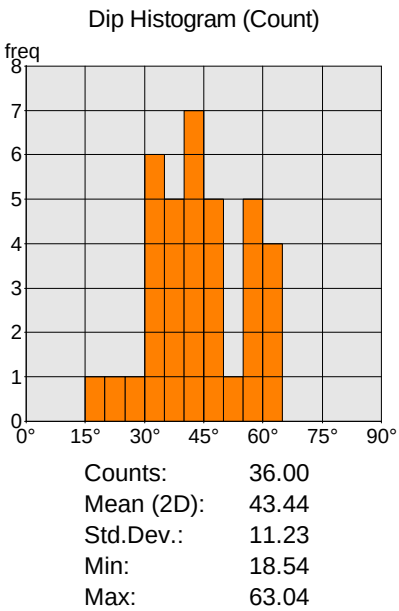
Fords, New Jersey
Tel: 732.661.0555

DATE(S) LOGGED: May 5, 2022

HRGS FILE: 22RG48
ORIENTATION REFERENCE: True North
MAGNETIC DECLINATION: 14.3° West

● Fracture Rank 1 ● Fracture Rank 2 ● Fracture Rank 3 ● Fracture Rank 4 ▲ Foliation / Vein

Dip Angle Histogram of Foliation & Veins



HAGER-RICHTER GEOSCIENCE, INC.	
B-206 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Lahlaf Geotechnical Consulting, Inc.
PROJECT	Northeast Metro Tech High School
LOCATION	Wakefield, Massachusetts
HRGS FILE	22RG48
DATE LOGGED	May 5, 2022
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 14.3° West)
DIP ANGLE	Measured from Horizontal

B-206 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
2.3	96	37	Fracture Rank 1
2.5	256	77	Fracture Rank 2
2.9	328	78	Fracture Rank 1
3.0	352	21	Fracture Rank 4
3.2	209	50	Fracture Rank 1
3.6	225	26	Fracture Rank 1
3.8	231	60	Fracture Rank 1
3.9	245	69	Fracture Rank 4
3.9	250	79	Fracture Rank 2
4.4	250	62	Fracture Rank 1
5.2	7	51	Foliation / Vein
6.1	357	32	Fracture Rank 2
6.2	305	73	Foliation / Vein
6.6	335	40	Foliation / Vein
6.9	38	8	Fracture Rank 3
7.1	60	1	Fracture Rank 4
8.3	155	11	Fracture Rank 1
8.6	282	72	Foliation / Vein
9.2	345	6	Fracture Rank 1
9.6	332	15	Fracture Rank 2
10.5	338	50	Foliation / Vein
10.8	10	52	Foliation / Vein
11.0	46	52	Foliation / Vein
11.9	337	51	Foliation / Vein
14.7	338	10	Fracture Rank 2
14.9	67	43	Foliation / Vein
16.0	338	9	Fracture Rank 3
16.3	24	14	Fracture Rank 4
17.1	190	14	Fracture Rank 2
17.2	306	17	Fracture Rank 2
18.4	266	32	Fracture Rank 2
19.1	96	36	Foliation / Vein
19.7	356	17	Fracture Rank 1

HAGER-RICHTER GEOSCIENCE, INC.	
B-208 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Lahlaf Geotechnical Consulting, Inc.
PROJECT	Northeast Metro Tech High School
LOCATION	Wakefield, Massachusetts
HRGS FILE	22RG48
DATE LOGGED	May 5, 2022
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 14.3° West)
DIP ANGLE	Measured from Horizontal

B-208 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
3.3	338	13	Fracture Rank 1
3.6	146	73	Fracture Rank 1
4.0	281	22	Fracture Rank 2
4.1	136	67	Fracture Rank 1
4.5	333	17	Fracture Rank 2
4.6	311	71	Fracture Rank 1
5.1	332	46	Foliation / Vein
7.1	341	56	Foliation / Vein
7.9	353	35	Foliation / Vein
8.2	152	73	Fracture Rank 1
9.0	102	59	Foliation / Vein
9.4	282	39	Foliation / Vein
9.7	260	46	Foliation / Vein
10.8	293	3	Fracture Rank 3
10.9	274	25	Fracture Rank 3
11.1	335	42	Foliation / Vein
11.6	271	34	Foliation / Vein
12.4	254	68	Fracture Rank 2
12.6	279	35	Fracture Rank 3
12.8	260	24	Foliation / Vein
13.8	203	80	Fracture Rank 2
13.9	0	41	Foliation / Vein
15.3	49	6	Fracture Rank 2
15.5	321	38	Foliation / Vein
15.6	3	15	Fracture Rank 2
16.1	8	9	Fracture Rank 4
16.4	331	36	Foliation / Vein
16.9	351	29	Fracture Rank 2
17.7	302	55	Foliation / Vein
19.4	343	45	Foliation / Vein
19.6	337	46	Foliation / Vein
19.9	334	42	Foliation / Vein
20.1	337	45	Foliation / Vein
20.5	69	43	Foliation / Vein
21.2	338	61	Foliation / Vein
21.8	359	27	Fracture Rank 2

B-208 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
22.0	286	69	Fracture Rank 2
22.3	359	33	Foliation / Vein
23.1	61	16	Fracture Rank 2
23.6	335	46	Fracture Rank 1
23.7	114	41	Fracture Rank 2
23.9	3	27	Foliation / Vein
24.2	95	57	Foliation / Vein
24.5	83	60	Foliation / Vein
24.6	356	36	Fracture Rank 1
24.7	10	29	Fracture Rank 2
24.8	358	45	Fracture Rank 2
25.4	21	56	Foliation / Vein
25.7	98	16	Fracture Rank 2
25.8	338	11	Fracture Rank 1
26.0	188	59	Fracture Rank 1
26.0	11	11	Fracture Rank 1
26.8	325	4	Fracture Rank 1
26.9	358	4	Fracture Rank 4
27.0	347	6	Fracture Rank 2
27.1	7	19	Foliation / Vein
27.2	356	9	Fracture Rank 1
28.1	161	23	Fracture Rank 2
28.2	161	29	Fracture Rank 2
28.5	355	12	Fracture Rank 1
28.5	47	40	Foliation / Vein
28.9	28	55	Fracture Rank 2
29.1	35	29	Fracture Rank 1
29.1	87	66	Fracture Rank 1
29.2	67	11	Fracture Rank 4
29.2	354	61	Foliation / Vein
29.6	348	63	Foliation / Vein
29.8	340	72	Fracture Rank 1
29.9	34	4	Fracture Rank 2
29.9	339	71	Fracture Rank 1
29.9	69	21	Fracture Rank 4
30.4	348	33	Foliation / Vein
30.5	356	31	Foliation / Vein
31.6	352	20	Fracture Rank 2
32.2	357	47	Foliation / Vein
32.7	348	19	Fracture Rank 3
32.8	113	53	Fracture Rank 1
33.2	34	22	Fracture Rank 2
33.4	47	29	Fracture Rank 3
33.5	74	41	Fracture Rank 1
33.6	34	32	Foliation / Vein
33.9	349	36	Foliation / Vein

B-208 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
34.1	3	40	Foliation / Vein
34.4	355	40	Foliation / Vein
34.6	357	57	Foliation / Vein

HAGER-RICHTER GEOSCIENCE, INC.	
B-206 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Lahlaf Geotechnical Consulting, Inc.
PROJECT	Northeast Metro Tech High School
LOCATION	Wakefield, Massachusetts
HRGS FILE	22RG48
DATE LOGGED	May 5, 2022
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 14.3° West)
DIP ANGLE	Measured from Horizontal

B-206 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
2.3	96	37	Fracture Rank 1
2.5	256	77	Fracture Rank 2
2.9	328	78	Fracture Rank 1
3.0	352	21	Fracture Rank 4
3.2	209	50	Fracture Rank 1
3.6	225	26	Fracture Rank 1
3.8	231	60	Fracture Rank 1
3.9	245	69	Fracture Rank 4
3.9	250	79	Fracture Rank 2
4.4	250	62	Fracture Rank 1
5.2	7	51	Foliation / Vein
6.1	357	32	Fracture Rank 2
6.2	305	73	Foliation / Vein
6.6	335	40	Foliation / Vein
6.9	38	8	Fracture Rank 3
7.1	60	1	Fracture Rank 4
8.3	155	11	Fracture Rank 1
8.6	282	72	Foliation / Vein
9.2	345	6	Fracture Rank 1
9.6	332	15	Fracture Rank 2
10.5	338	50	Foliation / Vein
10.8	10	52	Foliation / Vein
11.0	46	52	Foliation / Vein
11.9	337	51	Foliation / Vein
14.7	338	10	Fracture Rank 2
14.9	67	43	Foliation / Vein
16.0	338	9	Fracture Rank 3
16.3	24	14	Fracture Rank 4
17.1	190	14	Fracture Rank 2
17.2	306	17	Fracture Rank 2
18.4	266	32	Fracture Rank 2
19.1	96	36	Foliation / Vein
19.7	356	17	Fracture Rank 1

HAGER-RICHTER GEOSCIENCE, INC.	
B-208 - TABLE OF BEDROCK STRUCTURES	
CLIENT	Lahlaf Geotechnical Consulting, Inc.
PROJECT	Northeast Metro Tech High School
LOCATION	Wakefield, Massachusetts
HRGS FILE	22RG48
DATE LOGGED	May 5, 2022
LOG DATUM	Ground Surface
DIP AZIMUTH	True North (Magnetic Declination = 14.3° West)
DIP ANGLE	Measured from Horizontal

B-208 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
3.3	338	13	Fracture Rank 1
3.6	146	73	Fracture Rank 1
4.0	281	22	Fracture Rank 2
4.1	136	67	Fracture Rank 1
4.5	333	17	Fracture Rank 2
4.6	311	71	Fracture Rank 1
5.1	332	46	Foliation / Vein
7.1	341	56	Foliation / Vein
7.9	353	35	Foliation / Vein
8.2	152	73	Fracture Rank 1
9.0	102	59	Foliation / Vein
9.4	282	39	Foliation / Vein
9.7	260	46	Foliation / Vein
10.8	293	3	Fracture Rank 3
10.9	274	25	Fracture Rank 3
11.1	335	42	Foliation / Vein
11.6	271	34	Foliation / Vein
12.4	254	68	Fracture Rank 2
12.6	279	35	Fracture Rank 3
12.8	260	24	Foliation / Vein
13.8	203	80	Fracture Rank 2
13.9	0	41	Foliation / Vein
15.3	49	6	Fracture Rank 2
15.5	321	38	Foliation / Vein
15.6	3	15	Fracture Rank 2
16.1	8	9	Fracture Rank 4
16.4	331	36	Foliation / Vein
16.9	351	29	Fracture Rank 2
17.7	302	55	Foliation / Vein
19.4	343	45	Foliation / Vein
19.6	337	46	Foliation / Vein
19.9	334	42	Foliation / Vein
20.1	337	45	Foliation / Vein
20.5	69	43	Foliation / Vein

B-208 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
21.2	338	61	Foliation / Vein
21.8	359	27	Fracture Rank 2
22.0	286	69	Fracture Rank 2
22.3	359	33	Foliation / Vein
23.1	61	16	Fracture Rank 2
23.6	335	46	Fracture Rank 1
23.7	114	41	Fracture Rank 2
23.9	3	27	Foliation / Vein
24.2	95	57	Foliation / Vein
24.5	83	60	Foliation / Vein
24.6	356	36	Fracture Rank 1
24.7	10	29	Fracture Rank 2
24.8	358	45	Fracture Rank 2
25.4	21	56	Foliation / Vein
25.7	98	16	Fracture Rank 2
25.8	338	11	Fracture Rank 1
26.0	188	59	Fracture Rank 1
26.0	11	11	Fracture Rank 1
26.8	325	4	Fracture Rank 1
26.9	358	4	Fracture Rank 4
27.0	347	6	Fracture Rank 2
27.1	7	19	Foliation / Vein
27.2	356	9	Fracture Rank 1
28.1	161	23	Fracture Rank 2
28.2	161	29	Fracture Rank 2
28.5	355	12	Fracture Rank 1
28.5	47	40	Foliation / Vein
28.9	28	55	Fracture Rank 2
29.1	35	29	Fracture Rank 1
29.1	87	66	Fracture Rank 1
29.2	67	11	Fracture Rank 4
29.2	354	61	Foliation / Vein
29.6	348	63	Foliation / Vein
29.8	340	72	Fracture Rank 1
29.9	34	4	Fracture Rank 2
29.9	339	71	Fracture Rank 1
29.9	69	21	Fracture Rank 4
30.4	348	33	Foliation / Vein
30.5	356	31	Foliation / Vein
31.6	352	20	Fracture Rank 2
32.2	357	47	Foliation / Vein
32.7	348	19	Fracture Rank 3
32.8	113	53	Fracture Rank 1
33.2	34	22	Fracture Rank 2

B-208 - TABLE OF BEDROCK STRUCTURES

Depth (Feet)	Dip Azimuth (Degrees)	Dip Angle (Degrees)	Bedrock Structure Category
33.4	47	29	Fracture Rank 3
33.5	74	41	Fracture Rank 1
33.6	34	32	Foliation / Vein
33.9	349	36	Foliation / Vein
34.1	3	40	Foliation / Vein
34.4	355	40	Foliation / Vein
34.6	357	57	Foliation / Vein

Appendix F – Ground Penetrating Radar Geophysical Survey



**BEDROCK DEPTH INVESTIGATION
NORTHEAST METRO REGIONAL TECHNICAL
HIGH SCHOOL
WAKEFIELD, MA**

July 22th, 2022
File 2022031

Prepared for:
Lahlaf Geotechnical Consulting, Inc
100 Chelmsford Road, Suite 2
Billerica, MA 01862

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PLATE

Plate 1: Location of GPR Transects
Plate 2: Bedrock Depth Plot

APPENDIX

Appendix A: Figures G1-G3	Line1 2D Bedrock Depth Models
Appendix B: Figures G4-G13	Line2 2D Bedrock Depth Models

1.0 INTRODUCTION

This report details the results of a geophysical investigation conducted by Hager GeoScience (HGI) for Lahlaf Geotechnical Consulting, Inc. (LGCI) at the Proposed Northeast Metro Regional Vocational Technical High School in Wakefield, Massachusetts. Field data acquisition was performed on July 14th and 15th, 2022. An additional 1.5 days was necessary to clear the vegetation along the lines. The survey objective was to map the depth to bedrock along Line 1 (~780') and Line 2 (~1950') for a total length of 2750 linear feet.

Based on borehole and test pit information provided by LGCI, Ground Penetrating Radar (GPR) was chosen as a preferred method, considering the average shallow bedrock depth reported.

2.0 DATA ACQUISITION

2.1 GPR Survey

Due to dense vegetation and irregular topography, Lines 1 and 2 were split into multiple segments, in order to reduce the effect of survey wheel distance errors. Specifically:

- Line 1 has been segmented in three sections because of dense vegetation between L1-A and L1-B, and outcrop crossing between L1-B and L1-C. The resulted total line length covered is 765 feet.
- BH-206 and BH-208 information were used to calibrate the GPR data and assign the more adequate dielectric constant along Line 1.
- Line 2 has been segmented in ten sections due to difficult topography, resulting in distance error assigned to the GPR data, and obstacles along the line.
- TP-204 and TP-206 information were used to calibrate the GPR data and assign the more adequate dielectric constant along Line 2.

GPR survey locations are shown on Plate 1, an AutoCAD Map3D 2021 plot created from HGI field notes, GPR data, GPS measurements, and a base map provided by LGCI. Red and Blue colors were used to differentiate transects along Lines 1 and 2.

GPR data were collected as two-way travel time and reflection amplitude, in which measurements are made of the time for the input radar wave pulse to travel to a subsurface change in electrical properties and reflect back to the antenna at the ground surface, and the relative energy of the reflected signal. Depths to interfaces are determined from the recorded travel-time data using radar propagation velocities estimated through migration calculations and from material-specific velocity tables and published data.

HGI used a Geophysical Survey Systems Inc. (GSSI) SIR-4000 acquisition system with a 350 and 200-MHz antennas. The combination of a lower and higher frequency antenna allowed to image depth up to 40' below ground surface, and at the same time to maintain high resolution on shallower boundaries. The data acquisition parameters used for the GPR survey are shown in Table 1 below.

Table 1 - GPR Survey Acquisition Parameters

Antenna Frequency (MHz)	Range (ns)	Survey Mode¹	Scan Rate (scans/s)	Scan Interval (ft)	Samples/ Trace	Approx. Signal Depth (ft)
200	300	SW	177	24	512	40
350	200	SW	120	28	512	25

¹ SW-Survey Wheel

2.2 GPS Survey

Hager Geoscience used its Sokkia RTK GRX2 GPS system to locate surface features, transects, and other features of interest. Where an RTK solution was achieved, the Sokkia system provided a relative accuracy of around 0.0328 feet horizontally and 0.0492 feet vertically. All points were collected in MA83F State Plane coordinate system.

3.0 DATA REDUCTION AND ANALYSIS

Following the field data collection, the geophysical data were downloaded to a PC at the office, where they were archived, processed, and analyzed using the following proprietary software:

- GPR data processing: GSSI's RADAN® 7
- Graphic presentations: Microsoft Excel®, Golden Software Surfer© 23, AutoCAD® Map3D 2021

3.1 GPR Survey

GPR data were processed and analyzed using GSSI's RADAN® 7 software. Prior to analysis, the raw GPR data required processing to reduce the detrimental effects of site-specific noise associated with interfering background frequency signals, destructive reflections from surface and/or buried objects, and general signal attenuation. Several iterations of GPR data processing and analysis were necessary to mitigate the detrimental effects.

The processed profiles were analyzed for the location, depth, and orientation of reflective features relating to changes in soil and bedrock stratigraphy. Reflective boundaries interpreted as reflections from the bedrock surface were "picked" to produce a database of depth points for spatial mapping. The depths to GPR reflectors were calculated using two-way travel times to the GPR reflector and propagation velocities estimated using a priori information and experience.

Bedrock depth information from BH-206, BH-208, TP-204 and TP-206 were used to calibrate the GPR results interpreted for Lines 1 and 2.

4.0 RESULTS

As stated in Section 1.0 Introduction, the survey objective was to map the depth to bedrock along Line 1 (~780') and Line 2 (~1950') for a total length of 2750 linear feet.

The bedrock profiles along Lines 1 and 2 (shown in Figures G-1 to G13) reveal an undulating glacially eroded bedrock surface. GPR data indicate the presence of a variable weathering profile along the bedrock surface. In order to provide a consistent interpretation of the bedrock surface, the top of weathered bedrock was selected to represent the bedrock surface in areas where a weathered bedrock profile was observed.

The thickness of weathered bedrock has not been interpreted but most likely is less than 3 to 5 feet and consists of fractured vs. decomposed rock. The rippability of the bedrock surface can be determined from a seismic refraction survey.

The maximum depth to bedrock calculated for Line 1 is less than 4 feet below ground surface. Bedrock outcrop occurs between Line1-B and Line1-C. The maximum depth to bedrock calculated for Line 2 is less than 10 feet below ground surface.

5.0 THE GEOPHYSICAL METHODS

5.1 Ground Penetrating Radar (GPR)

5.1.1 Description of the Method. The principle of ground penetrating radar (GPR) is the same as that used by police radar, except that GPR transmits electromagnetic energy into the ground. The energy is reflected back to the surface from interfaces between materials with contrasting electrical (dielectric and conductivity) and physical properties. The greater the contrast between two materials in the subsurface, the stronger the reflection observed on the GPR record. The depth of GPR signal penetration depends on the properties of the subsurface materials and the frequency of the antenna used to collect radar data. Lower frequency antennas provide greater signal penetration, but result in lower object resolution.

5.1.2 Data Collection. HGI collects GPR data using a Geophysical Survey Systems (GSSI) SIR 2, 20, 2000, 3000, or 4000 ground penetrating radar system. Data are digitally recorded on the internal hard drive or flash memory of the GPR system. System controls allow the GPR operator to filter out noise, attributed to coupling noise caused by conductive soil conditions, spurious noise caused by local EMF fields, and internal system noise. For shallow surveys, we use antennas with center frequencies ranging from 2000- to 400-megahertz (MHz). For deeper penetration, we use lower frequency antennas ranging from 350 MHz to 15 MHz, depending on the anticipated target depth and the degree of signal penetration. All of these antenna configurations can collect data in

continuous mode, distance mode, or as discrete point measurements using signal-stacking techniques. Since there is a trade-off between signal penetration and resolution, test data are sometimes collected using antennas with several different frequencies, with the highest frequency antenna that produces the highest quality data used. In some cases, data are collected with several antenna frequencies.

The horizontal scale of the GPR record shows distance along the survey traverse. In the continuous data collection mode, the horizontal scale on each GPR record is determined by the antenna speed along the surface. When a survey wheel is used, the GPR system records data with a fixed number of traces per unit distance. The GPR record is automatically marked at specified distance intervals along the survey line. The vertical scale of the radar record is determined by the velocity of the transmitted signal in the media under study and the range setting, or recording time window of the GPR system. The recording time interval, or range, represents the maximum two-way travel time in which data are recorded. The conversion of the two-way travel time of the transmitted signals to depth is determined by the propagation velocity of the GPR signal, which is site (media) specific. When little or no information is available about the makeup of subsurface materials, we estimate propagation velocities from handbook values and experience at similar sites or by CDP velocity surveys with a bi-static antenna.

5.1.3 Data Processing. After completion of data collection, the GPR data are transferred to a PC for review and processing using RADAN® 7 software. When appropriate, we prepare 3D models of GPR data, which can be sliced in the X, Y, and Z directions.

The size, shape, and amplitude of GPR reflections are used to interpret GPR data. Objects such as metallic UST's and utilities produce reflections with high amplitude and distinctive hyperbolic shapes. Clay, concrete pipes, boulders and other in-situ features may produce radar signatures of similar shape but lower amplitude. The boundaries between saturated and unsaturated materials such as sand and clay, bedrock and overburden, generally also produce strong reflections.

5.1.4 Limitations of the Method. GPR signal penetration is site-specific and is determined by the dielectric properties of local soil and fill materials. GPR signals propagate well in resistive materials such as sand and gravel; however, soils containing clay, ash- or cinder-laden fill or fill saturated with brackish or otherwise electrically conductive groundwater cause GPR signal attenuation and loss of target resolution. Concrete containing rebar or wire mesh also inhibits signal penetration.

The interpreted depths of objects detected using GPR are based on on-site calibration, handbook values, and/or estimated GPR signal propagation velocities from similar sites. GPR velocities and depth estimates may vary if the medium under investigation or soil water content is not uniform throughout the site.

Utilities are interpreted on the basis of reflections of similar size and depth that exhibit a linear trend; however, GPR cannot unambiguously determine that all such reflectors are related. Fiberglass USTs or utilities composed of plastic or clay may be difficult to detect if situated in

soils with similar electromagnetic properties, or if situated in fill with other reflecting targets that generate “clutter” or signal scattering and thus obscure other deeper reflectors. Objects buried beneath reinforced concrete pads or slabs may also be difficult, but possible, to detect.

As a rule of thumb, GPR can resolve utilities with a diameter of 1” per foot of depth (i.e., a 1”-diameter utility can be detected to a burial depth of 1 foot).

Changes in the speed at which the GPR antenna is moved along the surface causes slight variations in the horizontal scale of the recorded traverse. Distance interpolation may be performed to minimize the error in interpreted object positions. The variation in the horizontal scale of the GPR record may be controlled, to a certain extent, with a distance encoder or survey wheel. The GPR antenna produces a cone-shaped signal pattern that emanates approximately 45 degrees from horizontal front and back of the antenna. Therefore, buried objects may be detected before the antenna is located directly over them. GPR anomalies may appear larger than actual target dimensions.

GPR interpretation is more subjective than other geophysical methods. The interpretive method is based on the identification of reflection patterns that do not uniquely identify a subsurface target. Borings, test pits, site utility plans and other ground-truth are recommended to verify the interpreted GPR results.

5.2 RTK GNSS Global Positioning System (GPS)

5.2.1 Description of the Method. The RTK GPS system consists of a base (reference) receiver and a roving receiver. The base receiver remains stationary during a survey and is mounted on a tribrach and tripod. A rover receiver is used to record points remotely and can be mounted on a staff, vehicle, or other object. The base provides real-time corrections to the rover over a radio connection. The system can produce accuracy on a centimeter scale, but the level of accuracy depends on factors that include the geometry of the transmitting satellites and the receivers’ view of the horizons (e.g., the density of buildings and trees). The data can be collected as quickly as 5 Hz or 5 readings per second.

5.2.2 Data Collection and Processing. We perform our GPS surveys using a Sokkia RTK GRX3 GPS system. The base station can be set up over a known or unknown point, with the position taken from satellite information. Once the system has achieved a fixed solution for the rover receiver, data points can be collected with survey-grade (centimeter-scale) precision. When GPS points are being collected at a site where the fixed solution is constantly lost and gained, points are checked multiple times for precision. All data points are saved to a Carlson Surveyor 2 field computer.

The GPS data are corrected automatically by the base receiver in the field prior to being recorded. If the base station is located on an unknown point that is later defined, the GPS data can be corrected in the office to fit the real world coordinates.

5.2.3 Limitations of the Method. The quality of the GPS signal is site-specific. The base and

rover receiver need to have clear views of the horizon and good satellite geometry to achieve the highest level of accuracy and precision. Although a fixed solution can be achieved in wooded environments or sites with taller buildings, it may take more time to achieve the solutions, the fixed solution may be lost frequently when moving the rover, and in some cases the fixed solution may be wrong. Each of these situations requires longer to locate data points accurately and precisely. When the point is too close to a building, beneath a building overhang, under a tree, or obscured by some other object, a fixed solution may not be possible.

When the base station is set up over an unknown point, the survey data location can be at least several tens of meters from the real world location. The data points will have survey grade precision relative to the location of the base station and other data points, but will have a real world accuracy discrepancy.

HGI does not guarantee to produce a surveyor-quality map from its GPS data, as this is not its profession. If survey-level accuracy is critical for a project, we recommend hiring professional surveyors for that purpose.



Legend

GPRTransect

HGI - Identified Borehole

HGI - Identified Test Pit

HGI - Identified Outcrop

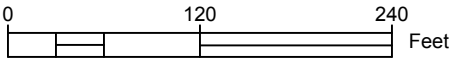
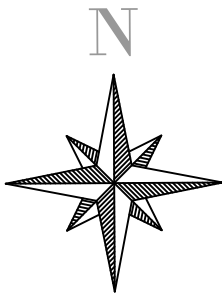


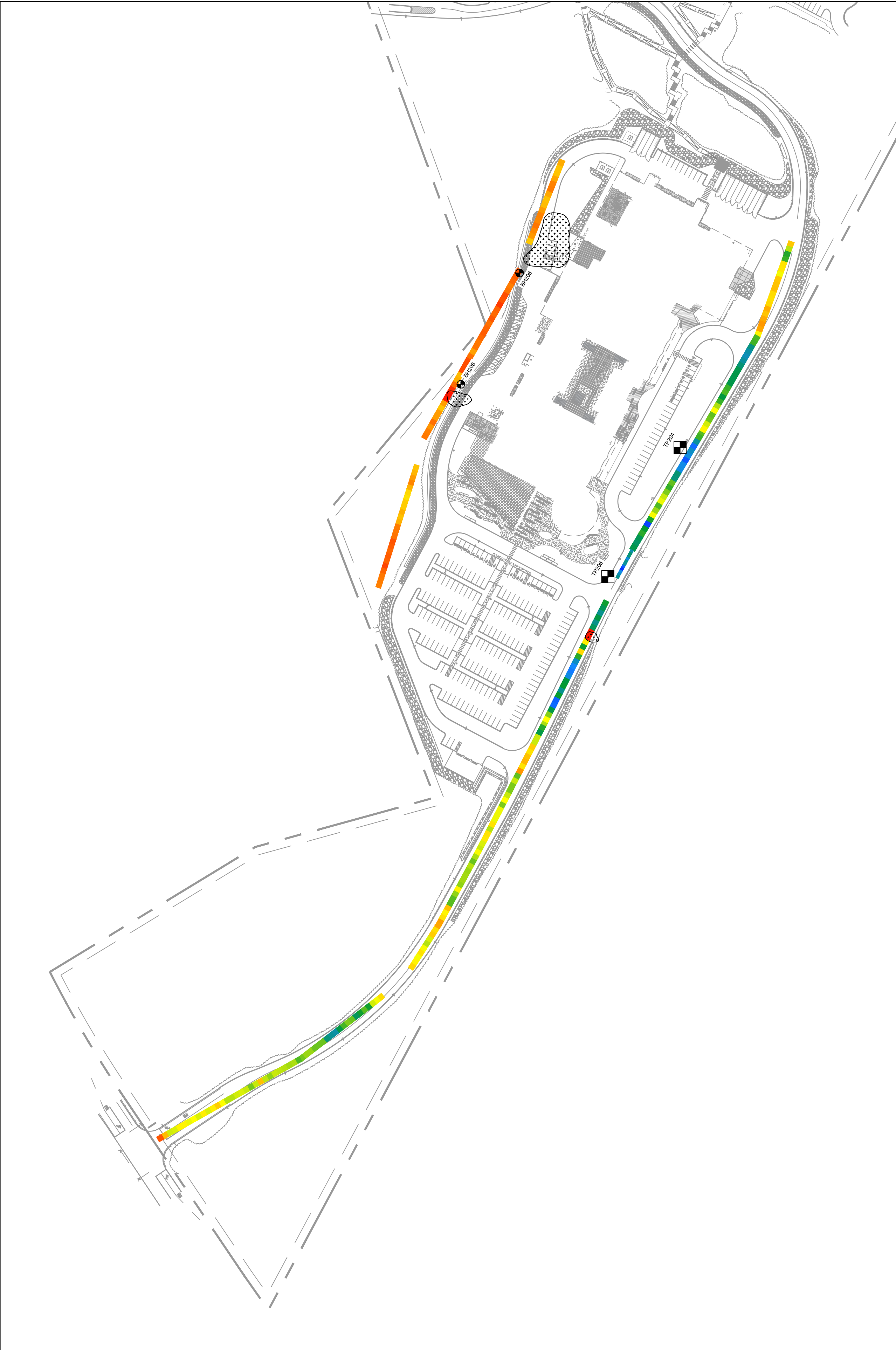
PLATE 1

July 2022 File #2022031

Bedrock Depth Investigation
Northeast Metro Regional
Technical High School
Wakefield, MA
Location of GPR Transects

- NOTES:
- 1.) The base map was created from HGI field notes, GPS and the file "2022-07-01_NEMT_DD_Cost Est_Site Plan.dwg" provided by LGCI.
 - 2.) HGI's contributions to the base map are listed in the legend. All other features are from the file listed above and have been grayed.
 - 3.) Shape and extension of HGI's Identified Outcrops are approximate.
 - 4.) Blue and red colors are been used to identify different GPR sections along Lines 1 and 2.

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Legend

 HGI - Identified Borehole

 HGI - Identified Test Pit

 HGI - Identified Outcrop

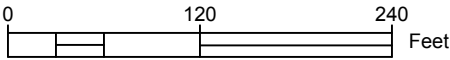
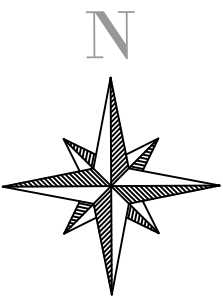
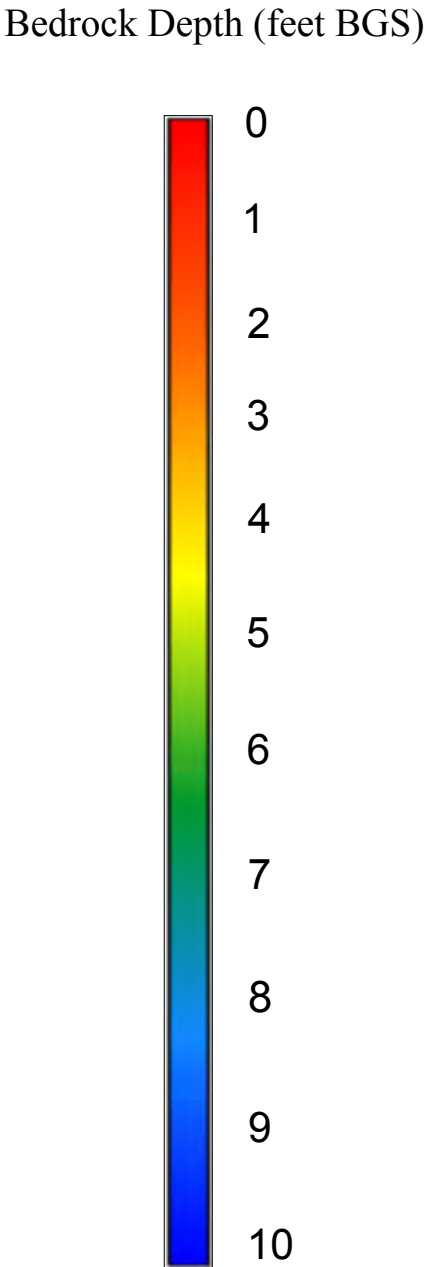


PLATE 2

July 2022 File #2022031

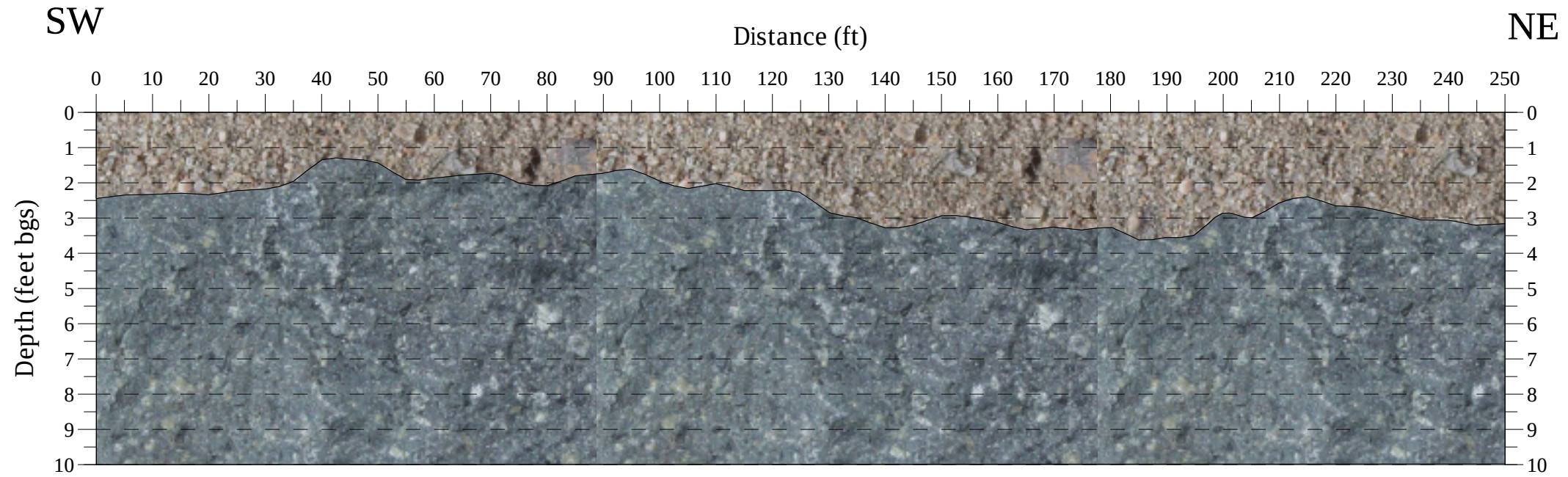
Bedrock Depth Investigation
Northeast Metro Regional
Technical High School
Wakefield, MA
Bedrock Depth Plot

NOTES:
1.) The base map was created from HGI field notes, GPS and the file "2022-07-01_NEMT_DD_Cost Est_Site Plan.dwg" provided by LGCI.
2.) HGI's contributions to the base map are listed in the legend. All other features are from the file listed above and have been grayed.
3.) Shape and extension of HGI's Identified Outcrops are approximate.

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Appendix A
Figure G1-G3
Line 1 Bedrock Depth Models

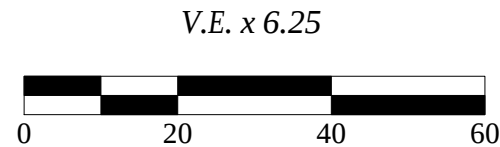
Figure G1
GPR Bedrock Depth Model
Line 1-A



Bedrock Depth Investigation
Northeast Metro Regional Technical High School
Wakefield, MA

July 2022

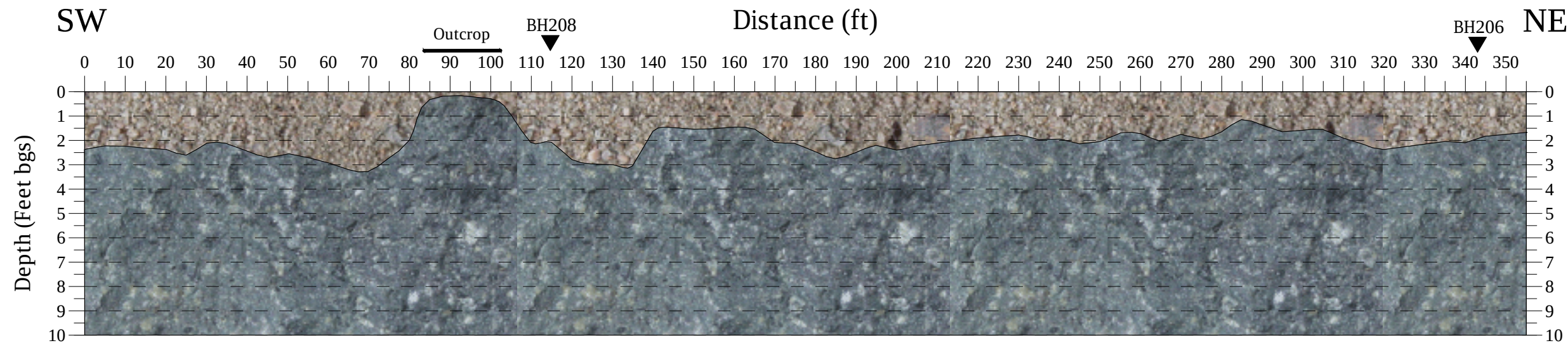
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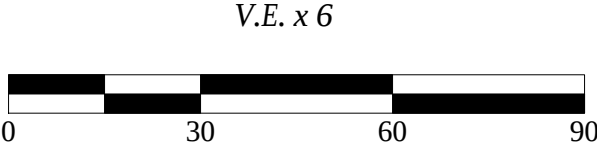


Figure G2
GPR Bedrock Depth Model
Line 1-B



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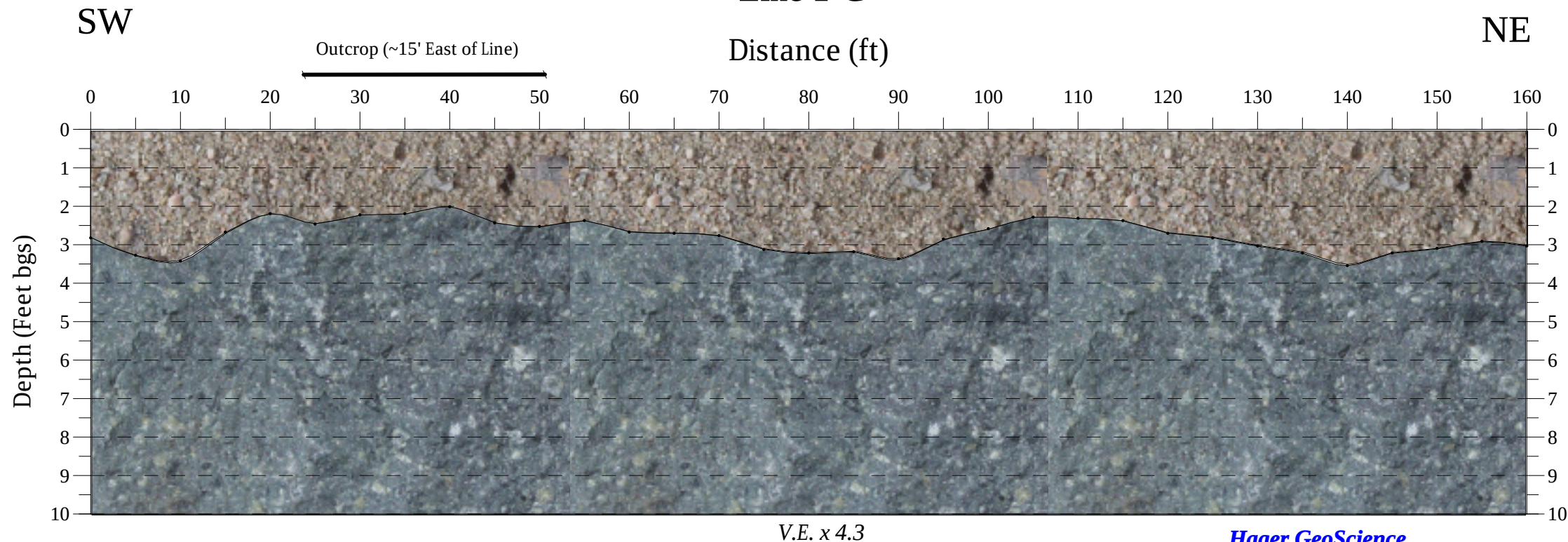
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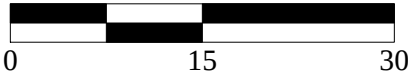
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Figure G3
GPR Bedrock Depth Model
Line 1-C



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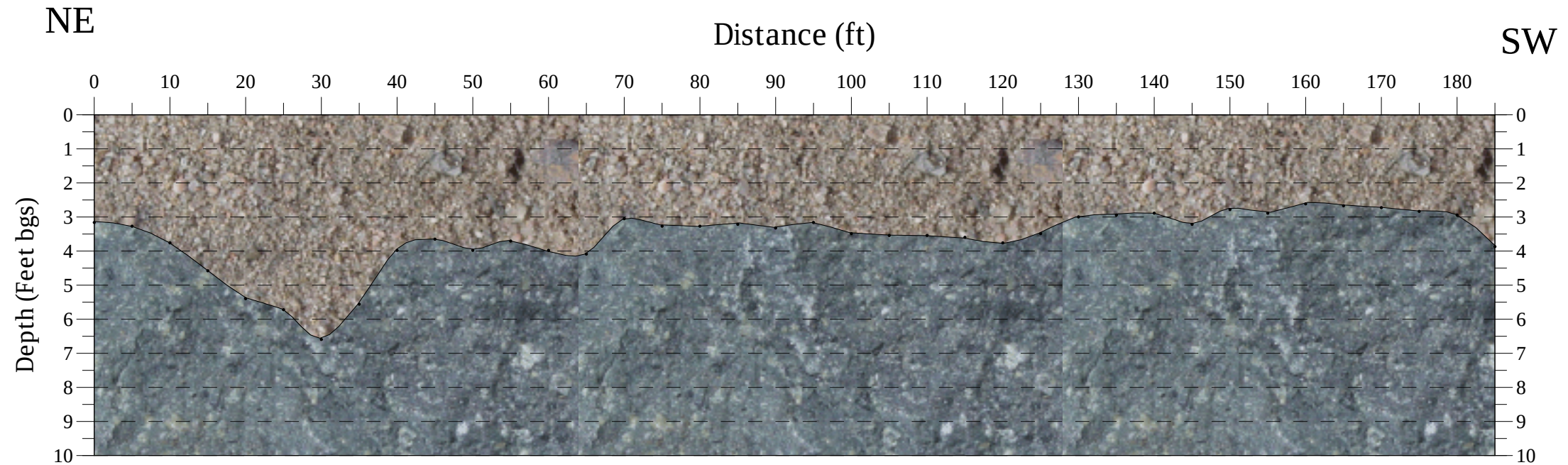


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Appendix B
Figure G4-G13
Line 2 Bedrock Depth Models

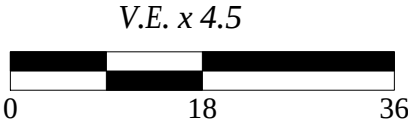
Figure G4
GPR Bedrock Depth Model
Line 2-A



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Wakefield, MA

July 2022

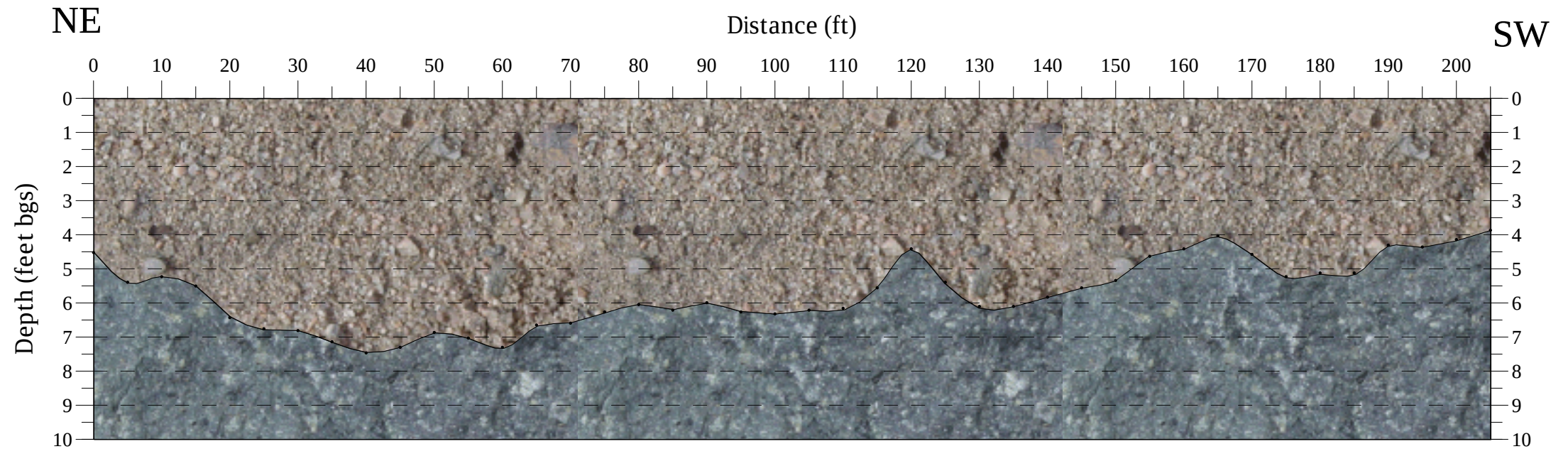
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Figure G5
GPR Bedrock Depth Model
Line 2-B

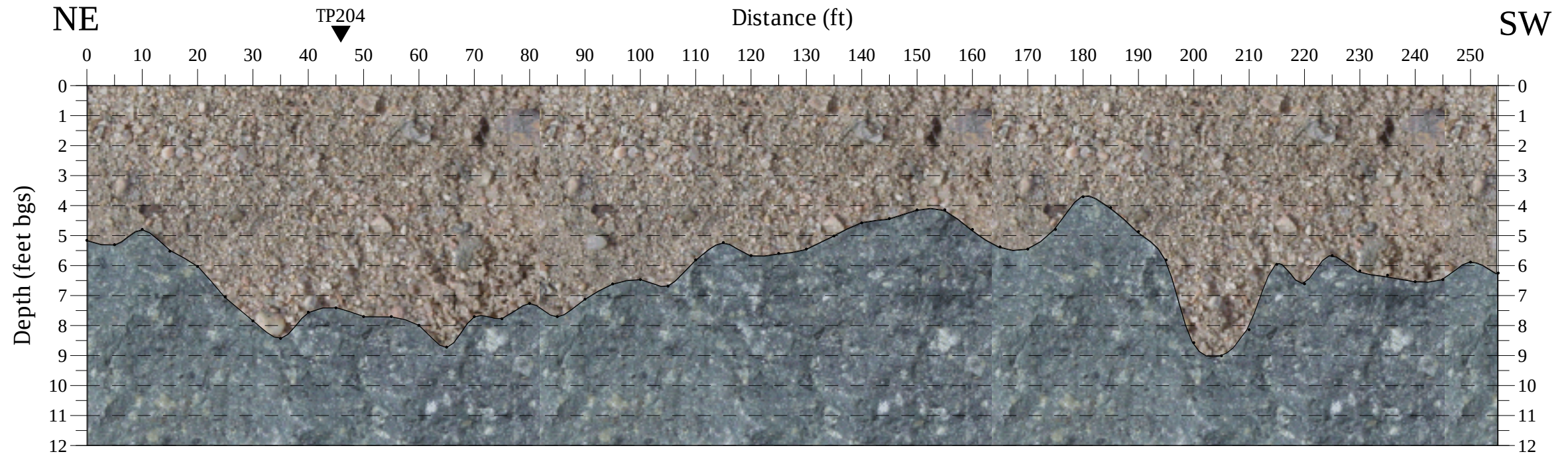


Bedrock Depth Investigation
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Wakefield, MA
July 2022 File 2022031

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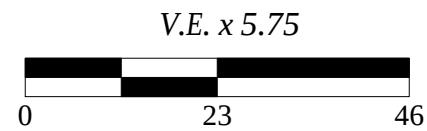
Figure G6
GPR Bedrock Depth Model
Line 2-C



Bedrock Depth Investigation
Northeast Metro Regional Technical High School
Wakefield, MA

July 2022

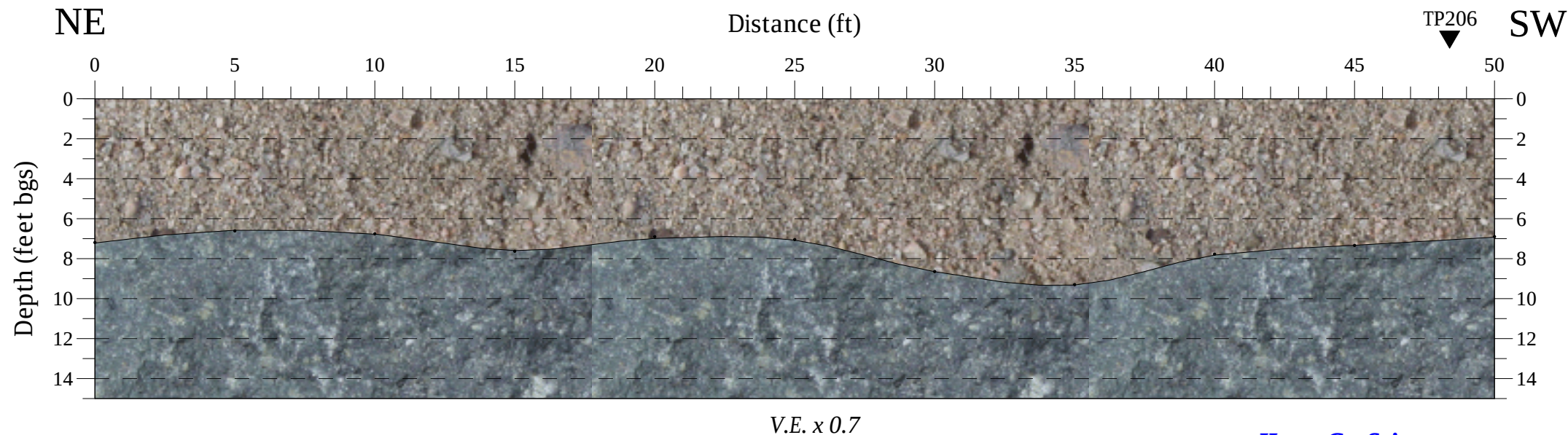
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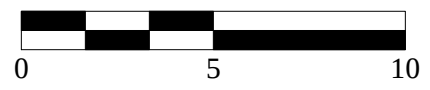
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Figure G7
GPR Bedrock Depth Model
Line 2-D



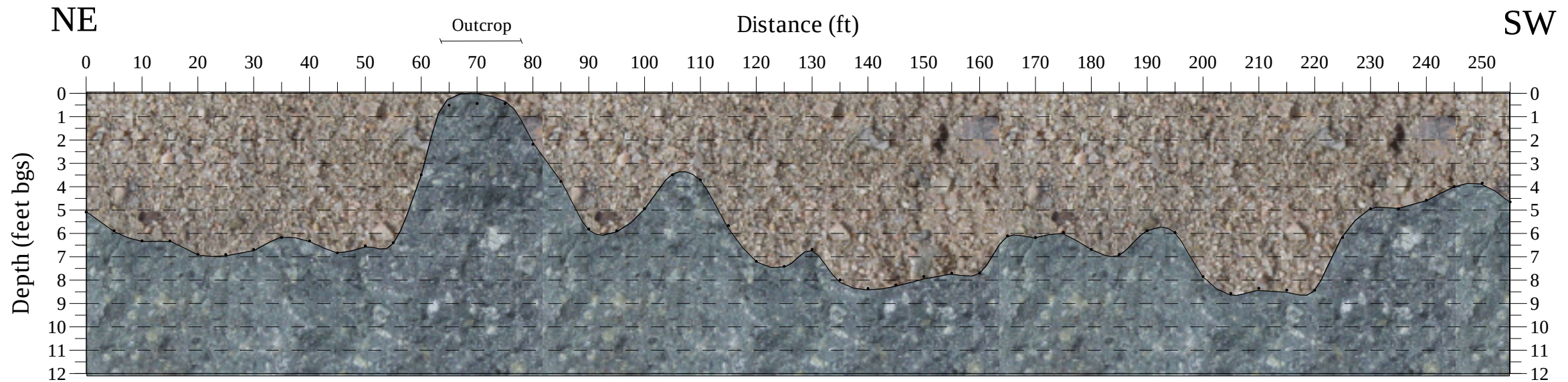
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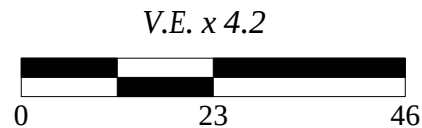
Figure G8
GPR Bedrock Depth Model
Line 2-E



Bedrock Depth Investigation
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Wakefield, MA

July 2022

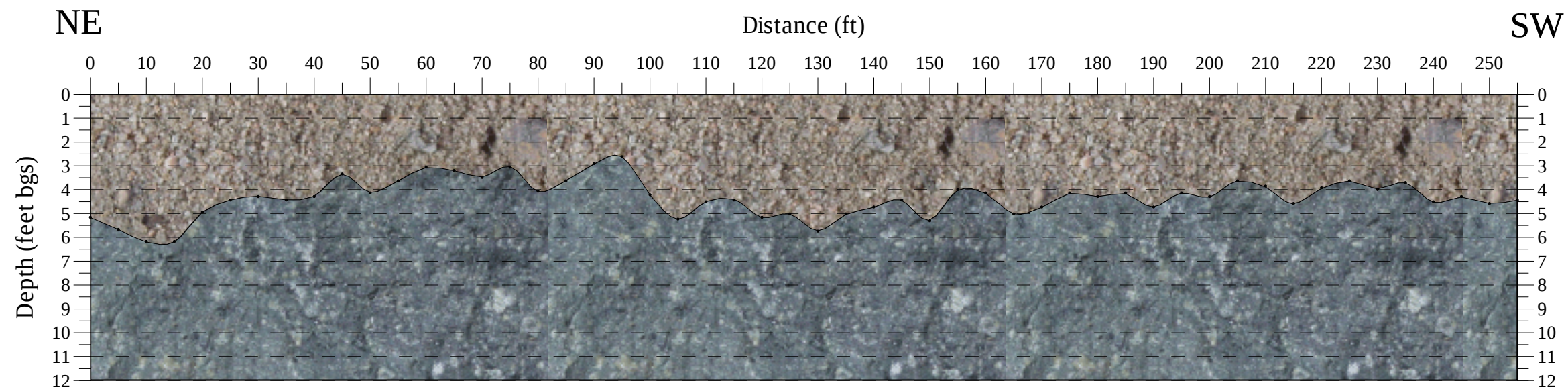
File 2022031



Hager GeoScience
A Collier Geophysics Company
596 Main Street
Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com



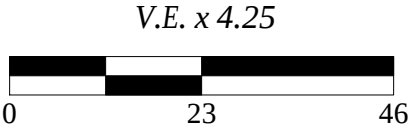
Figure G9
GPR Bedrock Depth Model
Line 2-F



Bedrock Depth Investigation
Northeast Metro Regional Technical High School
Wakefield, MA

July 2022

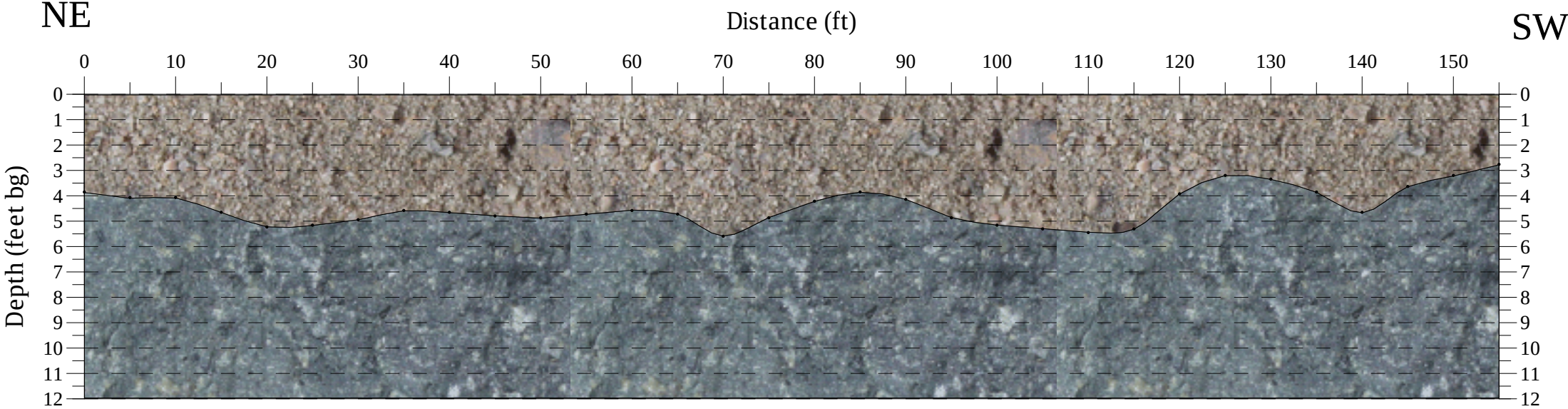
File 2022031



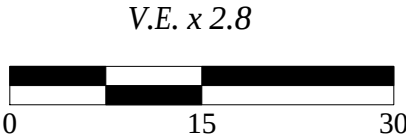
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A Collier Geophysics Company
596 Main Street
Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com



Figure G10
GPR Bedrock Depth Model
Line 2-G



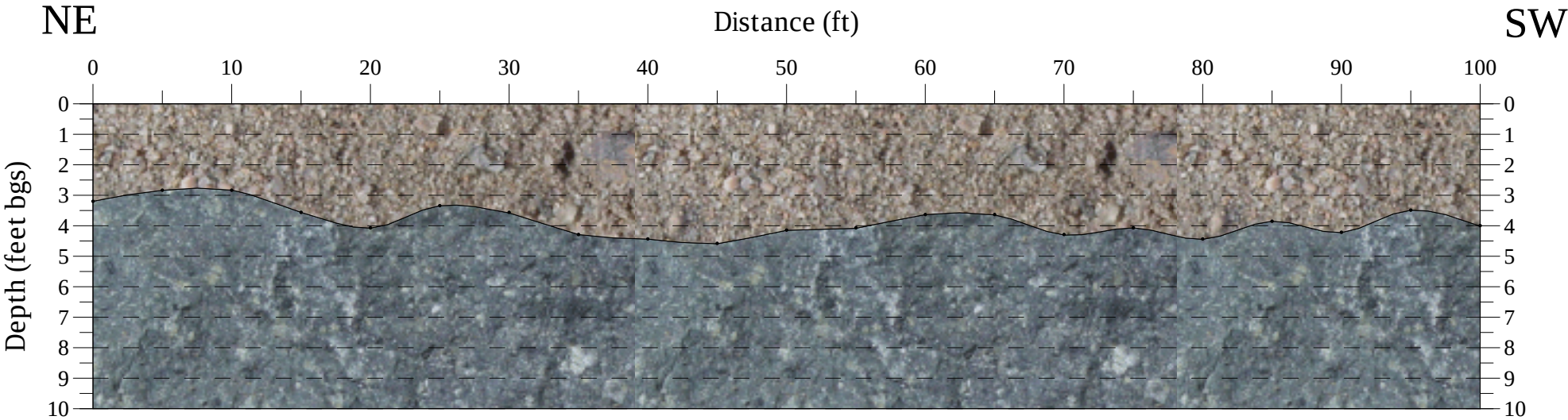
Bedrock Depth Investigation
Northeast Metro Regional Technical High School
Wakefield, MA
July 2022 File 2022031



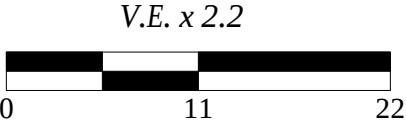
Hager GeoScience
A Collier Geophysics Company
596 Main Street
Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com



Figure G11
GPR Bedrock Depth Model
Line 2-H



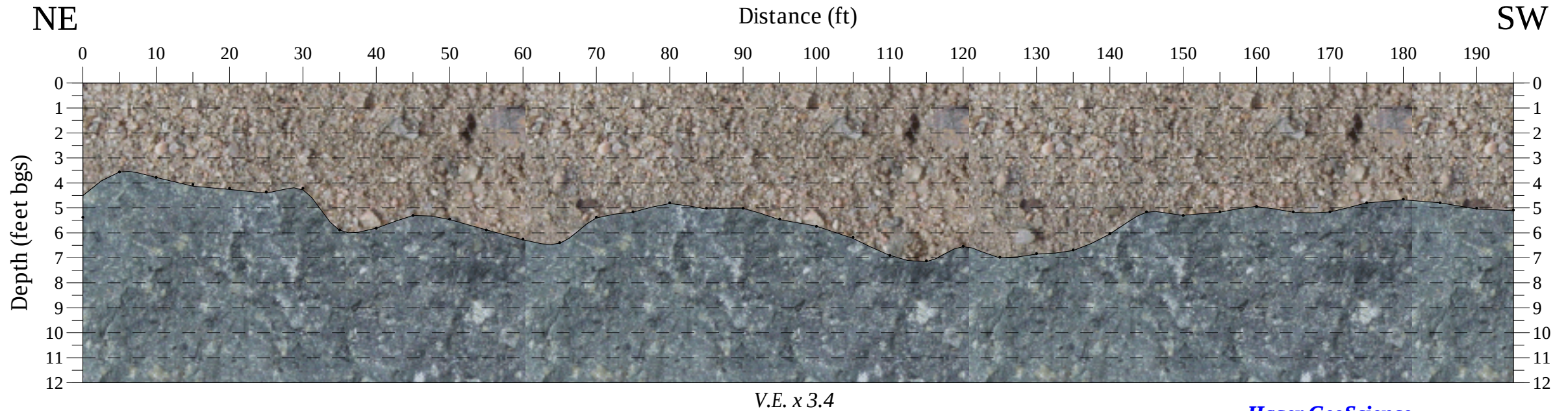
Bedrock Depth Investigation
Northeast Metro Regional Technical High School
Wakefield, MA
July 2022 File 2022031



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(781) 935-8111 hgi@hagergeoscience.com



Figure G12
GPR Bedrock Depth Model
Line 2-I

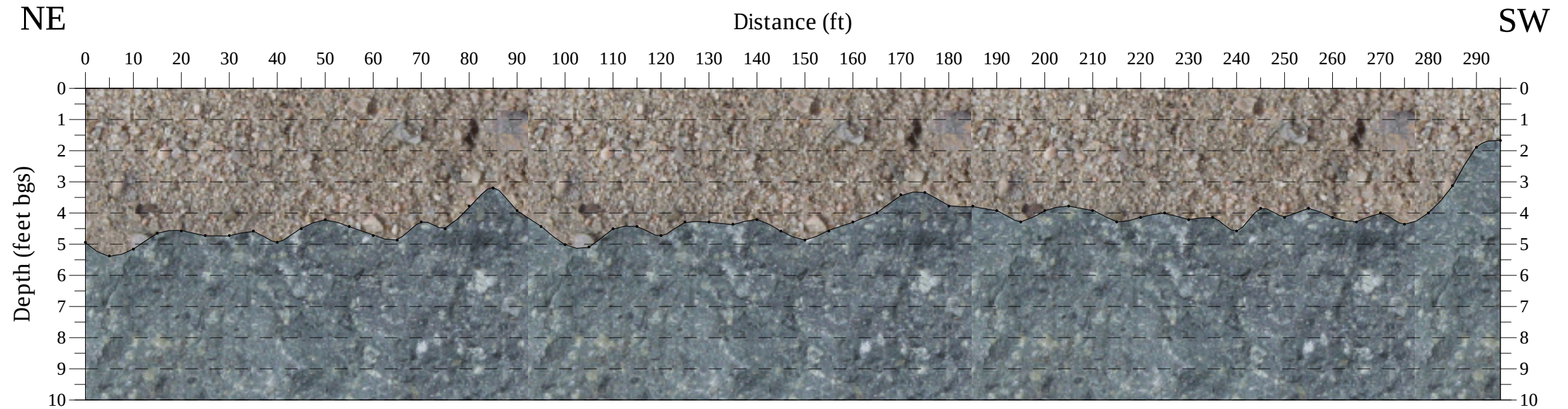


Bedrock Depth Investigation
Northeast Metro Regional Technical High School
Wakefield, MA
July 2022 File 2022031

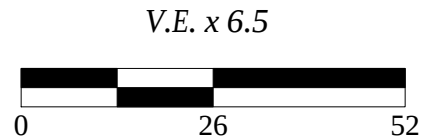
Hager GeoScience
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Figure G13
GPR Bedrock Depth Model
Line 2-K



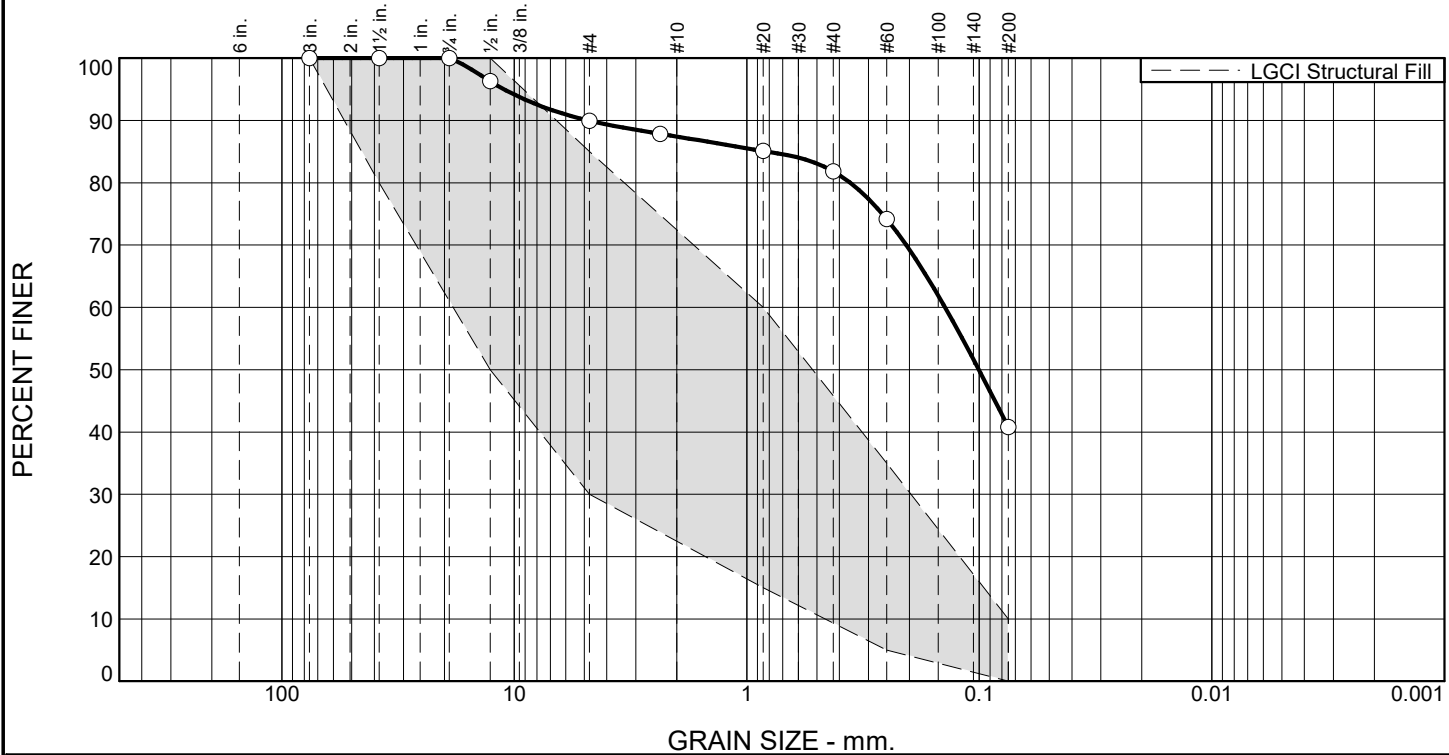
Bedrock Depth Investigation
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July 2022 File 2022031



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Appendix G – Results of Grain-size Analyses

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.0	2.6	5.6	41.0	40.8	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	96.3	50.0 - 100.0	
#4	90.0	30.0 - 85.0	X
#8	87.9		
#20	85.1	15.0 - 60.0	X
#40	81.8		
#60	74.2	5.0 - 35.0	X
#200	40.8	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND (SM), mostly fine, 40-45% fines, 10-15% fine subrounded gravel, light brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 4.8085 D₈₅= 0.8141 D₆₀= 0.1403
D₅₀= 0.1004 D₃₀= C_u= D₁₅=
D₁₀= C_c=

Remarks

Sand and Gravel Sample

Date Received: 04/28/2022 Date Tested: 05/03/2022

Tested By: RF

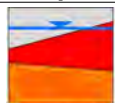
Checked By: TG

Location: Boring B-201

Sample Number: S3

Depth: 4.0'-6.0'

Date Sampled: 04/28/2022



LGCI

Lahlaf Geotechnical Consulting, Inc.

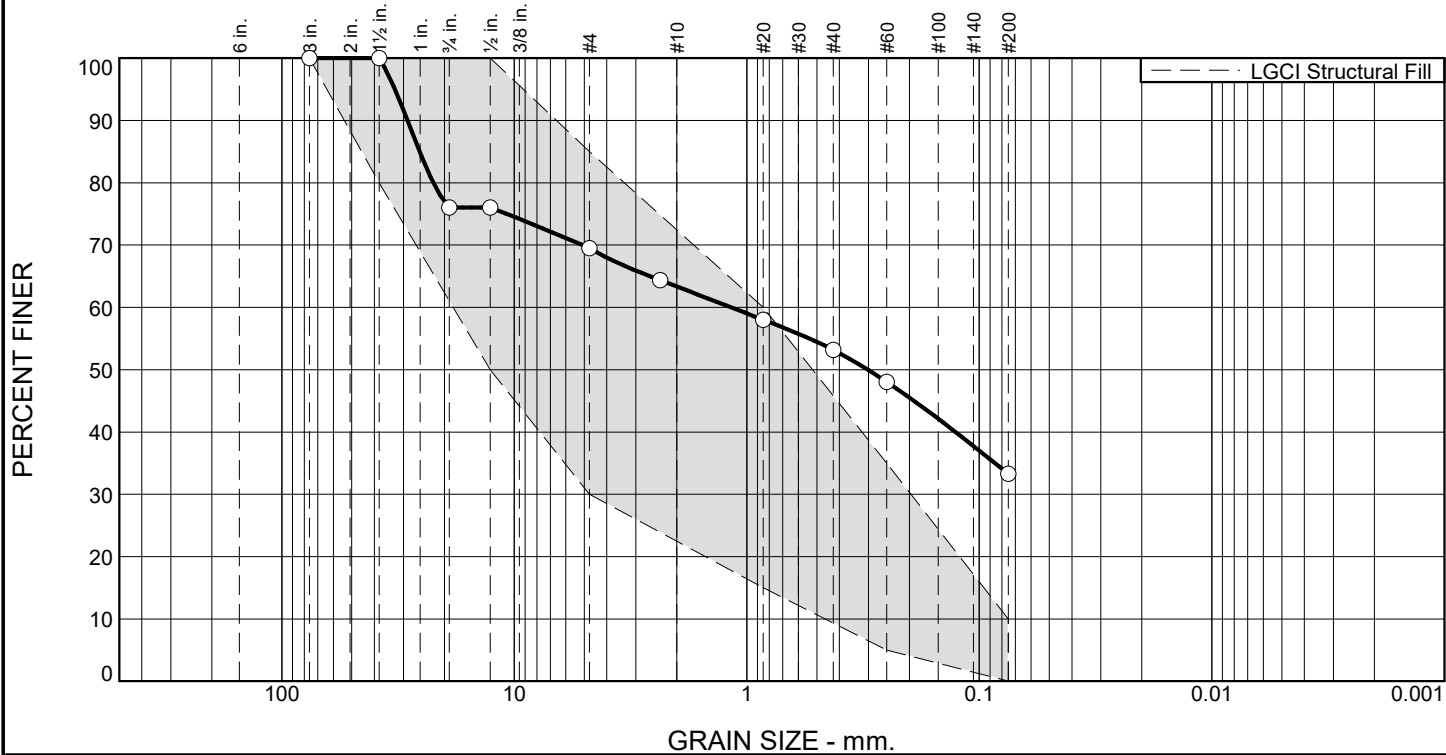
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	24.0	6.5	6.1	10.2	19.9	33.3	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	76.0		
0.5"	76.0	50.0 - 100.0	
#4	69.5	30.0 - 85.0	
#8	64.4		
#20	58.0	15.0 - 60.0	
#40	53.2		
#60	48.1	5.0 - 35.0	X
#200	33.3	0.0 - 10.0	X

* LGC Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND with Gravel (SM), fine to coarse, 30-35% fines, 30-35% fine to coarse subrounded gravel, brown to dark-brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 28.7958 D₈₅= 25.5251 D₆₀= 1.1681
D₅₀= 0.3010 D₃₀= C_u=
D₁₀= C_c=

Remarks

Subsoil Sample

Date Received: 4/27/22 Date Tested: 6/9/22

Tested By: HH

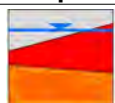
Checked By: RF

Location: Boring B-202

Sample Number: S1 Bot. 2"

Depth: 0.3'-1.8'

Date Sampled: 4/27/22



LGC

Lahlaf Geotechnical Consulting, Inc.

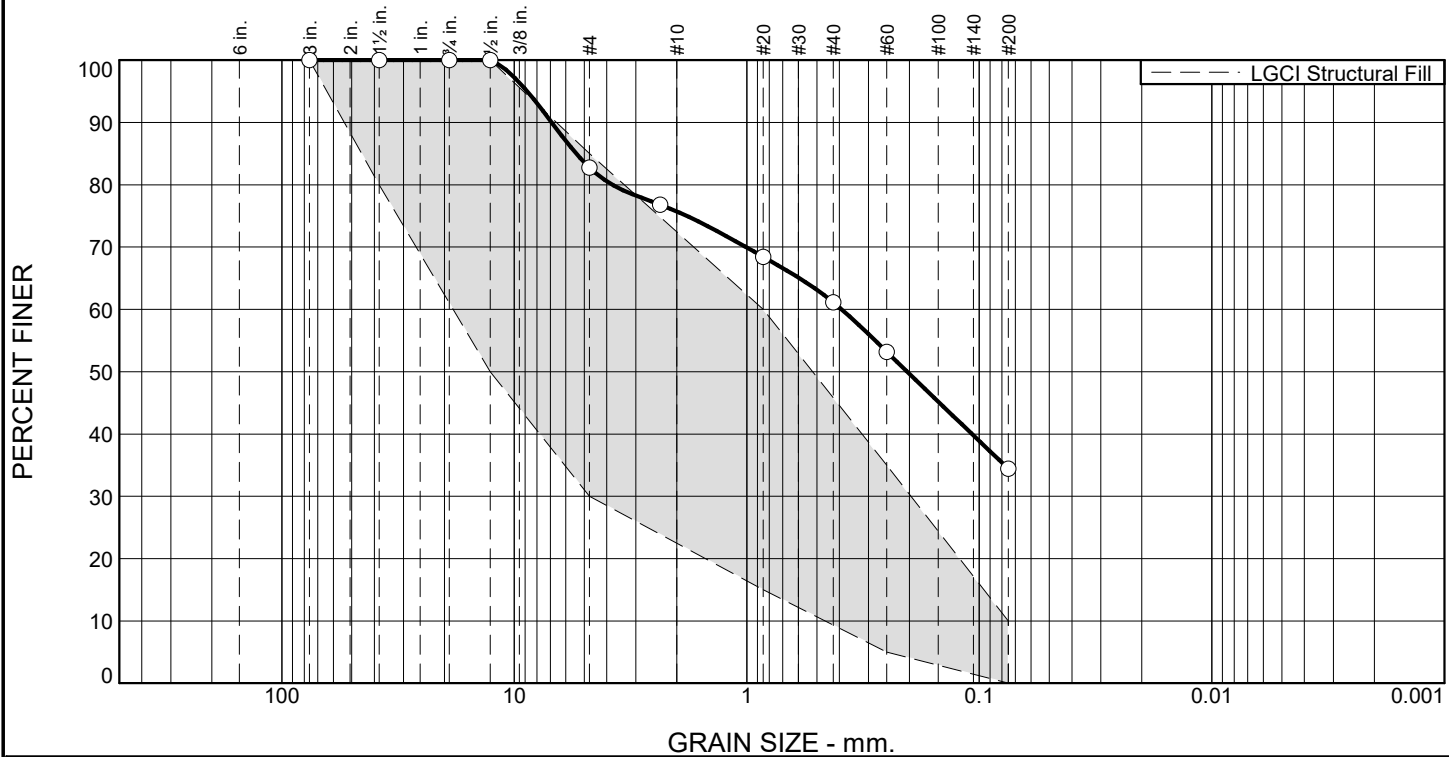
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	17.2	7.1	14.6	26.7	34.4	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	100.0	50.0 - 100.0	
#4	82.8	30.0 - 85.0	
#8	76.8		
#20	68.4	15.0 - 60.0	X
#40	61.1		
#60	53.2	5.0 - 35.0	X
#200	34.4	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND with Gravel (SM), fine to coarse, 30-35% fines, 15-20% fine subrounded gravel, dark brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 6.9003 D₈₅= 5.4064 D₆₀= 0.3904
D₅₀= 0.2041 D₃₀= C_u= D₁₅=
D₁₀= C_c=

Remarks

Subsoil Sample

Date Received: 5/2/22 Date Tested: 6/9/22

Tested By: HH

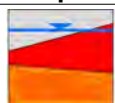
Checked By: RF

Location: Boring B-203

Sample Number: S1 Bot. 3"

Depth: 0.2'-2.0'

Date Sampled: 5/2/22



LGCI

Lahlaf Geotechnical Consulting, Inc.

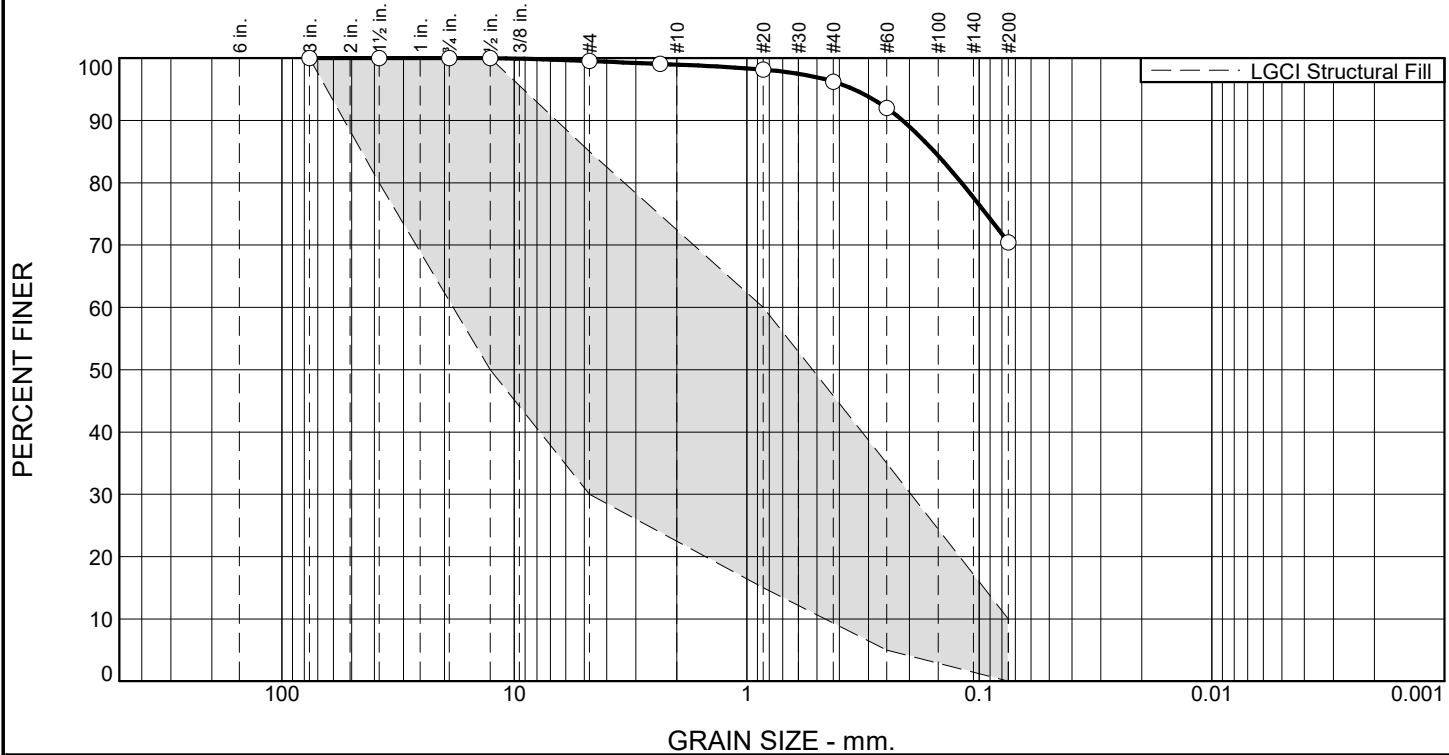
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	0.5	2.8	25.8	70.4	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	100.0	50.0 - 100.0	
#4	99.5	30.0 - 85.0	X
#8	99.1		
#20	98.2	15.0 - 60.0	X
#40	96.2		
#60	92.0	5.0 - 35.0	X
#200	70.4	0.0 - 10.0	X

* LGC Structural Fill

Material Description

ASTM (D 2488) Classification: SILT with Sand (ML), non-plastic, 25-30% fine to medium sand, trace coarse sand, 0-5% fine subrounded gravel, brown

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= _____ AASHTO (M 145)= _____

Coefficients

D₉₀= 0.2135 D₈₅= 0.1557 D₆₀= _____
D₅₀= _____ D₃₀= _____ D₁₅= _____
D₁₀= _____ C_u= _____ C_c= _____

Remarks

Subsoil Sample

Date Received: 5/4/22 **Date Tested:** 6/9/22

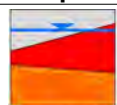
Tested By: HH

Checked By: NP

Location: Boring B-204-OW
Sample Number: S1 Bot. 6"

Depth: 0.3'-2.0'

Date Sampled: 5/4/22



LGC

Lahlaf Geotechnical Consulting, Inc.

Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Grain size distribution plot for LGCI Structural Fill. The y-axis is 'PERCENT FINER' (0-100) and the x-axis is 'GRAIN SIZE - mm.' (log scale, 100 to 0.075). The plot shows a solid curve with data points, a shaded region representing the specification range, and vertical dashed lines for sieve sizes. The legend indicates 'LGCI Structural Fill'.

Sieve Size (mm)	Percent Finer (%)
6 in.	100
3 in.	100
2 in.	100
1 1/2 in.	100
1 in.	100
3/4 in.	83
1/2 in.	70
3/8 in.	50
#4	39
#10	28
#20	22
#30	18
#40	10

<u>Material Description</u>		
ASTM (D 2488) Classification: Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, angular, 5-10% fines, 40-45% fine to coarse sand, brown to gray		
<u>Atterberg Limits (ASTM D 4318)</u>		
PL=	LL=	PI=
<u>Classification</u>		
USCS (D 2487)=	AASHTO (M 145)=	
<u>Coefficients</u>		
D ₉₀ = 23.7504	D ₈₅ = 20.1500	D ₆₀ = 8.2328
D ₅₀ = 4.5687	D ₃₀ = 1.0480	D ₁₅ = 0.1713
D ₁₀ = 0.0827	C _u = 99.59	C _c = 1.61
Remarks		
Sand and Gravel Sample		
Date Received: <u>5/4/22</u>	Date Tested: <u>6/9/22</u>	
Tested By: <u>HH</u>		
Checked By: <u>RF</u>		

Figure

The graph illustrates the gradation of LGC Structural Fill. The y-axis represents the percentage of material finer than a given sieve size, ranging from 0 to 100. The x-axis represents the sieve size in inches and millimeters. A solid curve shows the actual gradation, with data points marked by white circles. A shaded area between two dashed lines indicates the acceptable range for LGC Structural Fill.

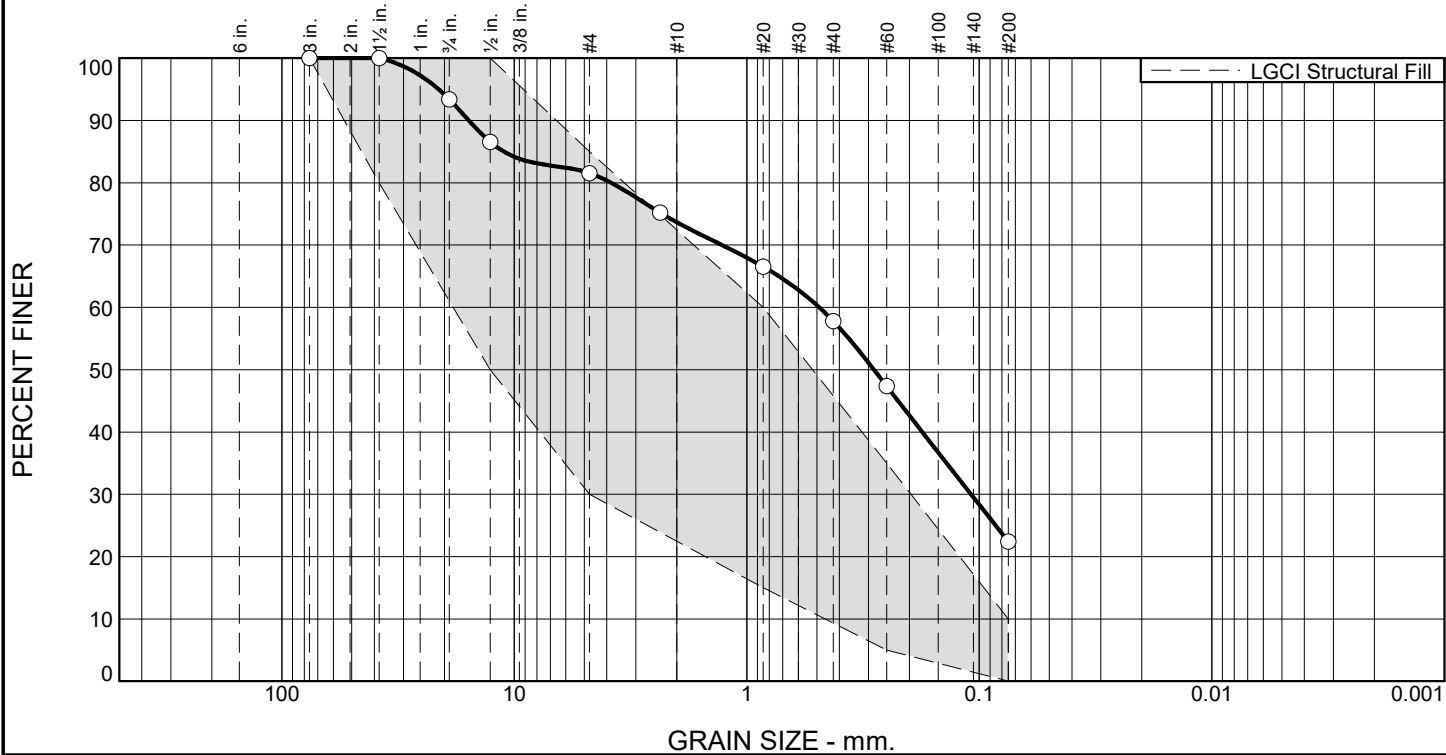
Sieve Size (in.)	Sieve Size (mm)	Percent Finer (%)
6 in.	152.4	100
3 in.	76.2	100
2 in.	50.8	100
1 1/2 in.	38.1	100
1 in.	25.4	95
3/4 in.	19.0	90
1/2 in.	12.5	80
3/8 in.	9.5	62
#4	4.75	50
#10	2.0	38
#20	0.85	30
#30	0.6	25
#40	0.425	16
#60	0.25	10
#100	0.15	5
#140	0.106	2
#200	0.075	1

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.4	32.2	15.1	16.8	14.1	16.4	

* LGCI Structural Fill

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.6	11.9	7.8	15.9	35.4	22.4	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	93.4		
0.5"	86.5	50.0 - 100.0	
#4	81.5	30.0 - 85.0	
#8	75.2		
#20	66.5	15.0 - 60.0	X
#40	57.8		
#60	47.4	5.0 - 35.0	X
#200	22.4	0.0 - 10.0	X

* LSCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND with Gravel (SM), fine to coarse, 20-25% fines, 15-20% fine to coarse subangular gravel, trace of bricks, brown to orange

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 15.6948 D₈₅= 11.0897 D₆₀= 0.4879
D₅₀= 0.2836 D₃₀= 0.1084 D₁₅=
D₁₀= C_u= C_c=

Remarks

Fill Sample

Date Received: 5/9/2022 Date Tested: 6/15/2022

Tested By: YSP

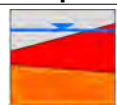
Checked By: RF

Location: Boring B-210

Sample Number: S2

Depth: 2.0'-4.0'

Date Sampled: 5/9/2022



LSCI

Lahlaf Geotechnical Consulting, Inc.

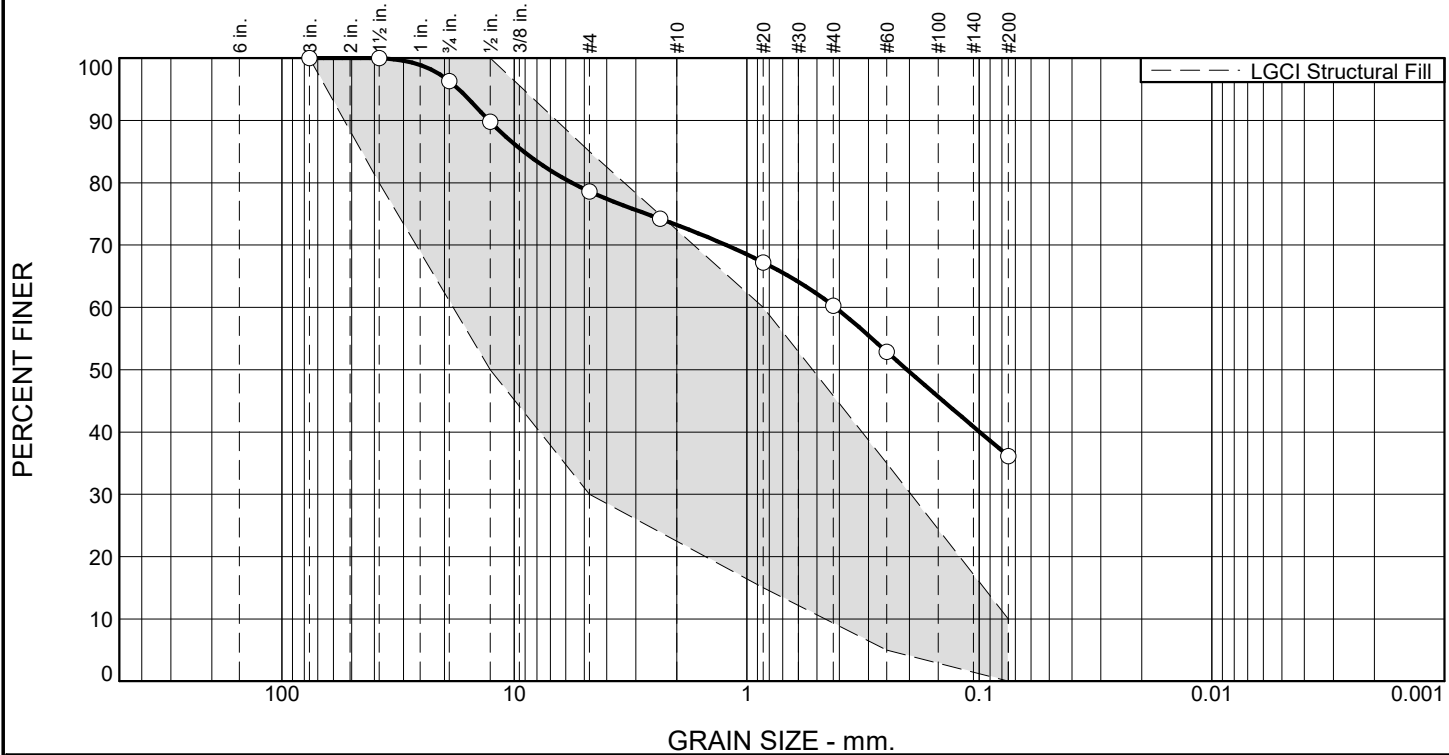
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.7	17.7	5.4	12.9	24.2	36.1	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	96.3		
0.5"	89.8	50.0 - 100.0	
#4	78.6	30.0 - 85.0	
#8	74.2		
#20	67.2	15.0 - 60.0	X
#40	60.3		
#60	52.9	5.0 - 35.0	X
#200	36.1	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND with Gravel (SM), fine to medium, trace coarse, 35-40% fines, 20-25% mostly fine subangular gravel, trace of organic soil, brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 12.8435 D₈₅= 9.1075 D₆₀= 0.4161
D₅₀= 0.2043 D₃₀= D₁₅=
D₁₀= C_u= C_c=

Remarks

Subsoil sample.

Date Received: 5/10/22 Date Tested: 6/17/22

Tested By: NP

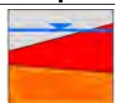
Checked By: YSP

Location: Boring B-220-OW

Sample Number: S2

Depth: 2.0'-4.0'

Date Sampled: 5/10/22



LGCI

Lahlaf Geotechnical Consulting, Inc.

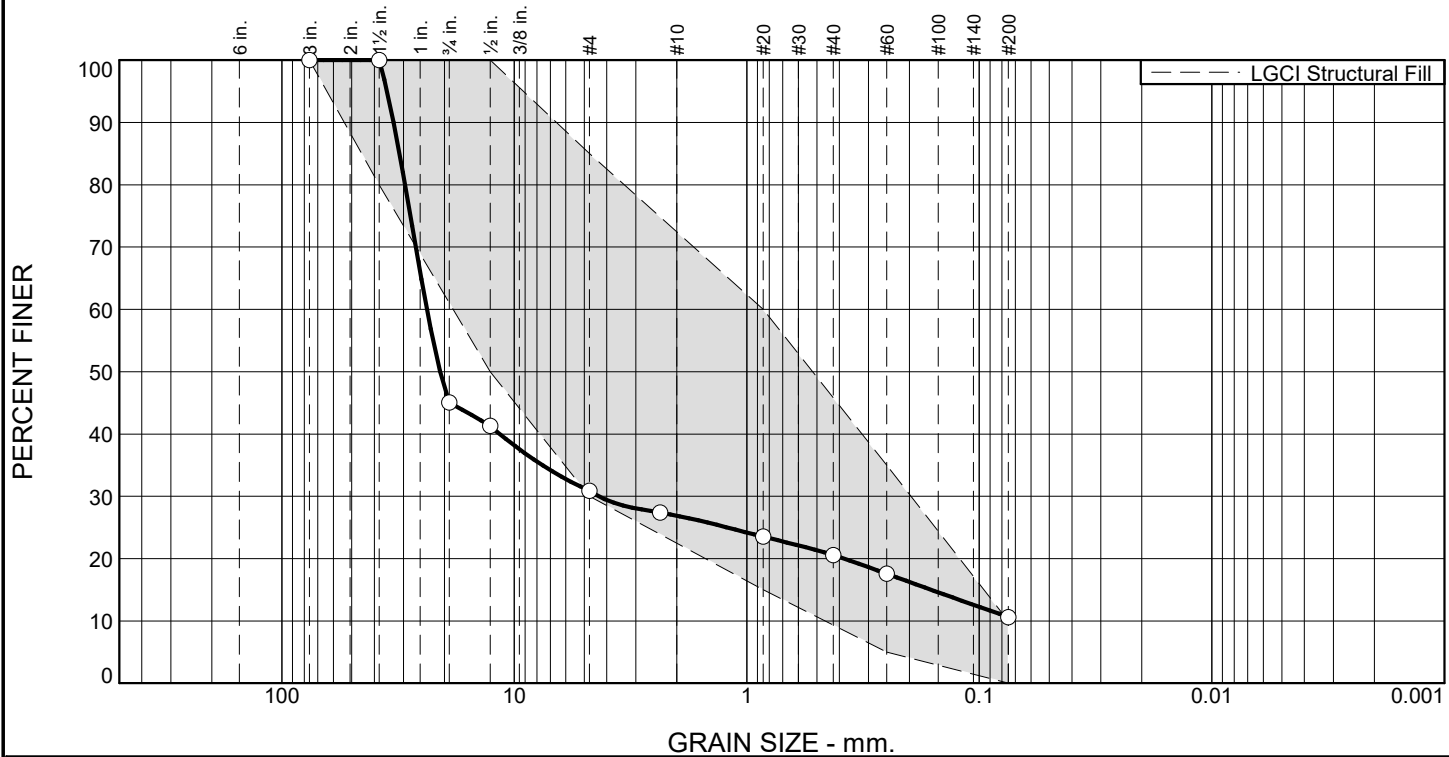
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	55.0	14.1	4.0	6.3	10.0	10.6	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	45.0		
0.5"	41.3	50.0 - 100.0	X
#4	30.9	30.0 - 85.0	
#8	27.4		
#20	23.5	15.0 - 60.0	
#40	20.6		
#60	17.6	5.0 - 35.0	
#200	10.6	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Poorly Graded GRAVEL with Silt and Sand (GP-GM), mostly coarse, angular, 10-15% fines, 20-25% fine to coarse sand, trace of weathered rock, light brown

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= _____ AASHTO (M 145)= _____

Coefficients

D₉₀= 33.0450 D₈₅= 31.1752 D₆₀= 23.7632
D₅₀= 20.8577 D₃₀= 4.3250 D₁₅= 0.1611
D₁₀= _____ C_u= _____ C_c= _____

Remarks

Natural sand and gravel sample.

Date Received: 5/10/22 **Date Tested:** 6/17/22

Tested By: NP

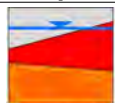
Checked By: YSP

Location: Boring B-220-OW

Sample Number: S3

Depth: 4.0'-5.3'

Date Sampled: 5/10/22



LGCI

Lahlaf Geotechnical Consulting, Inc.

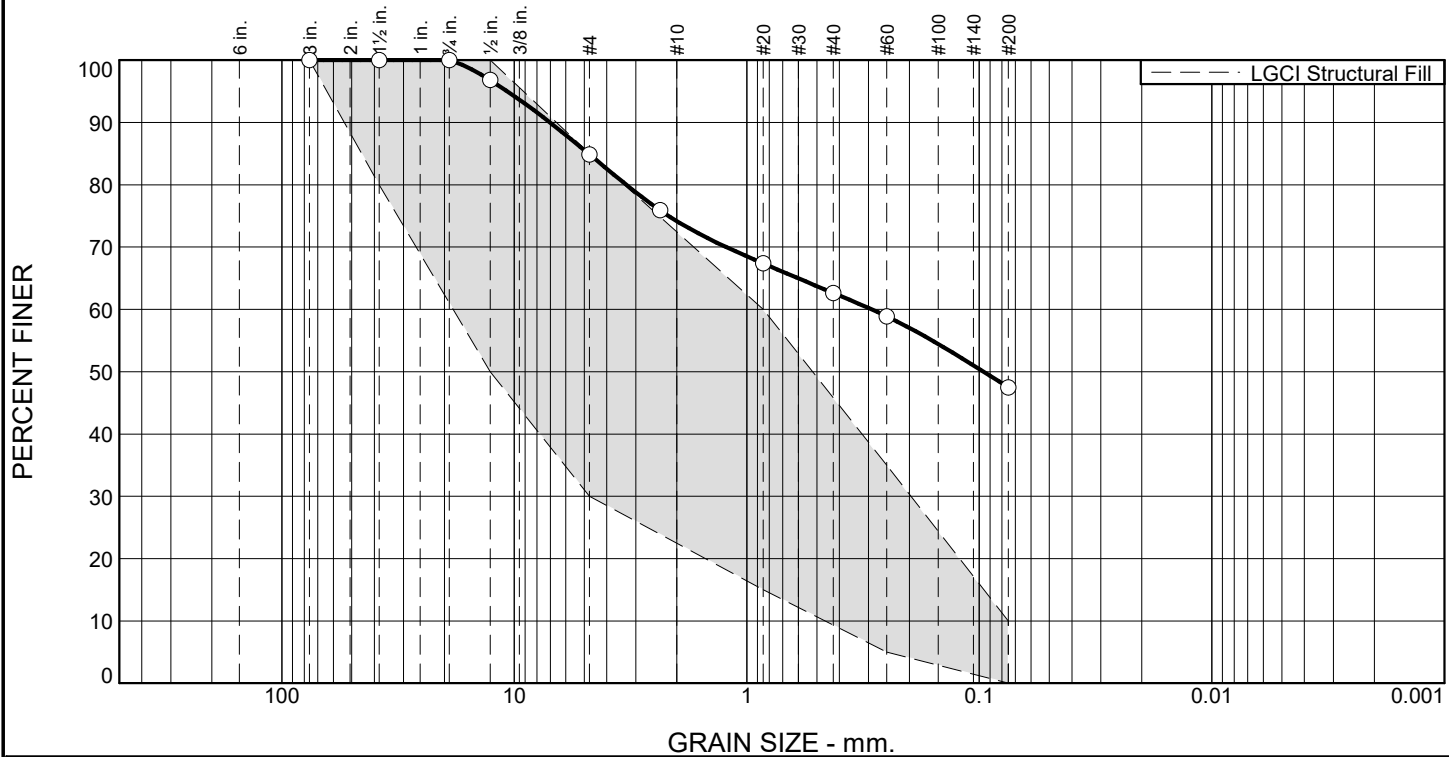
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	15.1	10.7	11.6	15.1	47.5	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	96.8	50.0 - 100.0	
#4	84.9	30.0 - 85.0	
#8	75.9		
#20	67.4	15.0 - 60.0	X
#40	62.6		
#60	58.9	5.0 - 35.0	X
#200	47.5	0.0 - 10.0	X

* LGC Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND with Gravel (SM), fine to coarse, 45-50% fines, 15-20% fine subangular gravel, light brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 7.0182 D₈₅= 4.7886 D₆₀= 0.2899
D₅₀= 0.0958 D₃₀= C_u= D₁₅=
D₁₀= C_c=

Remarks

Natural sand and gravel sample.

Date Received: 4/20/21 Date Tested: 6/17/22

Tested By: NP

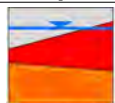
Checked By: YSP

Location: Test Pit TP-103

Sample Number: Grab

Depth: 2.4'-5.5'

Date Sampled: 4/20/21



LGC

Lahlaf Geotechnical Consulting, Inc.

Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

PERCENT FINER

6 in. 3 in. 2 in. 1½ in. 1 in. ¾ in. ½ in. 3/8 in. #4 #10 #20 #30 #40 #60 #100 #140 #200

100 90 80 70 60 50 40 30 20 10 0

0.01 0.001

— — — LGC Structural Fill

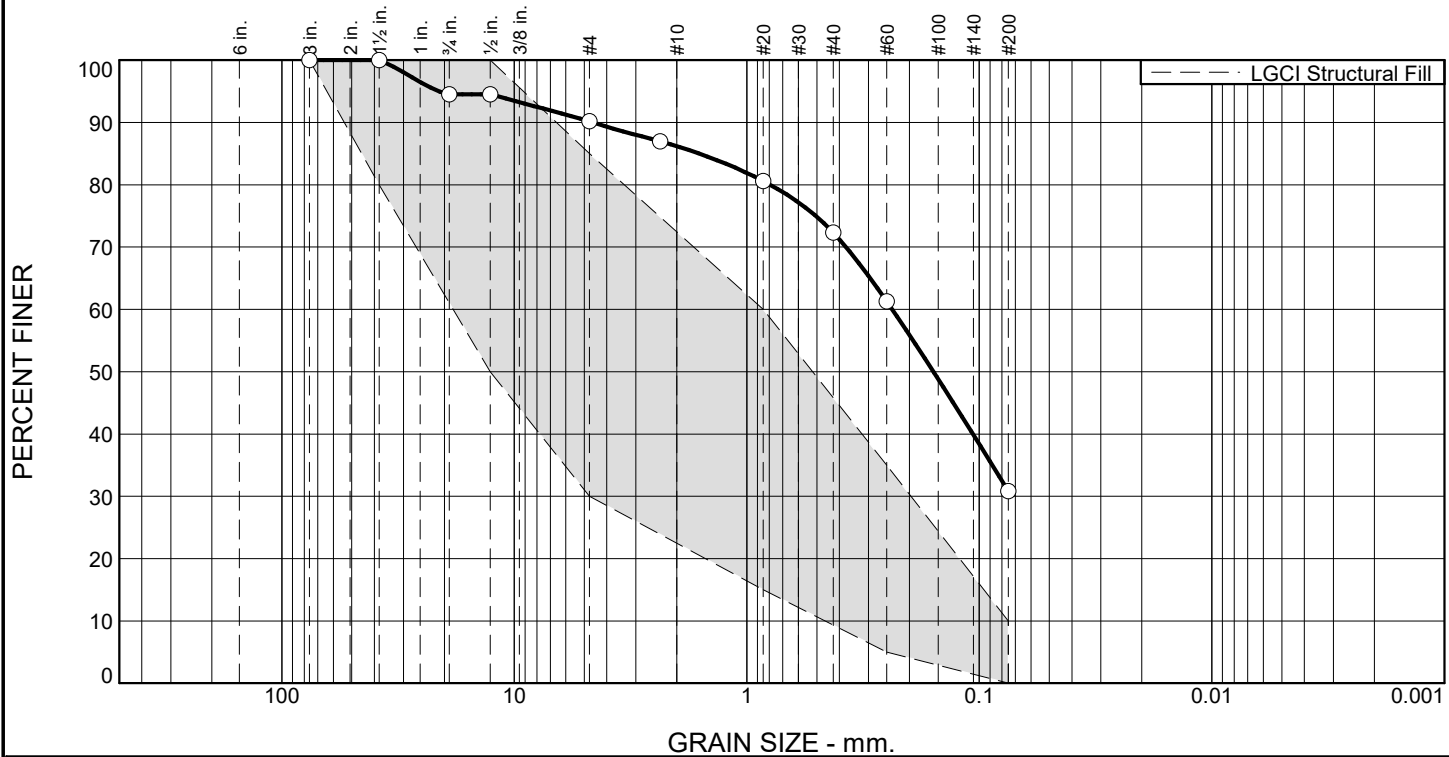
Sieve Size	Percent Finer (%)
6 in.	100
3 in.	100
2 in.	100
1½ in.	100
1 in.	87
¾ in.	78
½ in.	63
3/8 in.	53
#4	40
#10	30
#20	24
#40	19
#60	19
#100	19
#140	19
#200	19

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.0	24.4	11.2	21.7	10.9	18.8	

<u>Material Description</u>		
ASTM (D 2488) Classification: Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 35-40% fine to coarse subrounded gravel, trace of roots, trace of organic soil, brown		
<u>Atterberg Limits (ASTM D 4318)</u>		
PL=	LL=	PI=
<u>Classification</u>		
USCS (D 2487)=	AASHTO (M 145)=	
<u>Coefficients</u>		
D ₉₀ = 21.6946	D ₈₅ = 17.5239	D ₆₀ = 3.8979
D ₅₀ = 1.7886	D ₃₀ = 0.4348	D ₁₅ =
D ₁₀ =	C _u =	C _c =
Remarks		
Fill Sample		
Date Received: <u>4/27/22</u> Date Tested: <u>6/15/22</u>		
Tested By: <u>RF</u>		
Checked By: <u>YSP</u>		

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.5	4.3	4.0	13.9	41.5	30.8	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	94.5		
0.5"	94.5	50.0 - 100.0	
#4	90.2	30.0 - 85.0	X
#8	87.0		
#20	80.6	15.0 - 60.0	X
#40	72.3		
#60	61.3	5.0 - 35.0	X
#200	30.8	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND (SM), fine to medium, trace coarse, 30-35% fines, 5-10% fine to coarse subangular gravel, trace of roots, gray

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 4.5883 D₈₅= 1.5997 D₆₀= 0.2369
D₅₀= 0.1573 D₃₀= C_u= D₁₅=
D₁₀= C_c=

Remarks

Subsoil Sample

Date Received: 4/27/22 Date Tested: 6/15/22

Tested By: RF

Checked By: YSP

Location: TP-202

Depth: 2.0'-2.5'

Date Sampled: 4/27/22



LGCI

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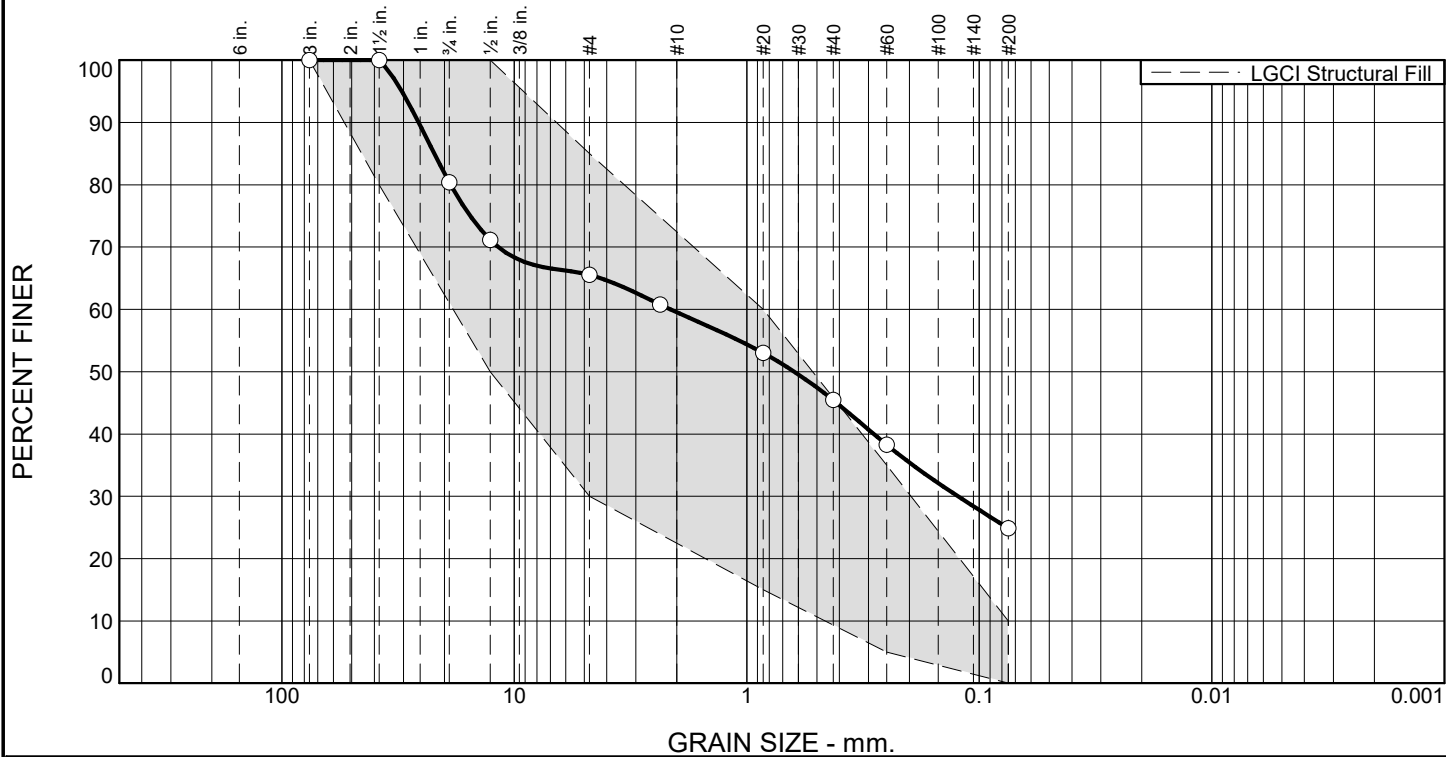
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.6	14.9	6.0	14.1	20.5	24.9	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	80.4		
0.5"	71.2	50.0 - 100.0	
#4	65.5	30.0 - 85.0	
#8	60.8		
#20	53.0	15.0 - 60.0	
#40	45.4		
#60	38.3	5.0 - 35.0	X
#200	24.9	0.0 - 10.0	X

* LGC Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND with Gravel (SM), fine to coarse, 20-25% fines, 30-35% fine to coarse subrounded gravel, trace of roots, light brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 25.7860 D₈₅= 22.0841 D₆₀= 2.1306
D₅₀= 0.6256 D₃₀= 0.1234 D₁₅=
D₁₀= C_u= C_c=

Remarks

Subsoil sample

Date Received: 04/26/2022 Date Tested: 05/03/2022

Tested By: RF

Checked By: HO

Location: Test Pit TP-204
Depth: 0.5'-3.0'

Date Sampled: 04/26/2022



LGC

Lahlaf Geotechnical Consulting, Inc.

Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

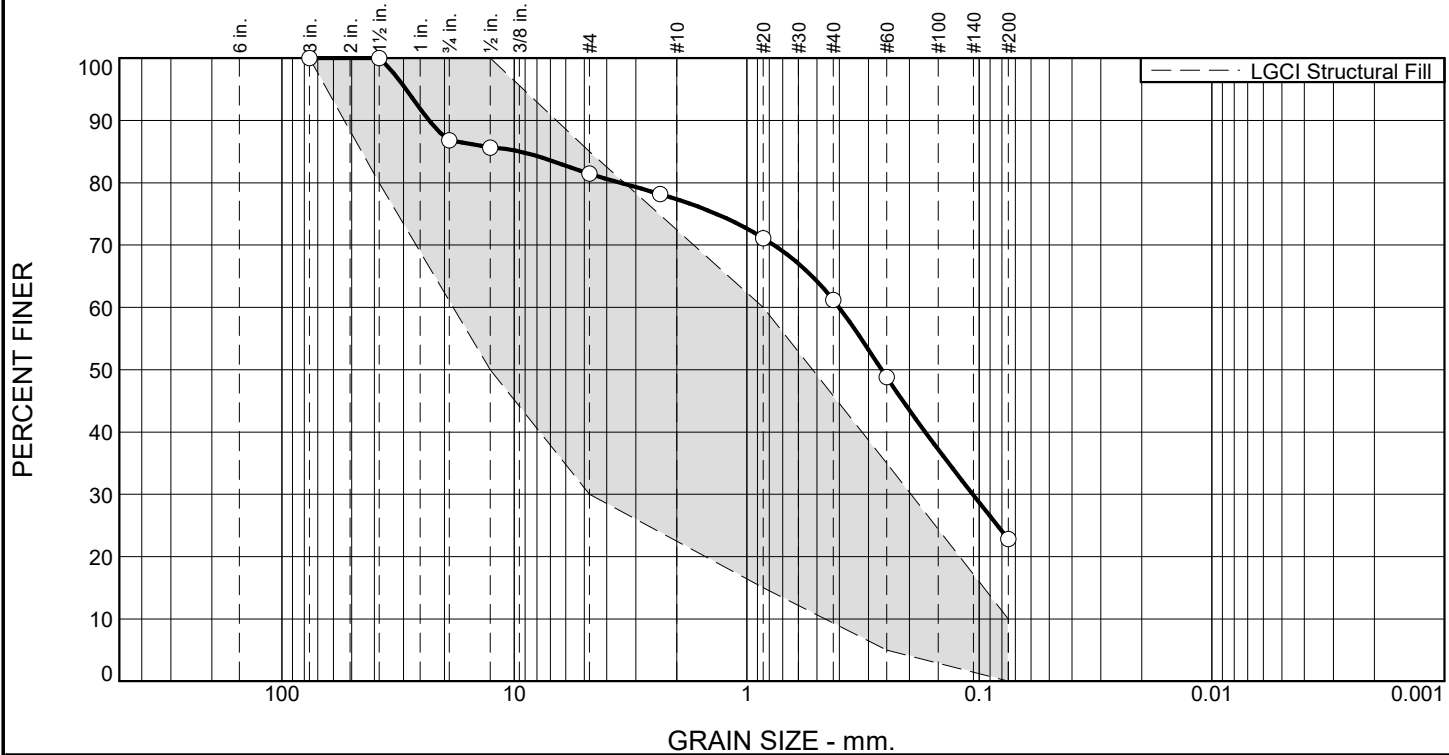
Grain size distribution plot for LGCI Structural Fill. The y-axis is 'PERCENT FINER' (0-100) and the x-axis is 'GRAIN SIZE - mm.' (log scale, 100 to 0.075). The plot shows a solid curve with data points and a shaded area representing the gradation range. A legend indicates 'LGCI Structural Fill'.

Grain Size (mm)	Percent Finer (%)
60	100
30	100
15	100
7.5	92
3.75	89
1.9	85
0.85	80
0.425	74
0.25	61
0.15	40

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	91.1		
0.5"	89.2	50.0 - 100.0	
#4	84.9	30.0 - 85.0	
#8	79.8		
#20	73.6	15.0 - 60.0	X
#40	67.8		
#60	61.1	5.0 - 35.0	X
#200	39.9	0.0 - 10.0	X

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.2	5.3	4.1	16.2	38.4	22.8	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	86.8		
0.5"	85.6	50.0 - 100.0	
#4	81.5	30.0 - 85.0	
#8	78.2		
#20	71.1	15.0 - 60.0	X
#40	61.2		
#60	48.8	5.0 - 35.0	X
#200	22.8	0.0 - 10.0	X

* LGC Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND with Gravel (SM), fine to medium, 20-25% fines, 15-20% fine to coarse subangular gravel, light brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 23.2680 D₈₅= 9.4282 D₆₀= 0.4009
D₅₀= 0.2627 D₃₀= 0.1066 D₁₅=
D₁₀= C_u= C_c=

Remarks

Natural sand and gravel sample.

Date Received: 4/26/22 Date Tested: 6/17/22

Tested By: NP

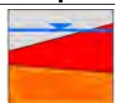
Checked By: YSP

Location: Test Pit TP-207

Sample Number: Grab

Depth: 3.0'-3.5'

Date Sampled: 4/26/22



LGC

Lahlaf Geotechnical Consulting, Inc.

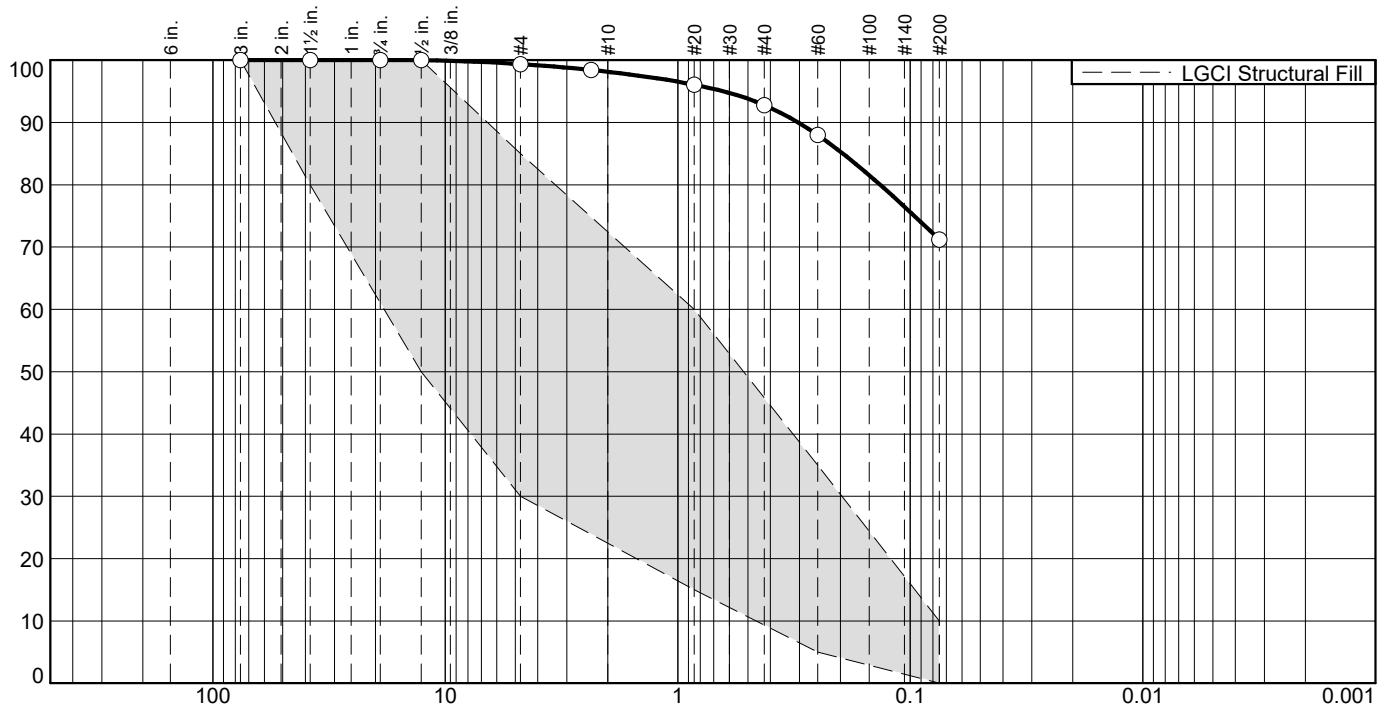
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

PERCENT FINER

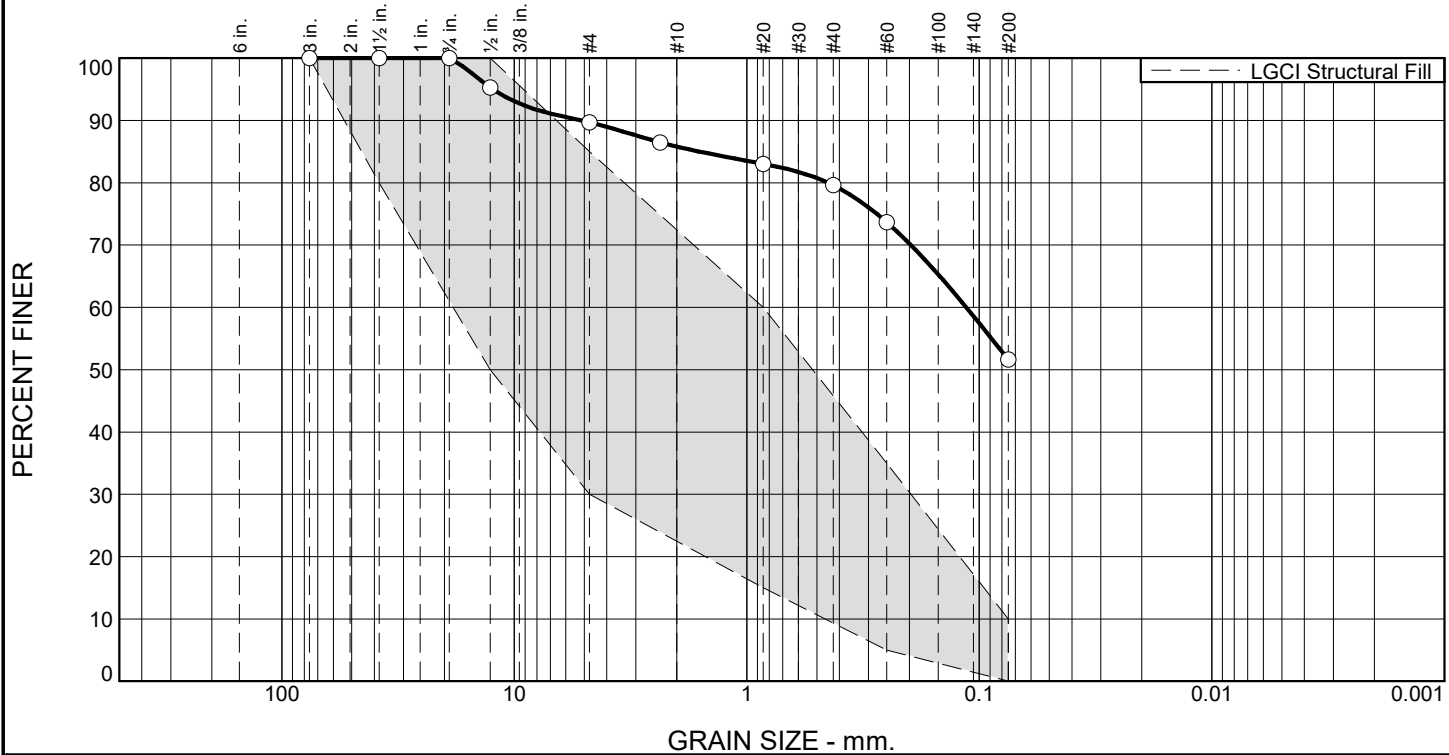


% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	1.3	5.3	21.6	71.2	

* LGCI Structural Fill

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.3	3.9	6.2	28.0	51.6	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	95.3	50.0 - 100.0	
#4	89.7	30.0 - 85.0	X
#8	86.5		
#20	83.0	15.0 - 60.0	X
#40	79.6		
#60	73.7	5.0 - 35.0	X
#200	51.6	0.0 - 10.0	X

* LGC Structural Fill

Material Description

ASTM (D 2488) Classification: Sandy SILT (ML), 35-40% fine sand, 10-15% fine subrounded gravel, trace of organic soil, trace of roots, trace of wood, brown, wet

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 5.1253 D₈₅= 1.5952 D₆₀= 0.1137
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Remarks

Subsoil

Date Received: 12/3/2020 Date Tested: 12/9/2020

Tested By: TG

Checked By: AML

Location: Test Pit TP-1
Depth: 0.7' - 3.5'

Date Sampled: 12/3/2020



LGC

Lahlaf Geotechnical Consulting, Inc.

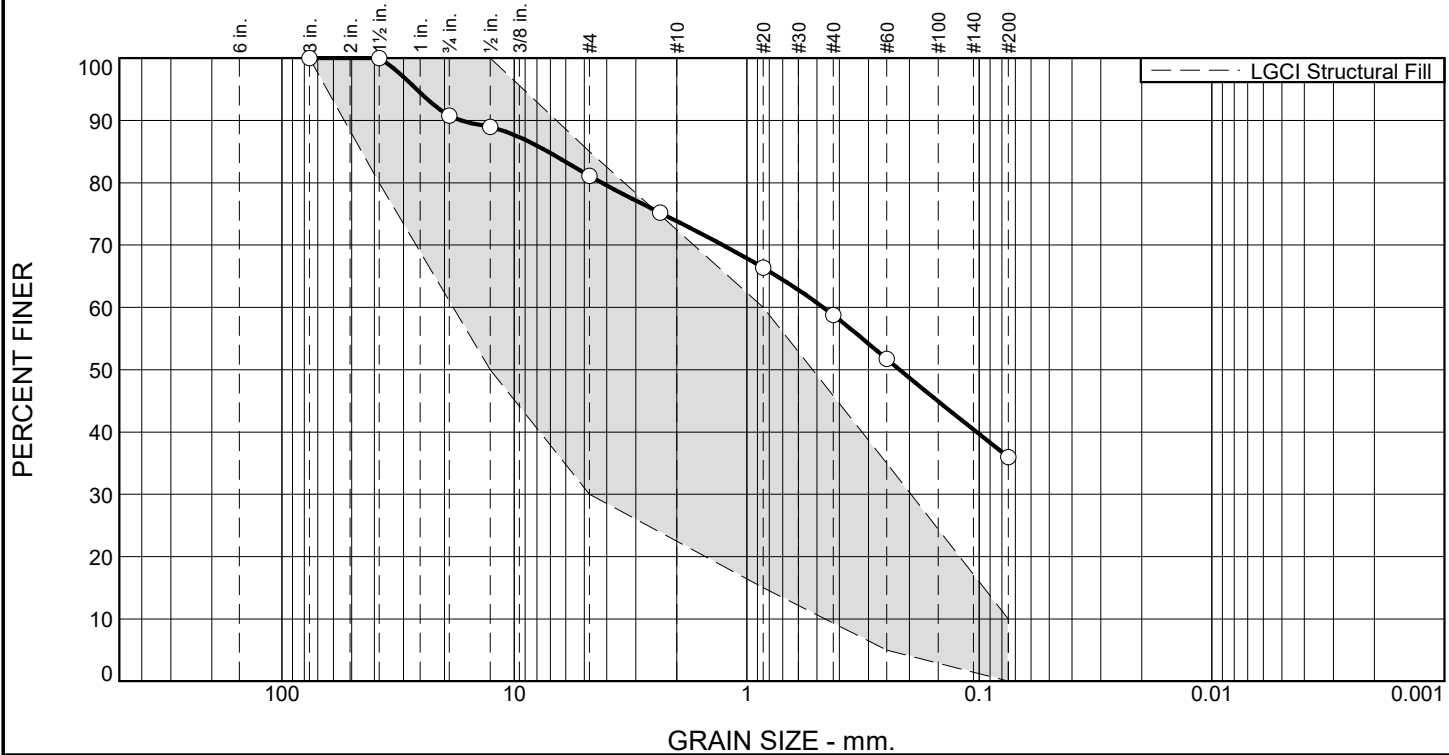
Client: Drummey Rosane Anderson, Inc.

Project: Proposed Northeast Metro Reg. Vocational Tech. H.S., Wakefield, MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.2	9.7	7.3	15.0	22.9	35.9	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	90.8		
0.5"	89.0	50.0 - 100.0	
#4	81.1	30.0 - 85.0	
#8	75.2		
#20	66.4	15.0 - 60.0	X
#40	58.8		
#60	51.7	5.0 - 35.0	X
#200	35.9	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND with Gravel, fine to coarse, 35-40% fines, 15-20% fine to coarse subrounded gravel, trace of organic soil, trace of roots, light brown, moist

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 16.9724 D₈₅= 7.1728 D₆₀= 0.4689
D₅₀= 0.2202 D₃₀= C_u= D₁₅=
D₁₀= C_c=

Remarks

Subsoil

Date Received: 12/3/2020 Date Tested: 12/9/2020

Tested By: TG

Checked By: AML

Location: Test Pit TP-5
Depth: 0.5' - 3.5'

Date Sampled: 12/3/2020



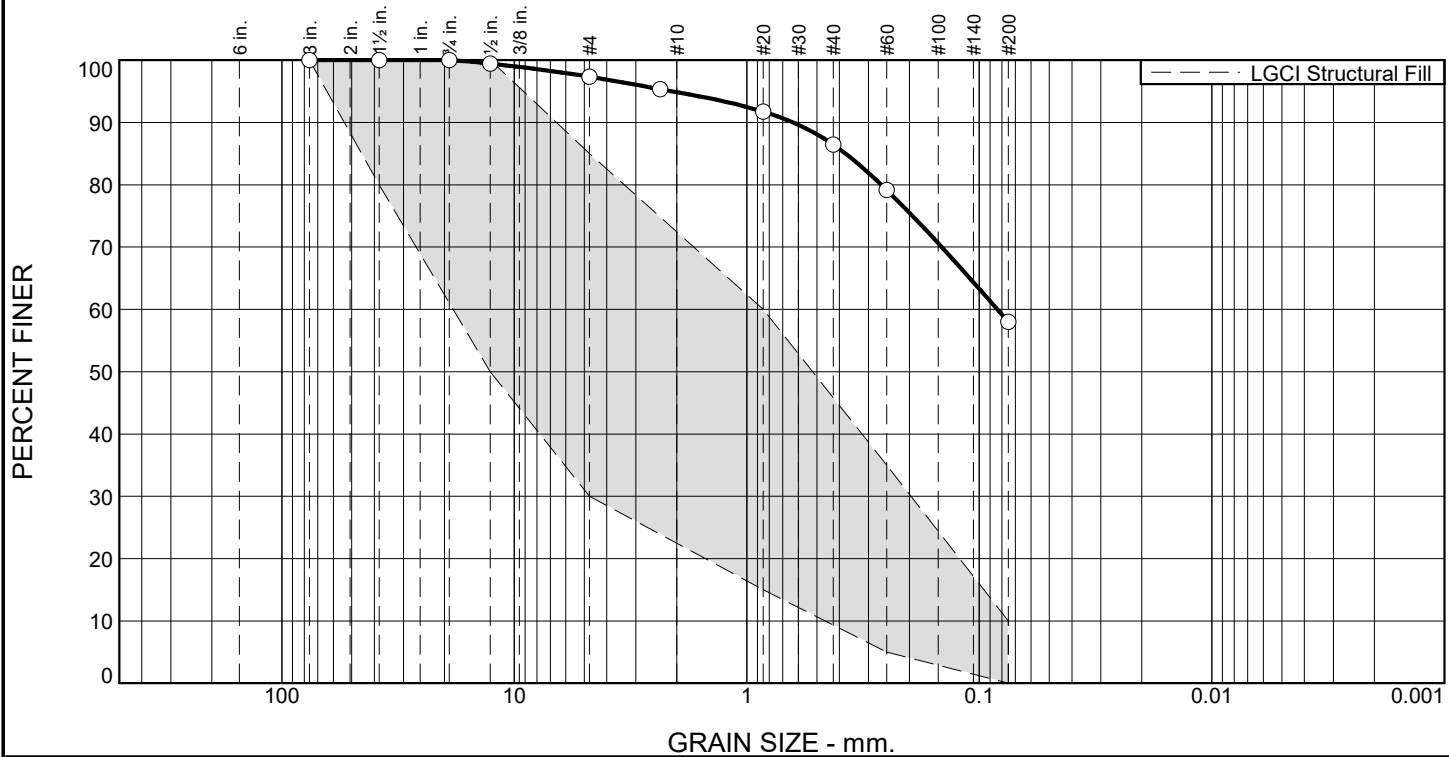
Client: Drummey Rosane Anderson, Inc.

Project: Proposed Northeast Metro Reg. Vocational Tech. H.S., Wakefield, MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.6	2.5	8.4	28.5	58.0	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	99.4	50.0 - 100.0	
#4	97.4	30.0 - 85.0	X
#8	95.4		
#20	91.7	15.0 - 60.0	X
#40	86.5		
#60	79.2	5.0 - 35.0	X
#200	58.0	0.0 - 10.0	X

* LGC Structural Fill

Material Description

ASTM (D 2488) Classification: Sandy SILT (ML), 35-40% fine sand, 0-5% fine subrounded gravel, trace of organic soil, trace of roots, 0-5% cobbles, brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 0.6334 D₈₅= 0.3753 D₆₀= 0.0836
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Remarks

Subsoil

Date Received: 12/3/2020 Date Tested: 12/9/2020

Tested By: TG

Checked By: AML

Location: Test Pit TP-6
Depth: 0.5' - 3'

Date Sampled: 12/3/2020



LGC

Lahlaf Geotechnical Consulting, Inc.

Client: Drummey Rosane Anderson, Inc.

Project: Proposed Northeast Metro Reg. Vocational Tech. H.S., Wakefield, MA

Project No: 2025

Figure

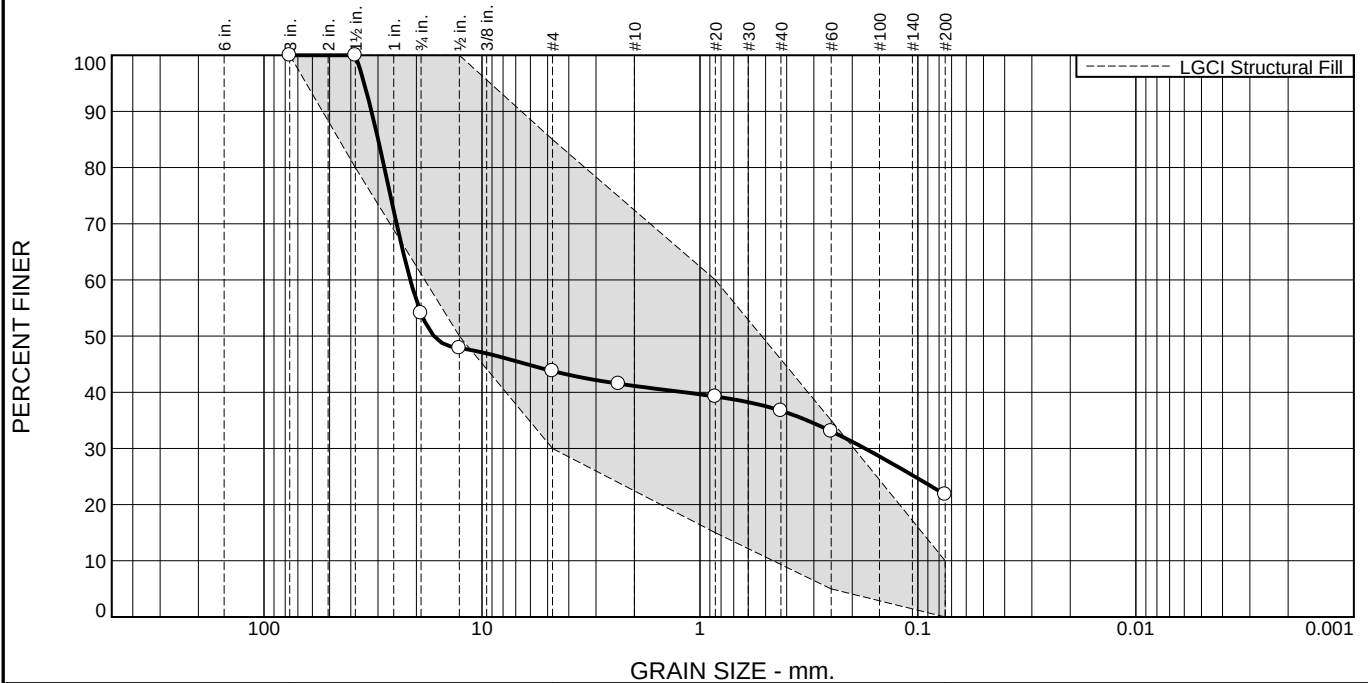
Grain size distribution plot for LGCI Structural Fill. The y-axis is 'PERCENT FINER' (0-100) and the x-axis is 'GRAIN SIZE - mm.' (log scale, 100 to 0.001). The plot shows a solid curve with data points and a shaded region representing the gradation range. Sieve sizes are labeled at the top: 6 in., 3 in., 2 in., 1 1/2 in., 1 in., 3/4 in., 1/2 in., 3/8 in., #4, #10, #20, #30, #40, #60, #100, #140, #200.

Sieve Size	Grain Size (mm)	Percent Finer (%)
6 in.	150	100
3 in.	75	100
2 in.	50	100
1 1/2 in.	37.5	100
1 in.	25	91
3/4 in.	18.75	87
1/2 in.	12.5	77
3/8 in.	9.375	67
#4	4.75	55
#10	2.0	46
#20	0.85	38
#40	0.425	23

<u>Material Description</u>		
ASTM (D 2488) Classification: Silty SAND with Gravel (SM), fine to coarse, 20-25% fines, 20-25% fine to coarse subrounded gravel, gray, moist		
<u>Atterberg Limits (ASTM D 4318)</u>		
PL=	LL=	PI=
<u>Classification</u>		
USCS (D 2487)=	AASHTO (M 145)=	
<u>Coefficients</u>		
D ₉₀ = 17.7802	D ₈₅ = 9.4700	D ₆₀ = 1.3106
D ₅₀ = 0.5834	D ₃₀ = 0.1424	D ₁₅ =
D ₁₀ =	C _u =	C _c =
Remarks		
Sand		
Date Received: <u>12/4/2020</u> Date Tested: <u>12/9/2020</u>		
Tested By: <u>TG</u>		
Checked By: <u>AML</u>		

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	45.9	10.3	2.7	4.4	14.9	21.8	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	54.1		
0.5"	47.9	50.0 - 100.0	X
#4	43.8	30.0 - 85.0	
#8	41.5		
#20	39.2	15.0 - 60.0	
#40	36.7		
#60	33.1	5.0 - 35.0	
#200	21.8	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty GRAVEL with Sand (GM), fine to coarse, 20-25% fines, 20-25% fine to coarse sand, trace of organic soil, trace of roots, brown, moist

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 32.1157 D₈₅= 29.9725 D₆₀= 21.3315
D₅₀= 16.6162 D₃₀= 0.1750 D₁₅=
D₁₀= C_u= C_c=

Remarks

Subsoil

Date Received: 4/19/21 Date Tested: 5/17/21

Tested By: KK

Checked By: IM

Location: TP-104
Depth: 0.5'-2.5'

Date Sampled: 4/19/21



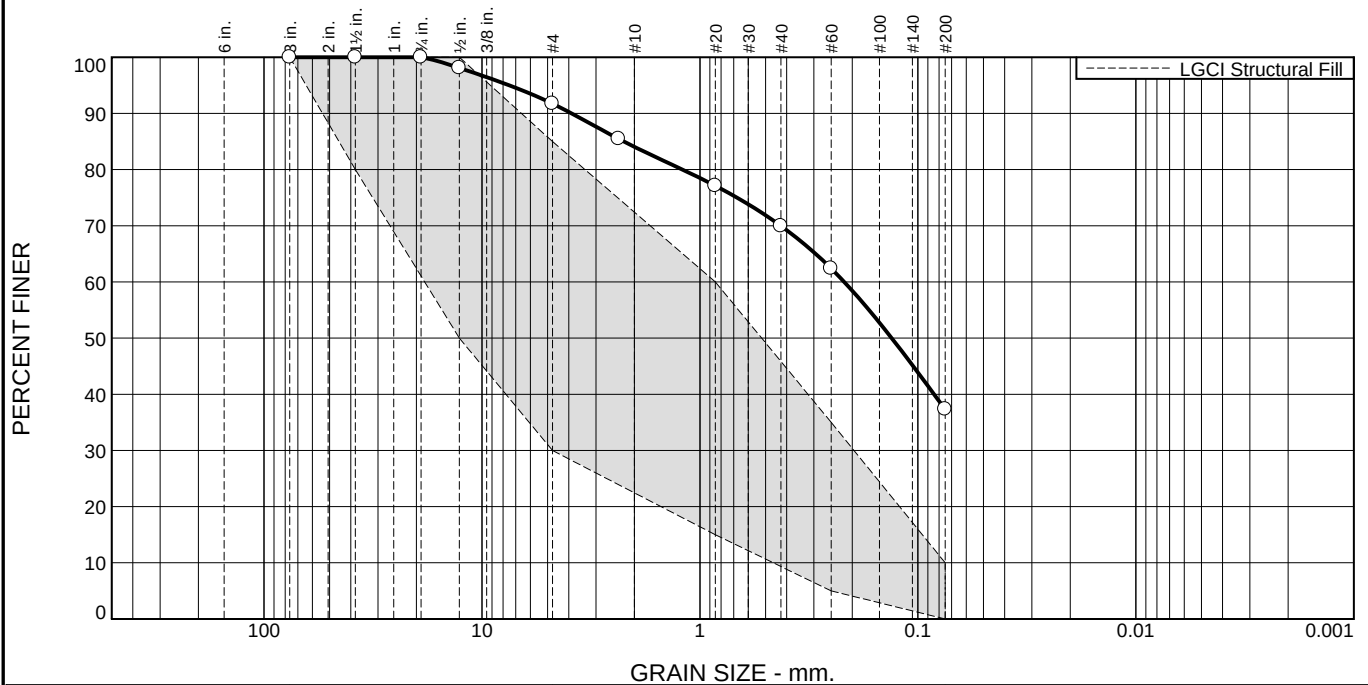
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.3	7.6	14.1	32.7	37.3	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	98.1	50.0 - 100.0	
#4	91.7	30.0 - 85.0	X
#8	85.5		
#20	77.1	15.0 - 60.0	X
#40	70.0		
#60	62.4	5.0 - 35.0	X
#200	37.3	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND (SM), fine to coarse, 35-40% fines, 5-10% fine gravel, trace of organic soil, trace of roots, brown, moist

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 3.8810 D₈₅= 2.2358 D₆₀= 0.2178
D₅₀= 0.1319 D₃₀= D₁₅=
D₁₀= C_u= C_c=

Remarks

Subsoil

Date Received: 4/20/2021 Date Tested: 5/17/2021

Tested By: KK

Checked By: IM

Location: TP-106
Depth: 0.5'-3.2'

Date Sampled: 4/20/2021



LGCI

Lahlaf Geotechnical Consulting, Inc.

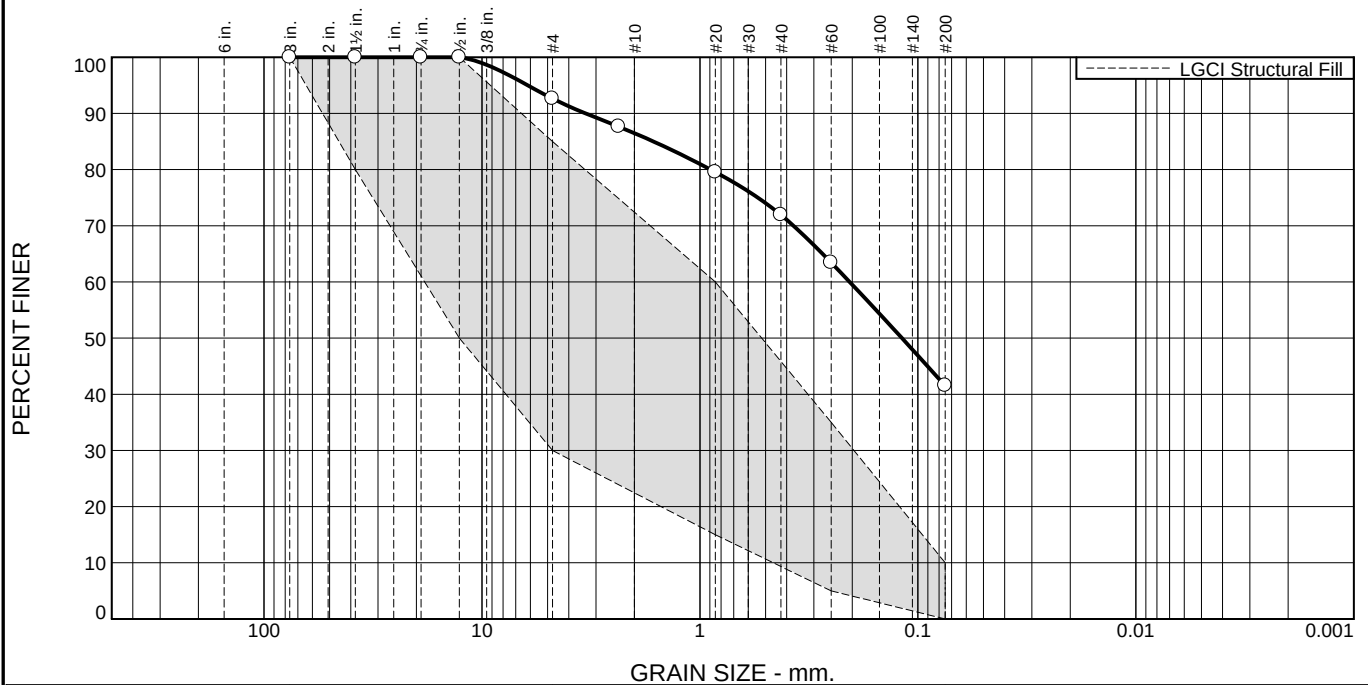
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.4	6.1	14.6	30.4	41.5	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	100.0	50.0 - 100.0	
#4	92.6	30.0 - 85.0	X
#8	87.6		
#20	79.6	15.0 - 60.0	X
#40	71.9		
#60	63.4	5.0 - 35.0	X
#200	41.5	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND (SM), fine to coarse, 40-45% fines, 5-10% fine subrounded to subangular gravel, gray, moist to wet

Atterberg Limits (ASTM D 4318)

PL=

LL=

PI=

Classification

USCS (D 2487)=

AASHTO (M 145)=

Coefficients

D₉₀= 3.3466

D₈₅= 1.6352

D₆₀= 0.2056

D₅₀= 0.1184

D₃₀=

D₁₅=

D₁₀=

C_u=

C_c=

Remarks

Natural Sand

Date Received: 4/20/2021 Date Tested: 5/17/2021

Tested By: KK

Checked By: IM

Location: TP-107
Depth: 2.1'-3.1'

Date Sampled: 4/20/2021



LGCI

Lahlaf Geotechnical Consulting, Inc.

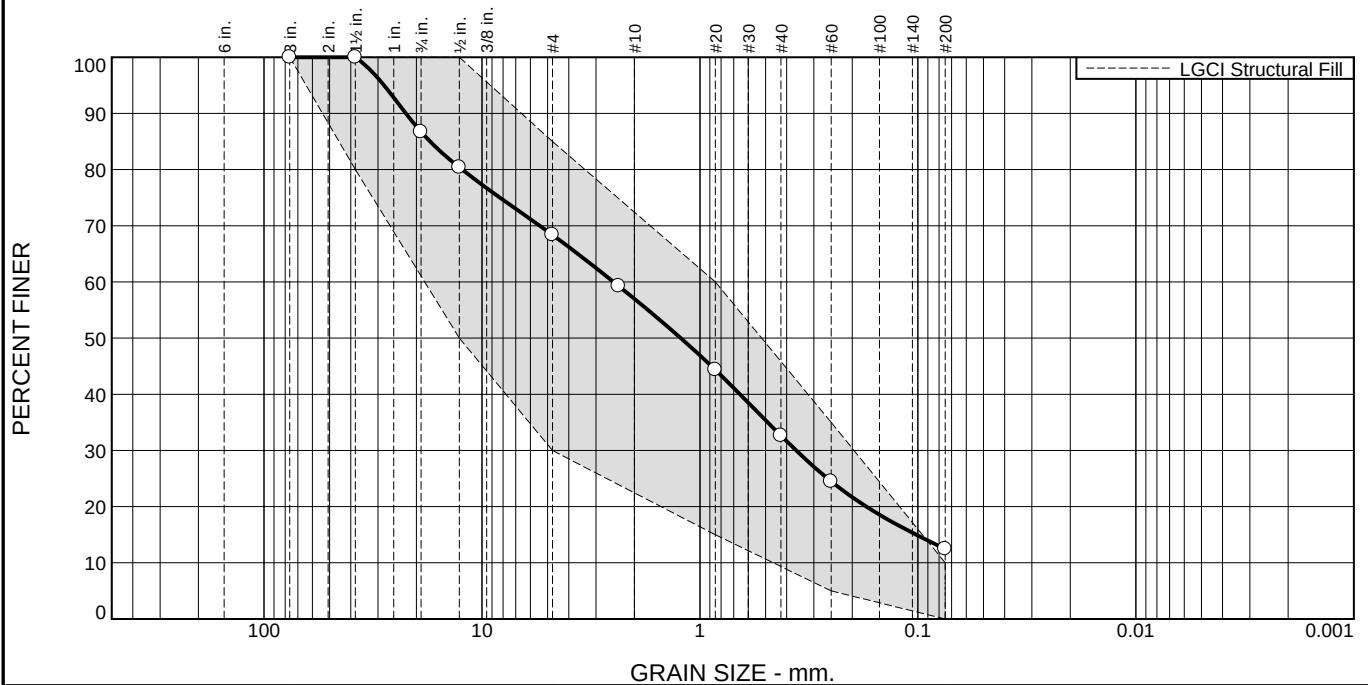
Client: Drummey Rosane Anderson, Inc.

Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA

Project No: 2025

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.3	18.3	11.4	24.4	20.1	12.5	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	86.7		
0.5"	80.4	50.0 - 100.0	
#4	68.4	30.0 - 85.0	
#8	59.3		
#20	44.3	15.0 - 60.0	
#40	32.6		
#60	24.5	5.0 - 35.0	
#200	12.5	0.0 - 10.0	X

* LGC Structural Fill

Material Description
ASTM (D 2488) Classification: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 10-15% fines, 30-35% fine to coarse subrounded gravel, trace of roots, light brown, moist

Atterberg Limits (ASTM D 4318)
PL= LL= PI=

Classification
USCS (D 2487)= AASHTO (M 145)=

Coefficients
D₉₀= 22.3370 D₈₅= 17.3210 D₆₀= 2.4930
D₅₀= 1.2241 D₃₀= 0.3617 D₁₅= 0.1018
D₁₀= C_u= C_c=

Remarks
Natural Sand

Date Received: 4/19/2021 Date Tested: 5/17/2021

Tested By: KK

Checked By: IM

Location: TP-113
Depth: 0.5'-3.0'

Date Sampled: 4/19/2021



Client: Drummey Rosane Anderson, Inc.
Project: Prop. Northeast Metropolitan Regional Vocational Technical High School, Wakefield MA
Project No: 2025 **Figure**

Appendix H – Results of Compressive Strength Tests

Client:	Lahlaf Geotechnical Consulting		
Project:	Prop. NE Metro. Reg. Voc. HS		
Location:	Wakefield, MA	Project No:	GTX-315626
Boring ID:	---	Sample Type:	---
Sample ID:	---	Test Date:	07/07/22
Depth :	---	Test Id:	672853
		Tested By:	tIm
		Checked By:	smd

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
C1	B-202	3.28-3.66 ft	186	18713	3	Yes	---
C2	B-206	8.73-9.13 ft	174	17340	1	Yes	---

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.
 All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.
 The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
 Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure
 (See attached photographs)

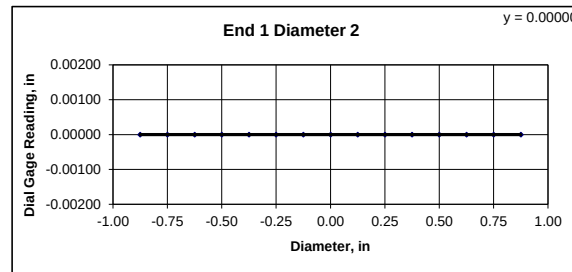
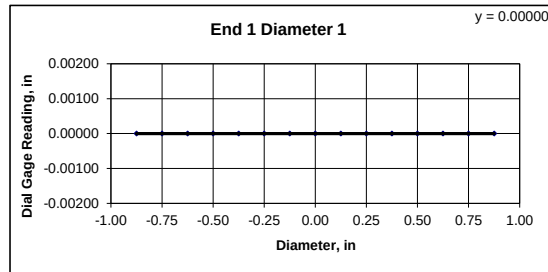


Client:	Lahlaf Geotechnical Consulting	Test Date:	6/28/2022
Project Name:	Prop. NE Metro. Reg. Voc. HS	Tested By:	bp
Project Location:	Wakefield, MA	Checked By:	smd
GTX #:	315626		
Boring ID:	C1		
Sample ID:	B-202		
Depth:	3.28-3.66 ft		
Visual Description:	See photographs		

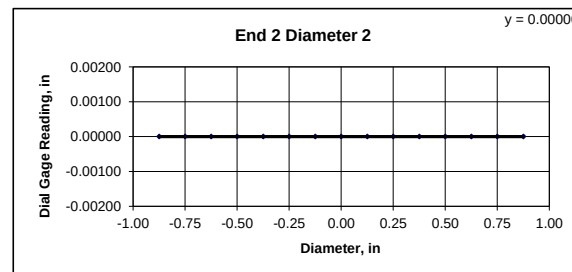
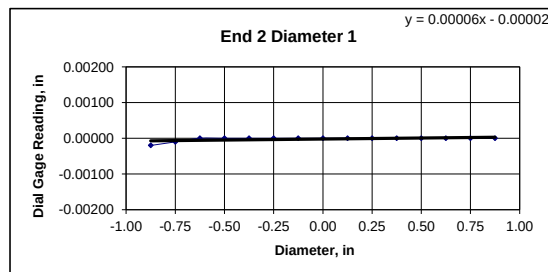
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate: Is the maximum gap $\leq$ 0.02 in.? YES	
Specimen Length, in:	4.45	4.45	4.45	Maximum difference must be $<$ 0.020 in.	
Specimen Diameter, in:	2.00	2.00	2.00	Straightness Tolerance Met? YES	
Specimen Mass, g:	685.64				
Bulk Density, lb/ft ³ :	186				
Length to Diameter Ratio:	2.2	Minimum Diameter Tolerance Met? YES			
		Length to Diameter Ratio Tolerance Met? YES			

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Difference between max and min readings, in:															
0° = 0.00000 90° = 0.00000															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Difference between max and min readings, in:															
0° = 0.0002 90° = 0															
Maximum difference must be < 0.0020 in. Difference = ± 0.00010															
Flatness Tolerance Met? YES															



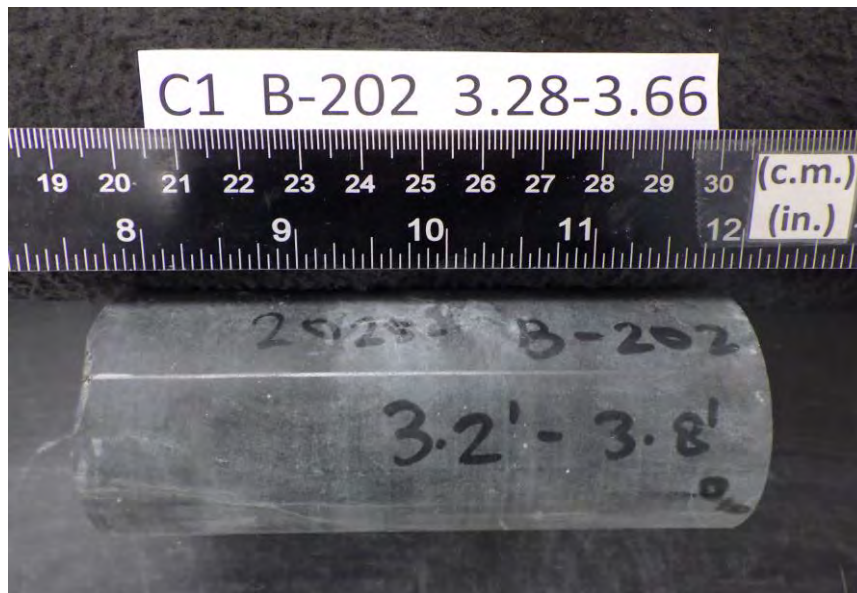
DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
End 2:	
Slope of Best Fit Line	0.00006
Angle of Best Fit Line:	0.00327
Maximum Angular Difference:	0.00327
Parallelism Tolerance Met? Spherically Seated	YES



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
End 2:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met? Spherically Seated	YES

PERPENDICULARITY (Procedure P1)						Maximum angle of departure must be $\leq$ 0.25°	
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?		
Diameter 1, in	0.00000	2.000	0.00000	0.000	YES		
Diameter 2, in (rotated 90°)	0.00000	2.000	0.00000	0.000	YES	Perpendicularity Tolerance Met? YES	
END 2							
Diameter 1, in	0.00020	2.000	0.00010	0.006	YES		
Diameter 2, in (rotated 90°)	0.00000	2.000	0.00000	0.000	YES		

Client:	Lahlaf Geotechnical Consulting
Project Name:	Prop. NE Metro. Reg. Voc. HS
Project Location:	Wakefield, MA
GTX #:	315626
Test Date:	6/29/2022
Tested By:	bp
Checked By:	smd
Boring ID:	B-202
Sample ID:	C1
Depth, ft:	3.28-3.66



After cutting and grinding



After break

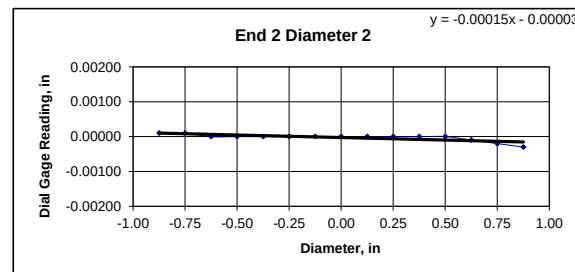
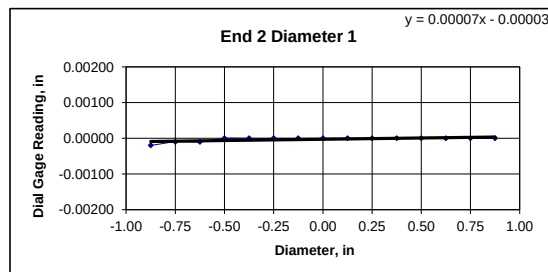
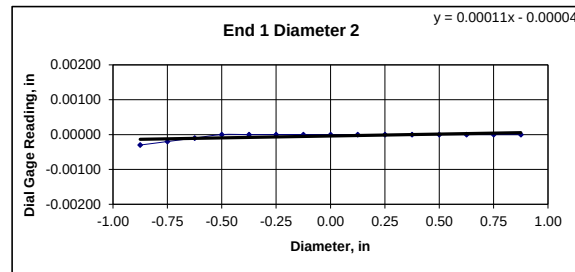
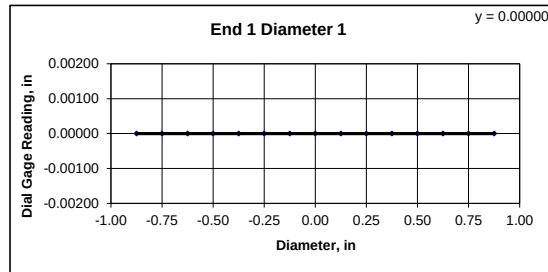


Client:	Lahlaf Geotechnical Consulting	Test Date:	6/28/2022
Project Name:	Prop. NE Metro. Reg. Voc. HS	Tested By:	bp
Project Location:	Wakefield, MA	Checked By:	smd
GTX #:	315626		
Boring ID:	C2		
Sample ID:	B-206		
Depth:	8.73-9.13 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate: Is the maximum gap $\leq$ 0.02 in.? YES	
Specimen Length, in:	4.32	4.32	4.32	Maximum difference must be < 0.020 in.	
Specimen Diameter, in:	2.00	2.00	2.00	Straightness Tolerance Met? YES	
Specimen Mass, g:	619.43				
Bulk Density, lb/ft ³ :	174				
Length to Diameter Ratio:	2.2	Minimum Diameter Tolerance Met? YES			
		Length to Diameter Ratio Tolerance Met? YES			

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Difference between max and min readings, in:															
0° = 0.00000												90° = 0.00030			
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030
Difference between max and min readings, in:															
0° = 0.0002												90° = 0.0004			
Maximum difference must be < 0.0020 in.														Difference = ± 0.00020	
Flatness Tolerance Met? YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
End 2:	
Slope of Best Fit Line	0.00007
Angle of Best Fit Line:	0.00409
Maximum Angular Difference:	0.00409
Parallelism Tolerance Met? Spherically Seated	YES

DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00011
Angle of Best Fit Line:	0.00622
End 2:	
Slope of Best Fit Line	0.00015
Angle of Best Fit Line:	0.00835
Maximum Angular Difference:	0.00213
Parallelism Tolerance Met? Spherically Seated	YES

PERPENDICULARITY (Procedure P1)						Maximum angle of departure must be $\leq 0.25^\circ$	
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?		
Diameter 1, in	0.00000	2.000	0.00000	0.000	YES		
Diameter 2, in (rotated 90°)	0.00030	2.000	0.00015	0.009	YES	Perpendicularity Tolerance Met? YES	
END 2							
Diameter 1, in	0.00020	2.000	0.00010	0.006	YES		
Diameter 2, in (rotated 90°)	0.00040	2.000	0.00020	0.011	YES		

Client:	Lahlaf Geotechnical Consulting
Project Name:	Prop. NE Metro. Reg. Voc. HS
Project Location:	Wakefield, MA
GTX #:	315626
Test Date:	6/29/2022
Tested By:	bp
Checked By:	smd
Boring ID:	C2
Sample ID:	B-206
Depth, ft:	8.73-9.13



After cutting and grinding



After break

Appendix I – Results of Loam Analyses

Soil Test Report

Prepared For:

Madjid Lahlaf
Lahlaf Geotechnical Consulting, Inc.
100 Chelmsford Road, Suite 2
Billerica, MA 01862

madjid.lahlaf@lgcinc.net

978-330-5912

Sample Information:

Sample ID: Topsoil Sample # 1+2

Order Number: 61477

Lab Number: S220617-129

Area Sampled:

Received: 6/21/2022

Reported: 6/24/2022

Results

Analysis	Value Found	Optimum Range	Analysis	Value Found	Optimum Range
Soil pH (1:1, H ₂ O)	6.0		Cation Exch. Capacity, meq/100g	10.3	
Modified Morgan extractable, ppm			Exch. Acidity, meq/100g	5.7	
Macronutrients			Base Saturation, %		
Phosphorus (P)	0.5	4-14	Calcium Base Saturation	38	50-80
Potassium (K)	36	100-160	Magnesium Base Saturation	5	10-30
Calcium (Ca)	784	1000-1500	Potassium Base Saturation	1	2.0-7.0
Magnesium (Mg)	66	50-120	Scoop Density, g/cc	0.92	
Sulfur (S)	8.7	>10	Optional tests		
Micronutrients *			Soil Organic Matter (LOI), %	5.2	
Boron (B)	0.0	0.1-0.5	Soluble Salts (1:2), dS/m	0.04	<0.6
Manganese (Mn)	1.0	1.1-6.3	Nitrate-N (NO ₃ -N), ppm	2	
Zinc (Zn)	0.7	1.0-7.6			
Copper (Cu)	0.1	0.3-0.6			
Iron (Fe)	11.8	2.7-9.4			
Aluminum (Al)	173	<75			
Lead (Pb)	2.2	<22			

* Micronutrient deficiencies rarely occur in New England soils; therefore, an Optimum Range has never been defined. Values provided represent the normal range found in soils and are for reference only.

Soil Test Interpretation

Nutrient	Very Low	Low	Optimum	Above Optimum
Phosphorus (P):				
Potassium (K):				
Calcium (Ca):				
Magnesium (Mg):				

Recommendations for Sports Turf/Golf Fairway-Establishment

Limestone (Target pH of 6.5)	Nitrogen, N	Phosphorus, P2O5	Potassium, K2O
100	2 - 4	2.5	5

Comments:

-For instructions on converting nutrient recommendations to fertilizer applications in lawns, see Reference "Step-by-Step Fertilizer Guide for Lawns" (listed below).

-For best results, split the N, P2O5, and K2O recommendations above into three to four applications over the course of the growing season at six to eight week intervals, beginning in mid- to late-April.

-Many fertilizer sources and rates may be combined to provide acceptable turfgrass fertility.

-The lead level in this soil is less than 22 ppm, which falls below the listed optimum level. However, many variables affect this result, and safety thresholds vary by location and soil use. There is still a potential risk of lead exposure for soils used for growing food or as play areas for children. Our Total Sorbed Metals test provides an accurate measurement of soil lead. For more information about lead levels in soil, see the fact sheet entitled "Soil Lead: Testing, Interpretation, & Recommendations," listed under General References at the end of this report. ATTN: The Total Sorbed Metals Test is currently unavailable. We apologize for any inconvenience.

References:

UMass Lawn and Landscape Turf Best Management Practices <http://extension.umass.edu/turf/publications-resources/best-management-practices>

Step-by-Step Fertilizer Guide for Lawns <http://ag.umass.edu/soil-plant-nutrient-testing-laboratory/fact-sheets/fertilizer-guide-for-lawns>

Recommendations for Sports Turf/Golf Fairway-Maintenance

Limestone (Target pH of 6.5)	Nitrogen, N	Phosphorus, P2O5	Potassium, K2O
100	3 - 5	2	5

Comments:

-Do not topdress with more than 50 lb limestone per 1000 sq ft at one time. Split the above application between early spring and mid-autumn.

-For instructions on converting nutrient recommendations to fertilizer applications in lawns, see Reference "Step-by-Step Fertilizer Guide for Lawns" (listed below).

-Many fertilizer sources and rates may be combined to provide acceptable turfgrass fertility.

-For best results, split the N, P2O5, and K2O recommendations above into three to four applications over the course of the growing season at six to eight week intervals, beginning in mid- to late-April.

-The lead level in this soil is less than 22 ppm, which falls below the listed optimum level. However, many variables affect this result, and safety thresholds vary by location and soil use. There is still a potential risk of lead exposure for soils used for growing food or as play areas for children. Our Total Sorbed Metals test provides an accurate measurement of soil lead. For more information about lead levels in soil, see the fact sheet entitled "Soil Lead: Testing, Interpretation, & Recommendations," listed under General References at the end of this report. ATTN: The Total Sorbed Metals Test is currently unavailable. We apologize for any inconvenience.

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Step-by-Step Fertilizer Guide for Lawns <http://ag.umass.edu/soil-plant-nutrient-testing-laboratory/fact-sheets/fertilizer-guide-for-lawns>



Soil and Plant Nutrient Testing Laboratory

203 Paige Laboratory
161 Holdsworth Way
University of Massachusetts
Amherst, MA 01003
Phone: (413) 545-2311
e-mail: soiltest@umass.edu
website: soiltest.umass.edu

General References:

Interpreting Your Soil Test Results

<http://soiltest.umass.edu/fact-sheets/interpreting-your-soil-test-results>

Soil Lead: Testing, Interpretation & Recommendations

<http://ag.umass.edu/soil-plant-nutrient-testing-laboratory/fact-sheets/soil-lead-fact-sheet>

For current information and order forms, please visit

<http://soiltest.umass.edu/>

UMass Extension Nutrient Management

<http://ag.umass.edu/agriculture-resources/nutrient-management>

Soil Test Report

Prepared For:

Madjid Lahlaf
Lahlaf Geotechnical Consulting, Inc.
100 Chelmsford Road, Suite 2
Billerica, MA 01862

madjid.lahlaf@lgcinc.net
978-330-5912

Sample Information:

Sample ID: Topsoil Sample #3

Order Number: 61477

Lab Number: S220617-130

Area Sampled:

Received: 6/21/2022

Reported: 6/24/2022

Results

Analysis	Value Found	Optimum Range	Analysis	Value Found	Optimum Range
Soil pH (1:1, H ₂ O)	5.2		Cation Exch. Capacity, meq/100g	12.1	
Modified Morgan extractable, ppm			Exch. Acidity, meq/100g	9.4	
Macronutrients			Base Saturation, %		
Phosphorus (P)	0.6	4-14	Calcium Base Saturation	19	50-80
Potassium (K)	38	100-160	Magnesium Base Saturation	2	10-30
Calcium (Ca)	467	1000-1500	Potassium Base Saturation	1	2.0-7.0
Magnesium (Mg)	27	50-120	Scoop Density, g/cc	1.12	
Sulfur (S)	7.5	>10	Optional tests		
Micronutrients *			Soil Organic Matter (LOI), %	5.8	
Boron (B)	0.0	0.1-0.5	Soluble Salts (1:2), dS/m	0.03	<0.6
Manganese (Mn)	0.7	1.1-6.3	Nitrate-N (NO ₃ -N), ppm	3	
Zinc (Zn)	1.1	1.0-7.6			
Copper (Cu)	0.2	0.3-0.6			
Iron (Fe)	15.2	2.7-9.4			
Aluminum (Al)	150	<75			
Lead (Pb)	2.6	<22			

* Micronutrient deficiencies rarely occur in New England soils; therefore, an Optimum Range has never been defined. Values provided represent the normal range found in soils and are for reference only.

Soil Test Interpretation

Nutrient	Very Low	Low	Optimum	Above Optimum
Phosphorus (P):				
Potassium (K):				
Calcium (Ca):				
Magnesium (Mg):				

Recommendations for Sports Turf/Golf Fairway-Establishment

Limestone (Target pH of 6.5)	Nitrogen, N	Phosphorus, P2O5	Potassium, K2O
lbs / 1000 sq ft			
175	2 - 4	2.5	5

Comments:

- Your magnesium level is low. Dolomitic limestone is recommended.
- For instructions on converting nutrient recommendations to fertilizer applications in lawns, see Reference "Step-by-Step Fertilizer Guide for Lawns" (listed below).
- For best results, split the N, P2O5, and K2O recommendations above into three to four applications over the course of the growing season at six to eight week intervals, beginning in mid- to late-April.
- Many fertilizer sources and rates may be combined to provide acceptable turfgrass fertility.
- The lead level in this soil is less than 22 ppm, which falls below the listed optimum level. However, many variables affect this result, and safety thresholds vary by location and soil use. There is still a potential risk of lead exposure for soils used for growing food or as play areas for children. Our Total Sorbed Metals test provides an accurate measurement of soil lead. For more information about lead levels in soil, see the fact sheet entitled "Soil Lead: Testing, Interpretation, & Recommendations," listed under General References at the end of this report. ATTN: The Total Sorbed Metals Test is currently unavailable. We apologize for any inconvenience.

References:

UMass Lawn and Landscape Turf Best Management Practices <http://extension.umass.edu/turf/publications-resources/best-management-practices>

Step-by-Step Fertilizer Guide for Lawns <http://ag.umass.edu/soil-plant-nutrient-testing-laboratory/fact-sheets/fertilizer-guide-for-lawns>

Recommendations for Sports Turf/Golf Fairway-Maintenance

Limestone (Target pH of 6.5)	Nitrogen, N	Phosphorus, P2O5	Potassium, K2O
lbs / 1000 sq ft			
175	3 - 5	2	5

Comments:

- Do not topdress with more than 50 lb limestone per 1000 sq ft at one time. Split the above application between early spring and mid-autumn.
- Your magnesium level is low. Dolomitic limestone is recommended.
- For instructions on converting nutrient recommendations to fertilizer applications in lawns, see Reference "Step-by-Step Fertilizer Guide for Lawns" (listed below).
- Many fertilizer sources and rates may be combined to provide acceptable turfgrass fertility.
- For best results, split the N, P2O5, and K2O recommendations above into three to four applications over the course of the growing season at six to eight week intervals, beginning in mid- to late-April.
- The lead level in this soil is less than 22 ppm, which falls below the listed optimum level. However, many variables affect this result, and safety thresholds vary by location and soil use. There is still a potential risk of lead exposure for soils used for growing food or as play areas for children. Our Total Sorbed Metals test provides an accurate measurement of soil lead. For more information about lead levels in soil, see the fact sheet entitled "Soil Lead: Testing, Interpretation, & Recommendations," listed under General References at the end of this report. ATTN: The Total Sorbed Metals Test is currently unavailable. We apologize for any inconvenience.

References:

UMass Lawn and Landscape Turf Best Management Practices <http://extension.umass.edu/turf/publications-resources/best-management-practices>

Step-by-Step Fertilizer Guide for Lawns <http://ag.umass.edu/soil-plant-nutrient-testing-laboratory/fact-sheets/fertilizer-guide-for-lawns>

General References:

Interpreting Your Soil Test Results <http://soiltest.umass.edu/fact-sheets/interpreting-your-soil-test-results>

Soil Lead: Testing, Interpretation & Recommendations <http://ag.umass.edu/soil-plant-nutrient-testing-laboratory/fact-sheets/soil-lead-fact-sheet>

For current information and order forms, please visit <http://soiltest.umass.edu/>

UMass Extension Nutrient Management <http://ag.umass.edu/agriculture-resources/nutrient-management>

Soil Test Report

Prepared For:

Madjid Lahlaf
Lahlaf Geotechnical Consulting, Inc.
100 Chelmsford Road, Suite 2
Billerica, MA 01862

madjid.lahlaf@lgcinc.net
978-330-5912

Sample Information:

Sample ID: Topsoil Sample #4

Order Number: 61477

Lab Number: S220617-131

Area Sampled:

Received: 6/21/2022

Reported: 6/24/2022

Results

Analysis	Value Found	Optimum Range	Analysis	Value Found	Optimum Range
Soil pH (1:1, H ₂ O)	6.3		Cation Exch. Capacity, meq/100g	10.1	
Modified Morgan extractable, ppm			Exch. Acidity, meq/100g	4.9	
Macronutrients			Base Saturation, %		
Phosphorus (P)	0.4	4-14	Calcium Base Saturation	43	50-80
Potassium (K)	22	100-160	Magnesium Base Saturation	7	10-30
Calcium (Ca)	880	1000-1500	Potassium Base Saturation	1	2.0-7.0
Magnesium (Mg)	90	50-120	Scoop Density, g/cc	1.02	
Sulfur (S)	9.0	>10	Optional tests		
Micronutrients *			Soil Organic Matter (LOI), %	5.2	
Boron (B)	0.0	0.1-0.5	Soluble Salts (1:2), dS/m	0.03	<0.6
Manganese (Mn)	0.7	1.1-6.3	Nitrate-N (NO ₃ -N), ppm	3	
Zinc (Zn)	2.7	1.0-7.6			
Copper (Cu)	0.4	0.3-0.6			
Iron (Fe)	9.6	2.7-9.4			
Aluminum (Al)	134	<75			
Lead (Pb)	2.9	<22			

* Micronutrient deficiencies rarely occur in New England soils; therefore, an Optimum Range has never been defined. Values provided represent the normal range found in soils and are for reference only.

Soil Test Interpretation

Nutrient	Very Low	Low	Optimum	Above Optimum
Phosphorus (P):				
Potassium (K):				
Calcium (Ca):				
Magnesium (Mg):				

Recommendations for Sports Turf/Golf Fairway-Establishment

Limestone (Target pH of 6.5)	Nitrogen, N	Phosphorus, P2O5	Potassium, K2O
75	2 - 4	2.5	5

Comments:

- For instructions on converting nutrient recommendations to fertilizer applications in lawns, see Reference "Step-by-Step Fertilizer Guide for Lawns" (listed below).
- For best results, split the N, P2O5, and K2O recommendations above into three to four applications over the course of the growing season at six to eight week intervals, beginning in mid- to late-April.
- Many fertilizer sources and rates may be combined to provide acceptable turfgrass fertility.
- The lead level in this soil is less than 22 ppm, which falls below the listed optimum level. However, many variables affect this result, and safety thresholds vary by location and soil use. There is still a potential risk of lead exposure for soils used for growing food or as play areas for children. Our Total Sorbed Metals test provides an accurate measurement of soil lead. For more information about lead levels in soil, see the fact sheet entitled "Soil Lead: Testing, Interpretation, & Recommendations," listed under General References at the end of this report. ATTN: The Total Sorbed Metals Test is currently unavailable. We apologize for any inconvenience.

References:

UMass Lawn and Landscape Turf Best Management Practices <http://extension.umass.edu/turf/publications-resources/best-management-practices>

Step-by-Step Fertilizer Guide for Lawns <http://ag.umass.edu/soil-plant-nutrient-testing-laboratory/fact-sheets/fertilizer-guide-for-lawns>

Recommendations for Sports Turf/Golf Fairway-Maintenance

Limestone (Target pH of 6.5)	Nitrogen, N	Phosphorus, P2O5	Potassium, K2O
75	3 - 5	2	5

Comments:

- Do not topdress with more than 50 lb limestone per 1000 sq ft at one time. Split the above application between early spring and mid-autumn.
- For instructions on converting nutrient recommendations to fertilizer applications in lawns, see Reference "Step-by-Step Fertilizer Guide for Lawns" (listed below).
- Many fertilizer sources and rates may be combined to provide acceptable turfgrass fertility.
- For best results, split the N, P2O5, and K2O recommendations above into three to four applications over the course of the growing season at six to eight week intervals, beginning in mid- to late-April.
- The lead level in this soil is less than 22 ppm, which falls below the listed optimum level. However, many variables affect this result, and safety thresholds vary by location and soil use. There is still a potential risk of lead exposure for soils used for growing food or as play areas for children. Our Total Sorbed Metals test provides an accurate measurement of soil lead. For more information about lead levels in soil, see the fact sheet entitled "Soil Lead: Testing, Interpretation, & Recommendations," listed under General References at the end of this report. ATTN: The Total Sorbed Metals Test is currently unavailable. We apologize for any inconvenience.

References:

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Step-by-Step Fertilizer Guide for Lawns <http://ag.umass.edu/soil-plant-nutrient-testing-laboratory/fact-sheets/fertilizer-guide-for-lawns>

**Soil and Plant Nutrient Testing Laboratory**

203 Paige Laboratory
161 Holdsworth Way
University of Massachusetts
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General References:

Interpreting Your Soil Test Results

<http://soiltest.umass.edu/fact-sheets/interpreting-your-soil-test-results>

Soil Lead: Testing, Interpretation & Recommendations

<http://ag.umass.edu/soil-plant-nutrient-testing-laboratory/fact-sheets/soil-lead-fact-sheet>

For current information and order forms, please visit

<http://soiltest.umass.edu/>

UMass Extension Nutrient Management

<http://ag.umass.edu/agriculture-resources/nutrient-management>

Particle Size Analysis - Comprehensive

Prepared For:

Abdelmadjid Lahlaf
Lahlaf GeoTechnical Consulting Inc
100 Chelmsford Rd, Suite 2
Billerica, MA 01821

madjid.lahlaf@lgcinc.net
978-330-5912

Sample Information:

Sample ID: TopSoil Sample #1&2

Order Number: 61529

Lab Number: X220621-103

Received: 6/21/2022

Reported: 6/28/2022

<u>USDA Size Fraction</u>			<u>Percent of Whole Sample Passing</u>		
<u>Main Fractions</u>	<u>Size (mm)</u>	<u>Percent</u>	<u>Size (mm)</u>	<u>Sieve #</u>	<u>Whole Sample % of Sample Passing</u>
Sand	0.05-2.0	68.8	2.00	#10	88.1
Silt	0.002-0.05	22.4	1.00	#18	84.2
Clay	<0.002	8.8	0.50	#35	73.4
			0.25	#60	50.0
			0.10	#140	34.6
			0.053	#270	27.5
			0.02	20 um	12.5
			0.005	5 um	8.1
			0.002	2 um	7.7
<u>Sand Fractions</u>	<u>Size (mm)</u>	<u>Percent</u>			
Very Coarse	1.0-2.0	4.4			
Coarse	0.5-1.0	12.2			
Medium	0.25-0.5	26.6			
Fine	0.10-0.25	17.5			
Very Fine	0.05-0.10	8.2			
<u>Silt Fractions</u>	<u>Size (mm)</u>	<u>Percent</u>			
Coarse	0.02-0.05	17.0			
Medium	0.005-0.02	5.0			
Fine	0.002-0.005	0.4			

USDA Textural Class: sandy loam

Gravel Content: (%) 11.9

Particle Size Analysis - Comprehensive

Prepared For:

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Sample Information:

Sample ID: Topsoil Sample #3

Order Number: 61529

Lab Number: X220621-104

Received: 6/21/2022

Reported: 6/28/2022

<u>USDA Size Fraction</u>			<u>Percent of Whole Sample Passing</u>		
<u>Main Fractions</u>	<u>Size (mm)</u>	<u>Percent</u>	<u>Size (mm)</u>	<u>Sieve #</u>	<u>Whole Sample % of Sample Passing</u>
Sand	0.05-2.0	61.2	2.00	#10	89.6
Silt	0.002-0.05	27.3	1.00	#18	82.9
Clay	<0.002	11.5	0.50	#35	71.5
			0.25	#60	52.2
			0.10	#140	40.3
			0.053	#270	34.7
			0.02	20 um	18.8
			0.005	5 um	13.2
			0.002	2 um	10.3
<u>Sand Fractions</u>	<u>Size (mm)</u>	<u>Percent</u>			
Very Coarse	1.0-2.0	7.4			
Coarse	0.5-1.0	12.7			
Medium	0.25-0.5	21.6			
Fine	0.10-0.25	13.3			
Very Fine	0.05-0.10	6.2			
<u>Silt Fractions</u>	<u>Size (mm)</u>	<u>Percent</u>			
Coarse	0.02-0.05	17.8			
Medium	0.005-0.02	6.2			
Fine	0.002-0.005	3.3			

USDA Textural Class: sandy loam

Gravel Content: (%) 10.4

Particle Size Analysis - Comprehensive

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Sample Information:

Sample ID: Topsoil Sample #4

Order Number: 61529

Lab Number: X220621-105

Received: 6/21/2022

Reported: 6/28/2022

<u>USDA Size Fraction</u>			<u>Percent of Whole Sample Passing</u>		
<u>Main Fractions</u>	<u>Size (mm)</u>	<u>Percent</u>	<u>Size (mm)</u>	<u>Sieve #</u>	<u>Whole Sample % of Sample Passing</u>
Sand	0.05-2.0	58.3	2.00	#10	88.2
Silt	0.002-0.05	30.8	1.00	#18	83.7
Clay	<0.002	10.9	0.50	#35	74.0
			0.25	#60	58.3
			0.10	#140	44.2
			0.053	#270	36.7
			0.02	20 um	20.4
			0.005	5 um	11.5
			0.002	2 um	9.6
<u>Sand Fractions</u>	<u>Size (mm)</u>	<u>Percent</u>			
Very Coarse	1.0-2.0	5.0			
Coarse	0.5-1.0	11.1			
Medium	0.25-0.5	17.8			
Fine	0.10-0.25	16.0			
Very Fine	0.05-0.10	8.4			
<u>Silt Fractions</u>	<u>Size (mm)</u>	<u>Percent</u>			
Coarse	0.02-0.05	18.5			
Medium	0.005-0.02	10.2			
Fine	0.002-0.005	2.1			

USDA Textural Class: sandy loam

Gravel Content: (%) 11.8

Appendix J – Rock Engineering Design and Recommendations



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25 July 2022

Internal Project No. 22-05

Lahlaf Geotechnical Consulting, Inc.
100 Chelmsford Road, Suite 2
Billerica, MA 01862

Attention: Abdelmadjid M. Lahlaf, Ph.D., P.E.
Principal

Subject: Rock Engineering Design & Construction Recommendations
New Northeast Regional Metro Voc. Tech. High School
Proposed Cut Slope "A"
100 Hemlock Road, Wakefield, Massachusetts

07/25/22



Dear Mr. Lahlaf,

We would like to thank Lahlaf Geotechnical Consulting, Inc. ("LGCI") for reaching out to Scarptec, Inc. ("Scarptec") for this assignment. This report summarizes our findings and recommendations relative to a proposed rock cut at the Northeast Metro Regional Vocational Technical High School (NMRVT) Project in Wakefield, Massachusetts. We understand that your client, Drummey Rosane Anderson, Inc. ("DRA"), has requested that LGCI (Project Geotechnical Engineer) assess potential rock slope cut angle configurations and slope stabilization/rockfall mitigation measures at the site, and that you have retained Scarptec to complete these technical evaluations, as set forth in this Report. Our work was completed in general accordance with our agreement titled: *Agreement for Subconsulting Services*, dated 5 July 2022, as executed by Scarptec on 7 July 2022.

1. Introduction

Based on discussions with you and our review of project documents provided by LGCI, proposed cuts in igneous (rhyolite/rhyodacite and granodiorite) bedrock are expected to be on the order of 30- to 35-foot high (max.) by approximately 650 feet long, situated along the north and west side of the proposed new school building. The location and extents of the proposed rock excavation (herein referred to as Rock Cut "A") are shown on the site Grading Plan (Ref. 1) as being approximately 375 feet south of the existing Hemlock Road parking area at the Vocational Technical ("Voc-Tech") High School, and about 900 feet east of Farm Street, as shown in Figure 1A. We understand the architect has shown the approximate slope cut line as a series of reverse curves in plan, with the range of orientations being between 0 deg. (due north) and 40 deg. (northeast), based on north relative to the Massachusetts State Plane Coordinate System.



We understand that bedrock will comprise the significant portion of the total exposed slope height and that the preliminary rock slope cut angle was initially anticipated to be nearly vertical (8V:1H); however, in order to advance the cut slope angle, the proposed slope geometry needed to be further evaluated relative to the presence of structural geologic “discontinuities” within the rock mass. Discontinuities include joints, bedding planes, shears/faults, foliations and other fractures, all of which may exert a pronounced influence on the long-term behavior of a rock slope.

There is a tradeoff between slope angle and the extent (and cost) of remedial measures required to provide a safe, stable and reliable slope. An over-steepened slope with respect to controlling geologic structure(s) may result in increased remedial measures (e.g., rock bolts, mesh, shotcrete) and long-term maintenance (i.e., increased long- and short-term costs). Such a slope may also require a larger rockfall catchment ditch at the toe of the slope and thus may consume additional premium space at the site. Alternatively, an overly flattened slope may impact abutters up at the crest. For these reasons, we recommended to LGCI that the slope angle be evaluated with respect to rock mass conditions, including the presence of controlling geologic structures.

We understand that the project is in the late stages of the Design Development (DD) phase and that quantity and cost estimates for construction are being actively developed. As part of these evaluations, the project design team wishes to understand final proposed cut slope angles in order to estimate rock cut volumes and rock slope reinforcement quantities, and the potential costs relative to both items. The remainder of this Report summarizes our findings from the field and recommendations for rock slope cut angles. We have also included recommendations and baseline quantities relative to scaling and rock reinforcement with passive (untensioned) rock dowels.

2. Engineering Geologic Site Evaluation

2.1 Regional & Site Geology

The north end of the proposed rock excavation (Rock Cut “A”) extends approximately 375 feet south of the existing school parking area along Hemlock Road, as shown in Figure 1A. The current paved parking area is bordered by a 15- to 20-foot-high rock cut constructed presumably when the existing Voc-Tech School was developed. Based on a review of Bedrock Geologic Maps of the Boston North, Boston South and Newton Quadrangles compiled by Clifford Kaye between 1975 and 1979 and published in 1980 by the U.S. Geological Survey (Ref. 2), the proposed site excavation appears to straddle two of the mapped units shown on the attached Figure 1B. The two mapped units include rhyolite and rhyodacite of the Precambrian-aged *Lynn Volcanic Complex* (“3VSI”) that is mapped near the crest of the hill where the cut will be developed, and a plutonic tonalite and granodiorite unit (“VGTG”) that represents an intrusive chilled contact facies.



The rhyodacitic unit was observed by us in the field and appeared to be dark gray to locally green in color, having a relatively high hardness, and breaking semi-conchoidally (i.e., brittle fracture). The granodiorite unit was also identified by us at the existing parking lot cut. The contact elevation between these two units appears to be variable; however, the horizontal extent of the contact appears to extend from the existing parking area and south-southwesterly up the hill approximately 350 to 400 feet, as inferred on the referenced geologic maps. The slightly younger granodiorite is fine to medium grained in texture and reportedly contains relict fragments of wall rock (i.e., host country rock that the igneous magma was injected through) that we also observed as “xenoliths” in the parking area rock cut.

Note that published geologic maps of the area infer the presence of localized steeply dipping joints as well as locally faulted bedrock around the perimeter of the site. A dike-filled fault associated with the contact was mapped by USGS between 350 and 400 feet up the hill from the parking area and trending east-west. This feature was not observed by us in the field and did not appear obvious within the boring logs we reviewed; however, it’s inferred 100- to 110-deg. strike azimuth appears to be nearly perpendicular to the proposed cut. (Note: We provide guidance on how to deal with this apparent “fault” feature in the *Recommendations* Section below)

2.2 General Site Observations

We met with representatives of LGCI on the morning of Wednesday, 6 July 2022, just prior to our field mapping and site reconnaissance activities. The proposed site was moderately to highly vegetated and generally increases in elevation (sloping upward) from the existing parking lot of the Voc-Tech School, with numerous rock outcrops visible throughout the wooded area. We observed that the topographic ground surface was undulating and hummocky and, in several places, the proposed cuts are likely to have surface water intermittently draining into/over the slope. The upper portions of the slopes may experience “backbreak” (i.e., overbreak) because the top part of the rock column has experienced “ringing-off” with postglacial isostatic rebound and appears to have a higher degree of fracturing, as also evidenced by locally reduced RQD values in the upper 4 to 8 feet of the LGCI borings.

As observed in the existing parking area cut and in the outcrops in the Voc-Tech school location, the two rock units appeared generally massive in nature with well-defined joint sets established by stress redistribution from a combination of post-glacial rebound and previous volcanic activity. It is noteworthy that during our mapping of the parking area cut, only one half-barrel cast (i.e., rock drillhole trace) was observed near to toe of the existing parking lot slope and had an inclination of roughly 86 degrees (from horizontal plane). Portions of the parking area slope angle along of Hemlock Road ranged from 50 to 60 degrees, suggesting either that the joints in the upper 5 to 10 feet of rock are more prevalent and the slope developed its own stable configuration; or, that the previous blasting was relatively uncontrolled and gas travel during blasting broke portions of the final slope back to between 50 to 60 degrees. This suggests



perimeter control measures during blasting of the existing parking lot slope were ineffective or were not used.

2.3 Surface Outcrop Discontinuity Mapping

During our 6 July site visit, we collected discontinuity data from five surface outcrop locations within the general vicinity of the proposed cut slope. These five “window mapping” locations are herein referred to as OC-1 through OC-5. Mapping was completed using an azimuthal Brunton® Geologic Compass and approximate outcrop positions were measured with respect to adjacent boring and observation well locations. Outcrop photos are included as Figures 1C through 1G of Attachment No. 1. In addition to general observations relative to rock mass quality, we collected discontinuity dip direction and dip angle measurements (n=35 points) for subsequent comparison with acoustic and optical televiewer logs produced by Hager-Richter Geoscience. Our field mapping data is attached as Table I at the end of this report. An assessment of field mapped structural data orientations is included as part of Section 2.5 below.

Based on our mapping observations and review of boring and lab testing data provided by LGCI (Refs. 3, and 4), we assess that the bedrock at the site can be described as moderately fractured, fresh to slightly weathered, very strong to extremely strong, granodiorite and rhyodacite. Zones with locally reduced intact rock uniaxial compressive strength (Ref. 5) values are possible in the upper 5 to 10 feet of the rock due to physical and chemical weathering and long-term mineral alteration. Reductions to intact, joint wall and overall rock mass strength values may also be coincident with locations of faults, shears or persistent high aperture discontinuities, especially those producing water.

2.4 Boring Logs, Core Photos and Downhole Optical and Acoustic Televiewer Logs

Scarptec reviewed boring logs and available core box photographs prepared by LGCI (Ref. 6), as well as geophysical logs of acoustic and optical televiewer (A/O TV) scans (Ref. 7) of core borings B206 and B208-OW, both of which are located on the proposed plan slope alignment. The core box photos appear to demonstrate that the dominant lithology is in the vicinity of the proposed slope is granodiorite with rhyodacite stockwork. Boring B208-OW was primarily granodiorite for the full 37-foot corehole depth, while Boring B206 appears to show evidence of mixing between granodiorite and rhyodacite stocks (i.e., dikes and sills). Rock Quality Designation (RQD) measurements of the cores showed the rock is generally massive and strong with RQDs mostly above 70% with locally reduced RQDs generally in the 40% range in near-surface cores.

Hager-Richter Geoscience, Inc. (HRG) completed A/O TV logging for the project. Televiewer logs were developed initially for the oil industry and are now commonly used for geotechnical and mining applications where detailed core logs and fracture analyses are required. The sondes include a rotating camera lens or acoustic transmitter that scans the corehole wall as the sonde is slowly raised in the corehole. The images developed from the scans are merged to prepare a



virtual corehole wall image or core. Sloping fractures and beds can be measured for dip and dip direction assuming a sinusoidal wave pattern in the scanned trace of a discontinuity. Processing of the scans incorporates data from an internal accelerometer, compass and magnetometer to provide an oriented virtual core that can be corrected for compass declination. Optical scans are possible in open holes with clean or no water; acoustic televiewer sondes are used below the water table to couple the acoustic impulse to the rock via the fluid and can be used in murky or muddy water.

The A/O TV log scans generally appeared to show that the majority of open discontinuities were north-northwest dipping sub-horizontal joints which appear to be dissolution joints where mineral-healed fractures had been dissolved by groundwater. Steeper features had little to no obvious apertures and appeared generally tight. The data from the A/O TV logs is summarized and included as Table II which is attached at the end of this report.

2.5 Stereographic Projections

Stereographic projections, commonly referred to as “stereonet”, are used to graphically present the orientation of discontinuities in a rock mass and evaluate the population(s) of the discontinuities relative to orientation (i.e., azimuth and inclination), and what major orientations are present and their relative prevalence. The most common types of stereonet seek to either display the trace of a discontinuity plane in a lower hemisphere projection (i.e., dip vector with plane penetrating the lower half of a sphere and passing through its center and both edges); or alternatively, as a single point in the case of a “pole” plot. By definition, a pole represents the normal to a discontinuity plane and is located 180 deg. out of phase with respect to dip direction (and $90 - \theta$ with respect to dip angle) on a stereonet. The plotted poles can be contoured for density of poles (statistical distribution) and divided into major discontinuity “sets”.

A series of stereonet were generated using Rocscience’s DIPS software to summarize the structural geologic discontinuities observed at the site, based on comparison of the field mapping data and the A/O TV logs. As was expected, the stereonet of field surface mapping data (n=35 data points) displayed a significantly wider distribution of joints sets given the distance between available outcrop locations (Figure 4C); however, the importance of the surface mapping data is that it helps to confirm joint sets that are well represented across the site. There appears to be relatively good agreement between the three-dimensional field mapping data and that shown in the A/O TV data, which is closer to a two-dimensional (vertically biased) scanline survey.

The A/O TV data from B206 (n=33) and B208-OW (n=85) show relatively good agreement between each other. Boring B206 and B208-OW each have five distinguishable discontinuity sets, although the correlation strength varies between both data sets because B208-OW has nearly three times the quantity of data points in comparison to B206, so additional discontinuity population intensities are reflected by the larger data set. The field mapping data indicated that there are at least eight discontinuity sets across the area of interest; however, out of those eight



mapped sets, there are only two sets that are strongly correlated to what is reflected in the A/O TV data.

In order to characterize the full suite of discontinuity sets at the site, we combined data from both A/O TV logs with our outcrop mapping data (n=153), as shown on Figures 4F and 4G. Based on the combined structural geologic data set, we estimate that there are 13 joint sets represented across the site; however, there are two very well represented joint sets that we anticipate will exert a strong influence on overall slope behavior, those being:

- Joint Set J1 – Dips at relatively shallow angles (10 to 15 deg.) to the north. This set is anticipated to dip parallel to oblique with respect to the strike of the slope;
- Joint Sets J3 & J4 – Likely part of the same set given the “smearing” of the data in this region of the net. This combined set generally dips moderately to the north-northwest at between 33 and 46 deg. This set is also anticipated to dip parallel to oblique with respect to the strike of the slope.

Less statistically represented, yet still present sets that may locally influence slope behavior include the following:

- Joint Set J2 – Dips at shallow angles to the east;
- Joint Set J5 – Dips at shallow to moderate angles to the west;
- Joint Set J6 – Dips at shallow to moderate angles to the northeast;
- Joint Set J7 – Dips steeply to the west-southwest;
- Joint Set J10 – Dips steeply to the southeast. Potential daylighting set.
- Joint Set J11 – Dips to moderately to steeply to the east. Potential daylighting set.

The next section details how these sets could influence slope stability failure modes based on their intersection with proposed slope geometry.

2.6 Kinematic Evaluations of Proposed Cut Slope

Kinematic analysis of discontinuity data is an iterative form of geometric analysis without consideration of disturbing forces and consists of looking at proposed slope orientation(s) with respect to discontinuities plotted on the same stereonet. Incorporating the estimated base (or design) friction angle of the rock joint planes, inclination of the proposed slope and dip and dip direction of the discontinuity sets facilitates identification of potentially unstable planes or plane intersections in a proposed rock face. Common failure modes include the following:

- *Planar (Sliding) Failures* - Discontinuities dipping the same direction but less steeply than the proposed slope angle (i.e., “daylighting”) yet dipping steeper than their inherent friction angle can result in planar (sliding) failures;

- *Wedge (Sliding) Failures* - For potential wedge failures forming on the proposed rock cut, the dip (or “plunge”) of the angle of intersection between two planes must exceed the composite friction angle of the planes and be less than 20 to 25 degrees oblique to the cut to be kinematically capable of sliding;
- *Toppling Failures* – Toppling blocks or slabs form when their center of gravity extends outward beyond the base of a block inducing rotation, and where secondary “release” planes along the base and sides of the block are also present;
- *Overall (Global) Rock Mass Failures* – Can result when there is a very large quantity of joint sets at many different orientations and low rock mass strength. Overall failure planes or “slip surfaces” tend to be curved, semi-curved or curvilinear if mixed mode failures coexist.
- *Complex (Hybrid) Failures* – Complex failures are mixed mode failure mechanisms coexisting as part of an (usually large scale) instability.

Convexly curved slopes negate the positive effects of oblique joints (self-buttressing) and provide more opportunity to align adverse joint orientations with a given slope. As such, linear cuts or inward curving slope orientations are generally most stable. To minimize convexities and reverse curves of the slope, we have shown four slope segments with strike orientations ranging from nearly due north to an azimuth of 40 deg. (bearing of N40E) with respect to the Mass. State Plane Coordinate System, as shown in Figure 1H. These four segments, their strike orientation (or bearing) and their approximate respective lengths are summarized below based on the following:

- **Segment 1** – 29 deg. with plan length of approx. 80 feet;
- **Segment 2** – 3 deg. with length of approx. 175 linear feet;
- **Segment 3** – 37 deg. with plan length of approx. 220 feet;
- **Segment 4** – 15 deg. and length of approx. 200 feet.

For kinematic analyses, we assumed cohesion is effectively zero and selected an average slope azimuth of 20 deg. (i.e., N20E) and a conservative value for base friction angle (ϕ) of 35 degrees. We varied slope face angles relative to known joint sets and joint set intersections to assess potential instability modes. The slope orientations and segments are generally consistent with what we discussed with the design team on our Monday, 18 July 2022 teleconference call. Based on our evaluations with respect to the proposed segment orientations noted above, we summarize the following conclusions relative to potential modes of rock slope instability along the segments comprising Rock Cut Slope A:

1. *Overall Rock Mass Failure and Complex Failures* – Very low probability given the distribution of poles shown on the stereonets and the hard, brittle nature of the rock mass; however, isolated “shatter” zones are always possible with volcanic emplacements containing highly brittle, previously stressed rock.



2. *Planar Sliding Failures* – Low probability given the quantity of potential sliding pole vectors indicated on Figure 4H. Additionally, approximately one third of the poles that fall within the red shaded area known as “Markland’s Critical Zone” are intact “foliations” and may be healed or non-throughgoing features; however, given the location and orientation of the cut, we cannot rule out the possibility of localized sliding blocks that may require rock dowels for enhanced shear resistance along suspect sliding planes.
3. *Wedge Failures* – The probability of wedge sliding along joint plane intersections is anticipated to be relatively low given the low population of pole vectors comprising sets with great circles with intersections that plunge out of the proposed slope, as indicated on Figures 4L and 4M. Localized wedge intersections are kinematically admissible, however, and we cannot rule out the possibility that such wedges may be encountered and require rock dowels for long-term stabilization.
4. *Toppling Failures* – Although flexural toppling is unlikely given the high intact rock strength and low distribution of poles falling in the critical zone, we assess that there is a moderate probability of direct and oblique block toppling along the proposed slope orientations, as depicted in Figure 4J. Notably, such toppling failure blocks may consist of blocks of varying size and, given ice action and the brittle nature of the rock, routine small to medium size rock blocks may become a maintenance concern for the catchment features. Detailed slope scaling is required to mitigate the hazards from toppling blocks. Spot rock dowels are also required to secure larger toppling blocks to the slope. We cannot rule out the possible need for localized underblock support in the form of “dental shotcrete”, dependent on the exposed cantilever arm length.

Based on the results of our iterative kinematic analyses, we conclude that the preliminary 8V:1H slope face angle is excessively steep and we recommend a rock cut slope angle of 3V:1H (approx. 71 deg. from horizontal). This proposed slope angle is based on reducing the chances that planar sliding joint sets steeper than 70 to 71 deg. will daylight from the slope. The proposed slope angle also reduces the chances for high-angle toppling failures. Based on our assessment at the “pinch point” of the lot line and zoning setback, angles shallower than 3V:1H may extend beyond the shown 15-foot setback line. Based on our estimate, it appears that there would be approximately 6 to 8 feet between the setback line corner and the crest of the proposed 3V:1H rock slope at the pinch point (25-foot cut height shown).

We also note based on our experience that drill holes steeper than about 4V:1H on slopes greater than 15- to 20-feet in height are frequently subject to drillhole wander during execution of blast hole drilling. This can result in a vertical or even partially overhanging final slope, which would require very tight perimeter control tolerances (e.g., line drilling or closely spaced presplit holes) to mitigate.



2.7 Rockfall & Icefall Hazards

The current catchment ditch width based on the Grading Plan (Ref. 1) is shown as 10 feet wide. Based on the Oregon Dept. of Transportation (ODOT)/FHWA study titled: *Rockfall Catchment Area Design Guide* (Ref. 11), a 15-foot-wide catchment ditch (assuming 6H:1V foreslope batter) is ideal for the proposed 3V:1H cut slope, as shown in the graphical aids included as Attachment No. 5. We understand that there are lot line and zoning restrictions at the top of the cut, as previously established above. Alternatively, a 12-foot-wide ditch with a 4H:1V foreslope batter would also work; however, this could add an additional 2- to 3-feet of rock excavation depth at the base of the slope. The catchment feature should be fitted with a guiderail or “rock rail” (Thrie-beam guiderail with a double beam behind as used by New York State) or similar to help capture rockfall and to help keep unauthorized persons from entry within the ditch. This approach assumes adequate scaling and rock reinforcement needs are addressed during construction

Long-term weathering from water and ice action may result in localized erosion, raveling and degradation of the slope and overlying backslope soils. Exposure of the rock mass to physical and chemical weathering and slope destressing necessitates periodic scaling of the completed rock slopes and monitoring of the rock reinforcement installed during construction.

Due to expected surface water runoff and episodic fracture-controlled hydraulic conductivity, localized ice buildup on the new slopes is likely. Ice build-up can induce ice jacking forces on the rock, which can in turn increase the chances of rockfall. During the spring thaw, icefalls can also occur when the temporary adfreeze bond strength of ice slabs melts back and is diminished. As such, it is prudent to drain (or direct) surface runoff away from the crests of the cut slopes. Additionally, drainage at the slope toe will be required and is typically handled as part of the catchment ditch hydraulic/grading requirements.

3. Recommendations

Based on our site observations, review of Hager-Richter’s Report and the results of our technical evaluations noted above, we provide the following recommendations relative to the design and construction of proposed Rock Cut Slope A:

1. Slope Angle and Orientation: Slope angle should be cut at 3V:1H (approx. 71 deg. from horizontal). We have provided recommended approximate slope orientations as shown in Sec. 2.6 above. The number of individual cut slope segments should be reduced to the fullest extent practical. Proposed reverse curvature with cuts should also be minimized, including cuts resulting in “convex” slope profiles.
2. Rock Reinforcement Elements: Passive (untensioned) rock dowels are intended to increase the shear resistance along potential sliding planes and are recommended as



outlined below. Post-tensioned rock anchors for slope stabilization are not anticipated for this project.

Spot Rock Dowels: Should be installed at locations determined by Scarptec during project construction. We recommend that the Project Owner carry 800 linear feet of 1-1/4-in. (#10) nom. dia. Grade 75 hot-dip galvanized, continuous threadbar by Williams Form Engineering, Dywidag® Systems International or equivalent. Dowel lengths will be determined by Scarptec in the field based on post-scaled slope conditions; however, we anticipate min. length of 10 ft. and max. length of 20 ft. Dowels shall be tremie grouted in-place using neat cement grout. Appropriate specification language and details will be included in Field Engineering Design Drawing sheets submitted upon completion of excavation and slope scaling. We can provide contact info for rock bolt installation contractors upon request (frequently same company as the one completing the scaling work). Depending on the blaster's means and methods and experience with rock reinforcement construction, rock dowels may also be installed during "top-down" excavation of individual lifts; however, the blaster will need to demonstrate (via submittal) in their Work Plan that blasting of subsequent lifts will not result in damaged rock dowels.

Pattern (Grid) Rock Dowels: Because the slope orientation varies along its length and joints are generally favorable at the proposed slope angle, pattern rock bolting is not anticipated for this project.

3. **Slope Drainage:** Given the presence of water in the Observation Well (OW) data provided by LGCI, we recommend that a small quantity of slope drains be included, with locations TBD based on post-excavation conditions. Assume min. 10 ft. long, max. 20 ft. long drain holes at 4H:1V upward batter. Include 200 linear ft. of drilled slope drains. Min. 3.5-in. dia. hole with lower (exposed) 5-ft. of hole sleeved with solid wall Sch. 40 PVC and extended 6 in. beyond final slope face. To mitigate potentially hazardous icefalls, scour/raveling/erosion of the slope and accelerated bedrock weathering, grade slope crest and backslope areas such that surface water drainage is directed away from the slope face, wherever possible.
4. **Rock Blasting & Excavation Considerations:** As noted above, the bedrock at the site is expected to be very hard and brittle. The blaster selected for the project will need to consider the use less (rather than more) explosives during presplit blast design to avoid excessive gas travel and backbreak that could create a shallower slope. Use of Perimeter Control Methods is recommended, and in particular, Precision Pre-splitting should be considered for final slope (neat) line development. This may include reducing the spacing of presplit holes and reducing the charge weights to avoid backbreak and excessive gas travel. Blasthole bore tracking and/or slope scanning should be implemented to minimize drillhole deviation and produce pre-split holes that do not deviate more than 6 inches out



of alignment over the full maximum vertical lift height. The blaster should be advised that localized silica-rich zones of bedrock may be encountered, and that drill bit selection should take into account the brittle, high strength and abrasive nature of the bedrock. The blasting contractor should also be made aware of the potential for encountering two different lithologies (i.e., rhyodacite and granodiorite). The mapped volcanic and igneous intrusive rocks may behave somewhat differently and require some adjustment of perimeter control blasting technique, especially where the lithology changes. The selected blasting contractor is ultimately responsible for the Blast Design and should submit a Blasting Plan for review of the project team. A blasting “test section” (i.e., test blast) should be included in the blaster’s work requirements.

5. Special Note: As noted herein, there appears to be a mapped fault feature located within the limits of the overall project site. This feature, if exposed within the limits of the proposed cut during construction, may require additional drainage or slope stabilization elements. Once the slope is excavated, we will observe slope conditions to assess potential impacts to rock mass integrity from historic or otherwise relic faulting.
6. Overburden Soils: Strip soils back min. 8 ft. from final slope crest. Slope back overburden soils to max. 2H:1V with revegetated slope face and use of geosynthetic matting, if required to maintain the slope and resist erosion.
7. Vegetation and Tree Removal: To preclude long term root-jacking forces, cut trees and vegetation within 15 ft. of the proposed slope crest.
8. Slope Scaling: Based upon the localized relatively low RQD values observed in borings at the top 5 to 10 ft. of the slope, we recommend that the slope be thoroughly scaled during and after development/excavation, as needed based on exposed field conditions and real-time construction safety considerations. We can provide contact info for experienced slope high scalers upon request. Detailed scaling will mitigate long-term rockfall hazards posed by raveling and erosion of rock slope surfaces subjected to weathering and ice jacking forces. Use of onsite construction equipment such as back hoes, excavators or similar, to “scrape” down the final slope face is not recommended. (Note: We noticed some loose rock in the lower (existing) parking area and recommend that the slope be scaled if it is not excavated for the new school project)
9. Long-Term Slope Monitoring & Maintenance (M&M): Like all natural earth materials, slopes are subject to long-term deterioration from physical/mechanical and chemical weathering. Periodic slope maintenance, including additional scaling (and possibly even supplemental rock reinforcement elements) will be required based on geotechnical monitoring visits and reporting. Scarptec will submit a brief (2 to 3 page) M&M recommendations letter upon completion of the slope construction work, which can be



referenced by the Owner for consideration of long-term slope observations and periodic maintenance.

10. Ditch Geometry: We recommend a min. 12-foot-wide ditch with a 4H:1V foreslope batter. The catchment ditch should be fitted with a guiderail or “rock rail” (Thrie-beam guiderail with a double beam behind as used by New York State) or similar to help capture rockfall and to help keep unauthorized persons from entry within the ditch. The ditch should be backfilled with a min. of 18-inches of $\frac{3}{4}$ -inch crushed stone. Rockfall catchment ditches at the toe of the slope also need to direct water away from excavation areas and should be evaluated by the site/civil engineer with respect to site drainage design and hydraulic considerations. Note that there are alternative ways to achieve the recommended ditch geometry, including use of an embedded barrier or wall type feature at/near the edge of pavement. We recommend that you reach out to us to discuss the range of possible alternatives as the site grading and drainage details become finalized.
11. Site Access Restrictions & Safety Protocols: Owner should provide security fences and signage up top so that people are warned about fall hazards and excluded from the slope crest area. Additionally, a fence/barrier structure like a guiderail or “rock rail” (Figure 11) should be installed and maintained along the outboard (roadway) side of the catchment ditch. Unauthorized persons should be excluded from entry within the catchment ditch and signage should be utilized to minimize entry. Vehicles should not be parked up against the slope or directly adjacent to the proposed catchment ditch.
12. Field Engineering Support During Construction: Scarptec will evaluate the slope for scaling and rock reinforcement needs after blasting and subsequent excavation of the slope face. Rock dowel locations will be determined after the slope is adequately scaled and cleaned of debris that could obscure potentially unstable rock blocks and their perimeter joint networks. We cannot rule out the possibility that additional localized rockfall mitigation measures will be required, including dental shotcrete or draped/anchored mesh.

Assumptions & Limitations

This Report is based on the following key assumptions and limitations:

1. LGCI has provided us with relevant photos, site excavation/topographic plans, boring logs, previous geotechnical reports and other relevant historical or geotechnical documents for our review and understanding of site issues.
2. We have made use of structural geologic data that has been corrected for magnetic north (-14 deg. west declination). Our kinematic slope stability evaluations and recommended slope orientations were determined relative to the Massachusetts State Plane Coordinate System north arrow shown on the referenced site plan drawings. We have

assumed that LGCI will notify us in the event the project coordinate system changes or if construction documents will show rotated or alternative coordinate systems.

3. We have no control over the quality and means and methods of rock excavation, including use of any blasting techniques. The final integrity of the slope face and ultimate quantity of rock slope stabilization elements will be strongly correlated with rock excavation technique. Scarptec provides no guarantee or warranty with respect to final as-constructed slope or rock mass conditions, or proposed slope stabilization quantities provided in this Report.
4. Scarptec did not assess potential rockfall hazards outside of the general limits of the Proposed Cut Slope A, including areas beyond inferred lot lines.
5. Our authorized Scope of Work (SOW) did not include design of shotcrete, anchored/draped mesh or rockfall barriers, if required. Our SOW provides for field determined design drawings and for field engineering during scaling and installation of rock dowels only, both during the construction phase. Design and Field Engineering services for additional rock slope stabilization and/or rockfall mitigation elements (if required based on actual slope conditions exposed) will require an agreement amendment.
6. A/O TV geophysical data was collected by others and was shared with us for our own internal technical assessments.
7. Our SOW did not provide for evaluation of bearing surfaces to receive structural concrete for the proposed new buildings. Likewise, blast and vibration monitoring were not included. Design of proposed cut and fill slopes in soils were also excluded from our Scope.
8. Scope of Work area includes the portion of the site along the north/west side of the proposed access roadway next to the new school building (Fig. 1A), where rock cuts are anticipated. Cuts outside this area were outside our SOW area and were excluded from our evaluations.
9. Development of bid quality contract documents (e.g., pre-bid drawings and specifications) were not included in our Scope.
10. No subconsultants, subcontractors or laboratory/materials testing were included with our Scope. Permitting, surveying, pavement design, storm/wastewater, foundation analyses and forensic/expert services were also excluded.



We appreciate the opportunity to submit this Report to LGCI and look forward to our further work with you on this project. Please contact the undersigned if you wish to discuss any aspect of this Report.

Sincerely,
SCARPTEC, INC.

A handwritten signature in black ink, appearing to read "D. Scarpato", with a long horizontal flourish extending to the right.

David J. Scarpato, P.E. (MA)
President & Principal Rock
Engineer

A handwritten signature in blue ink, appearing to read "P. Ingraham", with a long horizontal flourish extending to the right.

Peter C. Ingraham, P.E.
Senior Rock Engineer Consultant

Cc: (none) existing

Attachments:

1. Annotated Photographs (10 Sheets)
2. Table I - Field Mapping Data (1 sheet)
3. Table II - A/O TV Structural Geologic Data (1 Sheet)
4. Stereonets of Structural Data & Kinematic Evaluations (14 Sheets)
5. ODOT/FHWA Catchment Ditch Design Criteria Charts (2 Sheets)

C:\Users\Dave\Desktop\Scarptec\Projects & Leads\Billable Projects\22-05_LGCI_Wakefield Voc Tech HS_Rock Slope Design_MA\Deliverables\Final



References

1. Site Plan of proposed Northeast Metropolitan Regional Vocation High School, prepared by Drummey Rosane Anderson, Inc. (DRA) titled: *Grading Plan* (L401.1), dated 15 February 2022. Prelim. Limits of Proposed Rock Cut shown by RED line.
2. *Bedrock Geologic Maps of the Boston North, Boston South and Newton Quadrangles*, compiled by Clifford Kaye, published in 1980 by the U.S. Geological Survey (USGS).
3. Boring Logs for Prop. Northeast Metro Reg. Vocational Tech. H.S., prepared by LGCI, 33 sheets.
4. Boring Location Map titled: *Figure 3B –Test Pit and Boring Location Plan for Proposed Building*, prepared by LGCI, dated June 2022.
5. UCS Lab Test Data titled: *Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C*, results for five test core samples, 12 pages.
6. Select Core Box Photos, prepared by LGCI, 5 pages.
7. Report titled: BOREHOLE GEOPHYSICAL LOGGING - DATA REPORT. BOREHOLES B-206 & B-208, NORTHEAST METRO TECH HIGH SCHOOL, WAKEFIELD, MASSACHUSETTS, produced by Hager-Richter Geoscience, Inc., dated June 2022, 13 pages.
8. Test Pit Logs for Prop. Northeast Metro Reg. Vocational Tech. H.S., produced by LGCI, 40 sheets.
9. Report titled: *Draft Geotechnical Report, Proposed Northeast Metropolitan Regional Vocational Technical High School, Wakefield, Massachusetts*, produced by LGCI, dated 23 June 2022, 232 pages.
10. Groundwater Monitoring Data Table titled: *Table 3 - Summary of LGCI Groundwater Measurements, Proposed Northeast Metro Regional Vocational Technical High School, Wakefield, Massachusetts*, undated, 1 sheet.
11. Pierson, L.A., et al. (2001), ODOT/FHWA Pooled Research Study Report titled: *Rockfall Catchment Area Design Guide, Final Report No. SPR-3(032)*, 92 pages. (Design Charts)



ATTACHMENT NO. 1
ANNOTATED PHOTOGRAPHS & FIGURES
25 JULY 2022
INT. PROJ. NO. 22-05

PROJECT: PROP. NORTHEAST METRO. REGIONAL VOCATIONAL TECHNICAL HIGH SCHOOL (NMRVHS)

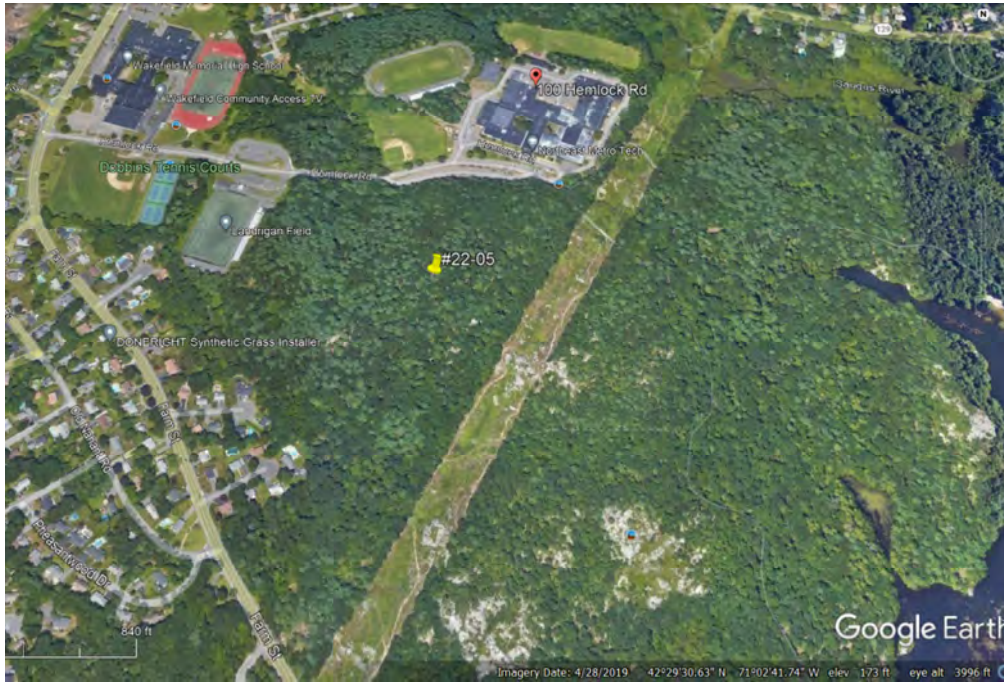
CLIENT: LAHLAF GEOTECHNICAL CONSULTING, INC. (LGCI)

OWNER: NORTHEAST METROPOLITAN REGIONAL VOCATIONAL SCHOOL DISTRICT

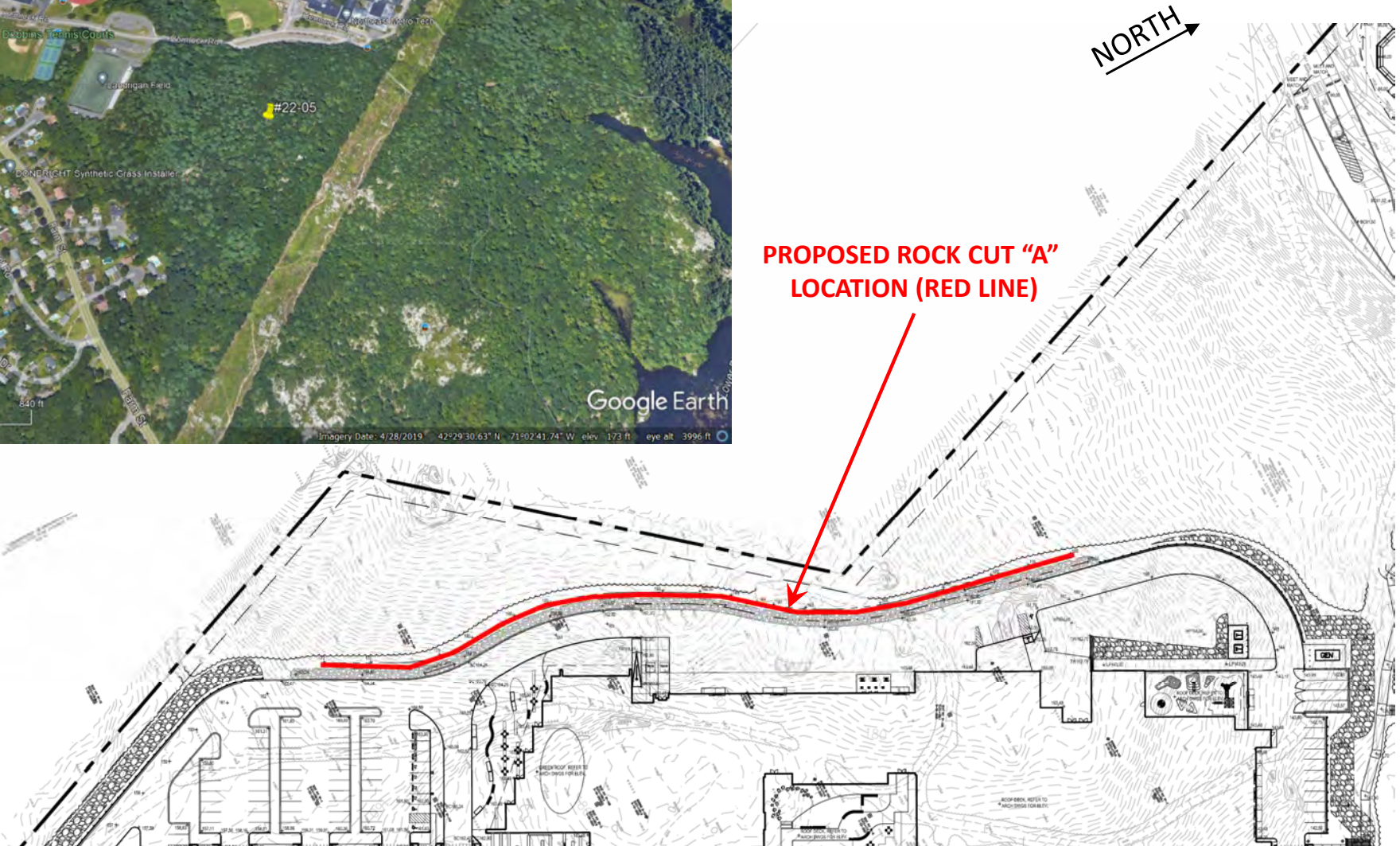
NOTES:

1. Any measurements shown are approximate.
2. Figures not to scale unless indicated otherwise.
3. All photos taken by Scarptec, Inc. unless shown otherwise.

FIG. 1A – SITE LOCUS MAP AND PROPOSED SLOPE LOCATION

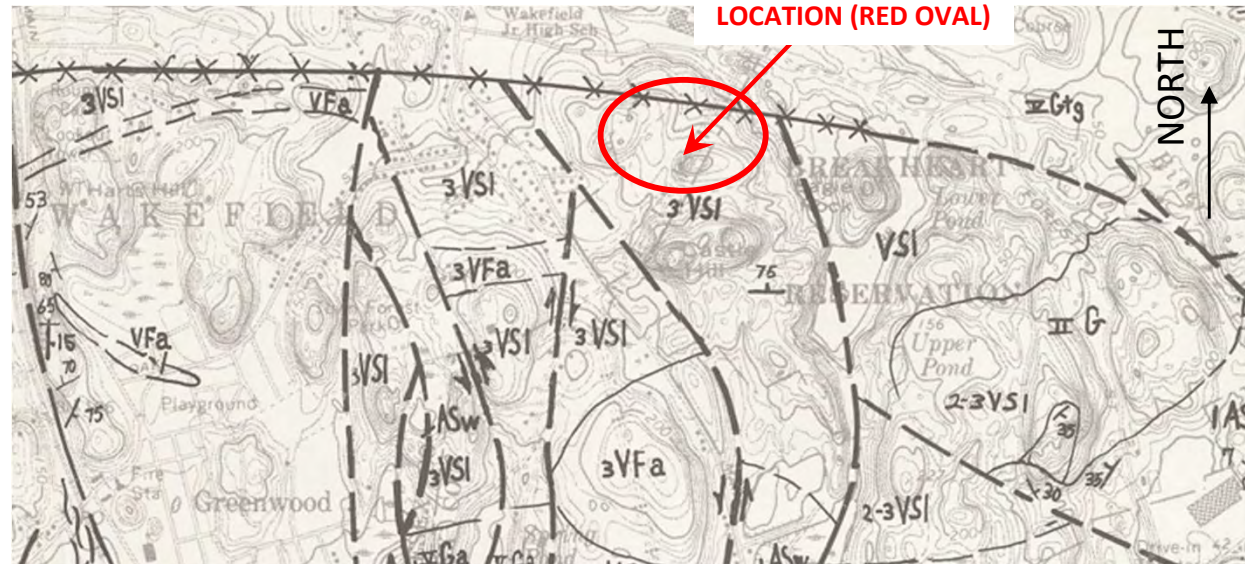
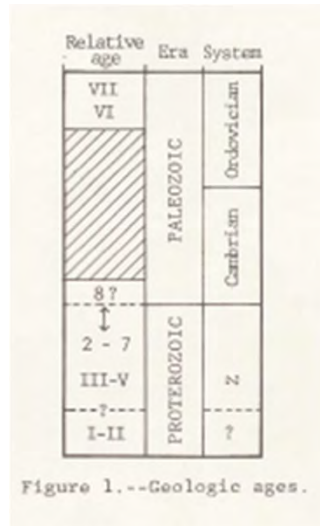


**PROPOSED ROCK CUT "A"
LOCATION (RED LINE)**



NOTE: IMAGE ADAPTED FROM REF. 1 GRADING PLAN.

FIG. 1B – USGS BEDROCK GEOLOGIC MAP, BOSTON NORTH



VOLCANIC ROCKS (in part, hypabyssal feeder vents)

- VS** RHYOLITE AND RHYODACITE - Felsitic and porphyrofelsitic flows; welded-ash flows; vitric, lithic, and lapilli tuffs; flow breccias; breccia pipes; and extrusion domes. Textures are felsitic, porphyritic, trachytic, and pyroclastic. Generally microporphyritic in a slightly translucent groundmass. Rocks are black, red, white, cream, and shades of reddish- and greenish-gray. Generally massive but with fine flow-lamination in welded-ash flows. Stratification partings locally developed in ashy tuffs and in thin-layered flows
- VS1** North of Boston. Rhyolite and rhyodacite in about equal proportion. (Lynn Volcanic Complex - Clapp, 1921; LaForge, 1932)

- Fault zone—Wide zone of small displacements on many discontinuous fracture-surfaces
- Thrust-fault—Teeth on upper plate. Solid where known; dashed where approximately located
- Fault intruded by dike—Solid where known; dashed where approximately located

BEDROCK GEOLOGIC MAPS OF THE BOSTON NORTH, BOSTON SOUTH, AND NEWTON QUADRANGLES, MASSACHUSETTS

By
Clifford A. Koye
1980

- Gm** Chilled contact facies of granodiorite-quartz monzonite (Gm). Fine-grained micrographic intergrowth of orthoclase and quartz with phenocrysts of zoned oligoclase. Toward margin of body micrographic mesh becomes increasingly fine-grained and more myrmekitic, and phenocrysts become smaller and sparser. (Lynn Volcanic Complex - LaForge, 1932)
- Gt** Tonalite-granodiorite. Uniformly fine-grained; light- to dark-gray, pink in western part. Megascopically, feldspar in characteristically uniform shapes. Microscopically, idiomorphic oligoclase in stubby zoned crystals, 25-55%; xenomorphic orthoclase or microcline, 0-15%; quartz in equigranular clusters, 30-60%; hornblende and biotite, about 15%. Feldspar largely to entirely altered to saussurite and fine sericite; quartz, badly strained; feldspar, largely to entirely altered to chlorite and epidote. Southern part of outcrop in Spot Pond area shows partial assimilation of older rocks. (Newburyport Quartz Diorite - Emerson, 1917; LaForge, 1932)
- Gtg** Chilled contact facies of tonalite-granodiorite (Gtg). Fine-grained, with pronounced micrographic texture; relict fragments of wall rock

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25 JULY 2022

FIG. 1C – OUTCROP LOCATION OC-1



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25 JULY 2022

FIG. 1D – OUTCROP LOCATION OC-3



FIG. 1E – OUTCROP LOCATION OC-5 ALONG EXISTING
PARKING AREA AT SCHOOL



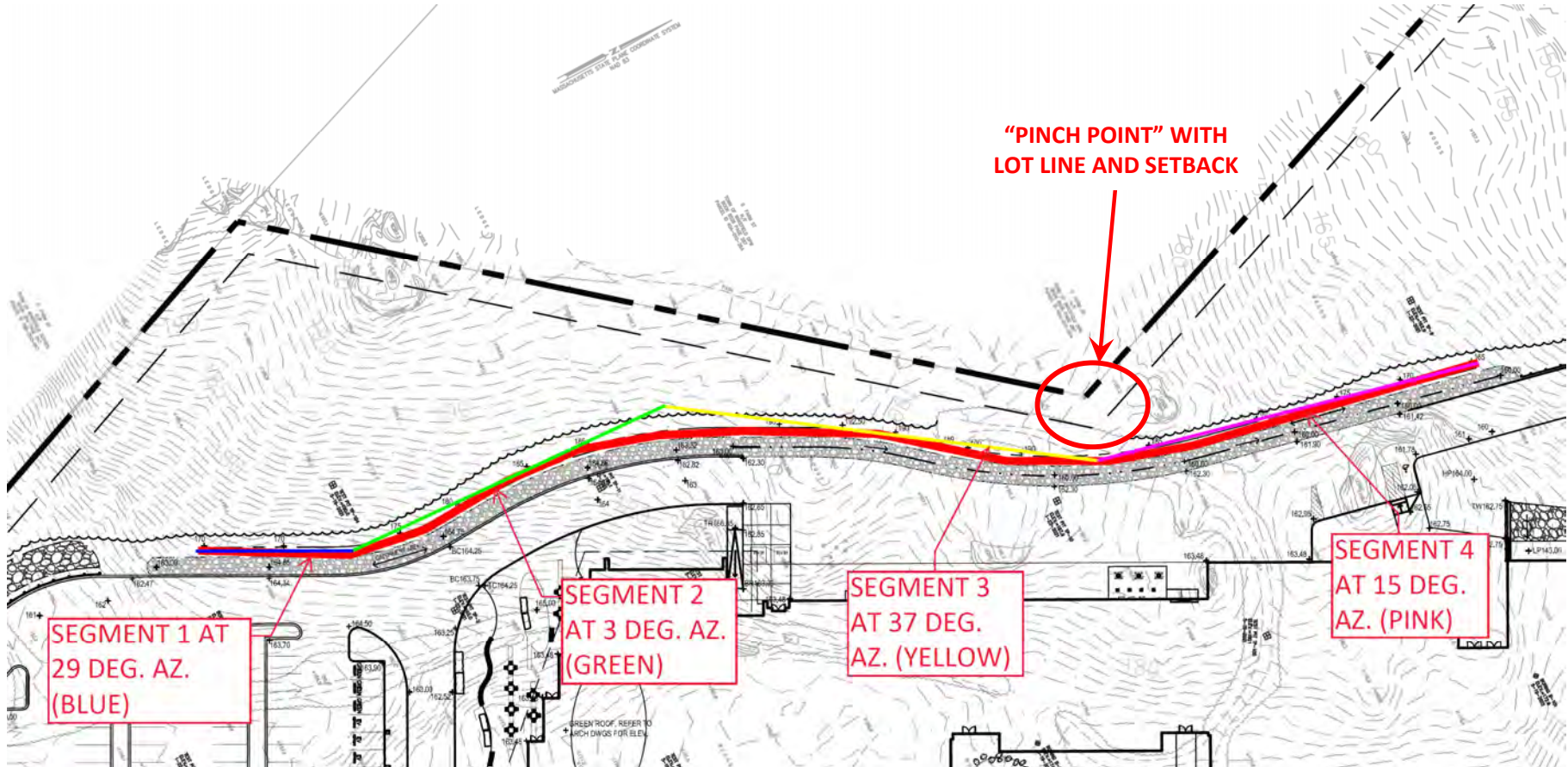
FIG. 1F – OUTCROP LOCATION OC-5 ALONG EXISTING
PARKING AREA AT SCHOOL



FIG. 1G – OUTCROP LOCATION OC-5 ALONG EXISTING PARKING
AT SCHOOL. NOTE UPPER PORTION OF SLOPE IS BROKEN BACK



FIG. 1H – PROPOSED CUT SEGMENTS. SEGMENT ORIENTATIONS AND LENGTHS SHOWN ARE APPROXIMATE



NOTE: IMAGE ADAPTED FROM REF. 1 GRADING PLAN.

FIG. 1I – EXAMPLE ROCK RAIL FOR CATCHMENT DITCHES



NOTE: IMAGES ADAPTED COURTESY OF NEW YORK STATE THRUWAY
AUTHORITY



ATTACHMENT NOS. 2 & 3

TABLES OF STRUCTURAL GEOLOGIC DATA

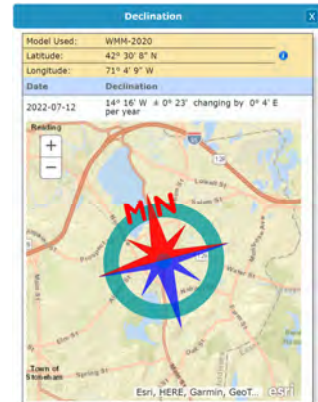


Staff Date

Des. By:	DJS	7/12/2022
Chk. By:	PCI	7/13/2022

PROPOSED SLOPE ORIENTATION (DEG.) ^{<1>}					
	Strike (Raw)	Strike (Corr.)	Dip Direc. (Raw)	Dip Direc. (Corr.)	Dip Angle
MIN	0	0	90	90	71
MAX	40	40	130	130	71

	No.	DISC. ORIENTATION (DEG.) ^{<2>}			Notes
		Dip Direction (Raw)	Dip Direction (Corr.)	Dip Angle	
OC-1	1	317	303	69	25 feet NW of B-101
	2	19	5	75	
	3	139	125	23	
	4	345	331	10	
	5	170	156	31	
	6	172	158	72	
	7	225	211	62	
OC-2	8	140	126	63	100 feet East of B208
	9	143	129	66	
	10	93	79	79	
OC-3	11	312	298	64	110 feet NW of B208
	12	32	18	70	
	13	270	256	87	
	14	259	245	54	
	15	175	161	41	
OC-4	16	213	199	71	Near B-1 Observation Well
	17	175	161	58	
OC-5	18	63	49	33	Parking Lot ^{<3>}
	19	35	21	78	
	20	356	342	89	
	21	233	219	80	
	22	24	10	56	
	23	102	88	87	
	24	110	96	85	
	25	234	220	85	
	26	160	146	20	
	27	297	283	78	
	28	235	221	88	
	29	1	347	15	
	30	347	333	54	
	31	210	196	74	
	32	168	154	89	
	33	225	211	88	
	34	25	11	17	
	35	358	344	64	



NOTES:

- Slope orientation estimated from proposed site plan titled: "Grading Plan", prepared by DRA and Warner Lawson, dated 15 February 2022. Plan dimensions based on Mass. State Plane Coordinate System.
- Magnetic declination per NOAA/NCEI is approx. -14 deg. west declination
- At OC-5, one half cast was observed at approx. 86 degree inclination, with backbrake at approx. 50-60 degrees apparent.

Int. Proj. No. 22-05
LGCI
Prop. NE Metro Regional Voc. Tech. High School
Rock Slope Stability Analyses
Discontinuity A/O TV Data (External Source)
TABLE II



Staff		Date
Des. By:	DJS	7/12/2022
Chk. By:	PCI	7/13/2022

B-206					B-208					B-208					B-208				
No.	Depth (ft.)	DISC. ORIENTATION (DEG.) ^{<2>}		Rank	No.	Depth (ft.)	DISC. ORIENTATION (DEG.) ^{<2>}		Rank	No.	Depth (ft.)	DISC. ORIENTATION (DEG.) ^{<2>}		Rank	No.	Depth (ft.)	DISC. ORIENTATION (DEG.) ^{<2>}		Rank
		Dip Direction	Dip Angle				Dip Direction	Dip Angle				Dip Direction	Dip Angle				Dip Direction	Dip Angle	
1	2.3	96	37	Fracture Rank 1	1	3.3	338	13	Fracture Rank 1	34	20.5	69	43	Foliation / Vein	67	29.6	348	63	Foliation / Vein
2	2.5	256	77	Fracture Rank 2	2	3.6	146	73	Fracture Rank 1	35	21.2	338	61	Foliation / Vein	68	29.8	340	72	Fracture Rank 1
3	2.9	328	78	Fracture Rank 1	3	4.0	281	22	Fracture Rank 2	36	21.8	359	27	Fracture Rank 2	69	29.9	34	4	Fracture Rank 2
4	3.0	352	21	Fracture Rank 4	4	4.1	136	67	Fracture Rank 1	37	22.0	286	69	Fracture Rank 2	70	29.9	339	71	Fracture Rank 1
5	3.2	209	50	Fracture Rank 1	5	4.5	333	17	Fracture Rank 2	38	22.3	359	33	Foliation / Vein	71	29.9	69	21	Fracture Rank 4
6	3.6	225	26	Fracture Rank 1	6	4.6	311	71	Fracture Rank 1	39	23.1	61	16	Fracture Rank 2	72	30.4	348	33	Foliation / Vein
7	3.8	231	60	Fracture Rank 1	7	5.1	332	46	Foliation / Vein	40	23.6	335	46	Fracture Rank 1	73	30.5	356	31	Foliation / Vein
8	3.9	245	69	Fracture Rank 4	8	7.1	341	56	Foliation / Vein	41	23.7	114	41	Fracture Rank 2	74	31.6	352	20	Fracture Rank 2
9	3.9	250	79	Fracture Rank 2	9	7.9	353	35	Foliation / Vein	42	23.9	3	27	Foliation / Vein	75	32.2	357	47	Foliation / Vein
10	4.4	250	62	Fracture Rank 1	10	8.2	152	73	Fracture Rank 1	43	24.2	95	57	Foliation / Vein	76	32.7	348	19	Fracture Rank 3
11	5.2	7	51	Foliation / Vein	11	9.0	102	59	Foliation / Vein	44	24.5	83	60	Foliation / Vein	77	32.8	113	53	Fracture Rank 1
12	6.1	357	32	Fracture Rank 2	12	9.4	282	39	Foliation / Vein	45	24.6	356	36	Fracture Rank 1	78	33.2	34	22	Fracture Rank 2
13	6.2	305	73	Foliation / Vein	13	9.7	260	46	Foliation / Vein	46	24.7	10	29	Fracture Rank 2	79	33.4	47	29	Fracture Rank 3
14	6.6	335	40	Foliation / Vein	14	10.8	293	3	Fracture Rank 3	47	24.8	358	45	Fracture Rank 2	80	33.5	74	41	Fracture Rank 1
15	6.9	38	8	Fracture Rank 3	15	10.9	274	25	Fracture Rank 3	48	25.4	21	56	Foliation / Vein	81	33.6	34	32	Foliation / Vein
16	7.1	60	1	Fracture Rank 4	16	11.1	335	42	Foliation / Vein	49	25.7	98	16	Fracture Rank 2	82	33.9	349	36	Foliation / Vein
17	8.3	155	11	Fracture Rank 1	17	11.6	271	34	Foliation / Vein	50	25.8	338	11	Fracture Rank 1	83	34.1	3	40	Foliation / Vein
18	8.6	282	72	Foliation / Vein	18	12.4	254	68	Fracture Rank 2	51	26.0	188	59	Fracture Rank 1	84	34.4	355	40	Foliation / Vein
19	9.2	345	6	Fracture Rank 1	19	12.6	279	35	Fracture Rank 3	52	26.0	11	11	Fracture Rank 1	85	34.6	357	57	Foliation / Vein
20	9.6	332	15	Fracture Rank 2	20	12.8	260	24	Foliation / Vein	53	26.8	325	4	Fracture Rank 1					
21	10.5	338	50	Foliation / Vein	21	13.8	203	80	Fracture Rank 2	54	26.9	358	4	Fracture Rank 4					
22	10.8	10	52	Foliation / Vein	22	13.9	0	41	Foliation / Vein	55	27.0	347	6	Fracture Rank 2					
23	11.0	46	52	Foliation / Vein	23	15.3	49	6	Fracture Rank 2	56	27.1	7	19	Foliation / Vein					
24	11.9	337	51	Foliation / Vein	24	15.5	321	38	Foliation / Vein	57	27.2	356	9	Fracture Rank 1					
25	14.7	338	10	Fracture Rank 2	25	15.6	3	15	Fracture Rank 2	58	28.1	161	23	Fracture Rank 2					
26	14.9	67	43	Foliation / Vein	26	16.1	8	9	Fracture Rank 4	59	28.2	161	29	Fracture Rank 2					
27	16.0	338	9	Fracture Rank 3	27	16.4	331	36	Foliation / Vein	60	28.5	355	12	Fracture Rank 1					
28	16.3	24	14	Fracture Rank 4	28	16.9	351	29	Fracture Rank 2	61	28.5	47	40	Foliation / Vein					
29	17.1	190	14	Fracture Rank 2	29	17.7	302	55	Foliation / Vein	62	28.9	28	55	Fracture Rank 2					
30	17.2	306	17	Fracture Rank 2	30	19.4	343	45	Foliation / Vein	63	29.1	35	29	Fracture Rank 1					
31	18.4	266	32	Fracture Rank 2	31	19.6	337	46	Foliation / Vein	64	29.1	87	66	Fracture Rank 1					
32	19.1	96	36	Foliation / Vein	32	19.9	334	42	Foliation / Vein	65	29.2	67	11	Fracture Rank 4					
33	19.7	356	17	Fracture Rank 1	33	20.1	337	45	Foliation / Vein	66	29.2	354	61	Foliation / Vein					

NOTES:
1. Magnetic declination per NOAA/NCEI is approx. -14 deg. west declination
2. Magnetic declination of approx. -14 deg. west declination has been accounted for in Hager-Richter's data report.



ATTACHMENT NO. 4

STEREOGRAPHIC PROJECTIONS & KINEMATIC ANALYSES

25 JULY 2022

INT. PROJ. NO. 22-05

PROJECT: PROP. NORTHEAST METRO. REGIONAL VOCATIONAL TECHNICAL
HIGH SCHOOL (NMRVHS)

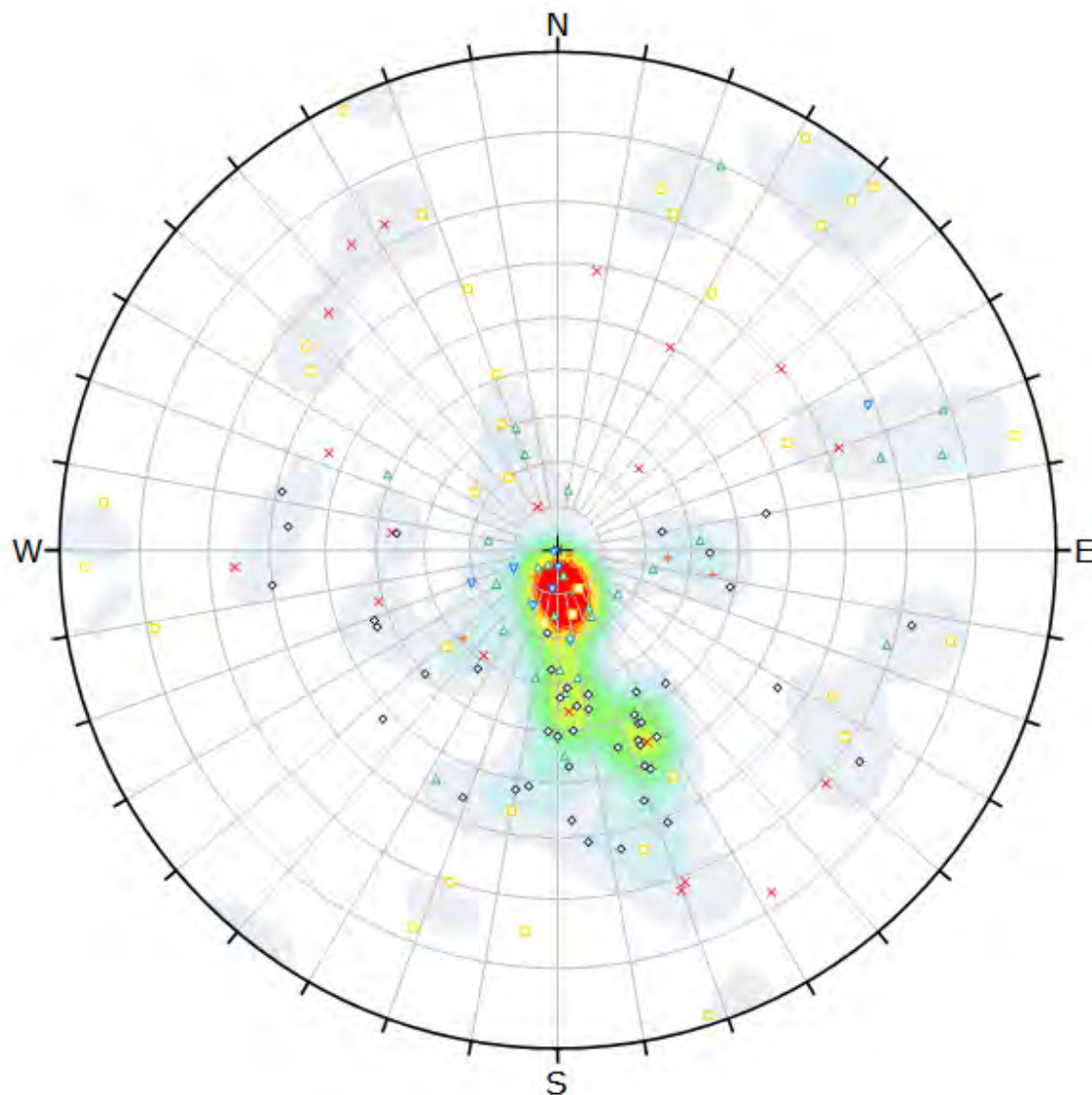
CLIENT: LAHLAF GEOTECHNICAL CONSULTING, INC. (LGCI)

OWNER: NORTHEAST METROPOLITAN REGIONAL VOCATIONAL SCHOOL
DISTRICT

NOTES:

1. Any measurements shown are approximate.

FIG. 4A – STEREONET OUTPUT GRAPHICS:
 ALL DATA COMBINED (POLES)



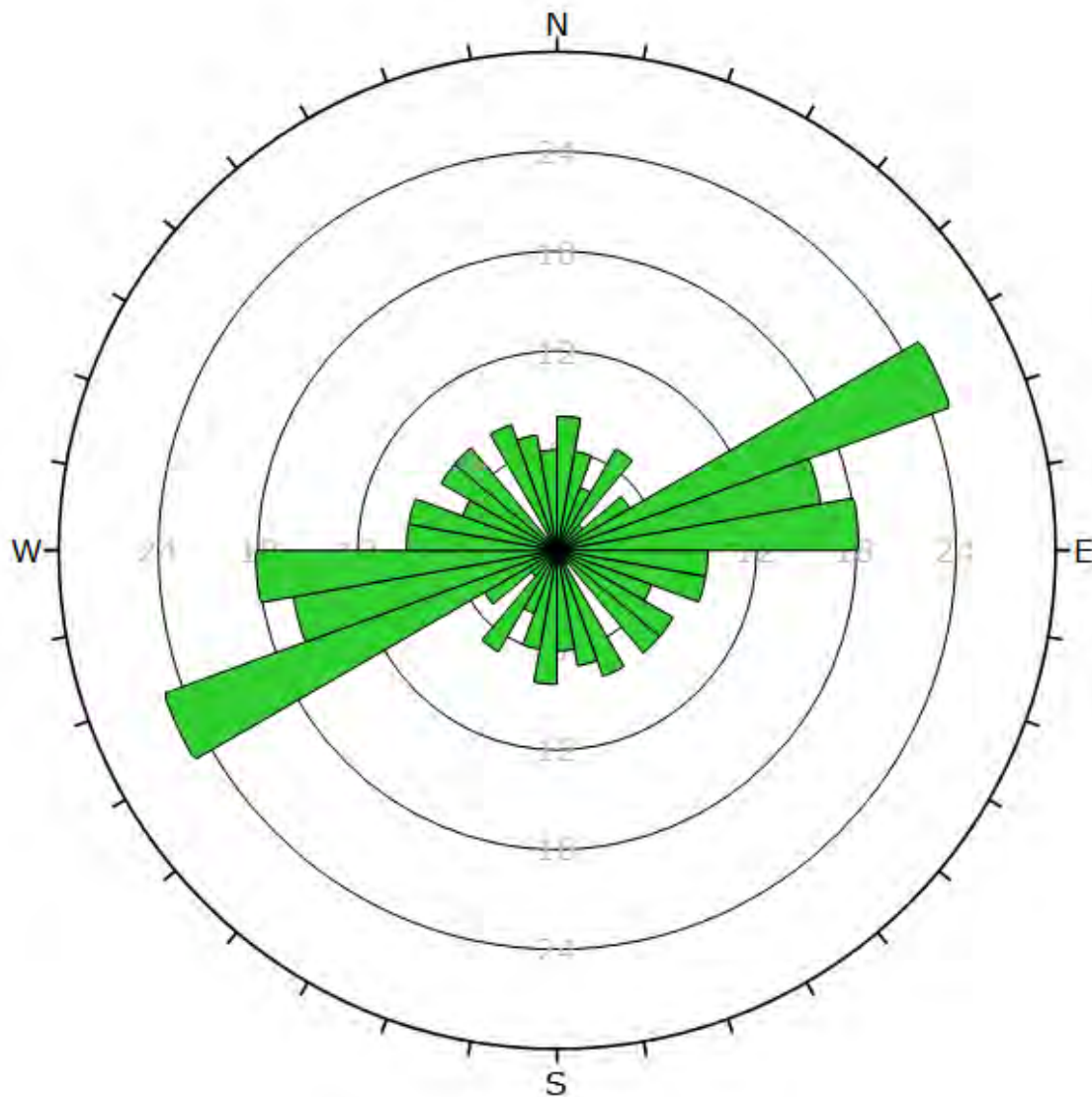
Symbol	RANK	Quantity
◊	Foliation / Vein	46
×	Fracture Rank 1	26
△	Fracture Rank 2	29
+	Fracture Rank 3	7
▽	Fracture Rank 4	8
□	[no data]	35

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 <

Contour Data	Pole Vectors
Maximum Density	12.63%
Contour Distribution	Fisher
Counting Circle Size	1.0%

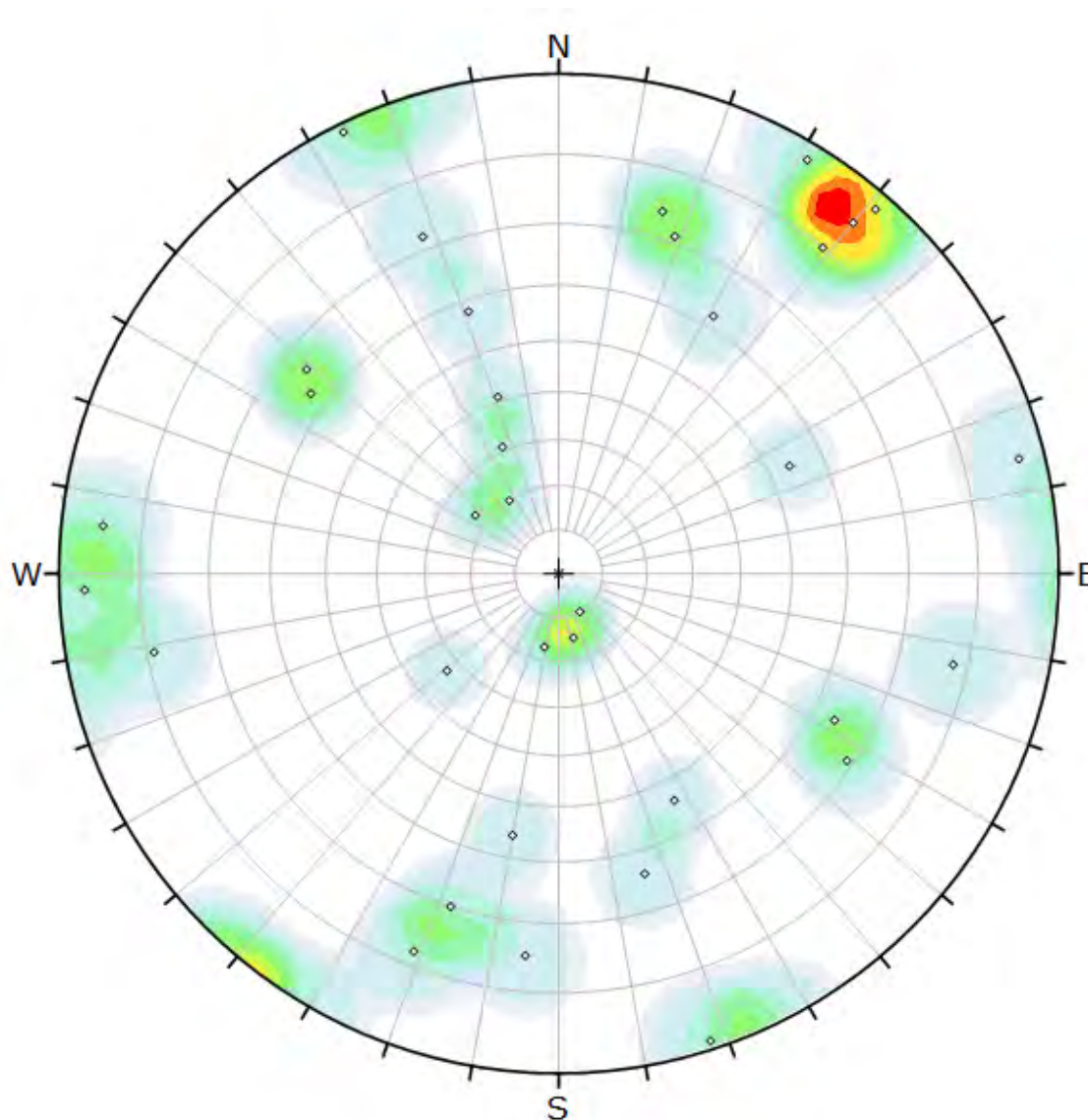
Plot Mode	Pole Vectors
Vector Count	153 (153 Entries)
Hemisphere	Lower
Projection	Equal Angle

FIG. 4B – STEREONET OUTPUT GRAPHICS:
 ALL DATA COMBINED (STRIKE ROSETTE)



Plot Mode	Rosette
Plot Data	Apparent Strike
Face Normal Trend	0.0
Face Normal Plunge	90.0
Bin Size	10°
Outer Circle	30 planes per arc
Planes Plotted	153
Minimum Angle To Plot	0.0°
Maximum Angle To Plot	90.0°

FIG. 4C – STEREONET OUTPUT GRAPHICS:
 FIELD SURFACE OUTCROP MAPPING DATA (POLES)



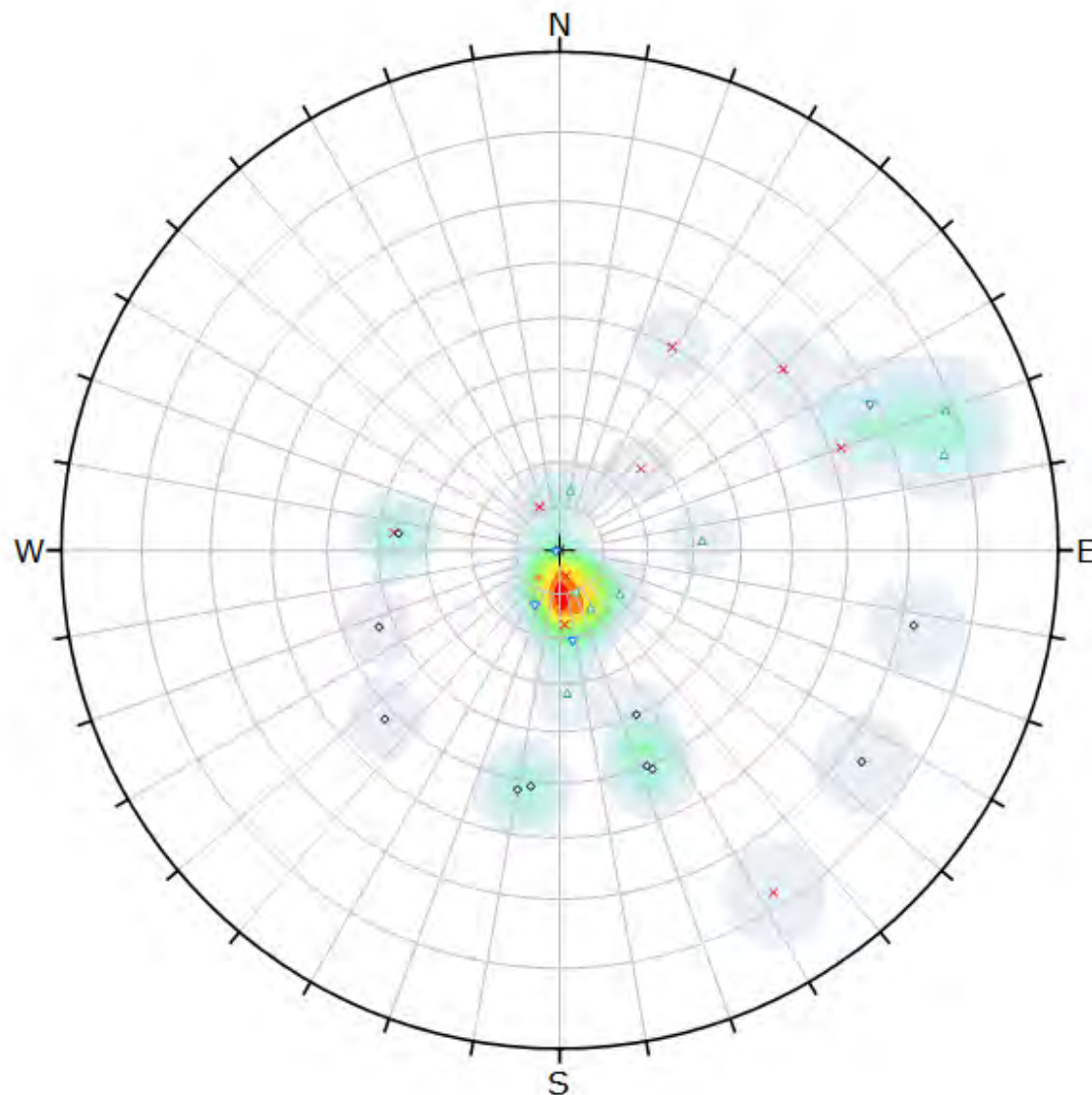
Symbol	Feature
◊	Pole Vectors

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00

Contour Data	Pole Vectors
Maximum Density	9.65%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	35 (35 Entries)
Hemisphere	Lower
Projection	Equal Angle

FIG. 4D – STEREONET OUTPUT GRAPHICS:
 DATA FROM TV LOG B-206, SYMBOLIC POLE PLOT



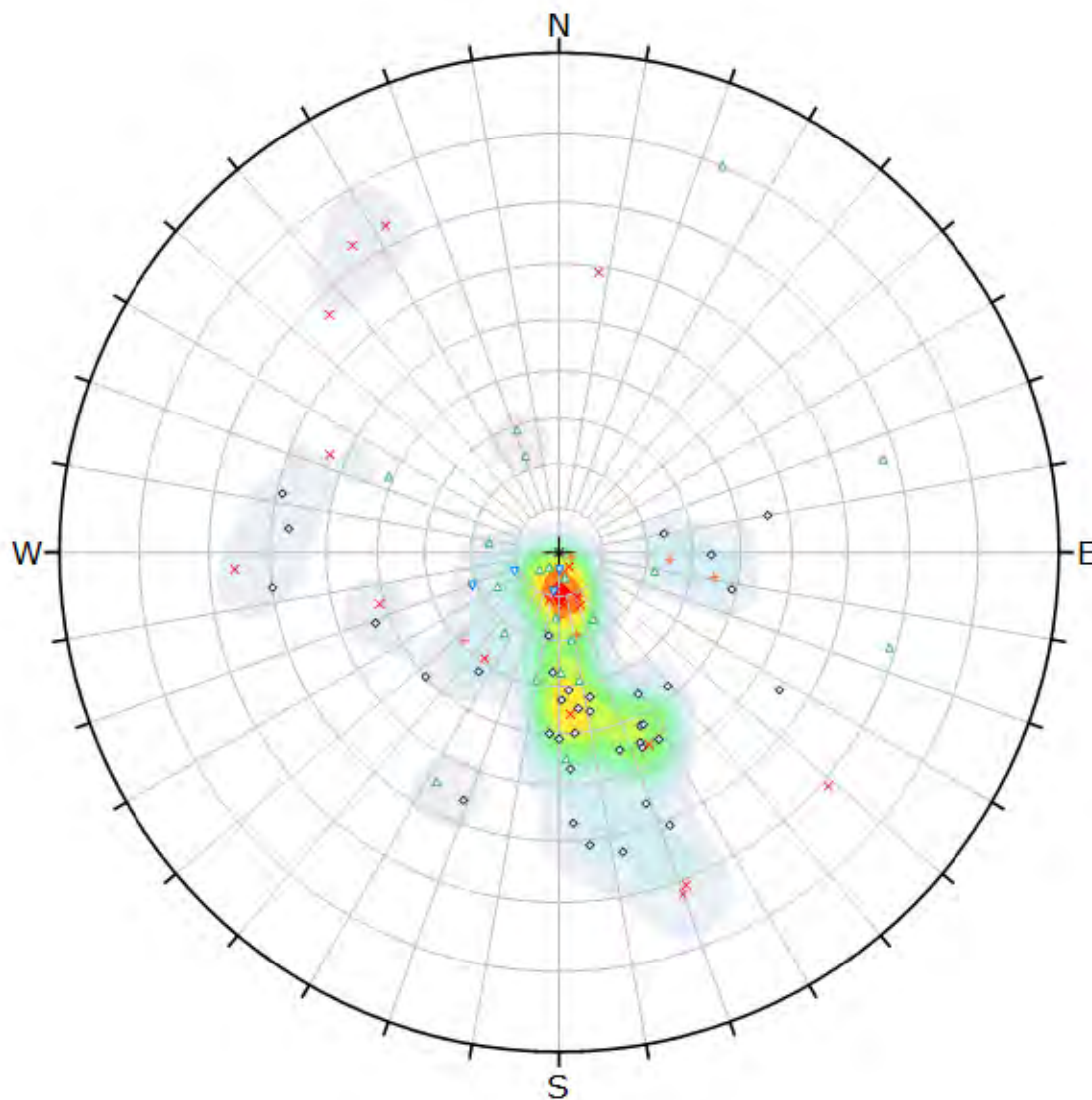
Symbol	RANK	Quantity
◇	Foliation / Vein	10
×	Fracture Rank 1	9
△	Fracture Rank 2	8
+	Fracture Rank 3	2
▽	Fracture Rank 4	4

Color	Density Concentrations
	0.00 ~ 1.80
	1.80 ~ 3.60
	3.60 ~ 5.40
	5.40 ~ 7.20
	7.20 ~ 9.00
	9.00 ~ 10.80
	10.80 ~ 12.60
	12.60 ~ 14.40
	14.40 ~ 16.20
	16.20 ~ 18.00

Contour Data	Pole Vectors
Maximum Density	17.32%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	33 (33 Entries)
Hemisphere	Lower
Projection	Equal Angle

FIG. 4E – STEREONET OUTPUT GRAPHICS:
 DATA FROM TV LOG B-208, SYMBOLIC POLE PLOT



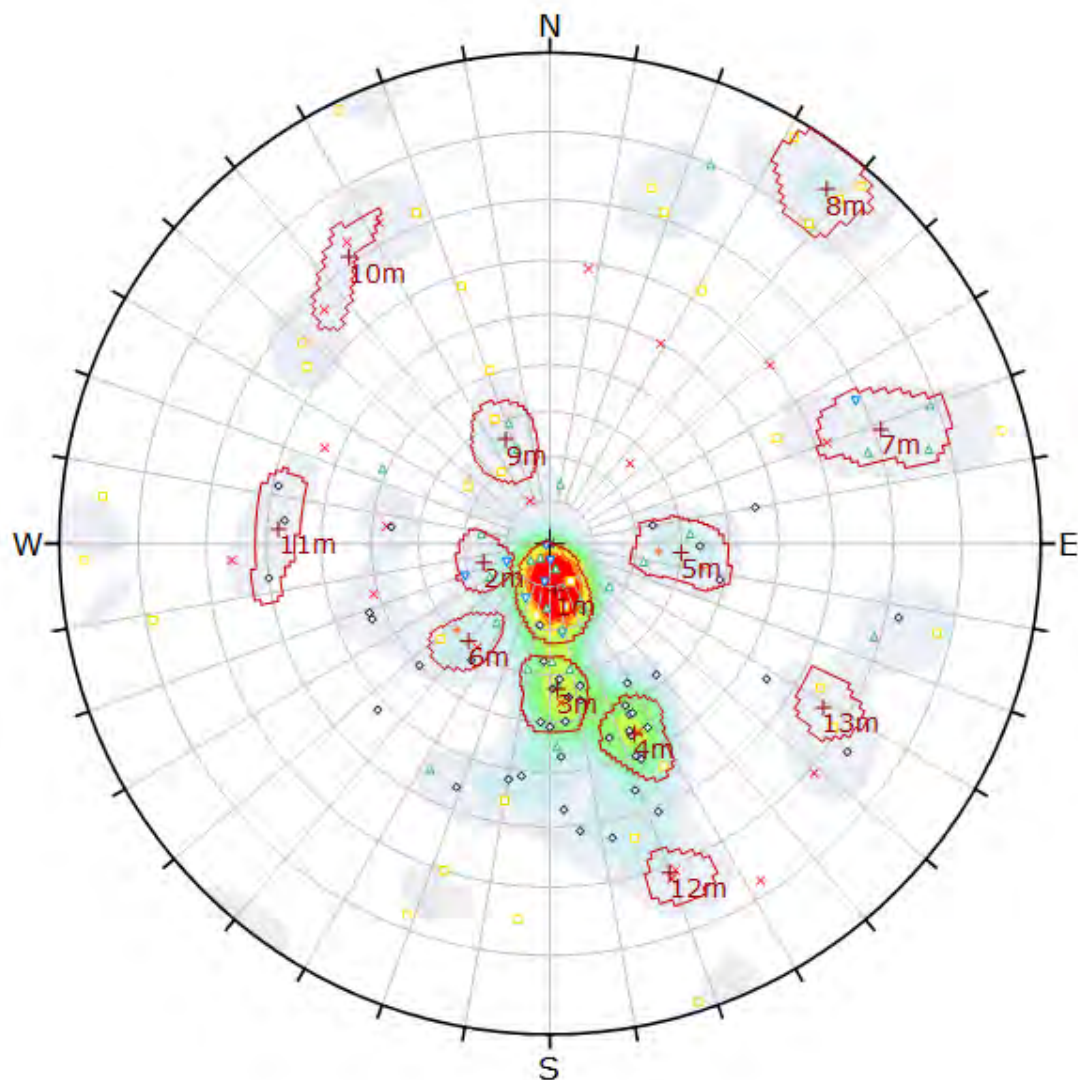
Symbol	RANK	Quantity
◇	Foliation / Vein	38
×	Fracture Rank 1	19
△	Fracture Rank 2	21
+	Fracture Rank 3	5
▽	Fracture Rank 4	4

Color	Density Concentrations
	0.00 – 1.40
	1.40 – 2.80
	2.80 – 4.20
	4.20 – 5.60
	5.60 – 7.00
	7.00 – 8.40
	8.40 – 9.80
	9.80 – 11.20
	11.20 – 12.60
	12.60 – 14.00

Contour Data	Pole Vectors
Maximum Density	13.57%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	85 (85 Entries)
Hemisphere	Lower
Projection	Equal Angle

FIG. 4F – STEREONET OUTPUT GRAPHICS:
 POSSIBLE SETS, NO CIRCLES



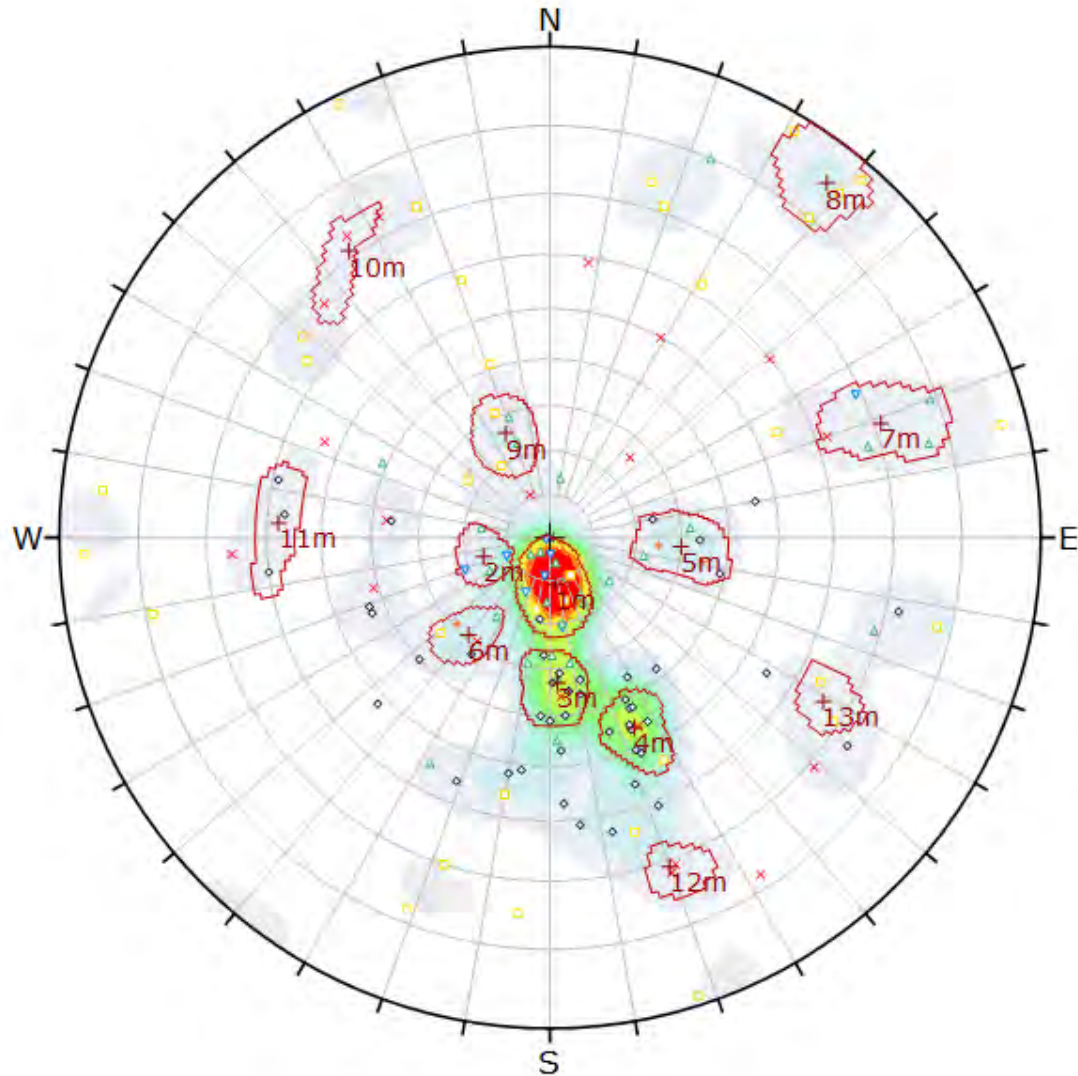
Symbol	RANK	Quantity
○	Foliation / Vein	46
×	Fracture Rank 1	28
△	Fracture Rank 2	29
+	Fracture Rank 3	7
▽	Fracture Rank 4	8
□	[no data]	35

Color	Density Concentrations
	0.00 ~ 1.00
	1.00 ~ 2.00
	2.00 ~ 3.00
	3.00 ~ 4.00
	4.00 ~ 5.00
	5.00 ~ 6.00
	6.00 ~ 7.00
	7.00 ~ 8.00
	8.00 ~ 9.00
	9.00 <

Contour Data	Pole Vectors
Maximum Density	12.63%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	153 (153 Entries)
Hemisphere	Lower
Projection	Equal Angle

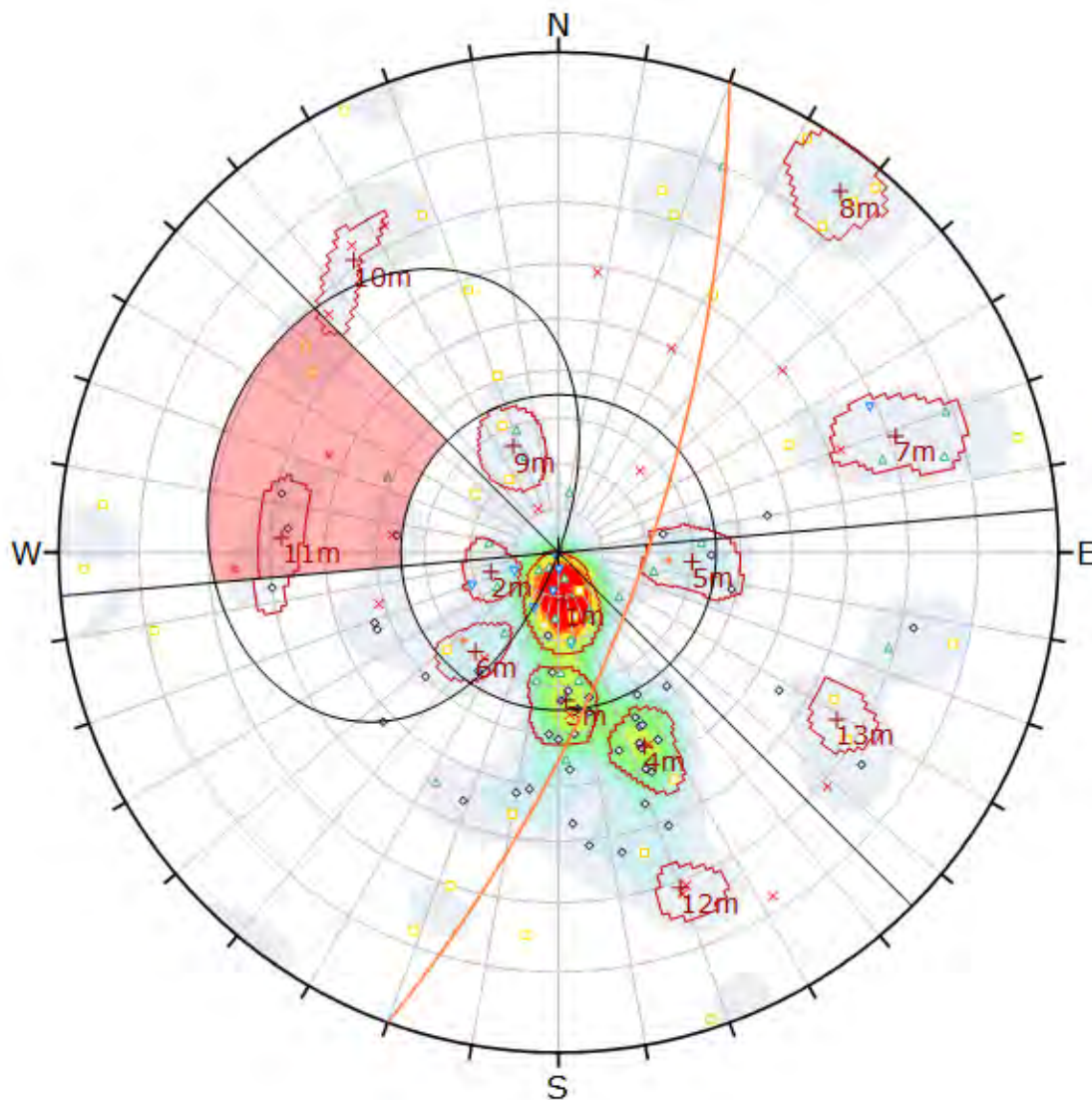
FIG. 4G – STEREONET OUTPUT GRAPHICS:
 POSSIBLE SETS, NO CIRCLES



Mean Set Planes

ID	Dip	Dip Direction	Label
1m	10.61	354.08	1
2m	15.53	73.76	2
3m	33.37	356.95	3
4m	46.05	336.00	4
5m	29.94	273.70	5
6m	28.83	40.18	6
7m	70.96	251.04	7
8m	85.24	217.75	8
9m	25.64	156.56	9
10m	70.88	144.78	10
11m	58.42	93.29	11
12m	71.50	339.50	12
13m	66.48	300.55	12

FIG. 4H – STEREONET OUTPUT GRAPHICS:
 PLANAR SLIDING AT STRIKE 20 DEG. AZ.



Symbol	RANK	Quantity
◇	Foliation / Vein	46
×	Fracture Rank 1	28
△	Fracture Rank 2	29
+	Fracture Rank 3	7
▽	Fracture Rank 4	8
□	[no data]	35

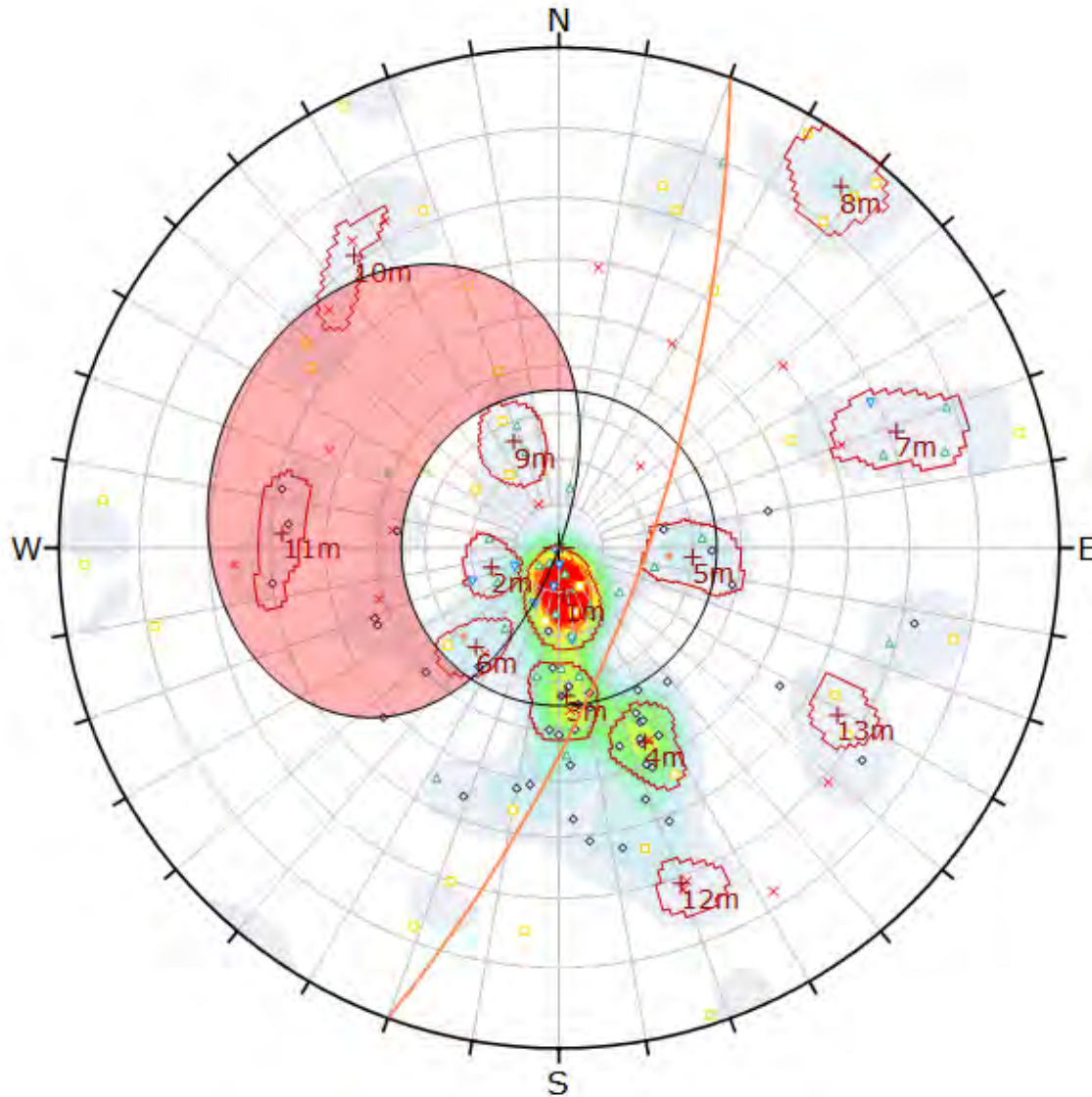
Color	Density Concentrations	
	0.00	1.00
	1.00	2.00
	2.00	3.00
	3.00	4.00
	4.00	5.00
	5.00	6.00
	6.00	7.00
	7.00	8.00
	8.00	9.00
	9.00	<

Contour Data	Pole Vectors
Maximum Density	12.63%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Planar Sliding			
Slope Dip	71			
Slope Dip Direction	110			
Friction Angle	35°			
Lateral Limits	25°			
	Critical	Total	%	
Planar Sliding (All)	9	153	5.88%	
Planar Sliding (Set 11: 11)	2	3	66.67%	

Plot Mode	Pole Vectors
Vector Count	153 (153 Entries)
Hemisphere	Lower
Projection	Equal Angle

FIG. 4I – STEREONET OUTPUT GRAPHICS:
PLANAR SLIDING AT STRIKE 20 DEG. AZ. (NO LIMITS)



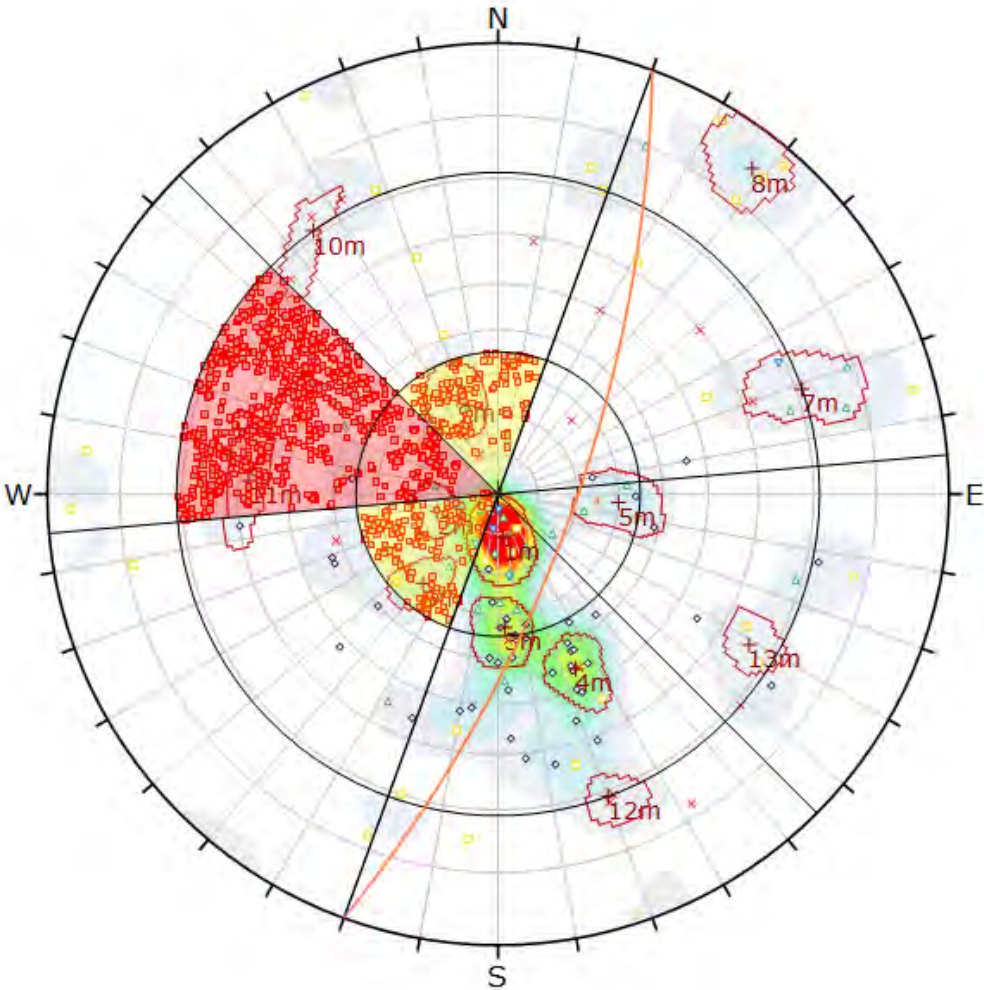
Symbol	RANK	Quantity
◇	Foliation / Vein	46
×	Fracture Rank 1	28
△	Fracture Rank 2	29
+	Fracture Rank 3	7
▽	Fracture Rank 4	8
□	[no data]	35

Color	Density Concentrations	
	0.00	1.00
	1.00	2.00
	2.00	3.00
	3.00	4.00
	4.00	5.00
	5.00	6.00
	6.00	7.00
	7.00	8.00
	8.00	9.00
	9.00	<
Contour Data		
Pole Vectors		
Maximum Density		
12.63%		
Contour Distribution		
Fisher		
Counting Circle Size		
1.0%		

Kinematic Analysis		Planar Sliding		
Slope Dip		71		
Slope Dip Direction		110		
Friction Angle		35°		
		Critical	Total	%
Planar Sliding (All)		17	153	11.11%
Planar Sliding (Set 10: 10)		1	3	33.33%
Planar Sliding (Set 11: 11)		3	3	100.00%

Plot Mode		Pole Vectors	
Vector Count		153 (153 Entries)	
Hemisphere		Lower	
Projection		Equal Angle	

FIG. 4J – STEREONET OUTPUT GRAPHICS:
DIRECT/OBLIQUE TOPPLING AT CUT STRIKE AZIMUTH 20 DEG.

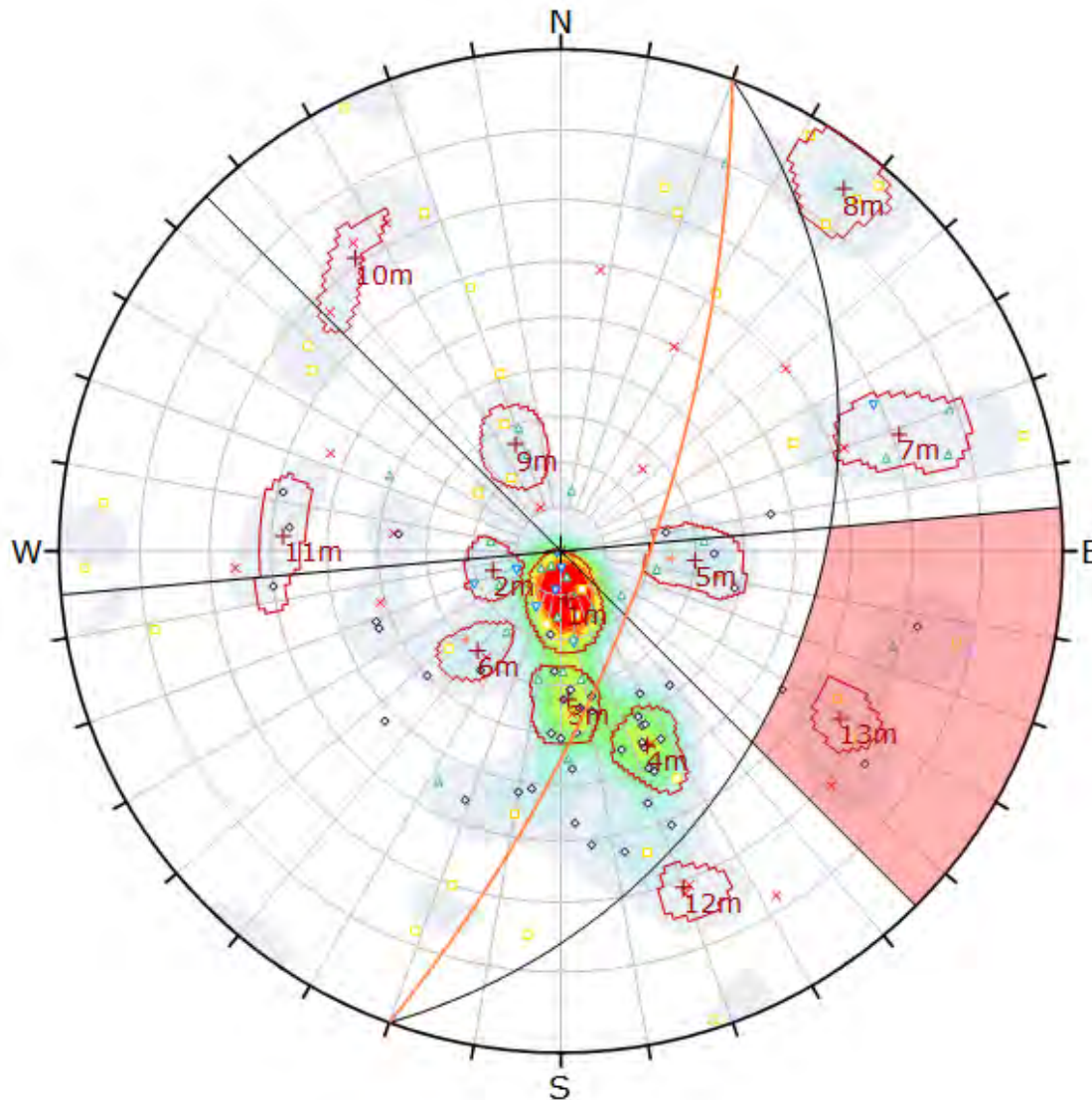


Symbol	RANK	Quantity
◊	Foliation / Vein	46
✕	Fracture Rank 1	26
△	Fracture Rank 2	29
⬢	Fracture Rank 3	7
⬢	Fracture Rank 4	8
□	[no data]	35
Symbol	Feature	
■	Critical Intersection	

Color	Density Concentrations	
	0.00	1.00
	1.00	2.00
	2.00	3.00
	3.00	4.00
	4.00	5.00
	5.00	6.00
	6.00	7.00
	7.00	8.00
	8.00	9.00
	9.00	<
Contour Data		Pole Vectors
Maximum Density		12.63%
Contour Distribution		Fisher
Counting Circle Size		1.0%

Kinematic Analysis	Direct Toppling		
Slope Dip	71		
Slope Dip Direction	110		
Friction Angle	35°		
Lateral Limits	25°		
	Critical	Total	%
Direct Toppling (Intersection)	1110	11626	9.55%
Oblique Toppling (Intersection)	307	11626	2.64%
Base Plane (All)	30	153	19.61%
Base Plane (Set 1: 1)	5	29	17.24%
Base Plane (Set 2: 2)	4	4	100.00%
Base Plane (Set 6: 6)	5	5	100.00%
Base Plane (Set 9: 9)	4	4	100.00%
Base Plane (Set 11: 11)	2	3	66.67%
Pivot Mode	Pole Vectors		
Vector Count	125 (125 Poles)		

FIG. 4K – STEREONET OUTPUT GRAPHICS:
 FLEXURAL TOPPLING AT CUT STRIKE AZIMUTH 20 DEG.



Symbol	RANK	Quantity
◇	Foliation / Vein	48
×	Fracture Rank 1	28
△	Fracture Rank 2	29
+	Fracture Rank 3	7
▽	Fracture Rank 4	8
□	[no data]	35

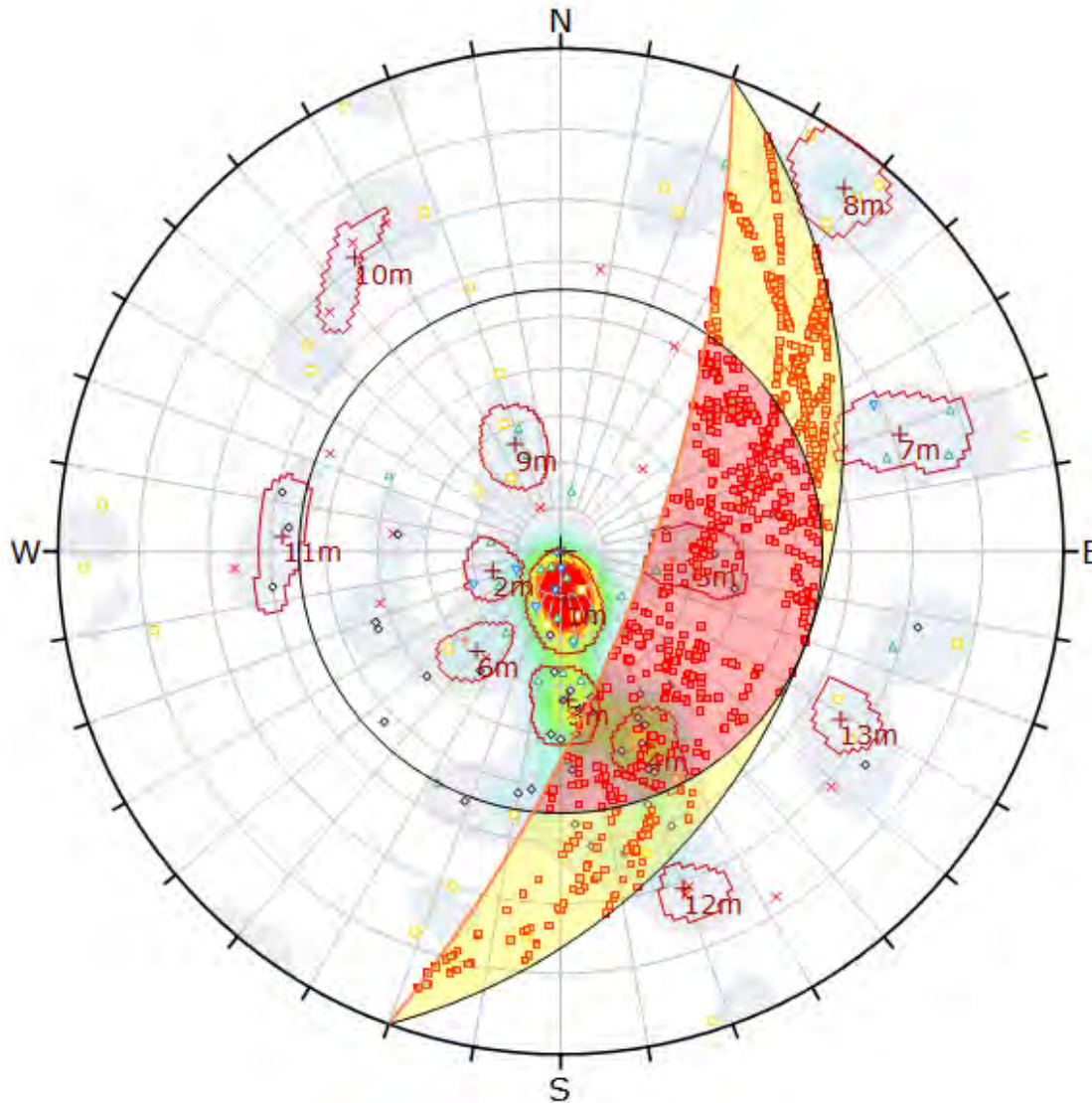
Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 <

Contour Data	Pole Vectors
Maximum Density	12.63%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Flexural Toppling		
Slope Dip	71		
Slope Dip Direction	110		
Friction Angle	35°		
Lateral Limits	25°		
	Critical	Total	%
Flexural Toppling (All)	8	153	5.23%
Flexural Toppling (Set 13: 12)	2	2	100.00%

Plot Mode	Pole Vectors
Vector Count	153 (153 Entries)
Hemisphere	Lower
Projection	Equal Angle

FIG. 4L – STEREONET OUTPUT GRAPHICS:
 WEDGE INTERSECTIONS AT CUT STRIKE AZ. 20 DEG.



Symbol	RANK	Quantity
◇	Foliation / Vein	48
×	Fracture Rank 1	28
△	Fracture Rank 2	29
+	Fracture Rank 3	7
▽	Fracture Rank 4	8
□	[no data]	35
Symbol	Feature	
■	Critical Intersection	

Color	Density Concentrations
	0.00 – 1.00
	1.00 – 2.00
	2.00 – 3.00
	3.00 – 4.00
	4.00 – 5.00
	5.00 – 6.00
	6.00 – 7.00
	7.00 – 8.00
	8.00 – 9.00
	9.00 <

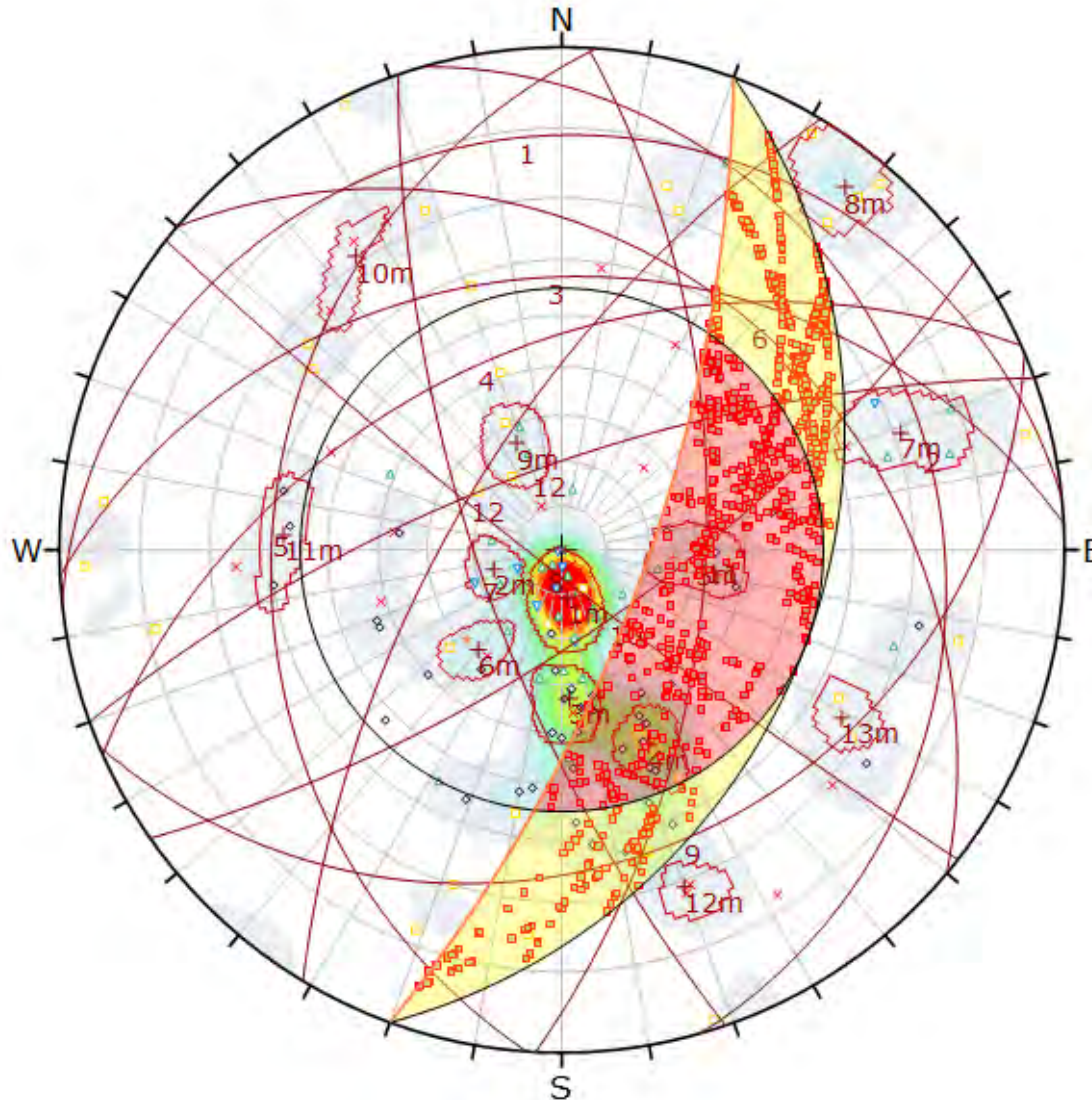
Contour Data	Pole Vectors
Maximum Density	12.63%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding
Slope Dip	71
Slope Dip Direction	110
Friction Angle	35°

	Critical	Total	%
Wedge Sliding	1019	11628	8.76%

Plot Mode	Pole Vectors
Vector Count	153 (153 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	11628
Hemisphere	Lower
Projection	Equal Angle

FIG. 4M – STEREONET OUTPUT GRAPHICS:
 WEDGE INTERSECTIONS & PLANES AT CUT STRIKE AZ. 20 DEG.



Symbol	RANK	Quantity
◇	Foliation / Vein	46
×	Fracture Rank 1	28
△	Fracture Rank 2	29
●	Fracture Rank 3	7
▽	Fracture Rank 4	8
□	[no data]	35
Symbol	Feature	
■	Critical Intersection	

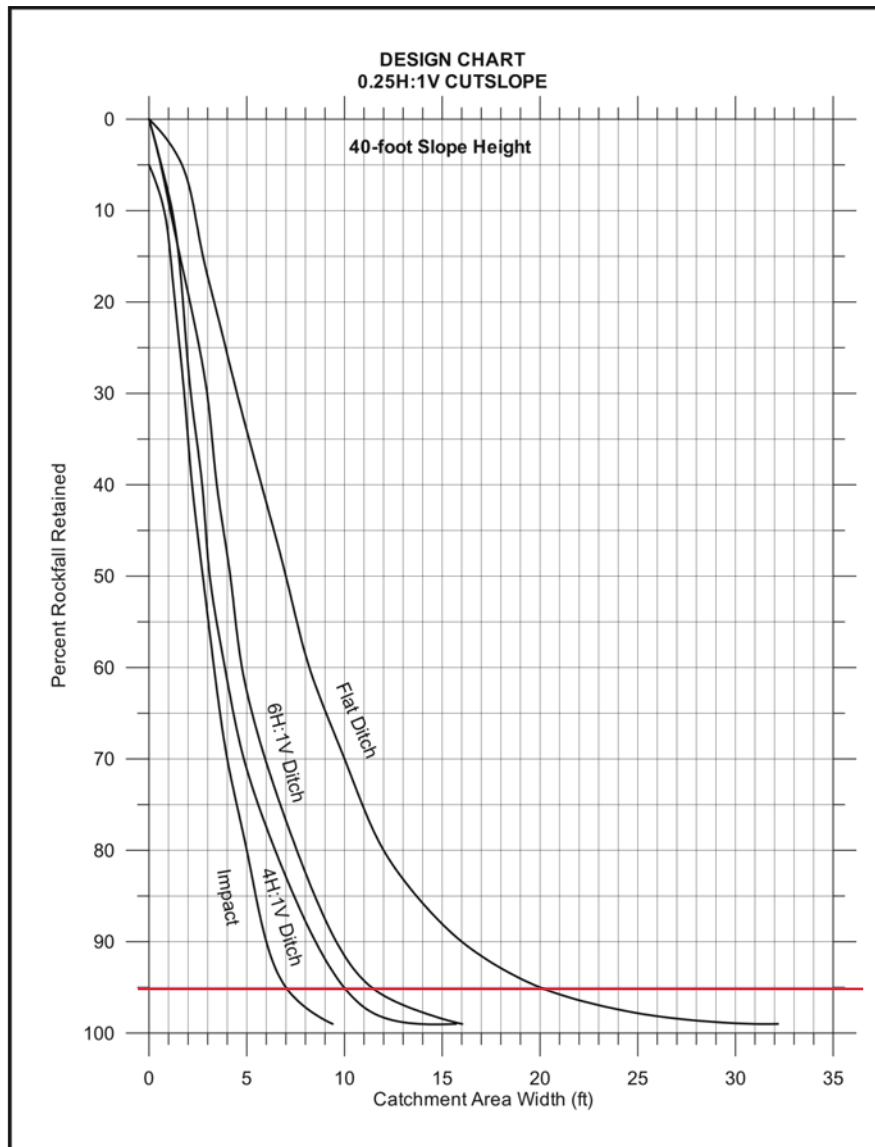
Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 <
Contour Data	
Maximum Density	
Contour Distribution	
Counting Circle Size	
Pole Vectors	
12.63%	
Fisher	
1.0%	

Kinematic Analysis	Wedge Sliding		
Slope Dip	71		
Slope Dip Direction	110		
Friction Angle	35°		
	Critical	Total	%
Wedge Sliding	1019	11628	8.78%

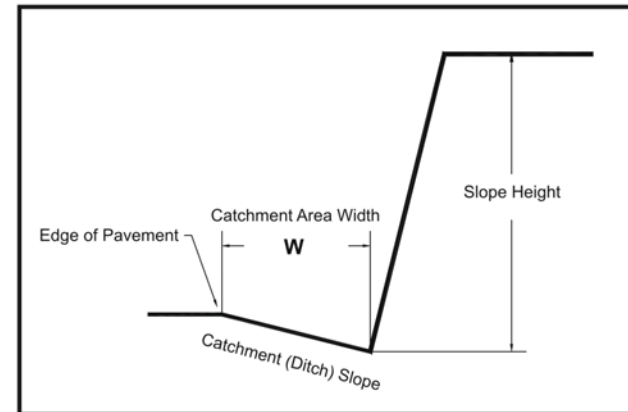
Plot Mode	Pole Vectors
Vector Count	153 (153 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	11628
Hemisphere	Lower
Projection	Equal Angle

ATTACHMENT NO. 5

ODOT/FHWA CATCHMENT GUIDE DESIGN CHARTS

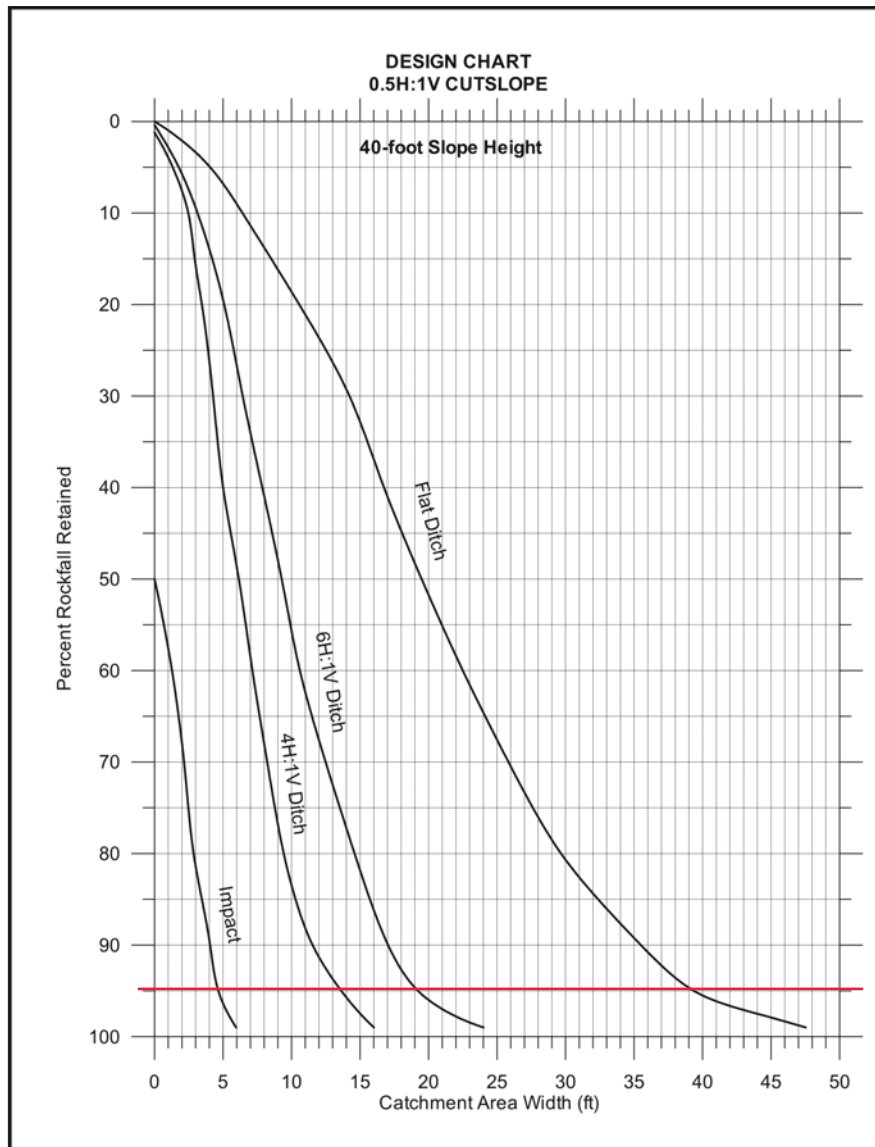


1. Report No. FHWA/OR-RD-02-04	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle ROCKFALL CATCHMENT AREA DESIGN GUIDE Final Report	5. Report Date November 2001	6. Performing Organization Code
7. Author(s) Lawrence A. Pierson, C.E.G., Landslide Technology, Portland, OR, USA C. Fred Gullixson, C.E.G., GeoHydro Section, Oregon Dept. of Transportation Ronald G. Chaoie, P.E., Geotechnical Engineer, FHWA (Retired)	8. Performing Organization Report No. SPR-032	

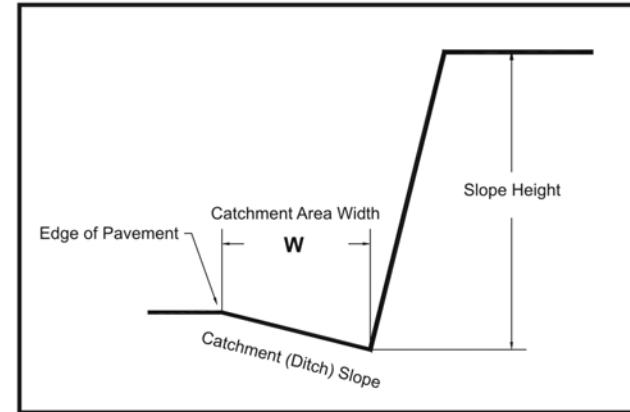


Quick Reference - 40-Ft Slope Catchment Area Width - W				
Percent Rockfall Retained	Impact W (ft)	Catchment Area Slope		
		4H:1V W (ft)	6H:1V W (ft)	Flat W (ft)
50%	3	3	4	7
75%	4	6	7	11
80%	5	6	8	12
85%	5	7	8	14
90%	6	9	10	16
95%	7	10	11	20
99%	9	16	16	32

Figure 5.6: Design chart for 40-foot high 0.25H:1V cutslopes



1. Report No. FHWA/OR-RD-02-04	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle ROCKFALL CATCHMENT AREA DESIGN GUIDE Final Report	5. Report Date November 2001	6. Performing Organization Code
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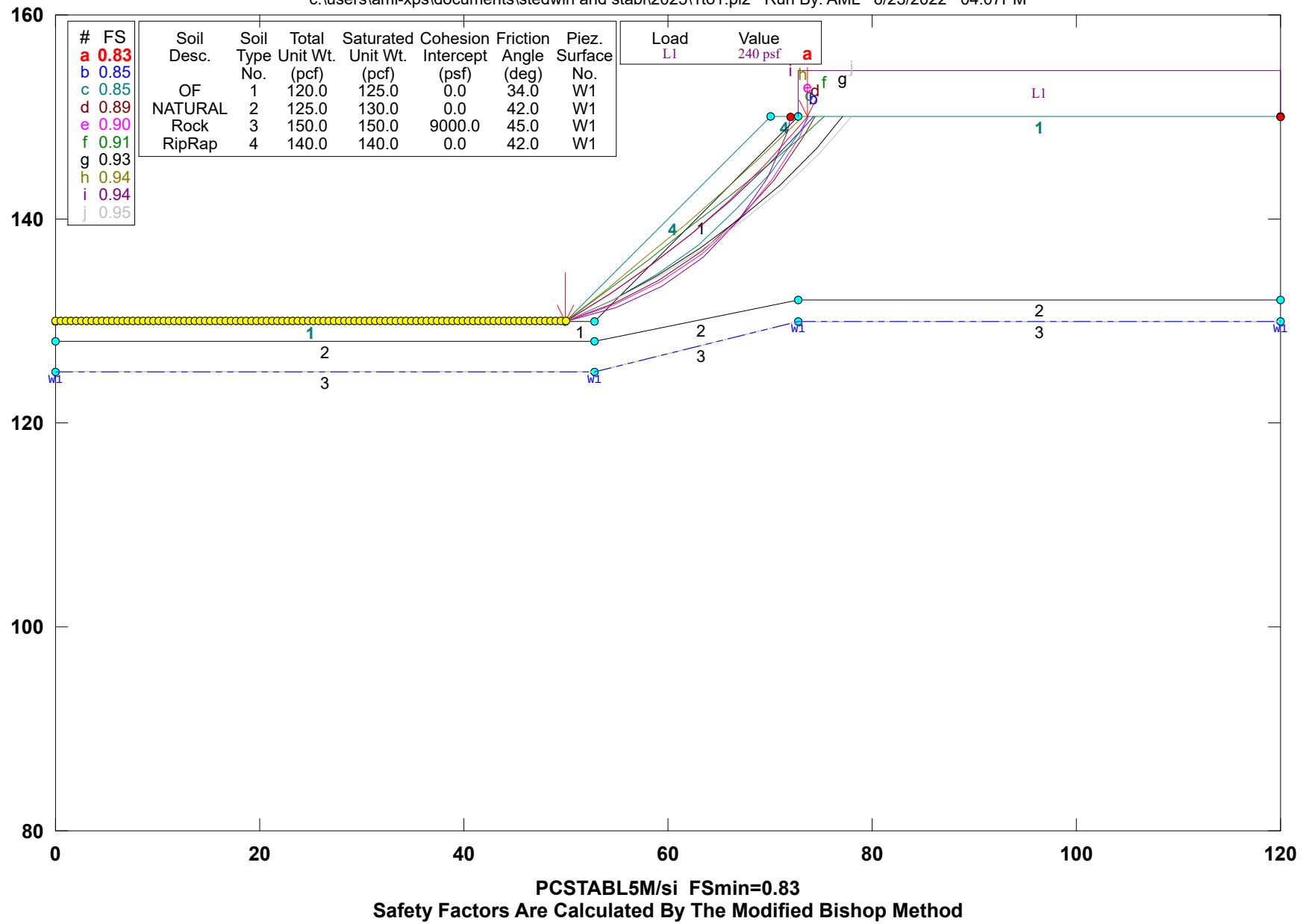


Quick Reference - 40-Ft Slope Catchment Area Width - W				
Percent Rockfall Retained	Impact W (ft)	Catchment Area Slope		
		4H:1V W (ft)	6H:1V W (ft)	Flat W (ft)
50%	0	6	9	19
75%	2	9	14	28
80%	3	9	15	30
85%	3	10	16	32
90%	4	11	17	35
95%	5	14	19	39
99%	6	16	24	48

Figure 5.11: Design chart for 40-foot high 0.5H:1V cutslopes

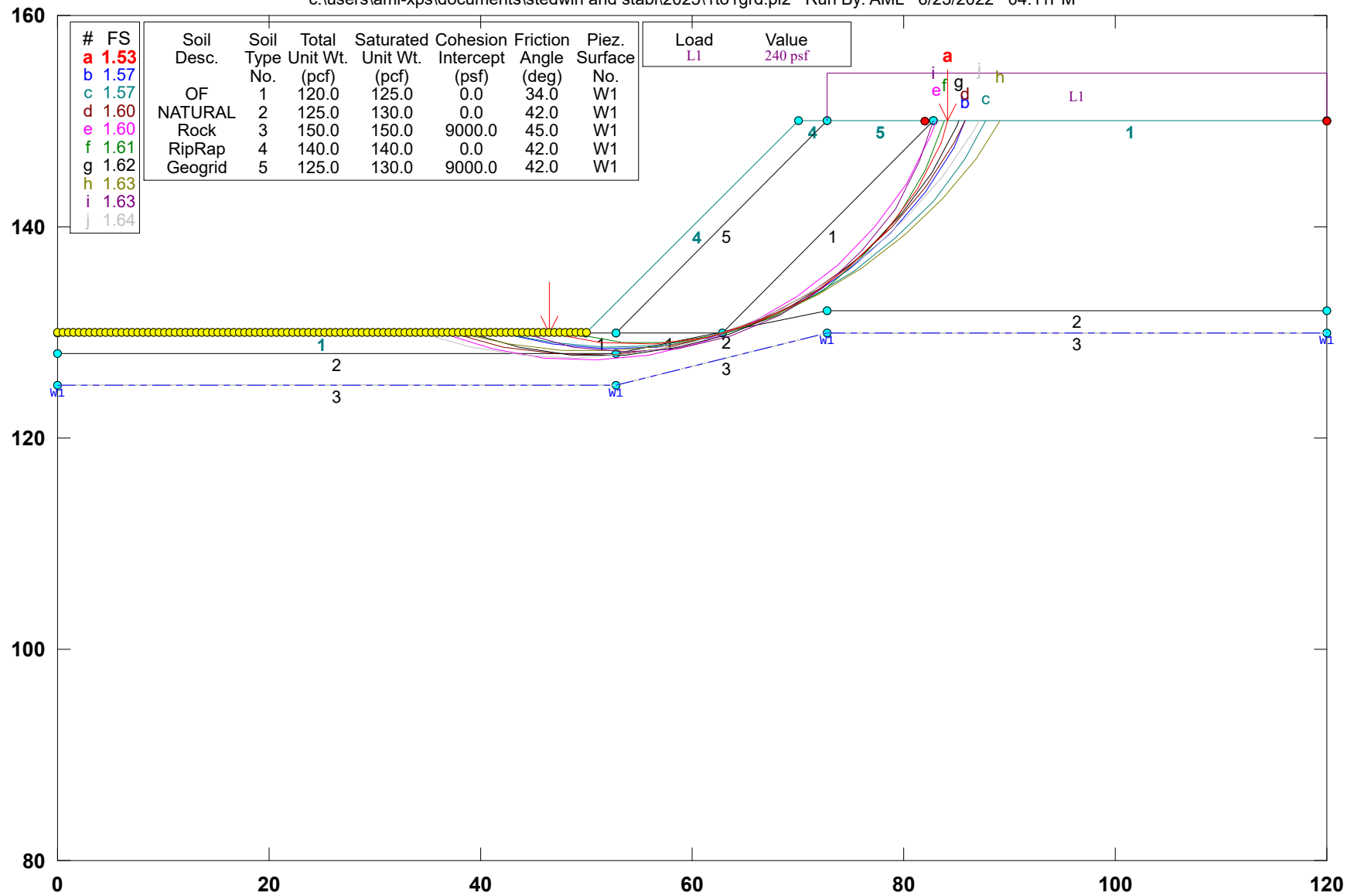
Appendix K – Results of Slope Stability Analyses

c:\users\aml-xps\documents\stedwin and stabl\2025\1to1.pl2 Run By: AML 6/23/2022 04:07PM



Fill Slope on Eastern Side of Site Rip-rapped at 1H:1V with Geogrid

c:\users\aml-xps\documents\stedwin and stabl\2025\1to1grd.pl2 Run By: AML 6/23/2022 04:11PM



PCSTABL5M/si FSmin=1.53
Safety Factors Are Calculated By The Modified Bishop Method



CDW CONSULTANTS, INC.
CIVIL & ENVIRONMENTAL ENGINEERS

HAZARDOUS MATERIALS SUMMARY REPORT

**Northeast Metropolitan Technical Vocational High School
100 Hemlock Road
Wakefield, MA 01880**

Prepared for

Drummey Rosane Anderson, Inc.
235 Bear Hill Road, 4th Floor
Waltham, MA 02451

April 2020

CDW Project # 1893.0



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TABLES

Table 1:	ACM Quantities
Table 2:	OHM Quantities

APPENDICES

Appendix A:	Asbestos Laboratory Reports
Appendix B:	Lead Paint Laboratory Reports



1.0 INTRODUCTION

CDW Consultants, Inc. (CDW) is pleased to present this Hazardous Materials Summary Report summarizing the findings of the suspect asbestos-containing materials (ACM) and lead-based paint (LBP) and hazardous materials inspection of the Northeast Metropolitan Technical Vocational High School (“Site”) located in Wakefield, Massachusetts. The ACM, LBP and hazardous materials survey were conducted in support of a Feasibility Study for school renovations. In February and March 2020, Ms. Susan Cahalan (Massachusetts DLS Asbestos Inspector #AI60784) conducted an inspection for suspect materials. An inspection is required by the United States Environmental Protection Agency (USEPA) Title 40 CFR Part 61 National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation and Massachusetts Department of Environmental Protection (MassDEP) Regulation 310 CMR 7.15. These regulations require that buildings be inspected for ACM prior to renovation/demolition projects.

2.0 PROJECT UNDERSTANDING

The hazardous materials inspection was conducted in support of a Feasibility Study for the Northeast Metropolitan Technical Vocational High School. The hazardous building material survey was conducted to identify ACM, LBP, visible hazardous materials including mercury switches, transformers, light ballasts, fluorescent tubes, and other visible hazardous materials connected to building systems. Electronic wastes are not part of building systems and will not be counted. This study excludes sampling for poly-chlorinated biphenyl (PCB) containing building materials.

3.0 GENERAL SITE CONDITIONS

CDW reviewed Plans prepared by Korslund, LeNormand & Quann, Inc. and dated November 24, 1967, the Massachusetts School Board Authority (MSBA) Statement of Interest and our observations for this summary. Northeast Metropolitan Regional Vocational High School, is a grades 9-12 comprehensive vocational and technical high school that is approximately 240,000 square feet which provides academic and vocational programs for approximately 1,250 students from twelve surrounding communities. The school is located on a 30-acre plot at 100 Hemlock Road in Wakefield, Massachusetts. On-site west and north of the building are a football/track field with grandstand, basketball courts, baseball/softball fields and a practice field. The Site building was built in 1968, with a small storage outbuilding constructed in 1975. Apart from minor alterations and construction of other small storage outbuildings, there have not been any significant renovations, additions, or improvements. The flat EPDM roofs were replaced in 1980.

The lowest level floor is a concrete slab-on-grade. The portion of the first floor above the basement is a 12-inch thick reinforced concrete flat slab supported on wide flange steel columns. The primary roof structure throughout the building consists steel bar joists supported on masonry bearing walls on the interior as well as the perimeter with a 2-inch poured gypsum deck. The Gymnasium roof consists of pre-cast concrete supported on pre-cast concrete beams on masonry bearing walls. The



typical second floor framing is a 2 ½-inch concrete slab on form deck supported on steel bar joists spanning between interior and exterior masonry walls. The pool roof is a concrete slab on metal deck supported on reinforced concrete pool walls and exterior walls. The basic exterior wall type is brick veneer over concrete masonry unit (CMU) back-up.

The majority of exterior doors are hollow metal with metal frames. Typical windows throughout the building are aluminum frames with a hopper-style, operable sash and non- insulated single pane glass. They are the original windows based on record drawings. Fiberglass-faced, insulated, translucent panels are located in the shop spaces and gymnasium.

Numerous types of flooring in various conditions were found throughout the Site building. Terrazzo flooring is located at the entrances, corridors, cafeteria and at shower bases in girl's locker room. Vinyl floor tile is located throughout the building in classrooms and administration spaces. Wood flooring is located in the gymnasium, stage in cafetorium, and platform flooring in a couple of rooms and the carpentry shop. Carpeted areas include the library, conference rooms and offices. Ceramic tile floors are located in locker rooms, the pool deck, and bathrooms. Red quarry tile is located in the main kitchen and student kitchen. Concrete slab flooring is located in the food storage area, loading dock, shop spaces, boiler room and area beneath the pool deck.

Walls also vary throughout the building. Some corridors, stair wells, the cafeteria and platform opening have brick walls with terrazzo base. Concrete Masonry corridors are painted CMU in good condition. The shop spaces also have painted and non-painted walls. Classroom spaces consist of 6" metal stud with metal lath and painted plaster finish. The pool, bathrooms and kitchen/food service area have 4"x4" ceramic wall tile and water fountains found in hallways are marked by the mosaic wall tile behind. Fiberglass reinforced panels are located in the weight room. A few offices in the administrative area have wood paneling. Moveable partition walls were noted in 2nd floor classrooms.

Acoustical ceiling tile are 2'x2' acoustical dropped ceiling systems with steel grids. The classrooms and cafetorium have 1'x1' suspended ceiling tiles. Shop spaces have exposed structural trusses revealing the gypsum roof deck system above. This system consists of gypsum concrete over formboards supported by a wire mesh system.

There are two (2) Cleaver Brooks CB 655-350 350 boiler horsepower fire-tube hot water boilers, which burn No. 4 fuel oil. These boilers are original to the building. Original #4 fuel oil UST supplies the oil burners. The UST is monitored by a Veeder Root TLS350 leak detection and monitoring system. The classroom areas are provided with individual wall mounted classroom unit ventilators located on the exterior wall of each space with adjacent fin tube radiation. All the unit ventilators, as well as fin tube, are served by the hot water heating system. The pool heating system has been mothballed and anti-freeze added to the piping system. The pool was heated by a cast iron boiler firing propane. The shops contain heating and ventilating units with roof mounted fresh air hoods. The Site building has a propane fired interior generator manufactured by Kohler.

Most of the building is air conditioned except for the gym and shop areas. A 255-ton electric chiller



was installed in 1995. The chiller connects to an open cooling tower located on the roof. The chiller is a Trane RTHA 255 screw chiller utilizing R-22 refrigerant.

Underground electricity runs into the vault that contains the transformer is housed. Switch gear is located in the adjoining electric room. Lighting fixtures throughout the Site building consist of retrofitted T8 lamps and electronic ballasts, T12 lamps and magnetic ballasts, recessed lighting in corridors, the gym has metal halide lamps, the Cafetorium has recessed LED lamps and the stage has incandescent fixtures.

Water piping that is visible is copper tubing with fiberglass insulation. Sanitary, waste, and vent piping is cast iron bell and some of the connections have lead packing. Natural gas is provided to the building for kitchen equipment, science classrooms and abandoned pool heating equipment.

4.0 ASBESTOS SURVEY

4.1 Report Review April 16, 2015

CDW Reviewed the Universal Environmental Consultants Hazardous Materials Summary Report dated May 2015. The materials collected and results are provided in the below tables.

April 16, 2015

Material and Location

Result

Exterior unit vent grille caulking	No Asbestos Detected
Exterior window framing caulking	No Asbestos Detected
Exterior window framing caulking	No Asbestos Detected
Exterior unit vent grille caulking	No Asbestos Detected
Exterior window framing caulking	No Asbestos Detected
Exterior window glazing caulking	No Asbestos Detected
Exterior door framing caulking	No Asbestos Detected
Exterior door framing caulking	No Asbestos Detected
Exterior window glazing caulking	8% Asbestos
Exterior window framing caulking	No Asbestos Detected
Exterior door framing caulking	No Asbestos Detected
Exterior window glazing caulking	8% Asbestos
Exterior caulking on window panel	No Asbestos Detected
Exterior glue daub on window panel	No Asbestos Detected
Exterior window framing caulking	No Asbestos Detected
Exterior unit vent grille caulking	5% Asbestos
Exterior window glazing caulking	No Asbestos Detected
Exterior window framing caulking	No Asbestos Detected
Exterior window glazing caulking	8% Asbestos
Exterior door framing caulking	No Asbestos Detected
Exterior window glazing caulking	No Asbestos Detected
Exterior window framing caulking	No Asbestos Detected
Exterior expansion joint caulking	No Asbestos Detected
Exterior concrete soffit fascia	No Asbestos Detected
Exterior caulking on window panel	No Asbestos Detected



April 22, 2015

Material and Location	Sample Result
Interior window glazing caulking at pool	No Asbestos Detected
Interior window glazing caulking at hallway by room 154	2% Asbestos
Interior window glazing caulking at room 158	2% Asbestos
Interior door glazing caulking at room 107	2% Asbestos
Interior door glazing caulking at room 104	2% Asbestos
Fire door insulation at cafeteria	60% Asbestos
Fire door insulation at cafeteria	60% Asbestos
1'x 1' Acoustical ceiling tile at room 135	No Asbestos Detected
1'x 1' Acoustical ceiling tile at room 157	No Asbestos Detected
2'x 2' Acoustical ceiling tile at break room	No Asbestos Detected
2'x 2' Acoustical ceiling tile at room 107	No Asbestos Detected
2'x 4' Acoustical ceiling tile at room 011	No Asbestos Detected
2'x 4' Acoustical ceiling tile at room 011	No Asbestos Detected
Plaster at room 120	No Asbestos Detected
Plaster at room 120	No Asbestos Detected
Plaster at room 126	No Asbestos Detected
Plaster at room 126	No Asbestos Detected
Plaster at room 128	No Asbestos Detected
Plaster at room 128	No Asbestos Detected
Plaster at room 128	No Asbestos Detected
Wall joint compound at room 152	No Asbestos Detected
Wall joint compound at room 152	No Asbestos Detected
Black sink coating at break room	5% Asbestos
Black sink coating at break room	5% Asbestos
Pink sink coating at room 153	3% Asbestos
Pink sink coating at room 153	3% Asbestos
White sink coating at room 019	No Asbestos Detected
White sink coating at room 019	No Asbestos Detected
Old lab countertop at room 123	No Asbestos Detected
Old lab countertop at room 123	No Asbestos Detected
Lab table at room 012	No Asbestos Detected
Lab table at room 012	No Asbestos Detected
Vertical caulking between block and column at room 162	5% Asbestos
Vertical caulking between block and column at room 162	5% Asbestos
Vertical caulking between block and block at gymnasium	No Asbestos Detected
Vertical caulking between block and block at gymnasium	No Asbestos Detected
Black mastic on fiberglass insulated pipe at mechanical room	No Asbestos Detected
Black mastic on fiberglass insulated pipe at mechanical room	No Asbestos Detected
Boiler gasket at boiler room	No Asbestos Detected



Material and Location	Sample Result
Boiler gasket at boiler room	No Asbestos Detected
Boiler exhaust insulation at boiler room	20% Asbestos
Boiler exhaust insulation at boiler room	20% Asbestos
Boiler exhaust insulation at boiler room	30% Asbestos
Generator exhaust insulation at generator room	3% Asbestos
Generator exhaust insulation at generator room	40% Asbestos
Generator exhaust insulation at generator room	30% Asbestos
Hard joint insulation off fiberglass pipe at pool mechanical room	No Asbestos Detected
Hard joint insulation off fiberglass insulated pipe at room 153	No Asbestos Detected
Hard joint insulation off fiberglass insulated pipe at room 158	No Asbestos Detected
Hard joint insulation off fiberglass insulated pipe at room 158	No Asbestos Detected
Hard joint insulation off fiberglass pipe at mechanical room	No Asbestos Detected
Cement floor at library	No Asbestos Detected
Cement floor at library	No Asbestos Detected
Beige 12" x 12" vinyl floor tile at room 128	3% Asbestos
Beige 12" x 12" vinyl floor tile at room 128	3% Asbestos
Black mastic for beige 12" x 12" vinyl floor tile at room 128	3% Asbestos
Black mastic for beige 12" x 12" vinyl floor tile at room 128	10% Asbestos
Brown 12" x 12" vinyl floor tile at room 155	3% Asbestos
Brown 12" x 12" vinyl floor tile at room 158	No Asbestos Detected
Brown 12" x 12" vinyl floor tile at room 158	2% Asbestos
Black mastic for brown 12" x 12" vinyl floor tile at room 155	10% Asbestos
Black mastic for brown 12" x 12" vinyl floor tile at room 158	10% Asbestos
Dark grey 12" x 12" vinyl floor tile at room 103	No Asbestos Detected
Dark grey 12" x 12" vinyl floor tile at room 103	No Asbestos Detected
Pink 12" x 12" vinyl floor tile at office	No Asbestos Detected
Pink 12" x 12" vinyl floor tile at office	No Asbestos Detected
Light blue 12" x 12" vinyl floor tile at room 010	No Asbestos Detected
Light blue 12" x 12" vinyl floor tile at room 010	No Asbestos Detected
White/green 12" x 12" vinyl floor tile at room 018	No Asbestos Detected
White/green 12" x 12" vinyl floor tile at room 018	No Asbestos Detected
Black mastic for white/green 12" x 12" vinyl floor tile at room 018	<1% Asbestos
Black mastic for white/green 12" x 12" vinyl floor tile at room 018	2% Asbestos
Yellow/blue 12" x 12" vinyl floor tile at room 019	No Asbestos Detected
Yellow/blue 12" x 12" vinyl floor tile at room 019	No Asbestos Detected
Black/white 12" x 12" vinyl floor tile at room 120	No Asbestos Detected
Black/white 12" x 12" vinyl floor tile at room 120	No Asbestos Detected
Blue 12" x 12" vinyl floor tile at room 161	No Asbestos Detected
Blue 12" x 12" vinyl floor tile at room 161	No Asbestos Detected
Tan 12" x 12" vinyl floor tile at room 120	2% Asbestos
Tan 12" x 12" vinyl floor tile at room 120	2% Asbestos
Black mastic for tan 12" x 12" vinyl floor tile at room 120	10% Asbestos
Black mastic for tan 12" x 12" vinyl floor tile at room 120	10% Asbestos



Material and Location	Sample Result
White/tan specks 12" x 12" vinyl floor tile at room 135	No Asbestos Detected
White/tan specks 12" x 12" vinyl floor tile at room 135	No Asbestos Detected
Black mastic for white/tan specks 12" x 12" floor tile at room 135	10% Asbestos
Black mastic for white/tan specks 12" x 12" floor tile at room 135	No Asbestos Detected
White/blue and red flecks 12" x 12" vinyl floor tile at room 151	No Asbestos Detected
White/blue and red flecks 12" x 12" vinyl floor tile at room 151	No Asbestos Detected
White/blue spots 12" x 12" vinyl floor tile at room 126	No Asbestos Detected
White/blue spots 12" x 12" vinyl floor tile at room 126	No Asbestos Detected
Slate window sill at room 126	5% Asbestos
Slate window sill at room 128	15% Asbestos
Interior caulking for exterior window	3% Asbestos
Interior caulking for exterior window	3% Asbestos

4.2 Methods

The USEPA and Massachusetts Department of Environmental Protection (MassDEP) are responsible for developing and enforcing regulations necessary to protect the general public from airborne contaminants that are known to be hazardous to human health. They regulate ACM associated with renovation, demolition, and asbestos abatement projects via the National Emissions Standard for Hazardous Air Pollutants (NESHAP) Title 40 CFR Part 61 regulation and MassDEP Regulation 310 CMR 7.15. These regulations require that buildings be inspected for ACM prior to renovation/demolition projects. They stipulate that all friable ACM as well as non-friable ACM that are in poor condition or will be made friable by renovation or demolition activity be removed or otherwise appropriately abated before they are disturbed. Samples of suspect materials were collected to confirm the presence or absence of ACM and LBP. Suspect materials were grouped into homogenous areas. A homogenous area is an area that is similar in color, texture and date of application. Hand tools were used to collect bulk samples which were promptly placed in sealed plastic bags using a unique numbering system. Samples were not collected of non-suspect materials, including wood, fiberglass, plastic/vinyl, ceramic, concrete, neoprene/rubber, glass, and carpeting.

The investigative work for the asbestos survey included conducting a visual inspection of physically accessible areas of the structure, reviewing plans and coring and repairing brick to observe any vapor barrier, as well as the roof for suspect materials. Once the inspection was completed, the building components were categorized into homogeneous areas. These homogeneous areas included: surfacing materials, thermal system insulation, and miscellaneous materials. CDW collected bulk samples of different homogeneous suspect materials for asbestos analysis. The bulk samples were delivered under chain of custody to Asbestos Identification Laboratory, Inc. (AIL), of Woburn, Massachusetts, fully accredited asbestos analytical laboratories, analyzed the bulk samples utilizing Polarized Light Microscopy (PLM) in accordance with the requirements of 40 CFR Part 763, Subpart F. Samples analyzed to contain greater than 1% asbestos are to be treated as ACM as defined by the USEPA and MassDEP. A positive stop method was used – if one sample in a



homogeneous group is positive then additional samples of the same material are not analyzed. The asbestos analytical reports are provided in Appendix A.

4.3 Findings

Field ID	Material	Location	Asbestos %
Roof-1A	Tan Paper Top + Bottom Roof Foam	Top of Roof Foam NW Core Wood Shop	None Detected
Roof-1B	Dark Gray Paper	Bottom Foam NW Core Wood Shop	None Detected
Roof-1C	Black Asphaltic Layer	Top of Roof Deck Gypsum NW Core Wood Shop	None Detected
Roof-1D	Gypsum Deck	Roof Core-NE Wood Shop	None Detected
Roof-2A	Gray Paper Top + Bottom Foam	Roof Core-North Over Auto	None Detected
Roof-2B	Asphaltic Layer	Roof Core-North Over Auto	None Detected
Roof-2C	Gypsum Deck	Roof Core-North Over Auto	None Detected
Roof-3A	Gray Paper Top + Bottom Foam	Roof Core-Low Roof Near Gym	None Detected
Roof-3B	Asphaltic Layer	Roof Core Low Roof Near Gym	None Detected
Roof-3C	Gypsum Roof Deck	Roof Core Low Roof Near Gym	None Detected
Roof-4	Gray Paper	Roof Expansion Joint N Side	None Detected
Roof-5A	Gray Paper Top + Bottom Foam	SW Roof Near Front	None Detected
Roof-5B	Asphaltic Layer	Roof-NW Near Core Front	None Detected
Roof-5C	Gypsum	Roof Deck-Core SW	None Detected
Roof-6A	Tan Paper Top + Bottom Foam	Top Pool/Gym Roof	None Detected
Roof-6B	White + Gray Membrane	Top Pool/Gym Roof	None Detected



Field ID	Material	Location	Asbestos %
Roof-6C	Gypsum Roof Deck	Top Pool/Gym Roof	None Detected
Roof-7A	Gray Paper Top + Bottom Roof Foam	Low Roof-Front	None Detected
Roof-7B	Asphaltic Layer	Low Roof-Front	None Detected
Roof-7C	Gypsum Deck	Low Roof-Front	None Detected
Roof-8A	DK Gray/Black Paper Top + Bottom Roof Foam	Roof-Middle Front	None Detected
Roof-8B	Asphaltic Layer	Roof Core Middle Front	None Detected
Roof-8C	Gypsum	Roof Deck Middle Front	None Detected
Roof-9A	Gray Paper Top + Bottom Roof Foam	Main Entrance Roof	None Detected
Roof-9B	Asphaltic Layer	Core- Main Entrance Roof	None Detected
Roof-9C	Gypsum	Roof Deck-Main Entrance Roof	None Detected
Roof-10A	Gray Paper Top + Bottom Roof Foam	Roof Core Center	None Detected
Roof-10B	Asphaltic Layer	Roof Core Center	None Detected
Roof-10C	Gypsum	Roof Deck-Roof Core Center	None Detected
Roof-11A	Gray Paper Top + Bottom Roof Foam	Roof Over Kitchen Cage	None Detected
Roof-11B	Asphaltic Layer	Roof Over Kitchen Café	None Detected
Roof-11C	Gypsum Deck	Roof Over Kitchen Café	None Detected
Roof-12A	Dark Gray Paper Top + Bottom Roof Foam	Sloped Roof	None Detected
Roof-12B	Asphaltic Layer	Sloped Roof	20% Chrysotile
Roof-12C	Gypsum	Sloped Roof	None Detected
Roof-13A	Gray Paper Top + Bottom Foam	Sloped Roof	None Detected



Field ID	Material	Location	Asbestos %
Roof-13B	Asphaltic Layer	Curb Cut at Chimney	None Detected
Roof-13C	Gypsum Deck	Curb Cut at Chimney	None Detected
Roof-13D	Black Tar	Curb Cut at Chimney Original Tar (Old)	None Detected
Roof-14A	Gray Paper Top + Bottom Foam	Front Older Roof	None Detected
Roof-14B	Asphaltic Layer	Front Older Roof	None Detected
Roof-14C	Gypsum Deck	Front Older Roof	None Detected
Roof-15A	Gray Paper Top + Bottom Foam	Front Older Roof	None Detected
Roof-15B	Asphaltic Material	Older Front Roof	None Detected
Roof-15C	Gypsum Deck	Older Front Roof	None Detected
1A, 1B, 1C	Gray Caulk	On Metal Flashing Wood Shop to Low Roof	2% Chrysotile
2A, 2B, 2C, 2D, 2E	Gray Window Glaze	Exterior at Frosted Windows Roof Level Gym and Shops	10% Chrysotile
3A, 3B, 3C, 3D, 3E	White Caulk	Gym Window Roof Level	None Detected
4A, 4B, 4C, 4D, 4E	Tan/Pinkish Hue Over Black Expansion Join	Gym Upper Level	None Detected
5A, 5B, 5C	White Caulk on Silicone	Roof Stand Pipe Vents	None Detected
6A, 6B, 6C	Black Brittle Tar	On Metal Flash Entrance Roof Top Lower Roof	None Detected
7A, 7B, 7C	Black Caulk	Around Roof Drains	None Detected
8A, 8B, 8C	White Caulk	On Steel Vents Near Chimney	None Detected
9A, 9B, 9C	Dark Gray Caulk	Inside Roof Drain Under Rubber	None Detected
10, 10B	Black Caulk	Corner of Chimney	5% Chrysotile



Field ID	Material	Location	Asbestos %
11A, 11B	Black Bumper Material	Kitchen Loading Dock	None Detected
12A, 12B	Gray Caulk	Around Large Vent Near Kitchen Dock	None Detected
13A, 13B	Interior Gray Window Glaze	Office in Kitchen	5% Chrysotile
14A, 14B, 14C	Gray/Black Mastic	Under Red Ceramic Tile in Kitchen	None Detected
15A, 15B, 15C	2'X2' Pindot + Fissure Ceiling Tile	Kitchen Storage	None Detected
16A, 16B, 16C	White Mastic	Under Ceramic Wall Tile Kitchen	None Detected
17A, 17B, 17C	Yellowish Grout	Under Ceramic Wall Tile, Kitchen	None Detected
18A, 18B, 18C, 18D, 18E	White Plaster	Kitchen Ceiling	None Detected
19A, 19B	Interior Door Assembly Window Glaze	Near Door 109	2% Chrysotile
20	White Material	Inside Wood Door Near 109	15% Chrysotile 10% Amosite
21A, 21B, 21C, 21D, 21E	Tan Expansion Joint-Vertical	Exterior Pool, Gym Near Front and Kitchen	None Detected
22A, 22B	Gray Caulk	Exterior Door #02	None Detected
23A, 23B	Gray White Caulk	Exterior Door #23	None Detected
24A	Black Window Glaze on Metal Door	Door #02	None Detected
25A, 25B	Gray Window Glaze	Side Light Windows Door #02	3% Chrysotile
26A, 26B	Gray Window Glaze, Exterior Windows	Door #23	3% Chrysotile
27A, 27B, 27C	White Caulk	Exterior Univents	3% Chrysotile



Field ID	Material	Location	Asbestos %
28	Interior Door Material	Next to Main Office Assembly	None Detected
29	Interior Door Material	Assembly Near Dental	None Detected
30	Interior Door Material	Gym Door	None Detected
31	Interior Tan Door Material	Door 104	None Detected
32	Interior Tan Door Material	Door 107	None Detected
33	Gray Glaze	Interior Door Window Above Room 107	2% Chrysotile
34	Gray Glaze on Interior Window	On Wood Door 107	2% Chrysotile
35	Gray Glaze on Interior Window Glaze	On Door Room 121	2% Chrysotile
36	Gray Glaze Interior Window	Window Above Door Room 121	2% Chrysotile
37	Gray Window Glaze	Interior Hall Assembly Near 109	2% Chrysotile
38A, 38B	Gray Glaze	Interior Windows Main Office	None Detected
39A, 39B, 39C, 39D, 39E, 39F, 39G, 39H, 39I	2'X2' Tan/Brown Textured Ceiling Tile	All Hallways	None Detected
40A, 40B, 40C, 40D, 40E, 40F, 40G	1'X1' Ceiling Tile Dot + Small Fissures	Classrooms and Cafetorium-Spline Set	None Detected
41A, 41B, 41C	Black Vinyl Cove Base	Gym	None Detected
42A, 42B, 42C	Yellow Glue	Under Black Cove Base-Gym	None Detected
43A, 43B, 43C	Black Tar	On Gym Deck Under Wood	5% Chrysotile
44A, 44B, 44C	DK Gray Grout Under Stone Window Sills	123, 107, + 121 Classrooms	2% Chrysotile



Field ID	Material	Location	Asbestos %
45A, 45B, 45C	Stone (Slate) Window Sills	132, 107, + 121 Classrooms	5% Chrysotile
46A, 46B, 46C, 46D, 46E, 46F, 46G	Plaster Skim on Walls	Rooms 103, 104, 118, 123, 125, 121, + Dental	None Detected
47A, 47B, 47C, 47D, 47E, 47F, 47G	Black Mastic	Under Terrazzo Halls + Stairs	None Detected
48A, 48B, 48C	Black Mastic	Under Terrazzo in Cafeteria	None Detected
49A, 49B	Black Mastic	Under Wood on Stage in Cafetorium	None Detected
50A, 50B, 50C	DK Brown Vinyl Cove Base	Science- Chem. + Biology	None Detected
51A, 51B, 51C	White Mastic	Under DK Brown Vinyl Cove Base	None Detected
52A, 52B, 52C	Black Vinyl Cove Base	Base of Science Tables	None Detected
53A, 53B, 53C	Black/Brown Mastic	Under Black Vinyl Cove Base	None Detected
54A, 54B, 54C	Brown Glue Daubs	Behind Acoustical Panels- Pool	None Detected
55A, 55B, 55C, 55D, 55E	Tan Grout	Under Ceramic Wall Tile- Pool	None Detected
56A, 56B, 56C, 56D, 56E	White Mastic	Under Wall Ceramic Wall Tile- Pool	None Detected
57A, 57B, 57C, 57E, 57F	Gray Grout	Under Ceramic Tile on Pool Deck	None Detected
58A, 58B, 58C	Gray Mastic	Under Ceramic Tile on Pool Deck	None Detected
59A, 59B, 59C	White Expansion Joint	Interior Walls Pool Area	None Detected
60A, 60B, 60C	White Ceiling Plaster	Girls Locker Room	None Detected
61A, 61B, 6C	White Ceiling Plaster	Bots Locker Room	None Detected



Field ID	Material	Location	Asbestos %
62A, 62B, 62C	Gray Grout	Under Ceramic Floor Tile, Girls Locker Room	None Detected
63A, 63B, 63C	Dark Gray Mastic	Under Ceramic Floor Tile, Girls Locker Room	None Detected
64A, 64B, 64C, 64D, 64E, 64F, 64G	Gray Mastic	Under Ceramic Wall Tile-Hallways	None Detected
65A.1, 65B.1, 65C.1, 65D.1, 65E.1, 65F.1, 65G.1	White Plaster/Grout Mix	Under Ceramic Wall Tile in Hallways	None Detected
65A, 65B, 65C, 65D, 65E	Black Coating on Copper	Behind Brick Facade	10% Chrysotile
66A, 66B, 66C	Thin Copper Flashing with Black Coating	Top of Foundation Sill	None Detected
67A, 67B, 67C	Gray Concrete Skim Coat	Exterior Gym-Roof Level	None Detected
68A, 68B, 68C	Green Paper, Under Concrete Skim	Exterior Gym, Roof Level	None Detected

Chrysotile = Asbestos Mineral

Amosite= Asbestos Mineral

4.4 Recommendations

ACM that will be impacted by renovation or demolition work must be removed before they are disturbed. This work must be conducted in accordance with a project design as prepared by a licensed Asbestos Abatement Project Designer. This report is not intended for use as an abatement design. Prior to disturbance, the ACM identified must be abated by a Commonwealth of Massachusetts-licensed asbestos abatement contractor following all federal, state & local regulations governing asbestos abatement. A copy of the asbestos Waste Shipment record must be received within 35 days of removal from the Site. Asbestos air quality sampling must be conducted under USEPA regulations following asbestos abatement and prior to re-occupancy of the spaces. If additional materials are discovered that have not been sampled, those materials should be considered ACMs until laboratory analysis determines otherwise. During the course of renovation or demolition work, it is possible that additional suspect ACM will be encountered. Contractors should be apprised to conduct any such work in a controlled manner. If suspect materials that have not been sampled are encountered, they should be assumed to contain asbestos, unless appropriate sampling and analysis indicates otherwise.

If any identified ACM will remain in place, then the ACM should be managed under an Operations and Maintenance Plan (O&M Plan) so that they are not inadvertently disturbed. The O&M Plan



would include establishing a Program Manager, recordkeeping, employee and contractor notifications, periodic surveillance and training requirements.

Other Observations and Plans Review

Other observations during CDW's survey include:

- CDW dug holes next to foundation/slab, no mastic was observed.
- The coated copper flashing behind brick façade only goes up about 4-5 courses of brick, and was not found at the front of the building

CDW reviewed architectural plans prepared by CDW reviewed Plans prepared by Korslund, LeNormand & Quann, Inc. and dated November 24, 1967. Some notable items include:

- Drawing 6 shows fireproofing plaster on steel beams enclosed within CMU at A-103, A-109, A-130, A-136
- Typical classroom elevations show a pipe enclosure behind each uninvent
- Thru wall flashing is shown on several drawings in several locations, and is unknown if it contains ACM
- Plan #15 depicts firebrick lining inside chimney
- A pipe tunnel is shown in the pool area

5.0 LEAD-BASED PAINT

5.1 Methods

CDW performed a visual inspection of painted surfaces. CDW collected samples from different color paints on various types of building component substrates. Samples were submitted to EMSL Analytical in Cinnaminson, New Jersey for lead analysis via Atomic Absorption Spectrometry (AAS).

5.2 Findings

The analytical results revealed that four of the nine samples analyzed had detectable concentrations of lead. The Environmental Protection Agency (EPA) defines LBP as any paint or surface coating that contains lead equal to exceeding one milligram per square centimeter (1.0 mg/cm²) or 5,000 ppm by weight. OSHA has not set numerical threshold limits for lead and the OSHA lead-in-construction standard defines lead containing paint (LCP) as a paint or coating containing any detectable level of lead. Based on the EPA and OSHA criteria listed above, 17 samples are LCP and six samples are LBP. The lead paint analytical results are provided in the below table. The laboratory analytical report is included in Appendix B.



Sample ID	Site	Lead Concentration (% Weight)
LP-1	White Paint on Wood-Sloped Roof Under Soffit	2.5
LP-2	White Paint on Wood Main Roof	6.7
LP-3	Red Paint-Steel Window Lintel	0.3
LP-4	Gray Paint on Roof Stair Rail	12
LP-5	Tan Door Paint on Metal Door #23	0.034
LP-6	Brown Paint Metal Door Assembly #23	0.068
LP-7	Brown Paint on Metal HVAC Ext. Near Kitchen	0.0084
LP-8	Tan Paint on Wood Garage Door	0.1
LP-9	Brown Paint Metal Door U2	0.12
LP-10	Brown Over Red Stair Rail Paint	20
LP-11A	White Textured Paint on Concrete- Front	0.035
LP-11B	White Textured Paint on Concrete- Front	0.013
LP-12	Tan Paint Ext. Metal Door	<0.008
LP-13	Brown Over Red Metal Door Assembly 109	0.42
LP-14	Pink- White Paint- Hall on CMU	0.0094
LP-15	Gray Paint Metal Door Dental	<0.008
LP-16	White Parking Stripe Paint Rear Near Kitchen	0.02
LP-17A	Yellow Paint on Curb	<0.008
LP-17B	Yellow Paint on Curb	0.6
LP-18	Gray Wall Paint on CMU Hall	<0.008
LP-19	Silver Paint on Bleachers Football Field	0.71
LP-20	DK Gray/Black/Green Announcement Booth	<0.008

5.3 Recommendations

Based on the conclusions of this testing, the following recommendations are offered:

- Renovation or demolition activities that disturb surfaces that contain lead must be conducted in accordance with the OSHA regulation 29 CFR 1926.62 “Lead Exposure in Construction: Interim Final Rule.” This regulation requires that a site-specific health and safety plan be prepared before conducting activities that create airborne lead emissions. Such a plan should include the identification of lead components, an exposure assessment, and, if applicable, the required work procedures and personnel protection to be used. Handling or impacting components that are covered by LBP may require compliance with the OSHA lead standard. To minimize exposure to airborne dust or fumes, torch burning, cutting, grinding, or similar high impact work on components covered by LBP should be avoided. Such work would need



to be conducted by properly trained workers using appropriate worker protection and engineering controls.

- In addition to the worker protection requirements stipulated by OSHA, MassDEP and the USEPA regulate the disposal of wastes that are potentially hazardous. Such wastes may include paint chips and residue generated during abatement or repainting work, or whole components, such as wood windows, doors, and trim that are coated with LBP and that are disposed of as the result of renovation or demolition work. To determine the required method for disposing of permeable items coated with LBP, the MassDEP and the USEPA require representative sampling of the debris to determine the quantity of lead that would be expected to leach into the environment if the debris were disposed of in a landfill. The representative sample(s) must be analyzed by the Toxicity Characteristic Leaching Process (TCLP) to determine the proper disposal method.
- Those components/colors not tested, or in locations not inventoried in this report, should be sampled for lead content prior to disturbance that may cause airborne release of lead.

6.0 HAZARDOUS MATERIALS SURVEY

6.1 Methods

OHM Visual Inspection

CDW visually inspected the Site building for universal, special and hazardous wastes associated with building materials. These included but were not limited to the following:

- Mercury-containing devices (fluorescent light tubes, thermostats, gauges, etc.);
- Polychlorinated bi-phenyl (PCB)-containing articles, equipment and devices (light ballasts, electrical switches, etc.);
- Chlorofluorocarbon (CFC)-containing equipment (refrigerants, air conditioners/HVAC equipment, water bubblers, etc.)
- Tritium-containing devices (Exit signs);
- Lead-Acid batteries (emergency lights, etc.); and
- Pressurized-cylinders (fire extinguishers, etc.).

6.2 Findings

OHM

The visual survey for hazardous materials identified mercury-containing light tubes, electronic



ballasts, mercury containing thermostats and switches, lead and tritium batteries, hydraulic fluids, science chemicals, hair chemicals, lead wall in dentistry, Xray materials, gas cylinders, oils, drums of waste oil, underground fuel tank, transformer, refrigerants and other hazardous materials. No hazardous materials sampling or analysis was conducted as part of this preliminary survey. A list of OHMs identified are included in Table 2.

6.3 Recommendations

Prior to removal, light tubes, ballasts, compact florescent bulbs, lead and tritium batteries, thermostats and switches will require proper handling, removal, transportation and off-site recycling/reclamation. Hydraulic oil from the automobile lift reservoirs, transformer and refrigerants will require handling and disposal in accordance with regulations. Any sludge in the science sink traps and drainage structures trenches in floor in science rooms and cosmetology rooms will need to be sampled for laboratory analysis of lead and mercury and other constituents via TCLP to determine proper disposal requirements. Laboratory and hair chemicals, gas cylinders, Xray and other reusable items should be properly stored, in their original containers, and are recommended for re-use. The UST will have to be removed under local, federal and state regulations.

7.0 POLYCHLORINATED BIPHENYLS SURVEY

CDW conducted a visual survey for polychlorinated biphenyls (PCBs) in building materials. No sampling for laboratory analysis was conducted. Suspect PCB containing materials include: interior expansion joints in hallway near gym, interior of gym, interior of pool, exterior expansion joints at the gym and pool building and tech shops, window glaze on frosted and glass windows, exterior window, door and uninvent caulk. The list of assumed PCB containing materials and quantities are included in Table 1.

Limitations

The conclusions are limited to the information available at the time of the field survey and the scope of services, as defined. No subsurface soil or groundwater sampling and analysis was performed. Where access to portions of the Site or to structures on the site was unavailable or limited, CDW renders no opinion as to the presence of hazardous material or the presence of indirect evidence related to hazardous material in that portion of the site or structure. A through, destructive survey cannot occur until the building is vacant. This report cannot be solely relied upon for renovation or demolition. The testing performed forms the basis for conclusions expressed and areas inaccessible for testing limits those conclusions. No other conclusions, interpretations or recommendations are contained or implied in this report other than those expressed. While CDW followed industry standards during the inspection, we do not warrant that all suspect hazardous building materials were identified in or on the buildings and shall not be held liable related to future abatement costs related to hazardous materials that are either not discovered or not



appropriately characterized. This is due in part to inherent problems with every building inspection, such as, but not limited to:

- Seemingly homogeneous materials that are not in fact homogeneous;
- Seemingly representative locations that are not in fact representative;
- Layered materials that are not uniformly present or are isolated;
- Materials that are present and accessible but were not considered to be hazardous,
- Materials that are present in an isolated and limited quantity; and
- Material that is present in locations that are unsafe or otherwise difficult to access.

Client acknowledges that CDW's inspection is limited and all hazardous materials may only become apparent during the course of future renovation or demolition. During the course of future renovation/demolition work, it is likely that additional hazardous materials or materials suspected of being hazardous will be identified. Such materials should be assumed to be hazardous unless appropriate evaluation or sampling and analysis demonstrate otherwise. No other use of this report is warranted without the written consent of CDW Consultants, Inc.

CDW appreciates the opportunity to provide our services to you on this project.

Very truly yours,

CDW CONSULTANTS, INC.

Susan Cahalan, PG, ISSP-SA
Senior Environmental Geologist

TABLES

TABLE 1
ACM Quantities
Northeast Metro Tech High School
Wakefield, Massachusetts

Material Description	NESHAP Cat.	Location	Est. Quantity	Units
Pipe Insulation and Fittings >6-Inches in Diameter	Friable ACM	Pipe Trench, Behind Wet Walls, Boiler Room, Fixed Walls, Tunnels	2,500	LF
Pipe Insulation and Fittings < 6-Inches in Diameter	Friable ACM	Pipe Trench, Behind Wet Walls, Boiler Room, Fixed Walls, Tunnels	12,000	LF
Thermal System Insulation	Friable ACM	Breeching in Boiler Room, Generator Exhaust Insulation	800	SF
Vinyl Floor Tiles and Mastic, Various Colors	Cat. 1 Non-friable ACM	Classrooms and Offices	93,000	SF
Wood Doors with Fire Insulation	Friable ACM	Majority of Classroom Doors with Windows, Doors Without Windows and Ten Doors in Cafetorium	240	EA
Wood Door Window Glaze	Cat. 2 Non-friable ACM	Majority of Classroom Doors with Windows	200	EA
Pink and Black Sink Coating	Cat. 2 Non-friable ACM	Science, Art, Break Rooms, Various Rooms	50	EA
Interior Window Glaze	Cat. 2 Non-friable ACM	Doors and Sidelights in Hall Assemblies	20	EA
Interior Window Glaze	Cat. 2 Non-friable ACM	2'x3' Windows Above Doors to Classrooms and Other to Hallways and Some Divider	200	EA
Interior Window Glaze	Cat. 2 Non-friable ACM	Admin Area, Offices in Kitchen Areas, Locker Rooms, Tech Areas. Majority 4'x4'	80	EA
Interior Vertical Caulking	Cat. 2 Non-friable ACM	Room 162	100	LF
Slate Window Sills Including Grout	Cat. 2 Non-friable ACM	Classrooms, Offices, Some Tech	2,000	LF
Black Mastic	Cat. 2 Non-friable ACM	Under Wood Floor In Gym	8,200	SF

TABLE 1
ACM Quantities
Northeast Metro Tech High School
Wakefield, Massachusetts

Material Description	NESHAP Cat.	Location	Est. Quantity	Units
Slate Boards With Glue Daubs	Suspect ACM, Not Sampled	Classrooms	100	EA
Old Flex Connectors	Suspect ACM, Not Sampled	On HVAC Near Ceiling in Technical Classrooms (HVAC, Auto Shop, Etc.), Gym, Other Areas in Tunnel or Fixed Walls	50	EA
Gaskets	Suspect ACM, Not Sampled	Located on Piping Connections, Valves, Ts	500	EA
Walk In Refrigerator and Freezer Mastic	Suspect ACM, Not Sampled	Cafeteria Kitchen and Kitchen for Foodservice	4	EA
Boilers	Suspect ACM, Not Sampled	Interior Components, Boiler Room and Pool Area	3	EA
Vault Door Fireproofing	Suspect ACM, Not Sampled	Admin Area	1	EA
Dry Transformer Transite	Suspect ACM, Not Sampled	Noted on Walls in Tech Shops	20	EA
Transite in Switch Gear	Suspect ACM, Not Sampled	In Electric Room, Typical Panels are 12"x6" with 20 Per Switch	100	EA
Fire Brick	Suspect ACM, Not Sampled	Chimney Lining	1	EA
Transite Fume Hood	Suspect ACM, Not Sampled	Science, Chemistry	1	EA
Gray Caulk	Cat. 2 Non-friable ACM	On Metal Flashing, Wood Shop to Low Roof	200	LF
Gray Window Glaze *also assumed to contain PCBs	Cat. 2 Non-friable ACM	On Fiberglass Frosted Windows, Tech Shops, Gym, Pool. Approximate Sizes 10'x4', 20'x10', 6'x4'	190	EA

TABLE 1
ACM Quantities
Northeast Metro Tech High School
Wakefield, Massachusetts

Material Description	NESHAP Cat.	Location	Est. Quantity	Units
Gray Window Caulk *assumed to contain PCBs	Non ACM, Sampled	Non ACM Exterior Window Caulk, Auumed to Contain PCBs	6,500	LF
Gray Window Glaze * also assumed to contain PCBs	Cat. 2 Non-friable ACM	On Exterior Windows, Various Sizes, Approximately 15'x4', 8'x4', 6'x4', 10'x4', 4'x4', other various sizes. Quantity includes any old caulk under new.	225	EA
Gray Caulk *also assumed to contain PCBs	Cat. 2 Non-friable ACM	Around Exterior Univents	480	LF
Dark Brown Caulk	Cat. 2 Non-friable ACM	Exterior of Chimney	40	LF
Roofing Asphaltic Type	Cat. 1 Non-friable ACM	Sloped Roof on Main School Building and Outbuilding with Football Training Gear	10,600	SF
Exterior Vapor Barrier	Cat. 2 Non-friable ACM	Black Coating on Copper Behind Brick Façade, Lower Courses Only	8,500	SF
Exterior Door Caulk *Also assumed to contain PCBs	Cat. 2 Non-friable ACM	Exterior Doors, Old Under New	600	LF
Subsurface Transite	Suspect ACM, Not Sampled	Subsurface	1,000	LF

Table 2
Hazardous Materials
Northeast Metrotech High School

Material Description	Location	Est. Quantity	Units
Compact Fluorescent Bulbs	Throughout	200	EA
Fluorescent Bulbs (Mercury)	Throughout	12000	Tubes
Electric Light Ballasts	Throughout	6000	Each
Thermostats and Switches (Mercury)	Throughout	500	Ampules
Emergency Light Batteries (Lead)	Throughout	80	EA
Refrigerants Associated With HVAC, Bubblers, HVAC Shop, Kitchen, Cooling Unit	Throughout	10000	Gallons
Fire Extinguishers (Compressed Gas)	Throughout	250	EA
Lead-Based Paint	Metal	NA	NA
Dark Room Chemicals	Dark Room	10	Gallons
Exit Signs (Tritium)	Throughout	80	EA
Chemicals in Sludge	Science Sink Traps, Drainage in Floor Trench, Science, Cosmetology, Xray, Auto Shop	50	Gallons
Laboratory Chemicals	Science Labs	Reuse	Reuse
Waste Oil and Other Fluids (Brake, Antifreeze, Etc.).	Automotive	20	Drums
Fuel Oil UST	Subsurface	1	Each
Lead Backed Wall and Door	Dental Shop	Reuse	Reuse
Xray	Dental Shop	Reuse	Reuse
Old Door Retractors	Remnant-Classrooms, Main Doors, Offices, Assemblies	50	Each

Table 2
Hazardous Materials
Northeast Metrotech High School

Material Description	Location	Est. Quantity	Units
Hydraulic Fluid	Old Hydraulic Reservoirs	200	Gallons
PCB Fluid	Transformers	200	Gallons

APPENDIX A



Asbestos Identification Laboratory

165 New Boston St., Ste 227

Woburn, MA 01801

781-932-9600

Web: www.asbestosidentificationlab.com

Email: mikemanning@asbestosidentificationlab.com

Batch:

51442



Lab Code: 200919-0

March 10, 2020

Susan Cahalan
CDW Consultants, Inc.
6 Huron Drive
Natick, MA 01760

Project Name: NE Metropolitan Technical Vocational
School, Wakefield, MA

Project Number:

Date Sampled: 2020-02-18

Work Received: 2020-03-04

Work Analyzed: 2020-03-09

Analysis Method: BULK PLM ANALYSIS EPA/600/R-93/116

Dear Susan Cahalan,

Asbestos Identification Laboratory has completed the analysis of the samples from your office for the above referenced project. The information and analysis contained in this report have been generated using the EPA /600/R-93/116 Method for the Determination of Asbestos in Bulk Building Materials. Materials or products that contain more than 1% of any kind or combination of asbestos are considered an asbestos containing building material as determined by the EPA. This Polarized Light Microscope (PLM) technique may be performed either by visual estimation or point counting. Point counting provides a determination of the area percentage of asbestos in a sample. If the asbestos is estimated to be less than 10% by visual estimation of friable material, the determination may be repeated using the point counting technique. The results of the point counting supersede visual PLM results. Results in this report only relate to the items tested. This report may not be used by the customer to claim product endorsement by NVLAP or any other U.S. Government Agency.

Laboratory results represent the analysis of samples as submitted by the customer. Information regarding sample location, description, area, volume, etc., was provided by the customer. Asbestos Identification Laboratory is not responsible for sample collection activities or analytical method limitations. Unless notified in writing to return samples, Asbestos Identification Laboratory discards customer samples after 30 days. Samples containing subsamples or layers will be analyzed separately when applicable. Reports are kept at Asbestos Identification Laboratory for three years. This report shall not be reproduced, except in full, without the written consent of Asbestos Identification Laboratory.

- NVLAP Lab Code: 200919-0
- Massachusetts Certification License: AA000208
- State of Connecticut, Department of Public Health Approved Environmental Laboratory Registration Number: PH-0142
- State of Maine, Department of Environmental Protection Asbestos Analytical Laboratory License Number: LB-0078(Bulk) LA-0087(Air)
- State of Rhode Island and Providence Plantations. Department of Health Certification: AAL-121
- State of Vermont, Department of Health Environmental Health License AL934461

Thank you Susan Cahalan for your business.

Michael Manning
Owner/Director

March 10, 2020

Susan Cahalan
CDW Consultants, Inc.
6 Huron Drive
Natick, MA 01760

Project Name: NE Metropolitan Technical Vocational
School, Wakefield, MA
Project Number:
Date Sampled: 2020-02-18
Work Received: 2020-03-04
Work Analyzed: 2020-03-09

Analysis Method: BULK PLM ANALYSIS EPA/600/R-93/116

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
Roof-1A	Tan Paper	Top of Roof Foam NW Core Wood Shop	tan	Fiberglass 10	None Detected
572983				Cellulose 10 Non-Fibrous 80	
Roof-1B	Dark Gray Paper	Bottom Foam NW Core Wood Shop	gray	Fiberglass 10	None Detected
572984				Cellulose 60 Non-Fibrous 30	
Roof-1C	Black Asphaltic Layer	Top of Roof Deck Gypsum NW Core Wood Shop	black	Fiberglass 20	None Detected
572985				Non-Fibrous 80	
Roof-1D	Gypsum Decl	Roof Core- NE Wood Shop	gray	Cellulose 3	None Detected
572986				Non-Fibrous 97	
Roof-2A	Grey Paper Top + Bottom Foam	Roof Core- North Over Auto	gray	Fiberglass 10	None Detected
572987				Cellulose 60 Non-Fibrous 30	
Roof-2B	Asphaltic Layer	Roof Core- Norht Over Auto	black	Fiberglass 20	None Detected
572988				Non-Fibrous 80	
Roof-2C	Gypsum Deck	Roof Core- North Over Auto	gray	Cellulose 3	None Detected
572989				Non-Fibrous 97	
Roof-3A	Grey Paper	Top + Bottom Foam Roof Core Low Roof Near Gym	gray	Fiberglass 30	None Detected
572990				Cellulose 50 Non-Fibrous 20	
Roof-3B	Asphaltic Layer	Roof Core Low Roof Near Gym	black	Fiberglass 20	None Detected
572991				Non-Fibrous 80	
Roof-3C	Gypsum Roof Deck	Roof Core Low Roof NEar Gym	gray	Cellulose 3	None Detected
572992				Non-Fibrous 97	
Roof-4	Gray Paper	Roof Expansion Joint N Side	gray	Fiberglass 20	None Detected
572993				Cellulose 60 Non-Fibrous 20	
Roof-5A	Gray Paper	Top + Bttom Foam SW Roof Near Front	gray	Fiberglass 20	None Detected
572994				Cellulose 50 Non-Fibrous 30	
Roof-5B	Asphaltic Layer	Roof- NW Near Core Front	black	Fiberglass 20	None Detected
572995				Non-Fibrous 80	
Roof-5C	Gypsum	Roof Deck- Core SW	gray	Cellulose 3	None Detected
572996				Non-Fibrous 97	

FieldID	Material	Location	Color	Non-Asbestos %	Asbestos %
LabID					
Roof-6A	Tan Paper Top + Bottom Foam	Top Pool/Gym Roof	brown	Cellulose 98 Non-Fibrous 2	None Detected
572997					
Roof-6B	White + Gray Membrane	Top Pool/Gym Roof	multi	Cellulose 20 Non-Fibrous 80	None Detected
572998					
Roof-6C	Gypsum Roof Deck	Top Pool/Gym Roof	multi	Cellulose 40 Non-Fibrous 60	None Detected
572999					
Roof-7A	Grey Paper Top + Bottom Roof Foam	Low Roof- Front	gray	Fiberglass 30 Cellulose 50 Non-Fibrous 20	None Detected
573000					
Roof-7B	Asphaltic Layer	Low Roof Front	black	Fiberglass 20 Non-Fibrous 80	None Detected
573001					
Roof-7C	Gypsum Deck	Low Roof Front	multi	Cellulose 5 Non-Fibrous 95	None Detected
573002					
Roof-8A	DK Gray/Black Paper	Top + Bottom Roof Foam Middle Front	gray	Fiberglass 30 Cellulose 50 Non-Fibrous 20	None Detected
573003					
Roof-8B	Asphaltic Layer	Roof Core Middle Front	black	Fiberglass 20 Non-Fibrous 80	None Detected
573004					
Roof-8C	Gypsum	Roof Deck Middle Front	gray	Cellulose 3 Non-Fibrous 97	None Detected
573005					
Roof-9A	Gray Paper	Top + Bottom Roof Foam Main Entrance Roof	gray	Fiberglass 20 Cellulose 50 Non-Fibrous 30	None Detected
573006					
Roof-9B	Asphaltic Layer	Core- Main Entrance Roof	black	Fiberglass 20 Non-Fibrous 80	None Detected
573007					
Roof-9C	Gypsum	Roof Deck Main Entrance Roof	gray	Cellulose 3 Non-Fibrous 97	None Detected
573008					
Roof-10A	Gray Paper Top + Bottom Roof Foam	Roof Core Center	gray	Fiberglass 20 Cellulose 60 Non-Fibrous 20	None Detected
573009					
Roof-10B	Asphaltic Layer	Roof Core Center	black	Fiberglass 20 Non-Fibrous 80	None Detected
573010					
Roof-10C	Gypsum	Roof Deck Roof Core Center	gray	Cellulose 2 Non-Fibrous 98	None Detected
573011					
Roof-11A	Gray Paper Top + Bottom Roof Foam	Roof Over Kitchen Cafe	gray	Fiberglass 20 Cellulose 60 Non-Fibrous 20	None Detected
573012					
Roof-11B	Asphaltic Layer	Roof Over Kitchen Cafe	black	Fiberglass 20 Non-Fibrous 80	None Detected
573013					
Roof-11C	Gypsum Deck	Roof Over Kitchen Cafe	gray	Cellulose 2 Non-Fibrous 98	None Detected
573014					

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
Roof-12A	Dark Gray Paper	Top + Bottom Roof Foam Sloped Roof	gray	Fiberglass 30	None Detected
573015				Cellulose 50 Non-Fibrous 20	
Roof-12B	Asphaltic Layer	Sloped Roof	black	Non-Fibrous 80	Detected Chrysotile 20
573016					
Roof-12C	Gypsum	Sloped Roof	multi	Cellulose 5	None Detected
573017				Non-Fibrous 95	
Roof-13A	Gray Paper Top + Bottom Foam	Sloped Roof	gray	Fiberglass 30	None Detected
573018				Cellulose 50 Non-Fibrous 20	
Roof-13B	Asphalt Layer	Curb Cut at Chimney	black	Fiberglass 20	None Detected
573019				Non-Fibrous 80	
Roof-13C	Gypsum Deck	Curb Cut at Chimney	gray	Cellulose 3	None Detected
573020				Non-Fibrous 97	
Roof-13D	Black Tar	Curb Cut at Chimney Original Tar (Old)	black	Non-Fibrous 100	None Detected
573021					
Roof-14A	Gray Paper	Top + Bottom Foam Front Older Roof	gray	Fiberglass 30	None Detected
573022				Cellulose 50 Non-Fibrous 20	
Roof-14B	Asphaltic Layer	Front Older Roof	black	Fiberglass 20	None Detected
573023				Non-Fibrous 80	
Roof-14C	Gypsum Deck	Front Older Roof	gray	Cellulose 3	None Detected
573024				Non-Fibrous 97	
Roof-15A	Gray Paper	Top + Bottom Foam Front Older Roof	gray	Fiberglass 20	None Detected
573025				Cellulose 60 Non-Fibrous 20	
Roof-15B	Asphaltic Material	Older Front Roof	black	Fiberglass 20	None Detected
573026				Non-Fibrous 80	
Roof-15C	Gypsum Deck	Older Front Roof	gray	Cellulose 3	None Detected
573027				Non-Fibrous 97	

Tuesday 10 March

Analyzed by:

Erik Longas

End of Report

Batch: 51442

Page 3 of 3

CHAIN OF CUSTODY

EPA/600/R-93/116

Asbestos Identification Lab

65 New Boston St.

Suite 227

Woburn, MA 01801

(781)932-9600

www.asbestosidentificationlab.com



Page 1 of 2

Turnaround Time Sample Method

Less 3 Hrs

Same Day

Next Day

Two Day

Bulk

Soil

Wipe

Point Count

Stop on 1st Positive? Yes/No

Notify Method: Mail/E-Mail/Verbal

Analyzed By: Lin [Signature]

Date: 3/4/2020

Client: CDM Consultants

Address: Le Huron Drive, Norick, MA

Project Site & #: NE Metro Technical Vocation

Phone / email address: School Wakefield, MA.

Contact: Susan Chelak

Relinquish by date: 3/3/2020

Received by date: 3/4/2020

of Samples Received: 45

Lab ID# (Lab Use Only)		Field ID/ (Client Reference)	Material / Location	% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence	Pleochroism	=	⊥	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other	Non-Fibrous
572983	Roof-1A	Material Tan Paper Location top of roof foam NW Core wood shop	0	~	~	~	~	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2	10	2				SD
18	Roof-1B	Material Dark Gray Paper Location Bottom foam NW Core wood shop	0	~	~	~	~	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2	10	2				30
18	Roof-1C	Material Black Asphaltic Layers Location top of Roof Deck Gypsum NW Core wood shop	0	~	~	~	~	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2	30					SD

[illegible]

Lab ID# (Lab Use Only)	Field ID/ (Client Reference)	Temp in Celcius = 91	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)							
			Material / Location	% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence		Pleochroism	 ⊥	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other
Material	% of Asbestos	Color													Homogeneity								
91	Roof-3B	Material Asphaltic layer Location Roof core Low roof near gym	0	Dark	~	~	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2						20
92	Roof-3C	Material Gypsum roof deck Location Roof core Low roof near gym	0	Dark	~	~	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite											2				99
93	Roof-4	Material Gray paper Location Roof Expansion Joint N, Side	0	Dark	~	~	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2						30
94	Roof-5A	Material Gray paper Location Top + Bottom foam SW Roof near front	0	Dark	~	~	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2						30
95	Roof-5B	Material Asphaltic layer Location Roof - SW near core front	0	Dark	~	~	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2						80

NE Auto Tech

Page 4 of 10

Lab ID# (Lab Use Only)		Field ID/ (Client Reference)	Temp in Celcius = 71	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)								
Material / Location				% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence	Pleochroism			⊥	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other	Non-Fibrous
96	Roof- SC	Gypsum Location Roof Deck - Core SD		0	25	~	~	~	Chrysotile																
97	Roof- LOA	Tan paper top + bottom roof frame Location Top pool/gym Roof		0	25	~	~	~	Chrysotile											2					2
98	Roof- LOB	Material White + Gray membrane Location Top pool/gym Roof		0	25	~	~	~	Chrysotile											2					2
99	Roof- LOC	Material Gypsum Roof Deck Location Top pool/gym Roof		0	25	~	~	~	Chrysotile											2					2
5730000	Roof- 7A	Material Gray Paper Top + Bottom Roof frame Location Low Roof - front		0	25	~	~	~	Chrysotile											2					2

Page _____ of _____

Lab ID# (Lab Use Only)		Field ID/ (Client Reference)	Temp in Celcius = 71	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)								
Material / Location				% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence	Pleochroism			⊥	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other	Non-Fibrous
10	Roof-7B	Material Asphaltic layer	Location Low Roof front	0	Black	~	~	~	~	Chrysotile															
										Amosite															
										Crocidolite															
										Tremolite															
										Anthrophyllite															
										Actinolite															
5	Roof-7C	Material Gypsum Deck	Location Low Roof front	0	White	~	~	~	~	Chrysotile															
										Amosite															
										Crocidolite															
										Tremolite															
										Anthrophyllite															
										Actinolite															
5	Roof-7A	Material Gray/Black Paper	Location Top + Bottom Middle Roof-foam front	0	Gray	~	~	~	~	Chrysotile															
										Amosite															
										Crocidolite															
										Tremolite															
										Anthrophyllite															
										Actinolite															
5	Roof-7B	Material Asphaltic layer	Location Low Roof front	0	Black	~	~	~	~	Chrysotile															
										Amosite															
										Crocidolite															
										Tremolite															
										Anthrophyllite															
										Actinolite															
5	Roof-7C	Material Gypsum Deck	Location Low Roof front	0	White	~	~	~	~	Chrysotile															
										Amosite															
										Crocidolite															
										Tremolite															
										Anthrophyllite															
										Actinolite															
5	Roof-7A	Material Gypsum Deck	Location Low Roof front	0	White	~	~	~	~	Chrysotile															
										Amosite															
										Crocidolite															
										Tremolite															
										Anthrophyllite															
										Actinolite															

NE Metro Tech

Page 10 of 10

Lab ID# (Lab Use Only)		Field ID/ (Client Reference)	Temp in Celcius = 21	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)							
Material / Location				% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence	Pleochroism		=	+	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other
Roof-9A	Material: Gray paper Location: Top + Bottom roof Main entrance roof			0	gray	~	fine	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2		2				30
Roof-9B	Material: Asphaltic layer Location: Core - Main Entrance roof			0	gray	~	fine	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2						30
Roof-9C	Material: Gypsum Location: Roof Deck roof Main Entrance roof			0	gray	~	fine	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite										2	3				99
Roof-10A	Material: Gray paper Location: Top + Bottom roof Roof core Center			0	gray	~	fine	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2		2				30
Roof-10B	Material: Asphaltic layer Location: Roof core Center			0	gray	~	fine	~	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									2						30

[illegible]

5

Page 9 of 10

[illegible]



Asbestos Identification Laboratory

165 New Boston St., Ste 227

Woburn, MA 01801

781-932-9600

Web: www.asbestosidentificationlab.com

Email: mikemanning@asbestosidentificationlab.com

Batch:

51493



Lab Code: 200919-0

March 11, 2020

Susan Cahalan
CDW Consultants, Inc.
6 Huron Drive
Natick, MA 01760

Project Name: *Northeast Metropolitan Vocational
Technical School, Wakefield, MA*

Project Number:

Date Sampled: 2020-03-02

Work Received: 2020-03-05

Work Analyzed: 2020-03-09

Analysis Method: BULK PLM ANALYSIS EPA/600/R-93/116

Dear Susan Cahalan,

Asbestos Identification Laboratory has completed the analysis of the samples from your office for the above referenced project. The information and analysis contained in this report have been generated using the EPA /600/R-93/116 Method for the Determination of Asbestos in Bulk Building Materials. Materials or products that contain more than 1% of any kind or combination of asbestos are considered an asbestos containing building material as determined by the EPA. This Polarized Light Microscope (PLM) technique may be performed either by visual estimation or point counting. Point counting provides a determination of the area percentage of asbestos in a sample. If the asbestos is estimated to be less than 10% by visual estimation of friable material, the determination may be repeated using the point counting technique. The results of the point counting supersede visual PLM results. Results in this report only relate to the items tested. This report may not be used by the customer to claim product endorsement by NVLAP or any other U.S. Government Agency.

Laboratory results represent the analysis of samples as submitted by the customer. Information regarding sample location, description, area, volume, etc., was provided by the customer. Asbestos Identification Laboratory is not responsible for sample collection activities or analytical method limitations. Unless notified in writing to return samples, Asbestos Identification Laboratory discards customer samples after 30 days. Samples containing subsamples or layers will be analyzed separately when applicable. Reports are kept at Asbestos Identification Laboratory for three years. This report shall not be reproduced, except in full, without the written consent of Asbestos Identification Laboratory.

- NVLAP Lab Code: 200919-0
- Massachusetts Certification License: AA000208
- State of Connecticut, Department of Public Health Approved Environmental Laboratory Registration Number: PH-0142
- State of Maine, Department of Environmental Protection Asbestos Analytical Laboratory License Number: LB-0078(Bulk) LA-0087(Air)
- State of Rhode Island and Providence Plantations. Department of Health Certification: AAL-121
- State of Vermont, Department of Health Environmental Health License AL934461

Thank you Susan Cahalan for your business.

Michael Manning
Owner/Director

March 11, 2020

Susan Cahalan
CDW Consultants, Inc.
6 Huron Drive
Natick, MA 01760

Project Name: Northeast Metropolitan Vocational
Technical School, Wakefield, MA
Project Number:
Date Sampled: 2020-03-02
Work Received: 2020-03-05
Work Analyzed: 2020-03-09

Analysis Method: BULK PLM ANALYSIS EPA/600/R-93/116

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
11A	Black Bumper Material	Kitchen Loading Dock		Cellulose 5	None Detected
573703				Non-Fibrous 95	
11B	Black Bumper Material	Kitchen Loading Dock		Cellulose 5	None Detected
573704				Non-Fibrous 95	
12A	Gray Caulk	Around Large Vent Near Kitchen Dock		Non-Fibrous 100	None Detected
573705					
12B	Gray Caulk	Around Large Vent Near Kitchen Dock		Non-Fibrous 100	None Detected
573706					
13A	Interior Gray Window Glaze	Office in Kitchen		Non-Fibrous 95	Detected Chrysotile 5
573707					
13B	Interior Gray Window Glaze	Office in Kitchen			Not Analyzed
573708					
14A	Gray/Black Mastic	Under Red Ceramic Tile in Kitchen		Non-Fibrous 100	None Detected
573709					
14B	Gray/Black Mastic	Under Red Ceramic Tile in Kitchen		Non-Fibrous 100	None Detected
573710					
14C	Gray/Black Mastic	Under Red Ceramic Tile in Kitchen		Non-Fibrous 100	None Detected
573711					
15A	2'x2' Pindot + Fissure Ceiling Tile	Kitchen Storage		Mineral Wool 30	None Detected
573712				Cellulose 60 Non-Fibrous 10	
15B	2'x2' Pindot + Fissure Ceiling Tile	Kitchen Storage		Mineral Wool 30	None Detected
573713				Cellulose 60 Non-Fibrous 10	
15C	2'x2' Pindot + Fissure Ceiling Tile	Kitchen Storage		Mineral Wool 30	None Detected
573714				Cellulose 60 Non-Fibrous 10	
16A	White Mastic	Under Ceramic Wall Tile, Kitchen		Non-Fibrous 100	None Detected
573715					
16B	White Mastic	Under Ceramic Wall Tile, Kitchen		Non-Fibrous 100	None Detected
573716					

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
16C 573717	White Mastic	Under Ceramic Wall Tile, Kitchen		Non-Fibrous 100	None Detected
17A 573718	Yellowish Grout	Under Ceramic Wall Tile, Kitchen		Non-Fibrous 100	None Detected
17B 573719	Yellowish Grout	Under Ceramic Wall Tile, Kitchen		Non-Fibrous 100	None Detected
17C 573720	Yellowish Grout	Under Ceramic Wall Tile, Kitchen		Non-Fibrous 100	None Detected
18A 573721	White Plaster	Kitchen Ceiling		Non-Fibrous 100	None Detected
18B 573722	White Plaster	Kitchen Ceiling		Non-Fibrous 100	None Detected
18C 573723	White Plaster	Kitchen Ceiling		Non-Fibrous 100	None Detected
18D 573724	White Plaster	Kitchen Ceiling		Non-Fibrous 100	None Detected
18E 573725	White Plaster	Kitchen Ceiling		Non-Fibrous 100	None Detected
19A 573726	Interior Door Assembly Window Glaze	Near Door 109		Non-Fibrous 98	Detected Chrysotile 2
19B 573727	Interior Door Assembly Window Glaze	Near Door 109			Not Analyzed
20 573728	White Material	Inside Wood Door Near 109		Non-Fibrous 75	Detected Chrysotile 15 Amosite 10
21A 573729	Tan Expansion Joint- Vertical	Exterior Pool, Gym Near Front Door & Kitchen		Non-Fibrous 100	None Detected
21B 573730	Tan Expansion Joint- Vertical	Exterior Pool, Gym Near Front Door & Kitchen		Non-Fibrous 100	None Detected
21C 573731	Tan Expansion Joint- Vertical	Exterior Pool, Gym Near Front Door & Kitchen		Non-Fibrous 100	None Detected
21D 573732	Tan Expansion Joint- Vertical	Exterior Pool, Gym Near Front Door & Kitchen		Non-Fibrous 100	None Detected
21E 573733	Tan Expansion Joint- Vertical	Exterior Pool, Gym Near Front Door & Kitchen		Non-Fibrous 100	None Detected
22A 573734	Gray Caulk	Exterior Door #02		Other 2 Non-Fibrous 98	None Detected

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
22B 573735	Gray Caulk	Exterior Door #02		Other Non-Fibrous 2 98	None Detected
23A 573736	Gray White Caulk	Exterior Door #23		Non-Fibrous 100	None Detected
23B 573737	Gray White Caulk	Exterior Door #23		Non-Fibrous 100	None Detected
24A 573738	Black Window Glaze on Metal Door	Door #02		Non-Fibrous 100	None Detected
25A 573739	Gray Window Glaze	Slide Light Windows Door #02		Non-Fibrous 97	Detected Chrysotile 3
25B 573740	Gray Window Glaze	Slide Light Windows Door #02			Not Analyzed
26A 573741	Gray Window Glaze, Exterior Windows	Door #23		Non-Fibrous 97	Detected Chrysotile 3
26B 573742	Gray Window Glaze, Exterior Windows	Door #23			Not Analyzed
27A 573743	White Caulk	Exterior Univents		Non-Fibrous 97	Detected Chrysotile 3
27B 573744	White Caulk	Exterior Univents			Not Analyzed
27C 573745	White Caulk	Exterior Univents			Not Analyzed

Wednesday 11 March

Analyzed by:

Erik Gonzales

End of Report

Batch: 51493

Page 3 of 3

CHAIN OF CUSTODY

EPA/600/R-93/116

Page 1 of 2

Turnaround Time Sample Method

Less 3 Hrs

Back

Same Day

Soil

Next Day

Wipe

Two Day

Point Count

Stop on 1st Positive? Yes/No

Notify Method: Mail/E-Mail/Verbal

Analyzed By: 3/14/2000

Date:

Asbestos Identification Lab

165 New Boston St.

Suite 227

Woburn, MA 01801

(781)932-9600

www.asbestosidentificationlab.com

Date Sampled: 3/14/2000



Client: CBF Consultants

Address: 6 Huron Drive Natick MA

Project Site & #: North East Metropolitan

Vocational/ Technical School, Wake

Phone / email address: field

Contact: Sabah Sabah

Relinquish by date: 3/14/2000

Received by date: 3/15/2000

of Samples Received: 43

BATCH#

51493

Rev 06/16

Temp in Celsius = 21

Stereo Scope

Optical Properties

RI

Non-Asbestos Percentage (%)

Lab ID#
(Lab Use Only)

Field ID/
(Client
Reference)

Material / Location

% of Asbestos

Color

Homogeneity

Texture

Friable

Asbestos
Minerals

Asbestos %

Morphology

Extinction

Sign of
Elongation

Birefringence

Pleochroism

||

⊥

Fiberglass

Mineral Wool

Cellulose

Hair

Synthetic

Other

Non-Fibrous

513763
111A
Material
Black bumper
Location
Kitchen loading
dock

% of Asbestos
Color
Homogeneity
Texture
Friable

Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite
Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite

Asbestos %
Morphology
Extinction
Sign of
Elongation
Birefringence
Pleochroism
||
⊥
Fiberglass
Mineral Wool
Cellulose
Hair
Synthetic
Other
Non-Fibrous

04
11B
Material
" "
Location
" "

% of Asbestos
Color
Homogeneity
Texture
Friable

Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite
Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite

Asbestos %
Morphology
Extinction
Sign of
Elongation
Birefringence
Pleochroism
||
⊥
Fiberglass
Mineral Wool
Cellulose
Hair
Synthetic
Other
Non-Fibrous

05
12A
Material
Grey Caulk
Location
Around door
Vent kitchen duct

% of Asbestos
Color
Homogeneity
Texture
Friable

Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite
Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite

Asbestos %
Morphology
Extinction
Sign of
Elongation
Birefringence
Pleochroism
||
⊥
Fiberglass
Mineral Wool
Cellulose
Hair
Synthetic
Other
Non-Fibrous

NE Metro Tech

Page 2 of 9

Lab ID# (Lab Use Only)	Field ID/ (Client Reference)	Temp in Celcius = 97	Stereo Scope					Asbestos Minerals	Optical Properties						RI	Non-Asbestos Percentage (%)							
			Material / Location	% of Asbestos	Color	Homogeneity	Texture		Friable	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence		Pleochroism	=	⊥	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic
06	12B	Material " "	Material " "	0	3	3	3	Chrysotile	5	3	=	+	✓	2 (100)									100
07	13A	Material Material Location Office in kitchen	Material " "	0	3	3	3	Chrysotile															0
08	13B	Material " "	Material " "					Chrysotile															
09	14A	Material Location under floor ceramic tile in kitchen	Material Gray/Black-Matrix	0	3	3	3	Chrysotile															100
10	14B	Material " "	Material " "	0	3	3	3	Chrysotile															100

DWA

NE Metro Tech

Page 4 of 9

Lab ID# (Lab Use Only)	Field ID/ (Client Reference)	Temp in Celcius = 21	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)							
Material / Location		% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence	Pleochroism	=	⊥	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other	Non-Fibrous	
16	16B Location " "	" "					Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite																100
17	16C Location " "	" "					Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite																100
18	17A Location " "	" "					Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite																100
19	17B Location " "	" "					Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite																100
20	17C Location " "	" "					Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite																100

Material
Yellowish
GROUT
Location
under Ceramic
Wall Tile Kitchen

Orange Brown

Orange Brown

[illegible]

[illegible]

[illegible]

NE Metro Tech

Lab ID# (Lab Use Only)	Field ID/ (Client Reference)	Temp in Celcius = 27	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)									
			Material / Location	% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence		Pleochroism	=	T	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other	Non-Fibrous
36	234	Material Gray White Quilt Location # 23		0.55 gms					Chrysotile																
		Material " "						Amosite																	
		Material " "						Crocidolite																	
		Material " "						Tremolite																	
		Material " "						Anthrophyllite																	
		Material " "						Actinolite																	
37	235	Material " "	0.55 gms					Chrysotile																	
		Material " "						Amosite																	
		Material " "						Crocidolite																	
		Material " "						Tremolite																	
		Material " "						Anthrophyllite																	
		Material " "						Actinolite																	
38	24	Material Black window Location Door # 22	0.55 gms					Chrysotile	3	W	=	+	+	+	+	+									
		Material " "						Amosite																	
		Material " "						Crocidolite																	
		Material " "						Tremolite																	
		Material " "						Anthrophyllite																	
		Material " "						Actinolite																	
39	25A	Material Gray window Location Side light windows Door # 22	0.55 gms					Chrysotile																	
		Material " "						Amosite																	
		Material " "						Crocidolite																	
		Material " "						Tremolite																	
		Material " "						Anthrophyllite																	
		Material " "						Actinolite																	
40	25B	Material " "						Chrysotile																	
		Material " "						Amosite																	
		Material " "						Crocidolite																	
		Material " "						Tremolite																	
		Material " "						Anthrophyllite																	
		Material " "						Actinolite																	

ONT

NE Metro Tech

Page 9 of 9

Lab ID# (Lab Use Only)	Field ID/ (Client Reference)	Temp in Celcius = 21	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)						
			Material / Location	% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence		Pleochroism	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other
41	210A	Material Gray Under of the exterior Location windows	Doc # 23					Chrysotile	3	3	2	+	+	2		+						47
42	210B	Material " "	Location " "					Chrysotile														
43	211A	Material White Caulk	Location Exterior Windows					Chrysotile	3	3	2	+	+	2		+						47
44	211B	Material " "	Location " "					Chrysotile														
573745	212C	Material " "	Location " "					Chrysotile														

DNA

DNA

DNA



Asbestos Identification Laboratory

165 New Boston St., Ste 227

Woburn, MA 01801

781-932-9600

Web: www.asbestosidentificationlab.com

Email: mikemanning@asbestosidentificationlab.com

Batch:

51443



Lab Code: 200919-0

March 10, 2020

Susan Cahalan
CDW Consultants, Inc.
6 Huron Drive
Natick, MA 01760

Project Name: *Northeast Metropolitan Technical
Vocational School- Wakefield, MA*

Project Number:

Date Sampled: 2020-02-18

Work Received: 2020-03-04

Work Analyzed: 2020-03-09

Analysis Method: BULK PLM ANALYSIS EPA/600/R-93/116

Dear Susan Cahalan,

Asbestos Identification Laboratory has completed the analysis of the samples from your office for the above referenced project. The information and analysis contained in this report have been generated using the EPA /600/R-93/116 Method for the Determination of Asbestos in Bulk Building Materials. Materials or products that contain more than 1% of any kind or combination of asbestos are considered an asbestos containing building material as determined by the EPA. This Polarized Light Microscope (PLM) technique may be performed either by visual estimation or point counting. Point counting provides a determination of the area percentage of asbestos in a sample. If the asbestos is estimated to be less than 10% by visual estimation of friable material, the determination may be repeated using the point counting technique. The results of the point counting supersede visual PLM results. Results in this report only relate to the items tested. This report may not be used by the customer to claim product endorsement by NVLAP or any other U.S. Government Agency.

Laboratory results represent the analysis of samples as submitted by the customer. Information regarding sample location, description, area, volume, etc., was provided by the customer. Asbestos Identification Laboratory is not responsible for sample collection activities or analytical method limitations. Unless notified in writing to return samples, Asbestos Identification Laboratory discards customer samples after 30 days. Samples containing subsamples or layers will be analyzed separately when applicable. Reports are kept at Asbestos Identification Laboratory for three years. This report shall not be reproduced, except in full, without the written consent of Asbestos Identification Laboratory.

- NVLAP Lab Code: 200919-0
- Massachusetts Certification License: AA000208
- State of Connecticut, Department of Public Health Approved Environmental Laboratory Registration Number: PH-0142
- State of Maine, Department of Environmental Protection Asbestos Analytical Laboratory License Number: LB-0078(Bulk) LA-0087(Air)
- State of Rhode Island and Providence Plantations. Department of Health Certification: AAL-121
- State of Vermont, Department of Health Environmental Health License AL934461

Thank you Susan Cahalan for your business.

Michael Manning
Owner/Director

March 10, 2020

Susan Cahalan
CDW Consultants, Inc.
6 Huron Drive
Natick, MA 01760

Project Name: Northeast Metropolitan Technical
Vocational School- Wakefield, MA
Project Number:
Date Sampled: 2020-02-18
Work Received: 2020-03-04
Work Analyzed: 2020-03-09

Analysis Method: BULK PLM ANALYSIS EPA/600/R-93/116

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
1A	Gray Caulk	On Metal Flashing Wood Shop to Low Roof	gray	Non-Fibrous 98	Detected Chrysotile 2
573070					
1B	Gray Caulk	On Metal Flashing Wood Shop to Low Roof			Not Analyzed
573071					
1C	Gray Caulk	On Metal Flashing Wood Shop to Low Roof			Not Analyzed
573072					
2A	Gray Window Glaze	Exterior at Frosted Windows Roof Level Gym	gray	Non-Fibrous 90	Detected Chrysotile 10
573073					
2B	Gray Window Glaze	Exterior at Frosted Windows Roof Level Gym			Not Analyzed
573074					
2C	Gray Window Glaze	Exterior at Frosted Windows Roof Level Gym			Not Analyzed
573075					
2D	Gray Window Glaze	Exterior at Frosted Windows Roof Level Gym			Not Analyzed
573076					
2E	Gray Window Glaze	Exterior at Frosted Windows Roof Level Gym			Not Analyzed
573077					
3A	White Caulk	Gym Window Roof Level	white	Non-Fibrous 100	None Detected
573078					
3B	White Caulk	Gym Window Roof Level	white	Non-Fibrous 100	None Detected
573079					
3C	White Caulk	Gym Window Roof Level	white	Non-Fibrous 100	None Detected
573080					
3D	White Caulk	Gym Window Roof Level	white	Non-Fibrous 100	None Detected
573081					
3E	White Caulk	Gym Window Roof Level	white	Non-Fibrous 100	None Detected
573082					
4A	Tan/Pink-ish Hue Over Black Expansion Joint	Gym Upper Level	multi	Non-Fibrous 100	None Detected
573083					

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
4B 573084	Tan/Pink-ish Hue Over Black Expansion Joint	Gym Upper Level	multi	Non-Fibrous 100	None Detected
4C 573085					
4D 573086	Tan/Pink-ish Hue Over Black Expansion Joint	Gym Upper Level	multi	Non-Fibrous 100	None Detected
4E 573087					
5A 573088	White Caulk on Silicone	Roof Stand Pipe Vents	gray	Non-Fibrous 100	None Detected
5B 573089					
5C 573090	White Caulk on Silicone	Roof Stand Pipe Vents	gray	Non-Fibrous 100	None Detected
6A 573091					
6B 573092	Black Brittle Tar	On Metal Flash Entrance Roof Top Lower Roof	black	Non-Fibrous 100	None Detected
6C 573093					
7A 573094	Black Brittle Tar	On Metal Flash Entrance Roof Top Lower Roof	black	Non-Fibrous 100	None Detected
7B 573095					
7C 573096	Black Caulk	Around Roof Drains	black	Non-Fibrous 100	None Detected
8A 573097					
8B 573098	Black Caulk	Around Roof Drains	black	Non-Fibrous 100	None Detected
8C 573099					
9A 573100	White Caulk	On Steel Vents Near Chimney	clear	Non-Fibrous 100	None Detected
9B 573101					
9A 573100	Dark Gray Caulk	On Steel Vents Near Chimney	clear	Non-Fibrous 100	None Detected
9B 573101					
9A 573100	Dark Gray Caulk	Inside Roof Drain Under Rubber	gray	Non-Fibrous 100	None Detected
9B 573101					

FieldID	Material	Location	Color	Non-Asbestos %	Asbestos %
LabID					
9C	Dark Gray Caulk	Inside Roof Drain Under Rubber	gray	Non-Fibrous 100	None Detected
573102					
10A	Black Caulk	Corner of Chimney	black	Non-Fibrous 95	Detected Chrysotile 5
573103					
10B	Black Caulk	Corner of Chimney			Not Analyzed
573104					

and

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

At Metro

Lab ID# (Lab Use Only)	Field ID/ (Client Reference)	Temp in Celcius = 21	Stereo Scope					Optical Properties						RI	Non-Asbestos Percentage (%)								
		Material / Location	% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence	Pleochroism			Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other	Non-Fibrous
5731 04	10A	Material Black Caulk Location corner chimney						Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite															
	10B	Material " " Location " "						Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite															
		Material Location						Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite															
		Material Location						Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite															
		Material Location						Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite															

DNA



Asbestos Identification Laboratory

165 New Boston St., Ste 227

Woburn, MA 01801

781-932-9600

Web: www.asbestosidentificationlab.com

Email: mikemanning@asbestosidentificationlab.com

Batch:

51550



Lab Code: 200919-0

March 12, 2020

Susan Cahalan
CDW Consultants, Inc.
6 Huron Drive
Natick, MA 01760

Project Name: *Northeast Metropolitan Vocational
Technical School, Wakefield, MA*

Project Number:

Date Sampled: 2020-03-02

Work Received: 2020-03-09

Work Analyzed: 2020-03-10

Analysis Method: BULK PLM ANALYSIS EPA/600/R-93/116

Dear Susan Cahalan,

Asbestos Identification Laboratory has completed the analysis of the samples from your office for the above referenced project. The information and analysis contained in this report have been generated using the EPA /600/R-93/116 Method for the Determination of Asbestos in Bulk Building Materials. Materials or products that contain more than 1% of any kind or combination of asbestos are considered an asbestos containing building material as determined by the EPA. This Polarized Light Microscope (PLM) technique may be performed either by visual estimation or point counting. Point counting provides a determination of the area percentage of asbestos in a sample. If the asbestos is estimated to be less than 10% by visual estimation of friable material, the determination may be repeated using the point counting technique. The results of the point counting supersede visual PLM results. Results in this report only relate to the items tested. This report may not be used by the customer to claim product endorsement by NVLAP or any other U.S. Government Agency.

Laboratory results represent the analysis of samples as submitted by the customer. Information regarding sample location, description, area, volume, etc., was provided by the customer. Asbestos Identification Laboratory is not responsible for sample collection activities or analytical method limitations. Unless notified in writing to return samples, Asbestos Identification Laboratory discards customer samples after 30 days. Samples containing subsamples or layers will be analyzed separately when applicable. Reports are kept at Asbestos Identification Laboratory for three years. This report shall not be reproduced, except in full, without the written consent of Asbestos Identification Laboratory.

- NVLAP Lab Code: 200919-0
- Massachusetts Certification License: AA000208
- State of Connecticut, Department of Public Health Approved Environmental Laboratory Registration Number: PH-0142
- State of Maine, Department of Environmental Protection Asbestos Analytical Laboratory License Number: LB-0078(Bulk) LA-0087(Air)
- State of Rhode Island and Providence Plantations. Department of Health Certification: AAL-121
- State of Vermont, Department of Health Environmental Health License AL934461

Thank you Susan Cahalan for your business.

Michael Manning
Owner/Director

March 12, 2020

Susan Cahalan
CDW Consultants, Inc.
6 Huron Drive
Natick, MA 01760

Project Name: Northeast Metropolitan Vocational
Technical School, Wakefield, MA
Project Number:
Date Sampled: 2020-03-02
Work Received: 2020-03-09
Work Analyzed: 2020-03-10

Analysis Method: BULK PLM ANALYSIS EPA/600/R-93/116

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
28	Interior Door Material	Next to Main Office Assembly	multi	Cellulose 95 Non-Fibrous 5	None Detected
574208					
29	Interior Door Material	Assembly Near Dental	multi	Cellulose 95 Non-Fibrous 5	None Detected
574209					
30	Interior Door Material	Gym Door	multi	Cellulose 95 Non-Fibrous 5	None Detected
574210					
31	Interior Tan Material	Door 104	multi	Cellulose 95 Non-Fibrous 5	None Detected
574211					
32	Interior Tan Door Material	Door 107	multi	Cellulose 95 Non-Fibrous 5	None Detected
574212					
33	Gray Glaze	Interior Door Window Above Rm 107	gray	Non-Fibrous 98	Detected Chrysotile 2
574213					
34	Gray Glaze on Interior Window	On Wood Door #107	gray	Non-Fibrous 98	Detected Chrysotile 2
574214					
35	Gray Glaze on Interior Window Glaze	On Door Rm 121	gray	Non-Fibrous 98	Detected Chrysotile 2
574215					
36	Gray Glaze Interior Window	Window Above Door Rm 121	gray	Non-Fibrous 98	Detected Chrysotile 2
574216					
37	Window Glaze Gray	Interior Hall Assembly Near 109	gray	Non-Fibrous 98	Detected Chrysotile 2
574217					
38A	Gray Glaze	Interior Windows Main Office	black	Non-Fibrous 100	None Detected
574218					
38B	Gray Glaze	Interior Windows Main Office	black	Non-Fibrous 100	None Detected
574219					
39A	2x2 Tan/Brown Textured Ceiling Tile	All Hallway	gray	Fiberglass 40 Mineral Wool 50 Non-Fibrous 10	None Detected
574220					
39B	2x2 Tan/Brown Textured Ceiling Tile	All Hallway	gray	Fiberglass 40 Mineral Wool 50 Non-Fibrous 10	None Detected
574221					

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
39C	2x2 Tan/Brown Textured Ceiling Tile	All Hallway	gray	Fiberglass 40	None Detected
574222				Mineral Wool 50	
				Non-Fibrous 10	
39D	2x2 Tan/Brown Textured Ceiling Tile	All Hallway	gray	Fiberglass 40	None Detected
574223				Mineral Wool 50	
				Non-Fibrous 10	
39E	2x2 Tan/Brown Textured Ceiling Tile	All Hallway	gray	Fiberglass 40	None Detected
574224				Mineral Wool 50	
				Non-Fibrous 10	
39F	2x2 Tan/Brown Textured Ceiling Tile	All Hallway	gray	Fiberglass 40	None Detected
574225				Mineral Wool 50	
				Non-Fibrous 10	
39G	2x2 Tan/Brown Textured Ceiling Tile	All Hallway	gray	Fiberglass 40	None Detected
574226				Mineral Wool 50	
				Non-Fibrous 10	
39H	2x2 Tan/Brown Textured Ceiling Tile	All Hallway	gray	Fiberglass 40	None Detected
574227				Mineral Wool 50	
				Non-Fibrous 10	
39I	2x2 Tan/Brown Textured Ceiling Tile	Classrooms	gray	Fiberglass 40	None Detected
574228				Mineral Wool 50	
				Non-Fibrous 10	
40A	1x1 Ceiling Tile Pin Dot + Small Fissures	Classrooms	tan	Fiberglass 40	None Detected
574229				Mineral Wool 50	
				Non-Fibrous 10	
40B	1x1 Ceiling Tile Pin Dot + Small Fissures	Classrooms	tan	Fiberglass 40	None Detected
574230				Mineral Wool 50	
				Non-Fibrous 10	
40C	1x1 Ceiling Tile Pin Dot + Small Fissures	Classrooms	tan	Fiberglass 40	None Detected
574231				Mineral Wool 50	
				Non-Fibrous 10	
40D	1x1 Ceiling Tile Pin Dot + Small Fissures	Classrooms	tan	Fiberglass 40	None Detected
574232				Mineral Wool 50	
				Non-Fibrous 10	
40E	1x1 Ceiling Tile Pin Dot + Small Fissures	Classrooms	tan	Fiberglass 40	None Detected
574233				Mineral Wool 50	
				Non-Fibrous 10	
40F	1x1 Ceiling Tile Pin Dot + Small Fissures	Classrooms	tan	Fiberglass 40	None Detected
574234				Mineral Wool 50	
				Non-Fibrous 10	
40G	1x1 Ceiling Tile Pin Dot + Small Fissures	Classrooms	tan	Fiberglass 40	None Detected
574235				Mineral Wool 50	
				Non-Fibrous 10	
41A	Black Vinyl Cove Base	Gym	black	Non-Fibrous 100	None Detected
574236					
41B	Black Vinyl Cove Base	Gym	black	Non-Fibrous 100	None Detected
574237					
41C	Black Vinyl Cove Base	Gym	black	Non-Fibrous 100	None Detected
574238					

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
42A 574239	Yellow Glue	Under Black Cove Base Gym	tan	Non-Fibrous 100	None Detected
42B 574240					
42C 574241	Yellow Glue	Under Black Cove Base Gym	tan	Non-Fibrous 100	None Detected
43A 574242					
43B 574243	Black Tar	On Gym Deck Under Wood	black	Cellulose 20 Non-Fibrous 75	Detected Chrysotile 5
43C 574244					
44A 574245	DK Gray Grout Under Stone Window Sills	123 + 107 -121 Classrooms	gray	Non-Fibrous 98	Detected Chrysotile 2
44B 574246					
44C 574247	DK Gray Grout Under Stone Window Sills	123 + 107 -121 Classrooms			Not Analyzed
45A 574248					
45B 574249	Stone (Slate) Window Sills	132 + 107 + 121 Classrooms	black	Non-Fibrous 95	Detected Chrysotile 5
45C 574250					
46A 574251	Plaster Skim on Walls	Rms 103 + 104 + 118 + 123 + 125 + 121 + Dental	white	Non-Fibrous 100	None Detected
46B 574252					
46C 574253	Plaster Skim on Walls	Rms 103 + 104 + 118 + 123 + 125 + 121 + Dental	white	Non-Fibrous 100	None Detected
46D 574254					
46E 574255	Plaster Skim on Walls	Rms 103 + 104 + 118 + 123 + 125 + 121 + Dental	white	Non-Fibrous 100	None Detected
46F 574256					

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
46G 574257	Plaster Skim on Walls	Rms 103 + 104 + 118 + 123 + 125 + 121 + Dental	white	Non-Fibrous 100 Non-Fibrous 90	None Detected
47A 574258					
47B 574259	Black Mastic	Under Terrazzo Halls + Stairs	black	Cellulose 10 Non-Fibrous 90	None Detected
47C 574260					
47D 574261	Black Mastic	Under Terrazzo Halls + Stairs	black	Cellulose 10 Non-Fibrous 90	None Detected
47E 574262					
47F 574263	Black Mastic	Under Terrazzo Halls + Stairs	black	Cellulose 10 Non-Fibrous 90	None Detected
47G 574264					
48A 574265	NO SAMPLE	NO SAMPLE			Not Analyzed
48B 574266					
48C 574267	Black Mastic	Under Terrazzo in Cafereria	gray	Cellulose 10 Non-Fibrous 90	None Detected
49A 574268					
49B 574269	Black Mastic	Under Side of Stage	brown	Cellulose 5 Non-Fibrous 95	None Detected
50A 574270					
50B 574271	DK Brown Vinyl Cove Base	Science- Chem + Biology	black	Non-Fibrous 100	None Detected
50C 574272					
51A 574273	White Mastic	Under DK Brown Vinyl Cove Base	brown	Non-Fibrous 100	None Detected
51B 574274					

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
51C 574275	White Mastic	Under DK Brown Vinyl Cove Base	brown	Non-Fibrous 100	None Detected
52A 574276					
52B 574277	Black Vinyl Cove Base	Base of Science Tables	black	Non-Fibrous 100	None Detected
52C 574278					
53A 574279	Black Vinyl Cove Base	Base of Science Tables	black	Non-Fibrous 100	None Detected
53A 574279					
53B 574280	Black/Brown Mastic	Under Black Vinyl Cove Base	black	Other Non-Fibrous 1090	None Detected
53B 574280					
53C 574281	Black/Brown Mastic	Under Black Vinyl Cove Base	black	Other Non-Fibrous 1090	None Detected
53C 574281					
54A 574282	Brown Glue Daubs	Behind Acoustical Panels-Pool	brown	Non-Fibrous 100	None Detected
54A 574282					
54B 574283	Brown Glue Daubs	Behind Acoustical Panels-Pool	brown	Non-Fibrous 100	None Detected
54B 574283					
54C 574284	Brown Glue Daubs	Behind Acoustical Panels-Pool	brown	Non-Fibrous 100	None Detected
54C 574284					
55A 574285	Tan Grout	Under Ceramic Wall Tile-Pool	tan	Cellulose Non-Fibrous 595	None Detected
55A 574285					
55B 574286	Tan Grout	Under Ceramic Wall Tile-Pool	tan	Non-Fibrous 100	None Detected
55B 574286					
55C 574287	Tan Grout	Under Ceramic Wall Tile-Pool	tan	Non-Fibrous 100	None Detected
55C 574287					
55D 574288	Tan Grout	Under Ceramic Wall Tile-Pool	tan	Non-Fibrous 100	None Detected
55D 574288					
55E 574289	Tan Grout	Under Ceramic Wall Tile-Pool	tan	Non-Fibrous 100	None Detected
55E 574289					
56A 574290	White Mastic	Under Wall Ceramic Tile-Pool	white	Non-Fibrous 100	None Detected
56A 574290					
56B 574291	White Mastic	Under Wall Ceramic Tile-Pool	white	Non-Fibrous 100	None Detected
56B 574291					
56C 574292	White Mastic	Under Wall Ceramic Tile-Pool	white	Non-Fibrous 100	None Detected
56C 574292					

FieldID	Material	Location	Color	Non-Asbestos %	Asbestos %
LabID					
56D	White Mastic	Under Wall Ceramic Tile-Pool	white	Non-Fibrous 100	None Detected
574293					
56E	White Mastic	Under Wall Ceramic Tile-Pool	white	Non-Fibrous 100	None Detected
574294					
57A	Mastic Gray	Under Ceramic Tile on Pool Deck	gray	Non-Fibrous 100	None Detected
574295					
57B	Mastic Gray	Under Ceramic Tile on Pool Deck	gray	Non-Fibrous 100	None Detected
574296					
57C	Mastic Gray	Under Ceramic Tile on Pool Deck	gray	Non-Fibrous 100	None Detected
574297					
57F	Mastic Gray	Under Ceramic Tile on Pool Deck	gray	Non-Fibrous 100	None Detected
574298					
57E	Mastic Gray	Under Ceramic Tile on Pool Deck	gray	Non-Fibrous 100	None Detected
574299					

Be Thursday 3-12-20

Client: CDU Consultants
Address: 10 Huron Drive North MA
Project Site & # Northeast Metropolitan Vaccination
Technical School Wakefield MA
Phone / email address: Saharano educators@cdus.com
Contact: SUSAN CAHOLA
Relinquish by date: 3/10/2020
Received by date: 3-9-20
of Samples Received: 92

CHAIN OF CUSTODY
EPA/600/R-93/116

Asbestos Identification Lab
165 New Boston St.
Suite 227
Woburn, MA 01801
(781) 932-9600
www.asbestosidentificationlab.com
Date Sampled: 3/2/2020-3/3/2020



Rev 06/16

BATCH# 151555

Page 1 **of** 19

Turnaround Time ☐ Less 3 Hrs ☒ Bulk ☐ Same Day ☐ Soil ☐ Next Day ☐ Wipe ☒ 3 Day ☐ Point Count ☒ Stop on 1st Positive? Yes/No ☒ Yes ☐ No

Notify Method: Mail/E-Mail/Verbal

Analyzed By: [Signature]

Date: 3/10/2020

Lab ID# (Lab Use Only)		Field ID/ (Client Reference)	Temp in Celsius = 23	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)						
Material / Location				% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence	Pleochroism			⊥	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic
574208		28		Material Interior Door Location Next to main office Assembly	0	~		gr	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									~					5
09		29		Material Interior Door Location Assembly Near Portal	0	~		gr	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									~					5
10		30		Material Interior door Material Location Gym Door	0	~		gr	Chrysotile Amosite Crocidolite Tremolite Anthophyllite Actinolite									~					5

OIE: Thursday 3-12-20

NE

Lab ID# (Lab Use Only)		Field ID/ (Client Reference)	Temp in Celcius = ____	Stereo Scope					Optical Properties										Non-Asbestos Percentage (%)						
Material / Location				% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence	Pleochroism	RI	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other	Non-Fibrous		
11	31	Material Interior TAN Location Door 104		0	Dark	~	Stk	h	Chrysotile														5		
12	32	Material Interior TAN Location Door 107		0	Dark	~	Stk	h	Chrysotile														5		
13	33	Material Gray Glaze Location Interior Door Window above		0	Dark	~	Stk	h	Chrysotile	2	~	0	+	~	~	1.55/1.551							98		
14	34	Material Gray Glaze on Interior window Location on Door # Window 107		0	Dark	~	Stk	h	Chrysotile	2	~	0	+	~	~	1.55/1.551							98		
15	35	Material Gray Glaze on Interior window Location on Door 121 on rm.		0	Dark	~	Stk	h	Chrysotile	2	~	0	+	~	~	1.55/1.551							98		

2704

AT Metro Tech

Page 3 of 19

Lab ID# (Lab Use Only)		Field ID/ (Client Reference)	Temp in Celsius =	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)						
Material / Location			% of Asbestos	Color	Homogeneity	Texture	Friable									Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other	Non-Fibrous	
16	34	Material Gray Glaze Location Interior Window above window door - 1st floor		0.55	2	2	2	Asbestos Minerals Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite	2	2	2	2	2	2	1.551	1.551							28
17	37	Material Window Glaze Location Wally Interior Hall Assembly room 109		0.55	2	2	2	Asbestos Minerals Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite	2	2	2	2	2	2	1.551	1.551							28
18	39A	Material Gray Glaze Location Interior windows main office		0.55	2	2	2	Asbestos Minerals Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite	2	2	2	2	2	2	1.551	1.551							100
19	388	Material " " Location " "		0.55	2	2	2	Asbestos Minerals Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite	2	2	2	2	2	2	1.551	1.551							100
20	39A	Material 2x2 Tan/Brown textured covering tile Location Hallway		0.55	2	2	2	Asbestos Minerals Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite	2	2	2	2	2	2	1.551	1.551							100

Lab ID# (Lab Use Only)		Field ID/ (Client Reference)	Temp in Celcius = _____	Stereo Scope					Asbestos Minerals	Optical Properties						RI	Non-Asbestos Percentage (%)							
				Material / Location	% of Asbestos	Color	Homogeneity	Texture		Friable	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence		Pleochroism	=	⊥	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic
21	39B	Material " "			088	✓	24	2	Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite									1	1	40	50			
22	39C	Material " "		0	28	✓	24	3	Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite									1	1	40	50			10
23	39D	Material " "		0	28	✓	24	3	Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite									1	1	40	50			10
24	39E	Material " "		0	28	✓	24	2	Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite									1	1	40	50			10
25	39F	Material " "		088	✓	24	2	Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite										1	1	40	50			10

[illegible]

Lab ID# (Lab Use Only)		Field ID/ (Client Reference)	Temp in Celcius = ____	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)						
Material / Location				% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence	Pleochroism			⊥	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic
31	40c	Material 11 Location 11	11 11	0+	✓	248	Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite										12	50					60
32	40D	Material 11 Location 11	11 11	0+	✓	248	Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite										12	50					60
33	40E	Material 11 Location 11	11 11	0+	✓	248	Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite										12	50					60
34	40f	Material 11 Location 11	11 11	0+	✓	248	Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite										12	50					60
35	40g	Material 11 Location 11	11 11	0+	✓	248	Chrysotile Amosite Crocidolite Tremolite Anthrophyllite Actinolite										12	50					60

[illegible]

Classroom

2. 1/2

[illegible]

[illegible]

NE Metro-Ted

Lab ID# (Lab Use Only)		Field ID/ (Client Reference)	Temp in Celcius = _____	Stereo Scope					Optical Properties							RI	Non-Asbestos Percentage (%)							
Material / Location				% of Asbestos	Color	Homogeneity	Texture	Friable	Asbestos Minerals	Asbestos %	Morphology	Extinction	Sign of Elongation	Birefringence	Pleochroism		=	+	Fiberglass	Mineral Wool	Cellulose	Hair	Synthetic	Other
61	47D	Material " "	" "	Obs	y	y		Chrysotile																70
62	47E	Material " "	" "	Obs	y	y		Chrysotile																60
63	47F	Material " "	" "	Obs	y	y		Chrysotile																50
64	47G	Material " "	" "	Obs	y	y		Chrysotile																90
59	48A	Material Bad-Mastic	Location Trazzo					Chrysotile																
								Amosite																
								Crocidolite																
								Tremolite																
								Anthophyllite																
								Actinolite																

NS.

[illegible]

[illegible]

[illegible]

17A

[illegible]

[illegible]

[illegible]



Asbestos Identification Laboratory

165 New Boston St., Ste 227

Woburn, MA 01801

781-932-9600

Web: www.asbestosidentificationlab.com

Email: mikemanning@asbestosidentificationlab.com

Batch:

51610



Lab Code: 200919-0

March 16, 2020

Susan Cahalan
CDW Consultants, Inc.
6 Huron Drive
Natick, MA 01760

Project Name: *Northeast Metro Technical Vocational H.S.,
Wakefield, MA*

Project Number:

Date Sampled: 2020-03-04

Work Received: 2020-03-11

Work Analyzed: 2020-03-12

Analysis Method: BULK PLM ANALYSIS EPA/600/R-93/116

Dear Susan Cahalan,

Asbestos Identification Laboratory has completed the analysis of the samples from your office for the above referenced project. The information and analysis contained in this report have been generated using the EPA /600/R-93/116 Method for the Determination of Asbestos in Bulk Building Materials. Materials or products that contain more than 1% of any kind or combination of asbestos are considered an asbestos containing building material as determined by the EPA. This Polarized Light Microscope (PLM) technique may be performed either by visual estimation or point counting. Point counting provides a determination of the area percentage of asbestos in a sample. If the asbestos is estimated to be less than 10% by visual estimation of friable material, the determination may be repeated using the point counting technique. The results of the point counting supersede visual PLM results. Results in this report only relate to the items tested. This report may not be used by the customer to claim product endorsement by NVLAP or any other U.S. Government Agency.

Laboratory results represent the analysis of samples as submitted by the customer. Information regarding sample location, description, area, volume, etc., was provided by the customer. Asbestos Identification Laboratory is not responsible for sample collection activities or analytical method limitations. Unless notified in writing to return samples, Asbestos Identification Laboratory discards customer samples after 30 days. Samples containing subsamples or layers will be analyzed separately when applicable. Reports are kept at Asbestos Identification Laboratory for three years. This report shall not be reproduced, except in full, without the written consent of Asbestos Identification Laboratory.

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- Massachusetts Certification License: AA000208
- State of Connecticut, Department of Public Health Approved Environmental Laboratory Registration Number: PH-0142
- State of Maine, Department of Environmental Protection Asbestos Analytical Laboratory License Number: LB-0078(Bulk) LA-0087(Air)
- State of Rhode Island and Providence Plantations. Department of Health Certification: AAL-121
- State of Vermont, Department of Health Environmental Health License AL934461

Thank you Susan Cahalan for your business.

Michael Manning
Owner/Director

March 16, 2020

Susan Cahalan
CDW Consultants, Inc.
6 Huron Drive
Natick, MA 01760

Project Name: Northeast Metro Technical Vocational H.S.,
Wakefield, MA
Project Number:
Date Sampled: 2020-03-04
Work Received: 2020-03-11
Work Analyzed: 2020-03-12

Analysis Method: BULK PLM ANALYSIS EPA/600/R-93/116

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
58A 575062	Gray Mastic	Under Ceramic Pool Deck Tiles	gray	Non-Fibrous 100	None Detected
58B 575063					
58C 575064	Gray Mastic	Under Ceramic Pool Deck Tiles	gray	Non-Fibrous 100	None Detected
59A 575065					
59B 575066	White Expansion Joint	Pool Area Interior Walls	white	Non-Fibrous 100	None Detected
59C 575067					
60A 575068	White Ceiling Plaster	Girls Locker Room	white	Non-Fibrous 100	None Detected
60B 575069					
60C 575070	White Ceiling Plaster	Girls Locker Room	white	Non-Fibrous 100	None Detected
61A 575071					
61B 575072	White Ceiling Plaster	Boys Locker Room	white	Non-Fibrous 100	None Detected
61C 575073					
62A 575074	Gray Grout	Under Ceramic Floor Tile, Girls Locker Room	gray	Non-Fibrous 100	None Detected
62B 575075					

FieldID LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
62C 575076	Gray Grout	Under Ceramic Floor Tile, Girls Locker Room	gray	Non-Fibrous 100	None Detected
63A 575077					
63B 575078	Dark Gray Mastic	Under Ceramic Floor Tile, Girls Locker Room	gray	Cellulose 10 Non-Fibrous 90	None Detected
63C 575079					
64A 575080	Dark Gray Mastic	Under Ceramic Floor Tile, Girls Locker Room	gray	Cellulose 10 Non-Fibrous 90	None Detected
64B 575081					
64C 575082	Gray Mastic	Under Ceramic Wall Tile - Halls	gray	Non-Fibrous 100	None Detected
64D 575083					
64E 575084	Gray Mastic	Under Ceramic Wall Tile - Halls	gray	Non-Fibrous 100	None Detected
64F 575085					
64G 575086	Gray Mastic	Under Ceramic Wall Tile - Halls	gray	Non-Fibrous 100	None Detected
65A 575087					
65B 575088	Black Coating on Copper	Behind Brick Facade	black	Cellulose 10 Non-Fibrous 80	Detected Chrysotile 10
65C 575089					
65D 575090	Black Coating on Copper	Behind Brick Facade			Not Analyzed
65E 575091					
66A 575092	Black Coating on Copper	Behind Brick Facade			Not Analyzed
66B 575093					
66A 575092	Thin Copper Flashing With Black Coating	Top Foundation Sill	black	Cellulose 20 Non-Fibrous 80	None Detected
66B 575093					

FieldID	Material	Location	Color	Non-Asbestos %	Asbestos %
LabID					
66C	Thin Copper Flashing With Black Coating	Top Foundation Sill	black	Cellulose 15	None Detected
575094				Non-Fibrous 85	
67A	Gray Concrete Skim	Exterior Gym Roof Level	gray	Non-Fibrous 100	None Detected
575095					
67B	Gray Concrete Skim	Exterior Gym Roof Level	gray	Non-Fibrous 100	None Detected
575096					
67C	Gray Concrete Skim	Exterior Gym Roof Level	gray	Non-Fibrous 100	None Detected
575097					
68A	Green Paper	Under Concrete Skim	green	Non-Fibrous 100	None Detected
575098					
68B	Green Paper	Under Concrete Skim	green	Non-Fibrous 100	None Detected
575099					
68C	Green Paper	Under Concrete Skim	green	Non-Fibrous 100	None Detected
575100					
65A.1	Plaster		white	Non-Fibrous 100	None Detected
575101					
65B.1	Plaster		white	Non-Fibrous 100	None Detected
575102					
65C.1	Plaster		white	Non-Fibrous 100	None Detected
575103					
65D.1	Plaster		white	Non-Fibrous 100	None Detected
575104					
65E.1	Plaster		white	Non-Fibrous 100	None Detected
575105					
65F.1	Plaster		white	Non-Fibrous 100	None Detected
575106					
65G.1	Plaster		white	Non-Fibrous 100	None Detected
575107					

OKAY DUE MONDAY 5/16 PER 805411

CHAIN OF CUSTODY

EPA/600/R-93/116

Page 1 of 1

Turnaround Time Sample Method

Less 3 Hrs

Bulk

Same Day

Soil

Next Day

Wipe

Two Day

Point Count

Stop on 1st Positive? Yes/No

Notify Method: Mail/E-Mail/Verbal

Analyzed By: Chad Blakely

Date: 3/12/2020

Asbestos Identification Lab

165 New Boston St.

Suite 227

Woburn, MA 01801

(781)932-9600

www.asbestosidentificationlab.com

Date Sampled: 3/4/2022



BATCH#

51610

Rev 06/16

Client: CD Cantharts

Address: LeHaven Drive Natick MA

Project Site & # Northeast Metro Technical

Phone / email address: Peasnow H.S. Wakefield

Stahala & Cantharts

Contact: David Cantharts

Relinquish by date: 3/9/2020

Received by date: 3/11/2020

of Samples Received: 37 410

Temp in Celsius = 25.1

Stereo Scope

Optical Properties

RI

Non-Asbestos Percentage (%)

Lab ID#
(Lab Use Only)

Field ID/
(Client
Reference)

Material / Location

% of Asbestos

Color

Homogeneity

Texture

Friable

Asbestos
Minerals

Asbestos %

Morphology

Extinction

Sign of
Elongation

Birefringence

Pleochroism

||
⊥

Fiberglass

Mineral Wool

Cellulose

Hair

Synthetic

Other

Non-Fibrous

Material
Gray Mastic

Location
Under Ceramic
Floor Deck Tiles

0 6y N 6r N

Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite
Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite

Asbestos %
Morphology
Extinction
Sign of
Elongation
Birefringence
Pleochroism

Fiberglass
Mineral Wool
Cellulose
Hair
Synthetic
Other
Non-Fibrous

Material
"

Location
"

0 6y N 6r N

Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite

Asbestos %
Morphology
Extinction
Sign of
Elongation
Birefringence
Pleochroism

Fiberglass
Mineral Wool
Cellulose
Hair
Synthetic
Other
Non-Fibrous

Material
"

Location
"

0 6y N 6r N

Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite

Asbestos %
Morphology
Extinction
Sign of
Elongation
Birefringence
Pleochroism

Fiberglass
Mineral Wool
Cellulose
Hair
Synthetic
Other
Non-Fibrous

Material
"

Location
"

0 6y N 6r N

Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite

Asbestos %
Morphology
Extinction
Sign of
Elongation
Birefringence
Pleochroism

Fiberglass
Mineral Wool
Cellulose
Hair
Synthetic
Other
Non-Fibrous

Material
"

Location
"

0 6y N 6r N

Chrysotile
Amosite
Crocidolite
Tremolite
Anthophyllite
Actinolite

Asbestos %
Morphology
Extinction
Sign of
Elongation
Birefringence
Pleochroism

Fiberglass
Mineral Wool
Cellulose
Hair
Synthetic
Other
Non-Fibrous

[illegible]

girls locker room

Page 7 of 10

[illegible]

DM

[illegible]

[illegible]

[illegible]

APPENDIX B

**EMSL Analytical, Inc.**

200 Route 130 North, Cinnaminson, NJ 08077

Phone/Fax: (856) 303-2500 / (856) 786-5974

<http://www.EMSL.com>cinnaminsonleadlab@emsl.com

EMSL Order: 202003023

CustomerID: CDWC26

CustomerPO:

ProjectID:

Attn: **Susan Cahalan**
CDW Consultants
6 Huron Drive
Natick, MA 01760

Phone: (508) 875-2657
 Fax:
 Received: 03/12/20 10:15 AM
 Collected: 3/5/2020

Project: **NE Metro Tech Voc Wakefield****Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)***

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Weight</i>	<i>Lead Concentration</i>
LP-1	202003023-0001	3/5/2020	3/13/2020	0.2537 g	2.5 % wt
Site: White Paint on Wood Sloped Roof					
LP-2	202003023-0002	3/5/2020	3/13/2020	0.2523 g	6.7 % wt
Site: White Paint on Wood Main Roof					
LP-3	202003023-0003	3/5/2020	3/13/2020	0.2521 g	0.30 % wt
Site: Red Paint - Steel Window Lintel					
LP-4	202003023-0004	3/5/2020	3/13/2020	0.2647 g	12 % wt
Site: Gray Paint on Roof Stair Rail					
LP-5	202003023-0005	3/5/2020	3/13/2020	0.2529 g	0.034 % wt
Site: Tan Door Paint on Metal #23					
LP-6	202003023-0006	3/5/2020	3/13/2020	0.2925 g	0.068 % wt
Site: Brown Paint Metal Door Assembly #23					
LP-7	202003023-0007	3/5/2020	3/13/2020	0.2636 g	0.0084 % wt
Site: Brown Paint on Metal HVAC Ext Near Kitch					
LP-8	202003023-0008	3/5/2020	3/13/2020	0.2531 g	0.10 % wt
Site: Tan Paint On Wood Garage Door					
LP-9	202003023-0009	3/5/2020	3/13/2020	0.2512 g	0.12 % wt
Site: Brown Paint Metal Door U2					
LP-10	202003023-0010	3/5/2020	3/13/2020	0.2592 g	20 % wt
Site: Brown Over Red Stair Rail Paint					
LP-11A	202003023-0011	3/5/2020	3/13/2020	0.2865 g	0.035 % wt
Site: White Textured Paint on Concrete - Front					
LP-11B	202003023-0012	3/5/2020	3/13/2020	0.2897 g	0.013 % wt
Site: White Textured Paint on Concrete - Front					
LP-12	202003023-0013	3/5/2020	3/13/2020	0.2516 g	<0.0080 % wt
Site: Tan Paint Ext Metal Door					
LP-13	202003023-0014	3/5/2020	3/13/2020	0.2571 g	0.42 % wt
Site: Brown Over Red Metal Door Assembly 109					
LP-14	202003023-0015	3/5/2020	3/13/2020	0.2587 g	0.0094 % wt
Site: Pink - White Paint - Hall on CMU					

Phillip Worby, Lead Laboratory Manager
 or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 03/14/2020 10:31:44

**EMSL Analytical, Inc.**

200 Route 130 North, Cinnaminson, NJ 08077

Phone/Fax: (856) 303-2500 / (856) 786-5974

<http://www.EMSL.com>cinnaminsonleadlab@emsl.com

EMSL Order: 202003023

CustomerID: CDWC26

CustomerPO:

ProjectID:

Attn: **Susan Cahalan**
CDW Consultants
6 Huron Drive
Natick, MA 01760

Phone: (508) 875-2657
Fax:
Received: 03/12/20 10:15 AM
Collected: 3/5/2020

Project: **NE Metro Tech Voc Wakefield****Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)***

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Weight</i>	<i>Lead Concentration</i>
LP-15	202003023-0016	3/5/2020	3/13/2020	0.2560 g	<0.0080 % wt
Site: Gray Paint Metal Door Dental					
LP-16	202003023-0017	3/5/2020	3/13/2020	0.2634 g	0.020 % wt
Site: White Parking Stripe Paint Rear Near Kitchen					
LP-17A	202003023-0018	3/5/2020	3/13/2020	0.2769 g	<0.0080 % wt
Site: Yellow Paint on Curb					
LP-17B	202003023-0019	3/5/2020	3/13/2020	0.2586 g	0.60 % wt
Site: Yellow Paint on Curb					
LP-18	202003023-0020	3/5/2020	3/13/2020	0.2531 g	<0.0080 % wt
Site: Gray Wall Paint on CMU Hall					
LP-19	202003023-0021	3/5/2020	3/13/2020	0.2503 g	0.71 % wt
Site: Silver Paint on Bleachers FB Field					
LP-20	202003023-0022	3/5/2020	3/13/2020	0.2703 g	<0.0080 % wt
Site: Dk Gray/Black/Green Annocement Both					

Phillip Worby, Lead Laboratory Manager
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 03/14/2020 10:31:44

EMSL

Lead (Pb) Chain of Custody

EMSL Order ID (Lab Use Only):

Cinnaminson, NJ 08077

PHONE: 1-800-220-3675

FAX: (856) 786-5974

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LABORATORY • PRODUCTS • TRAINING
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202003023

Company: CDW Consultants		EMSL-Bill to: ☒ Same ☐ Different If Bill to is Different note instructions in Comments**	
Street: 6 Huron Drive		Third Party Billing requires written authorization from third party	
City: Natick	State/Province: MA	Zip/Postal Code: 01760	Country: US
Report To (Name): susan cahalan		Telephone #: 5088752657	
Email Address: scahalan@cdwconsultants.com		Fax #:	Purchase Order:
Project Name/Number: NE Metro Tech Voc Wakefield		Please Provide Results: ☐ Fax ☒ Email	
U.S. State Samples Taken: MA		CT Samples: ☐ Commercial/Taxable ☐ Residential/Tax Exempt	
Turnaround Time (TAT) Options* - Please Check			
☐ 3 Hour	☐ 6 Hour	☒ 24 Hour	☒ 48 Hour
☐ 72 Hour	☐ 96 Hour	☐ 1 Week	☐ 2 Week
*Analysis completed in accordance with EMSL's Terms and Conditions located in the Price Guide			
Matrix	Method	Instrument	Reporting Limit
Chips ☒ % by wt. ☐ mg/cm ² ☐ ppm (mg/kg)	SW846-7000B	Flame Atomic Absorption	0.01%
Air	NIOSH 7082	Flame Atomic Absorption	4 µg/filter
	NIOSH 7105	Graphite Furnace AA	0.03 µg/filter
	NIOSH 7300M/NIOSH 7303	ICP-OES	0.5 µg/filter
Wipe* ☐ ASTM non ASTM ☐	SW846-7000B	Flame Atomic Absorption	10 µg/wipe
*if no box checked, non-ASTM Wipe assumed	SW846-6010B or C	ICP-OES	1.0 µg/wipe
TCLP	SW846-1311/7000B/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)
	SW846-1311/SW846-6010B or C	ICP-OES	0.1 mg/L (ppm)
SPLP	SW846-1312/7000B/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)
	SW846-1312/SW846-6010B or C	ICP-OES	0.1 mg/L (ppm)
TTLC	22 CCR App. II, 7000B/7420	Flame Atomic Absorption	40 mg/kg (ppm)
	22 CCR App. II, SW846-6010B or C	ICP-OES	2 mg/kg (ppm)
STLC	22 CCR App. II, 7000B/7420	Flame Atomic Absorption	0.4 mg/L (ppm)
	22 CCR App. II, SW846-6010B or C	ICP-OES	0.1 mg/L (ppm)
Soil	SW846-7000B	Flame Atomic Absorption	40 mg/kg (ppm)
	SW846-6010B or C	ICP-OES	2 mg/kg (ppm)
Wastewater Unpreserved ☐	SM3111B/SW846-7000B	Flame Atomic Absorption	0.4 mg/L (ppm)
Preserved with HNO ₃ pH < 2 ☐	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)
	EPA 200.7	ICP-OES	0.020 mg/L (ppm)
Drinking Water Unpreserved ☐	EPA 200.8	ICP-MS	0.001 mg/L (ppm)
Preserved with HNO ₃ pH < 2 ☐	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)
	EPA 200.5	ICP-OES	0.003 mg/L (ppm)
TSP/SPM Filter	40 CFR Part 50	ICP-OES	12 µg/filter
	40 CFR Part 50	Graphite Furnace AA	3.6 µg/filter
Other:			
Name of Sampler: Susan Cahalan		Signature of Sampler: [Signature]	
Sample #	Location	Volume/Area	Date/Time Sampled
1 LP-1	White Paint on Wood Slop Roof		3/5/2020
2 LP-2	White Paint on Wood Main Roof		
Client Sample #s		Total # of Samples:	
Relinquished (Client): [Signature]	Date: 3/11/2020	Time:	
Received (Lab): [Signature]	Date: 3/12/2020	Time: 10:15am	
Comments:			

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LABORATORY • PRODUCTS • TRAINING

LEAD (Pb) CHAIN OF CUSTODY

EMSL ORDER ID (Lab Use Only):

202003023

Cinnaminson, NJ 08077

PHONE: 1-800-220-3675

FAX: (856) 786-5974

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Location	Volume/Area	Date/Time Sampled
3 LP-3	Red paint - Steel window lintel	-	3/5/2020
4 LP-4	Gray paint on wood stair rail	-	
5 LP-5	Tan door paint on Metal #23	-	
6 LP-6	Brown ^{paint} Metal Door Assembly #23	-	
7 LP-7	Brown paint on Metal HVAC ext ^{near} kitel	-	
8 LP-8	Tan paint on wood garage door	-	
9 LP-9	Brown paint metal door 02	-	
10 LP-10	Brown over red stair rail paint	-	
11 LP-11A	White textured paint on concrete - front	-	
12 LP-11B	" " " "	-	
13 LP-12	Tan paint ext Metal door	-	
14 LP-13	Brown over red Metal door ^{Assembly} 109	-	
15 LP-14	Pink-White paint - Hall on CMU	-	
16 LP-15	Gray paint Metal door Dental	-	
17 LP-16	White parking stripe paint ^{near} kitchen	-	
18 LP-17A	Yellow paint on curb	-	
19 LP-17B	" " "	-	
20 LP-18	Silver paint on Bleach ^{#B final} SS ^{SSC}	-	
Comments/Special Instructions: ↑ Gray wall paint on CMU Hall			



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LEAD (Pb) CHAIN OF CUSTODY

EMSL ORDER ID (Lab Use Only):

202003023

Cinnaminson, NJ 08077

PHONE: 1-800-220-3675

FAX: (856) 786-5974

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

[illegible]

Comments/Special Instructions:

SECTION 011100
SUMMARY OF WORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents
 - 2. Contract Method
 - 3. Contract Conditions
 - 4. Work under other contracts
 - 5. Work Sequence and phasing.
 - 6. Owner-furnished products
 - 7. Construction Manager use of premises
 - 8. Permits, inspection and testing required by Governing Authorities
 - 9. Specification formats and conventions.
 - 10. Reference standards.
 - 11. Miscellaneous Provisions.
 - 12. Available project information.

1.3 WORK UNDER THIS CONTRACT

- A. Project Identification:
Northeast Metropolitan Regional Vocational High School
- B. Project Location:
Wakefield, MA
- C. Architect:
Drummey Rosane Anderson, Inc.
235 Bear Hill Rd., 4th Floor
Waltham, MA 02451

D. Description of the Project Scope

1. Without limitation, the project consists of the construction of a new four-story high school at the site of the existing Northeast Metropolitan Regional Vocational High School (NEMT) in Wakefield, MA. Site work includes but not limited to significant ledge removal operation, construction of the new access driveway with traffic light and turn-off lanes at the new site entrance. The Work consists of a steel framed, concrete masonry, and light gauge metal framing walls with large scale CMU veneer, manufactured stone veneer, and high performance insulated rainscreen panels at exterior envelope of the building. The exterior envelope also includes metal shingles and insulated metal panels. The roofing system includes but not limited to low slope single-ply membrane roofing over tapered and non-tapered insulation, roof pavers plazas, and vegetated roof areas.
2. The Work includes the demolition and removal of the existing Vocational High School after completion of the new construction.
3. The work also includes construction of several freestanding accessory structures.
4. Phasing: The Project will be constructed in four major phases, an Early Site Preparation Phase, an Early Structure Phase, a Building Construction Phase, and an Existing Building demolition/final site work phase. The existing building will be occupied during the first three phases. The new building will be occupied during the last phase.
5. Sustainable Design: LEED V4.0 for Schools.

E. Description of Early Site Preparation Phase

1. This phase consists of site preparation and blasting required for site enabling including
 - a. Excavation and backfill for site utilities and building(s) foundations.
 - b. Installation of site utilities
 - c. Subgrades shall be installed to design subgrade for driveways, curbing, hardscapes and landscapes. Asphalt paving, curbing, hardscapes and landscape materials procurement and installation are excluded from the Early Site Preparation phase.
2. All drawings and specifications labeled for reference (either on the sheets or in the table of contents) are not final and subject to revision as the project design evolves.
3. Sustainable Design: LEED V4.0 for Schools.

- F. All work mentioned or indicated in the Contract Documents shall be provided as part of this Contract unless it is specifically indicated in the Contract Documents that such work is to be done by others. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Construction Manager and Trade Contractors. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all. For example, any item indicated in the Specifications which is omitted from the Drawings or vice versa shall be construed as though contained in both. Should the Drawings or the Specifications disagree in themselves or with each other, the Construction Manager and Trade Contractors shall provide the better quality or greater quantity of Work unless otherwise directed by written addendum to the Contract.

1.4 CONTRACT METHOD:

- A. Project will be constructed under a single prime contract. This Contract shall be a Construction Manager at Risk, bid as required by Public Bid Laws.

1.5 CONTRACT CONDITIONS

- A. This Contract is subject to applicable State and local laws and all amendments thereto. Where any requirements contained herein do not conform to statutes governing the Work of this Contract, the statutes shall govern.
- B. This Project will be constructed for a political subdivision of the Commonwealth of Massachusetts, and is therefore exempt from State Sales and Use Tax. All bids shall be prepared and purchase of materials for the Project made on the basis of such exemption. After execution of the Contract, the Owner will furnish the Construction Manager with the exemption number to be used.
- C. The provisions of the Federal Occupational Safety and Health Act (OSHA) apply to the execution of the Work of this Contract, in addition to all other laws, ordinances, rules, regulations, and orders of any Federal, State, or local public authority bearing on the performance of the Work.
- D. Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if, through mistake or otherwise, any such provision is not inserted, or is not correctly inserted, then upon application of either part the Contract shall forthwith be physically amended to make such insertion or correction.

1.6 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
 - 1. General Building Commissioning.
 - 2. Owner initiated construction inspection and testing services.
 - 3. Other applicable work if so indicated on Contract Documents.

1.7 WORK SEQUENCE AND PHASING

- A. General: The Construction Manager's attention is directed toward the critical activities and limitations listed in this Article to highlight unusual conditions present in this Project.
 - 1. The Construction Manager shall be responsible for scheduling the Work accordingly, and in conformance with requirements of all other specifications for the Project.
 - 2. Sequencing requirements shall be clearly identified on all construction schedules required under Section 013200 - Construction Progress Documentation.
 - 3. General Sequence of Work:
 - a. Building and site constructions.
 - b. Existing building abatement and demolition.

1.8 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.
1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Construction Manager.
 2. Owner will arrange and pay for delivery of Owner-furnished items according to Construction Manager's Construction Schedule.
 3. After delivery, Owner will inspect delivered items for damage. Construction Manager shall be present for and assist in Owner's inspection.
 4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
 5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Construction Manager.
 6. Owner will furnish Construction Manager the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Construction Manager shall designate delivery dates of Owner-furnished items in Construction Manager's Construction Schedule.
 7. Construction Manager shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
 8. Construction Manager is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
 9. Construction Manager is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
 10. If Owner-furnished items are damaged as a result of Construction Manager's operations, Construction Manager shall repair or replace them.
 11. Construction Manager shall install and otherwise incorporate Owner-furnished items into the Work.
- B. Note that items labeled "N.I.C." on the Drawings will be furnished and installed by the Owner under a separate contract after the completion of the Work.

1.9 CONSTRUCTION MANAGER USE OF PREMISES

- A. General: Construction Manager shall have full use of premises for each phase of construction operations, including use of Project site, during construction period.
1. Confine operations at the site to areas permitted by laws, by-laws, permits and contract limit lines.
 2. Do not unreasonably encumber the site with materials or equipment.
 3. Coordinate with Owner and Architect work in connection with adjacent occupied buildings or areas, driveways, walks, and other facilities which would prevent access thereto or interrupt, restrict, or otherwise infringe upon use thereof.
- B. On-Site Work Hours: Subject to approval and coordination with the Town of Wakefield, work shall be generally performed inside the building during normal business working hours of 7AM – 6PM Weekdays // 7AM – 5PM Saturdays // No Work Sundays & Holidays. Comply with local noise ordinance. Construction Manager shall be required to seek work hour variance for requested/planned Work on-site outside of the hours above.

- C. Existing Utility Interruptions: Refer to Section 011400 - Work Restrictions.
- D. Construction Manager Parking: Parking of Construction Manager's vehicles and those of his Subcontractors will be allowed only within Limit of Work area located where shown on Drawings. Construction Manager shall be responsible for parking arrangements, regulation and control of such parking and resulting traffic. Each Subcontractor shall make arrangements with Construction Manager for required parking of his vehicles.
- E. On-Site Delivery and Storage of Construction Materials: Do not permit materials and fabricated work to be stacked on, or be transported over, floor and roof construction in such a manner as to stress any construction beyond the designed live loads. Assume full responsibility for protection and safekeeping of products stored on premises. Obtain and pay for use of additional storage or work areas needed for operations. Limit use of site to work and storage of materials for this project.
 - 1. Maintain clean, dry storage areas for construction materials and minimize their exposure to dust. Refer to individual Division 2 through 50 Sections for additional requirements.
 - 2. Do not store foamed polystyrene, polyurethane or like materials within the building. Take proper precautionary measures regarding the Storage of such materials outside the building.
- F. Construction Manager shall be responsible for adequate site drainage during the entire construction period and shall use any appropriate temporary means that does not adversely affect construction progress or abutting property; as applicable to their work areas only.
- G. Construction Manager shall take all necessary safety precautions and maintain an adequate level of fire protection at all times.
- H. Do not use areas outside the Limit of Work area for temporary storage or structures without specific written permission from the Architect and Owner.

1.10 PERMITS, INSPECTION AND TESTING REQUIRED BY GOVERNING AUTHORITIES

- A. If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested, or approved, the Construction Manager shall give the Designer and such Authority timely notice of its readiness so the Designer may observe such inspection and testing.
- B. Prior to the commencement of construction, the Construction Manager shall complete application to the appropriate Building Code enforcement authority for a Building Permit. Such Permit shall be displayed in a conspicuous location at the Project Site.
- C. Payment requirements for this permit fee are waived by the Owner. Waiver of the permit fee in this instance shall not be understood to apply to other permit fee requirements for the project.

1.11 REFERENCE STANDARDS

- A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

- B. The date of the standard is that in effect as of the bid date, except when a specific date is specified.
- C. Obtain copies of standards when required by Contract Documents. Maintain copy at job site during progress of the specific work.

1.12 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.
 - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 - 2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. All instructions in the Specifications are addressed to the Construction Manager unless the responsibility of the Designer or Owner is clearly indicated.
 - a. Where products are listed or described in outline form, the phrase "The Construction Manager shall furnish these products" is implied.
 - b. Where installation instructions or performance criteria are listed or described in outline form, the phrase "The Construction Manager shall perform the Work in accordance with these requirements" is implied.
 - c. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
- C. Definitions:
 - 1. Indicated: The word "indicated" refers to graphic representations, notes or schedules on Drawings, Paragraphs or schedules in Specifications, and similar requirements in Contract Documents. Terms such as "shown", "noted", "scheduled", and "specified" are used to help locate a reference. No limitation on location is intended except as specifically noted.
 - 2. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted", are hereby defined as "directed by Designer", "requested by Designer", "authorized by Designer", and other like items. No implied meaning shall be interpreted to extend the Designer's responsibility into the Construction Manager's area of construction supervision.
 - 3. Approve: The term "approved" when used in conjunction with the Designer's action on the Construction Manager's submittals, applications, and similar requests, is limited to

the duties and responsibilities of the Designer as stated in GENERAL CONDITIONS. Such approval shall not release the Construction Manager from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.

4. **Furnish:** Supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
 5. **Install:** Operations at Project Site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
 6. **Provide:** To furnish and install, complete and ready for intended use.
 7. **Installer:** The Construction Manager or entity engaged by the Construction Manager, either as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 8. **Owner:** The Awarding Authority.
 9. **Authority having Jurisdiction:** Any State, Local, or legal authority, as defined by statute.
- D. "Or Equal", "Or Equivalent": clause:
1. Where products or materials are prescribed by manufacture name, trade name or catalogue reference, the word "or approved equal" shall be understood to follow.
 2. An item shall be considered equal or equivalent to the named item, if all of the following conditions are met:
 - a. It is at least equal in appearance, quality, durability, strength and design.
 - b. It meets or exceeds all performance requirements specified.
 - c. It performs the function of the item to an equal or superior standard as does the named item.
 3. All deviations from products specified shall be submitted as substitutions. For related procedures, refer to Section 013300 – Submittal Procedures.

1.13 MISCELLANEOUS PROVISIONS

- A. **Discovery:** If during the excavation or other work, articles of unusual value, or of historical or archaeological significance are encountered the ownership of such articles is retained by the Owner, and information regarding their discovery shall be immediately furnished to the Designer.
1. If the nature of the article is such that the work cannot proceed without danger of damaging same, work in that area shall be immediately discontinued until the Designer has decided the proper procedure to be followed.
 2. Any time lost thereby shall be a condition for which the time of the Contract may be extended.
 3. All costs incurred after discovery in the salvaging of such articles shall be borne by the Owner.
- B. Refer to Section 013100 – Project Management and Coordination, Article 1.4, B. for particular project supervision requirements.
- C. **Product and Material Requirements:** In addition to product and material requirements as specified throughout the Project Manual, preference shall be given to materials mined or manufactured in Massachusetts first and the United States of America second wherever possible.
- D. **Proprietary Items:** No proprietary Items at this time.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 011400
WORK RESTRICTIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Construction Manager responsibility for Architect's additional services.
 - 2. Construction Documents, Project Electronic Files and graphic reproduction of Contract Documents.
 - 3. Interpretation and modification of Contract Documents.
 - 4. Construction Manager's reports.
 - 5. Cleaning materials
 - 6. Safety and disposal requirements.
 - 7. Conduct of the Work.
 - 8. Existing Utilities.
 - 9. Conduct of construction personnel and noise control.
 - 10. Safety and disposal requirements and accident prevention.
 - 11. Welding and cutting.
 - 12. Fire watch.
 - 13. Municipal police services
 - 14. Storage of materials off-site
 - 15. Dust control.
 - 16. Cleaning during construction.
 - 17. Debris control and removal of rubbish.
 - 18. Pollution control.
 - 19. Owner's occupancy requirements
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION: Preparation and execution of construction schedule.
 - 2. Section 013100 – PROJECT MANAGEMENT COORDINATION: Procedures and re-

- sponsibilities for coordinating the Work.
- 3. Section 013300 – SUBMITTAL PROCEDURES. Submittal procedures.
- 4. Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for additional information on temporary measures required during construction.
- 5. Section 017400 – CONSTRUCTION WASTE MANAGEMENT, for removal of non-hazardous debris including provisions for recycling and disposal.
- 6. Section 017700 – CLOSEOUT PROCEDURES: Procedures for completing the Work.
- 7. Section 017839– PROJECT RECORD DOCUMENTS: Preparation of record drawings and other documents.
- 8. Section 310000 – EARTHWORK, for removal of contaminated soils and liquids.

1.3 SUBMITTALS

- A. General: Refer to Section 013300– SUBMITTALS, for submittal provisions and procedures.
- B. Layout of Temporary Construction Facilities: Submit location plan showing office, trailer and storage layout.
- C. Logistics Plan:
 - 1. Construction Manager shall submit to the Architect, at the Pre-construction Meeting, a detailed Logistics Plan, which shall include:
 - a. Delivery Hours and Delivery Routes
 - b. Gate location, and wheel washing location.
 - c. Hours of Work
 - d. Trailer Area, and Layout of trailers
 - e. Parking locations for use of Owner and Construction Manager within the area of work
 - f. Temp fencing, erosion control, and metering locations
 - g. Location for stockpiling of soil
 - h. Location for stockpiling plowed snow
 - i. Locations for waste management containers.
 - j. Protection of existing curbs and walkways.
 - k. Lighting Plan
 - l. Traffic plan.
 - m. Police detail.
 - n. Pedestrian safety plan on site.
 - 2. Refer to Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for specifications for temporary construction and other items to be shown on Logistics Plan.
 - 3. No work shall commence until the Logistics Plan has been approved.
 - 4. Refer to the attached Safety and Traffic Control Plan, which is hereby made part of the Contract Documents.
- D. Photographs: Progress Prints and videotapes as specified in this Section.
- E. Reports:
 - 1. Documentation of off-site storage facilities.

2. With each Application for Payment, submit the following reports, compiled on a monthly basis:
 - a. Construction Manager's Reports
 - b. Proof of submission of Certified weekly payrolls to Owner.
 - c. Monthly cost projections.

1.4 CONSTRUCTION MANAGER RESPONSIBILITY TO THE OWNER FOR ARCHITECT'S ADDITIONAL SERVICES

- A. The Contract between the Owner and the Architect contains provisions for additional services that may be required of the Architect during construction due to unforeseen conditions.
 1. Where such additional services become necessary due to the activities of the Construction Manager, as determined by the Owner's Project Manager, costs for such services will be the responsibility of the Construction Manager, and will be deducted from the Contract Amount.
- B. Additional services for which the Construction Manager is responsible for cost to the Owner may include the following activities of the Architect:
 1. Review of Requests for Information and Change Order Requests for work determined to be covered in the Contract Documents. Refer to related Articles in this Section.
 2. Continuation of construction administration beyond the dates specified for Final Completion of the Work: Refer to Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION.
 3. Review of re-submitted submittals and Substitution Requests that have been rejected: Refer to Section 013300 – SUBMITTAL PROCEDURES.
 4. Re-inspection of incomplete work: Refer to Section 017700 – CLOSEOUT PROCEDURES.
 5. Design services for the resolution of non-conforming work.

1.5 CONSTRUCTION DOCUMENTS

- A. The Construction Manager shall retain copies of the Contract Documents issued to them for bidding purposes.
 1. The Owner will furnish to the Construction Manager, without additional charge, an additional ten (10) complete sets of the Contract Documents, including Drawings and Specifications, for use during the construction period.
 2. Extra sets returned by bidders and not required for other purposes, as determined by the Owner's Project Manager, will be made available to Construction Manager and Subcontractors for the Work.
- B. All other hard copies of the Contract Documents required by the Construction Manager or subcontractors for use during the construction period shall be purchased by the party requiring same. Owner's Project Manager will furnish approximate costs of such additional copies and will transmit originals to local printing companies with whom he regularly does business, but will not receive bills for such printing through his account. All negotiations for such printing shall be between Construction Manager and Printer.
 1. Refer to provisions in this Section, for electronic copies of documents to be made avail-

able for the Construction Manager's use during construction.

2. Refer to Section 017839 – PROJECT RECORD DOCUMENTS, for additional sets to be provided by the Owner to the Construction Manager for the purpose of maintaining record prints of the Work as construction proceeds.

1.6 PROJECT ELECTRONIC FILES

A. Definitions:

1. Contract Documents: Printed hard copies of drawings and other documents, as defined in the General Conditions and listed in the signed copy of the Form of Agreement between Owner and Construction Manager.
 - a. In case of conflict between the Contract Documents and documents obtained through electronic means, the Contract Documents shall govern.

B. General Procedures: At the Pre-Construction Meeting, the Architect will present to the Construction Manager one compact disc (CD) with Project Electronic Files, for use in the preparation of coordination and record documents for the Project.

1. Additional copies of the compact disc with Project Electronic Files will be available from the Architect at an additional cost.

C. Electronic File Format:

1. Editable Files: Electronic files for drawings will be furnished in "*.DWG" or other agreed upon format.
2. Printable, Non-Editable Files: Electronic files for all Drawings in the Bid Set and for Drawings issued as Addenda will be furnished in "*.PDF" format (Adobe Acrobat Reader, version 6.0).
3. The Architect does not warrant that these electronic documents are compatible with any software or hardware other than those on which they were produced.

D. Permitted Use of Project Electronic Files: Use of electronic files by the Construction Manager and Sub-Contractors is limited to the following activities:

1. Project Electronic Files may be used as a guide only for the preparation of Coordination Drawings and Record Drawings to be submitted as a requirement for the Project.
2. Project Electronic Files may be used as a guide only for preparation of shop drawings. Exact copies of Contract Documents will not be accepted if submitted for these purposes, unless specifically permitted by an individual specification Section.

E. Responsibilities of Construction Manager: Use and reproduction of Project Electronic Documents are subject to the following conditions:

1. The use of Project Electronic Files, reproduced either electronically or by other graphic reproduction methods, does not in any way alter the responsibilities of the Construction Manager for final system coordination. The Construction Manager shall incur all liability in this respect.
2. The Construction Manager and all Subcontractors are responsible for checking the dimensions and completeness of the Project Electronic Files, and for determining any possible errors and omissions, as required by the General Conditions.

3. The Construction Manager is responsible for updating Project Electronic Files as necessary to incorporate changes to the Work shown in Addenda and documents issued during construction.
 4. In no event shall the Architect, or any other Person or Firm involved in the creation, production or distribution of the reproducible or electronic documents, be liable to the persons utilizing the documents, on account of any claim for damages. Each Person or Firm utilizing these documents agrees to release, indemnify, hold harmless and defend the Architect, its officers, employees and consultants from an against all liability arising out of such firm's use of the electronic or reproduced documents or information referred to herein.
- F. Ownership of Documents: By transferring copies of Project Electronic Files, the Architect and the Owner do not in any way convey the copyright in the designs contained therein, nor do they convey a license to copy or use them for any purpose except as required for the construction of the Project.
- G. License for Software: By transferring copies of Project Electronic Files, the Architect does not in any way convey transfer license to use the software on which the documents were prepared. Each entity using Project Electronic Files is responsible for obtaining licenses as needed for its use of those files.
- 1.7 GRAPHIC REPRODUCTION OF CONTRACT DOCUMENTS
- A. Reproduction of Contract Documents issued for the Project, by graphic reproduction methods, shall be subject to the conditions outlined for reproduction of Project Electronic Files.
- 1.8 INTERPRETATION AND MODIFICATION OF CONSTRUCTION DOCUMENTS
- A. Refer to General and Supplementary Conditions for general information on Change Orders, Work Change Directives, Field Orders and Architect's written amendments and clarifications. The intent of this Article is to provide for additional procedures to be followed during construction.
- B. Requests for Information: Each time the Construction Manager or Subcontractor has a reasonable question on the interpretation of the Contract Documents, they shall submit in writing a Request for Information (RFI) to the Architect for response.
1. The Construction Manager shall examine field conditions carefully and review the Drawings and Specifications thoroughly prior to issuing an RFI.
 2. The Construction Manager shall keep a log of RFI's, numbering them in the order in which they are issued.
 3. Each RFI shall contain a clear statement of the question, references to relevant Contract Documents and additional background information as needed to facilitate the Architect's review.
 4. All requests for information from Subcontractors shall be made through the Construction Manager and addressed to the Architect, and the Architect will distribute them as needed to the appropriate Consultants. A copy of each RFI shall be given to the OPM.
 5. RFI's shall be issued in a timely manner to permit a thorough review and preparation of a response by the Architect and their Consultants. The Construction Manager shall identify on the RFI form whether the RFI is low, medium or highly critical and shall note

- the date that the RFI response is due in order not to affect the construction progress schedule.
6. The Architect will prepare a written response to each RFI within 10 workdays, or sooner if the Construction Manager provides a realistic date when the response will be needed.
- C. Proposal Requests: During construction, it may become necessary or desirable to modify the Contract Drawings or Specifications in response to concealed existing conditions, changes in the Owner's program or other unforeseen circumstances.
1. Where such a modification may involve a change in the Contract price or time, the Architect will prepare a Proposal Request describing the modification under consideration, including sketches or drawings, specifications and other information to permit pricing by the Construction Manager.
 2. Copies of each Proposal Request and its attachments will be distributed to the Owner, OPM and Construction Manager.
 3. The Construction Manager shall respond in a timely manner with a Proposed Change Order detailing the estimated costs and change in Contract duration, for review by the Architect and approval by the Owner.
 4. A Proposal Request will not constitute direction to proceed with the modification unless accompanied by a Work Change Directive and an estimated price.
- D. Change Order Requests: If the Construction Manager is required to perform Work that they consider to represent a change in the cost of the Project, they may submit Change Order Requests for such work in accordance with the General Conditions and Supplementary General Conditions.
1. Each Change Order Request shall be accompanied by a document describing the modification under consideration, including sketches or drawings, specifications and other information to permit review of pricing by the Architect and Owner.
 2. Distribute copies of each Change Order Request and its attachments to the Owner, OPM and Architect.
 3. The Architect and Owner will respond in a timely manner with a Proposed Change Order incorporating the Change Order Request if it is approved.
 4. Verbal approval of a Change Order Request will not constitute direction to proceed with the modification unless accompanied by a Change Order, or a Construction Change Directive with an estimated price.
- E. Architect Review of Construction Manager-Generated Requests for Information and Change Order Requests: The Architect will review and prepare written responses to the Construction Manager's Requests for Information and Change Order Requests that are submitted in accordance with the requirements of this section.
1. If the Construction Manager submits an excessive number of requests for information that are incomplete, or for which the information requested is available from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Construction Manager-prepared or other prior Project correspondence or documentation, then the Construction Manager shall be responsible to the Owner for costs for Additional Services of the Architect to review those requests for information.
 2. If the Architect determines that the Work covered by a Change Order Request is covered by the scope of the Contract Documents, the Construction Manager shall be responsible to the Owner for costs for Additional Services of the Architect to evaluate pro-

- posals and prepare Instruments of Service associated with such Change Order Request.
3. Refer to other paragraphs in this Section for procedures required in cases where Construction Manager is responsible to the Owner for costs for Additional Services of the Architect.

1.9 CONSTRUCTION MANAGER'S REPORTS

- A. A daily report summarizing the work performed, weather conditions, number of workers, amount and kinds of equipment, unusual occurrences, and the like shall be submitted by the Construction Manager's Field Superintendent to the Architect, the Owner, the OPM, each working day covering the work performed on the previous working day.
- B. Form of the daily report shall be as approved by the Architect.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

- A. Use only those materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer or surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 CONDUCT OF WORK

- A. The Contract Site shall be as shown on the Drawings, and shall include the entire area bound by the "Contract Limit" or "Limit of Work" lines as well as all areas outside of the Limit of Work Lines when required for performance of work under this Contract.
- B. Construction Manager shall take all steps necessary to protect existing conditions to remain. Damage to existing work caused by Construction Manager's operations under this Contract shall be repaired at Construction Manager's expense.
- C. Any street, paving, curb and/or sidewalk damaged as the result of work under this Contract, whether within or outside the limits of the Work, shall be repaired and/or replaced with new matching construction by the Construction Manager at his expense and in a manner satisfactory to the Architect and authorities having jurisdiction.
- D. Protection of Curbs and Walkways: Where existing curbs or walks are to remain, or after new curbs or walks are constructed and trucking is required over them, they shall be suitably protected as shown on approved Logistics Plan.

- E. Trenching and other work outside construction limits shall be expedited to the fullest and carried out with minimum of inconvenience to normal operations of Owner and public traffic. Walks, paved or landscaped areas over which temporary driveways cross shall, upon completion of the Work, be restored to their original condition with new construction. Temporary roadways shall be bridged over trenched areas.
- F. Provide continuous, lawful, safe, adequate and convenient access to the site. Construction Manager shall construct and maintain in good, safe, usable condition temporary roads, capable of supporting emergency vehicles, and appurtenances as required, and when no longer required, remove temporary construction and restore such areas to their original condition, or as otherwise specified in the Contract Documents.

3.2 EXISTING UTILITIES

- A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner, or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- B. Immediately repair any active existing utility lines (cables, conduit, ducts, and piping), damaged during the course of construction. Protect and maintain such active existing utilities in use, until relocation of same has been completed or utilities have been cut, capped, or prepared for new service connections, as applicable. Perform such repair and protection work at no additional cost to the Owner.
- C. If any existing active utility not indicated on the Drawings is unintentionally damaged, and such utility is to remain, immediately repair the damage and restore the utility to its original integrity. Reimbursement of cost for performing such repair will be made by an adjustment in the Contract Price in accordance with the General Conditions of the Contract.
- D. Any adjustment as outlined above shall be based on the assumption that the Construction Manager has performed in a prudent manner at the time such damage occurred. If extra expense is incurred in protecting and maintaining any utility line not shown on the Drawings, nor revealed by a "Dig-Safe" inspection, an adjustment in the Contract Price shall be made.
- E. The Owner will cooperate and assist the Construction Manager in locating and identifying underground utilities. Construction Manager shall cooperate and participate in "Dig Safe" programs, notifying proper authorities before proceeding.
- F. If it becomes necessary to interrupt power, water line, sewer, gas or other utilities to adjacent buildings, notify the Architect and Owner's Project Manager at least four (4) days in advance. Schedule such interruptions at such times as will minimize disruption and inconvenience to users. Construction Manager shall be responsible for notification to neighboring properties as required.

3.3 CONDUCT OF CONSTRUCTION PERSONNEL

- A. Under the provisions of the Education Reform Act of 1993, smoking is not permitted on the

property, including the construction site.

- B. Under no circumstances shall workers on site have interactions with students.
- C. Use of profanity is prohibited.

3.4 NOISE CONTROL

- A. Develop and maintain a noise-abatement program and enforce strict discipline over all personnel to keep noise to a minimum. Submit noise abatement program to Owner's Project Manager and Architect for review prior to use of noise generating equipment.
 - 1. Publish a schedule of designated quiet days to coincide with the school's scheduled academic testing and similar activities that are deleteriously affected by construction noise.
- B. Execute construction work by methods and by use of equipment that will reduce noise and which will provide minimum interference with neighborhood activities.
 - 1. Employ construction methods and equipment that will produce the minimum amount of noise.
 - 2. Equip air compressors with silencers, and power equipment with mufflers.
 - 3. Handle vehicular traffic and scheduling to reduce noise.
- C. Do not allow radio and electronic entertainment equipment to be operated at volume that makes ordinary conversation difficult at ten (10) feet from such equipment.

3.5 SAFETY AND DISPOSAL REQUIREMENTS

- A. Standards: Maintain project in accordance with State Building Code and local ordinances.
- B. Hazards Control: Store volatile wastes in covered metal containers and remove from premises. Prevent accumulation of wastes which create hazardous conditions. Provide adequate ventilation during use of volatile and noxious substances.
- C. Disposal: Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws. Do not burn or bury rubbish and waste materials on project site. Do not dispose of hazardous wastes such as solvents, mineral spirits, oil, paint, paint thinner in storm or sanitary drains. Do not dispose of wastes into streams or waterways.

3.6 ACCIDENT PREVENTION

- A. Comply with all Federal, State and municipal recommendations and requirements for safety and accident prevention, those of the Associated General Contractors of America and the American National Standards Institute (ANSI Standard A10.2). Conduct regular, frequent inspections of the site for compliance with safety regulations.
- B. Neither the Owner nor the Architect will be responsible for providing a safe working place for the Construction Manager, Subcontractors, or their employees, or any individual responsible to them for the Work.

3.7 WELDING AND CUTTING

- A. Where electric or gas welding or cutting work is done above or within ten (10) feet of combustible material or above space that may be occupied by persons, use interposed shields of incombustible material to protect against fire damage or injury due to sparks and/or hot metal.
- B. Place tanks supplying gases for gas welding or cutting at no greater distance from the work than is necessary for safety, securely fastened and maintained in an upright position where practicable. Such tanks, when stored for use, shall be remote from any combustible material and free from exposure to the direct rays of the sun or high temperatures. Storage shall be secured under lock and key, to prevent unauthorized use of gas and equipment.
- C. Maintain suitable fire extinguishing equipment near all welding and cutting operations. When operations cease for the noon hour or at the end of the day, thoroughly wet down the surroundings adjacent to welding and cutting operations. Properly protect any new materials, stored or installed, that are subject to water damage.
- D. Station a worker equipped with suitable fire extinguishing equipment near welding and cutting operations to see that sparks do not lodge in floor cracks or pass through floor to wall openings or lodge in any combustible material. Keep the worker at the source of work which offers special hazards for a minimum of thirty (30) minutes after the job is completed to make sure that smoldering fires have not been started.
- E. Place a qualified electrician in charge of installing and repairing electric and arc welding equipment.

3.8 FIRE WATCH

- A. Comply with authorities having jurisdiction for fire watch requirements during hot work operations. Hot work shall include but not be limited to welding, torch and open flame work, cutting of steel, and other similar operations. Schedule and pay for fire watch services as required by authorities having jurisdiction.

3.9 MUNICIPAL POLICE SERVICES

- A. Make all necessary arrangements with the municipal police department in advance of times when regular, off-duty, or reserve police officers will be needed for traffic control or protection due to operations performed under this Contract.
- B. Pay police officers in accordance with rates established by the municipality for such services:

3.10 STORAGE OF MATERIALS OFF SITE

- A. The Construction Manager, Subcontractors and Sub-subcontractors shall obtain prior written approval from the Owner through the Architect for permission to store materials to be incorporated in the Work, for which Progress Payments will be requested, at off-site locations. Any and all charges for storage, including insurance, shall be borne solely by the Construction Manager. Before approval, Owner will require proper proof of insurance and a letter in which is furnished:

1. The names of the Construction Manager and/or Subcontractor or subordinate Subcontractor leasing the storage area.
 2. The location of such leased space.
 3. Description of the leased area: The entire premises or certain areas of a warehouse giving the number of floors or portions thereof.
 4. The date on which the material is first stored.
 5. The value of the material stored.
 6. Transfer of title for such materials in a form acceptable to the Owner.
- B. Requirements for storage facility at which materials will be stored off-site:
1. The storage facility shall be a bonded warehouse.
 2. The Construction Manager shall permit access to the storage facility to the OPM, Architect, and Owner upon request.
- C. Construction Manager, Subcontractors and subordinate Subcontractors shall provide prior to the request for payment for such stored materials, adequate advanced notice, to the Architect so that the Owner, OPM, or Architect can inspect, at their convenience, the materials being stored at any location.
- D. Each sealed carton shall be marked with the Project name, the Owner's name and the Architect's name as they appear in the Agreement.
- E. A perpetual inventory shall be maintained for all materials held in storage for which payment has been requested.
- F. Payment for materials stored off site shall be at the sole discretion of the Owner. Any additional costs to the Owner resulting from storage of material off site for which payment is requested, such as, but not limited to, travel expenses and time for inspectors shall be back-charged to, and paid by, the Construction Manager.
- 3.11 DUST CONTROL
- A. Maintain the construction site, stockpiles, access, detour, and haul roads, staging and parking area used for the Work, free of dust which would cause a hazard or a nuisance to those at the site or adjacent sites.
 - B. Provide environmentally safe and positive methods and dust control materials to minimize raising dust from construction operations, and provide positive means to prevent air-borne dust from dispersing into the atmosphere.
 - C. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
 - D. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
 - E. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces, including paint, coatings, sealants, caulking, adhesives.
 - F. Furnish, erect, and maintain for the duration of the work period, temporary fire-retardant dust

proof coverings and partitions as required to prevent the spread of dust beyond the immediate area where work is being performed.

- G. These provisions do not supersede any specific requirements for methods of construction or applicable regulations or general conditions set forth elsewhere in the Contract with regard to performance obligations of the Construction Manager.

3.12 CLEANING DURING CONSTRUCTION

- A. Execute cleaning during progress of work and at Substantial Completion, as required by General Conditions, and as herein specified. Refer to Section 017400 – Construction Waste Management for more information.
- B. Maintain premises and public properties free from accumulations of waste, debris and rubbish caused by operations. At completion of work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all exposed surfaces; leave project clean and ready for occupancy.
- C. Cleaning shall be in addition to cleaning specified under other sections and shall include all surfaces, interior and exterior in which or to which the Construction Manager has had access.
- D. Refer to Sections of the Specifications for cleaning of specific products.
- E. Execute cleaning to ensure that the building, the site, and adjacent properties are maintained free from accumulations of waste materials and rubbish and windblown debris, resulting from construction operations.
- F. Provide on-site containers for collection of waste materials, debris and rubbish.
- G. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal areas off site.
- H. Handle materials in a controlled manner with as few handling as possible. Do not drop or throw materials from heights.
- I. Schedule cleaning operations so that dust and other contaminants resulting from cleaning processes will not fall on wet newly painted surfaces, uncured caulking, sealants, adhesives, and other like items

3.13 DEBRIS CONTROL AND REMOVAL OF RUBBISH

- A. Ensure that each Subcontractor engaged in the Work bears full responsibility for cleaning up during on a daily bases and immediately upon completion of his work, and removes all rubbish, waste, tools, equipment, and appurtenances caused by and used in the execution of his work; but this shall in no way be construed to relieve the Construction Manager of primary responsibility for maintaining a clean building and site free of debris, leaving all work broom clean and in a condition satisfactory to the Architect, Project Manager, and Owner. Refer to Section 017400 – Construction Waste Management for more information.
- B. Provide at least one tightly built chute serving each level which shall lead down to angle off-

set and sliding panel chute at a convenient loading point for trucks or dumpsters.

- C. Do not permit any material to be thrown from open floors, windows or roof of the building.
- D. Immediately after unpacking, remove all packing materials, case lumber, excelsior, wrapping and other rubbish, flammable and otherwise, from the building and premises.
- E. Initiate and maintain a specific program to prevent the accumulation of debris at the construction site, storage and parking areas, or along access roads and haul routes:
Provide containers for deposit of debris and schedule periodic collection and disposal of debris. Prohibit overloading of trucks to prevent spillage on access and haul routes.
- F. Construction Manager shall make provisions for snow and ice removal, as required. CM to take all reasonable measures to maintain clean neighborhood streets

3.14 POLLUTION CONTROL, GENERAL

- A. Provide methods, means and facilities required to prevent contamination of soil, water and atmosphere by the discharge of noxious substances from construction operations.
- B. Remediation of Spills: Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids. Excavate and dispose of contaminated earth off site and replace with suitable uncontaminated compacted fill and topsoil, in accordance with the requirements of Section 310000 - EARTHWORK.
- C. Take special measures to prevent harmful substances from entering public waters. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams or in sanitary or storm sewers.
- D. Provide systems for control of atmospheric pollutants. Prevent toxic concentrations of chemicals. Prevent harmful dispersal of pollutants into the atmosphere.

3.15 OWNER'S OCCUPANCY REQUIREMENTS

- A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion dates, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 - 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

- B. If the Project is substantially complete by the specified date for Substantial Completion, the Owner at his election may from time to time, or permanently, occupy the building or any portion thereof as the work is completed to such a degree as will, in the opinion of the Owner, permit the use of the building or other portions of the Project for the purpose for which they are intended.
- C. The Owner will, prior to any such partial occupancy, give notice to the Construction Manager thereof and such occupancy shall be predicated upon the following conditions:
 - 1. In the case of partial occupancy prior to the stipulated completion date, the Owner shall secure endorsement from the Construction Manager's insurance carrier and consent of the surety permitting occupancy of the building or use of the Project during the remaining period of construction.
 - 2. In the case of partial occupancy after the stipulated completion date, the Construction Manager shall extend all the necessary insurance coverage as stipulated until the date of Final Acceptance of the Project. Owner's use and occupancy prior to final Acceptance shall not relieve the Construction Manager of his responsibility to maintain the insurance coverage as required by the Contract Documents.
 - 3. In case of such partial occupancy, the guarantee period called for by the Contract Documents shall commence on the date of Substantial Completion of the Phase containing the guaranteed Work.
 - 4. Occupancy of the building or any portion thereof by the Owner, shall not constitute an acceptance of the Work or of work not performed in accordance with the Contract Documents or relieve the Construction Manager of responsibility to perform any work required by the Contract but not completed at the time of occupancy.
 - 5. If the Owner occupies the building as a result of the Construction Manager's failure to substantially complete the work by the specified date, the Construction Manager shall pay maintenance costs on the portion of the building occupied under this Agreement until Substantial Completion.
 - 6. The Construction Manager shall be required to furnish heat, electricity and water used in the occupied portion of the building, from the time of the occupancy by the Owner until Substantial Completion of the project.

END OF SECTION

NORTHEAST METROPOLITAN REGIONAL VOCATIONAL SCHOOL DISTRICT
100 Hemlock Road – Wakefield, MA 01880-3597
(781) 246-0810 – FAX (781) 246-4919

NEMRV – CH 385
G

CORI REQUEST FORM

Northeast Metropolitan Regional Vocational School has been certified by the Criminal History Systems Board for access to all criminal case data including conviction, non-conviction and pending. As an Applicant/employee for the position of _____, I understand that a Criminal record check will be conducted for conviction, non-conviction and pending criminal case information only and that it will not necessarily disqualify me. The information below is correct to the best of my knowledge.

Applicant/Employee Signature

APPLICANT / EMPLOYEE INFORMATION (PLEASE PRINT)

LAST NAME **FIRST NAME** **MIDDLE NAME**

MAIDEN NAME OR ALIAS (IF APPLICABLE) **PLACE OF BIRTH**

DATE OF BIRTH _____ **LAST SIX DIGITS OF**
SOCIAL SECURITY NUMBER: _____ - _____

MOTHER'S MAIDEN NAME: _____

CURRENT AND FORMER ADDRESSES: _____

SEX: _____ **HEIGHT:** ____ ft. ____ in. **WEIGHT:** _____ **EYE COLOR** _____

STATE DRIVER'S LICENSE NUMBER: _____

*****THE ABOVE INFORMATION WAS VERIFIED BY REVIEWING THE**
FOLLOWING FORM OF GOVERNMENT ISSUED PHOTOGRAPHIC
IDENTIFICATION: _____

REQUESTED BY: _____
SIGNATURE OF CORI AUTHORIZED EMPLOYEE

SECTION 012200
UNIT PRICES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. This Section includes administrative and procedural requirements for unit prices.
- B. Related Sections include the following:
 - 1. DIVISION 02 through DIVISION 33 for procedures, materials, and execution requirements related to unit price work.

1.3 DEFINITIONS

- A. Unit Price: A unit price is an amount proposed by Bidders on the Bid Form as a price per unit of measurement for materials or services added or subtracted from the Contract Sum by appropriate modification.

1.4 PROCEDURES

- A. Each unit price includes all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are as follows:
 - 1. For work covered by scheduled quantities, notify the Owner and Architect a minimum of 24 hours in advance of the performance of such work.
 - 2. Document such work in writing, identifying type of work, quantity and location of work. Submit documentation on Construction Manager's letterhead.
 - 3. All documentation of work covered by scheduled quantities will be subject to verification and approval by the Owner and Architect.
 - 4. In order to be considered for payment, documentation for work covered by scheduled quantities shall be submitted within one month of performance of such work. Requests for payment of such work submitted more than one month after the work has

- been performed will not be accepted.
5. Only Documentation signed and verified by the Construction Manager, Trade, and the Owner's Representative will be considered valid. Documentation not signed by all these parties will be considered invalid.
- C. Owner reserves the right to reject Construction Manager's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Construction Manager.
- D. Schedule of Unit Prices immediately follows this section.
- E. UNIT PRICES: Should the quantities of work performed under unit prices be increased or decreased from those on which the bid is based, by approval of the Architect, the undersigned agrees that the Unit Prices set forth below and in the Specifications will be the basis of payment to the Contractor or credit to the Awarding Authority for such increase, or decrease in the Work. The undersigned agrees that the Unit Prices given represent the exact amount per unit to be paid to the Contractor (in the case of additions or increases) or to be refunded to the Awarding Authority (in the case of decreases), and that no additional adjustment will be requested or allowed for general conditions, overhead, profit, insurance, worker's compensation insurance, or other direct or indirect expenses of Contractor or sub-contractors. The Awarding Authority will have the right to reject any or all proposed Unit Prices at any time prior to signing the Agreement, in which case the cost of extra work shall be as determined by one of the other methods set forth in the General Conditions.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

APPENDIX 012201
UNIT PRICE SCHEDULE
**NORTHEAST METROPOLITAN REGIONAL HIGH SCHOOL
WAKEFIELD, MA**

1. The following unit prices as defined in the specifications are designated for items of work on the basis of unknown quantities or quantities estimated by the Designer. These unit prices will be used to add or to deduct from the dollar amounts shown, depending on whether the actual amount is greater or less than the estimated amount. UNIT PRICES GIVEN HEREIN SHALL BE FOR ADDITIONAL WORK ONLY. DECREASED WORK SHALL BE AT THE "ADD" PRICE LESS FIFTEEN PERCENT (15%).

Unit Price Number	Specification section and Description	Unit Measure	Unit Price Dollars/Cents
	REFER TO BALANCE OF CONTRACT DOCUMENTS & GILBANE BIDDING DOCUMENTS FOR SPECIFIC UNIT PRICES TO CARRY FOR THIS BID PACKAGE.		

2. The unit prices identified herein shall include their pro-rata share of all costs for the indicated items of work, including such items as overhead, superintendence, general conditions, profit, bond, labor, materials, payments to and coordination of subcontractors, equipment costs, disposal fees, and all other work incidental thereto.
3. Quantities and measurements indicated in the Specifications are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the

Owner shall determine payment.

END OF APPENDIX

SECTION 012300
ALTERNATES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by Bidders and Trade-Bidders, and stated on the appropriate Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Each General Bidder and each Sub-Bidder shall examine the Alternates generally defined herein and in the Drawings and Specifications and determine any modifications to his work caused by any Alternate whether or not his particular trade Section is mentioned herein.
- B. Listing of Alternates on Bid Forms:
 - 1. Each Trade-Bidder shall enter in the FORM FOR SUB-BID only the amount of the addition or subtraction necessitated by the Alternate that pertains to the work of his trade.
 - 2. General Bidders shall enter a single amount in the appropriate space provided in the FORM FOR GENERAL BID, which total amount shall consist of the Trade-Bidders' amounts and the amount for all work to be performed by the Construction Manager.

3. Work of Sections that are affected by Alternates but which are not designated as Trade-Bid Sections shall be included in the work of the Construction Manager.
- C. Alternates will be considered in numerical sequence as required by Chapter 149, Section 44G of the Massachusetts General Laws.

1.5 COORDINATION

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
 2. The amount listed for each alternate shall include all costs related to coordination, modification and adjustments of the Work associated with that alternate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections affected by alternates contain requirements for materials necessary to achieve the work described under each alternate.

3.2 SCHEDULE OF ALTERNATES

- A. Refer to drawings.
- B. Add Locker Room Building
- C. Add Concessions/Toilet Building
- D. Add Synthetic Turf Football Field
- E. Add Irrigate Baseball Field

- F. Add Irrigate Soccer Field
- G. Add Protection/Cover board at the roof
- H. Add Fit out for Bank
- I. Add Terrazzo in lieu of porcelain paver tile in Lobby A119 and Corridor C105
- J. Add Terrazzo in lieu of porcelain paver tile in Stair S-1

END OF SECTION

SECTION 012400
SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes requirements for the following procedures:
 - 1. Preparation and submittal of the Preliminary and Final Schedule of Values
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Requirements for construction schedules: Section 013200 – Construction Progress Documentation.
 - 2. General procedures for submittals: Section 013300 – Submittal Procedures.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Construction Manager allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Construction Manager's Applications for Payment.

1.4 SUBMITTALS

- A. Prepare and submit the following submittals in accordance with the requirements of Section 013300 – Submittal Procedures.
- B. Schedule of Values:
 - 1. Schedule of Values shall be typewritten on 8-1/2 by 11 inch white paper.
 - 2. Submit to the Architect three (3) copies of each Schedule of Values within 7 days of

receipt of Notice to Proceed.

3. Provide Schedule of Values in AIA-G702 and G703 format.
- C. List of Subcontractors and Sub-subcontractors: Attached to the Preliminary Schedule of Values shall be a list of the names, addresses (and whether individual, partnership or corporation) of each Subcontractor or Sub-Subcontractor who is to perform all or any part of each subdivision. In the event any Subcontractors, or Sub-subcontractors are not known at the time said schedule is prepared, an amended or supplementary list containing the names of the Subcontractors and Sub-Subcontractors involved and indicating their division of the Work shall be furnished to the Architect as soon as the information is available. A code number for identification on requisitions shall be used to identify the Construction Manager, each of the Subcontractors and subordinate Subcontractors, and shall be shown in each requisition where any part of the Work performed by the Construction Manager, such Subcontractor, Sub-Subcontractors or material supplier is incorporated in the amount of the requisition for which payment is requested.
 - D. Monthly Updates: Submit to the Owner with the Schedule of Values on a monthly basis such schedules of quantities and costs, payrolls, reports, estimates, records, and other data as the Owner may request concerning work performed or to be performed under this Contract. The Schedule of Values shall be submitted at the same time as the updated CPM Schedule showing the current status of the work, as required under Section 013200 – Construction Progress Documentation.

1.5 SCHEDULE REQUIREMENTS

- A. General: Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project CPM Schedule. Provide line items for principal subcontract amounts, where appropriate, and for portions of the work designated in this Section.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section. Identify each line item by Specification Number and Title, and by portion of the Work of that Section where the Work of a Section is allocated to more than one line item.
- C. The Schedule of Values shall be arranged in vertical columns identified with titles, including Names Of Items; Original Amounts, Percent Completed To Date; Previous Payments; Current Requests; and Balance Not Yet Requested. A summary of the total amount due to date and the amount of the five percent retained shall be included in the statement which shall be signed by the Construction Manager. A separate sheet shall be included with each requisition showing status of work covered by approved Change Orders. The Schedule of Values shall be revised if later found by the Architect to be inaccurate.
- D. In preparing the Schedule, each sub-division or classification of the Work shall be identified by code number referring to each individual Section (or Sub-Section where applicable) of the Specifications. The Schedule of Values shall be prepared in accordance with AIA Documents G702 and G703.
- E. Initial values will be recognized to be an accurate accounting of the value of the work. Upon request by the Architect, support values given with data that will substantiate their correctness.

- F. Identify quantities of designated materials or materials stored on which payment is expected to be made.
- G. Use monthly submissions of Schedule of Values only as basis for Construction Manager's Application for Payment.

1.6 PREPARING SCHEDULE OF VALUES

- A. General Procedures:
 - 1. Prepare Preliminary Schedule of Values for review by Architect, Owner and Owner's Project Manager.
 - 2. Incorporate requested modifications to produce a Final Schedule of Values, which will become the basis for documenting the progress of the Work with each Application for Payment.
 - 3. Update Final Schedule of Values as necessary to reflect changes in the Work.
- B. Itemize separate line item cost for each of the general cost items as specified in this Section.
- C. Breakdown installed costs into:
 - 1. Delivered cost of product
 - 2. Total installation cost, with overhead and profit.
 - 3. Construction phase.
 - 4. Note that the Owner is exempt from Sales and Use Tax for all materials incorporated into the Work.
- D. For each line item which has installed value of more than \$20,000.00 breakdown costs to list major products, components, or operations under each line.
- E. Sum of costs of all items listed in schedule shall be equal to total Contract Sum.

1.7 LINE ITEMS FOR SCHEDULE OF VALUES

- A. Work Covered in Division 1: Itemize separate line item cost for each of the following general cost items:
 - 1. Builder's Risk Insurance
 - 2. Performance and Payment Bonds for Construction Manager and Trade contractors.
 - 3. Field engineering; photographic documentation.
 - 4. Coordination; project management.
 - 5. Coordination drawings.
 - 6. Preparation of construction schedule and periodic updates.
 - a. If periodic updates of schedule are not performed in a timely manner, the amount shown on the Schedule of Values for this line item shall be forfeit.

7. Weather protection; temporary fence.
 8. Temporary heat, water, power and lighting.
 9. Temporary office facilities; temporary sanitary facilities.
 10. Construction aids, including staging, scaffolding, shoring.
 11. Project sign.
 12. Indoor air quality provisions.
 13. Construction waste management.
 14. Cutting and patching.
 15. Final cleaning.
 16. Punchlist preparation and response.
 17. Maintenance of as-built documents for architectural and site work; preparation of close-out documents.
 18. Commissioning coordination activities.
 19. Overhead.
 20. Other items of work as requested by the Architect or Owner.
- B. Work Covered in Divisions 2 through 50: Provide at least one separate line item for each Section of the Specifications. Section line items shall be further subdivided into separate line items as follows:
1. Subdivide each line item into separate line items for individual floors of the project where applicable.
 2. Identify material costs separately from labor costs.
 3. Provide separate line items for the following where applicable:
 - a. Submittals
 - b. Maintenance of as-built documents for mechanical and electrical work
 - c. Preparation of closeout documents
 - d. Operations and Maintenance Manuals;
 - e. Training
 - f. Other items of work as requested by the Architect or Owner.
 4. For mechanical and electrical work, provide the following additional separate line items where applicable:
 - a. Commissioning coordination activities other than demonstration of FPT to the Commissioning Firm
 - b. Commissioning coordination activities associated with demonstration of FPT to the Commissioning Firm
 5. For each line item which has installed value of more than \$20,000.00 break down costs to list major products, components, or operations under each line.

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Responsibility for coordination of the Work.
 - 2. Surveying and engineering.
 - 3. Coordination Drawings.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Survey information available to bidders: Section 011100– SUMMARY OF THE WORK
 - 2. General requirements for submittals: Section 013300 – SUBMITTAL PROCEDURES.

1.3 SUBMITTALS

- A. Prepare and submit documentation in accordance with Section 013300 – SUBMITTAL PROCEDURES.
- B. Drawings:
 - 1. Survey of base plate elevations and anchor bolt locations.
 - 2. Survey of as-built conditions: Certified survey showing all as-built dimensions, locations, angles and elevations of construction, to be submitted at Substantial Completion of the Work.
 - 3. Coordination Drawings as described in this Section.
- C. Certifications required for Work described in this Section:
 - 1. Field Engineering: Submit name and address of surveyor and professional engineer to Architect.

1.4 COORDINATION

- A. General: The Construction Manager shall be responsible for the proper fitting of all work and the coordination of the operations of all trades, Subcontractors, material installers and equipment engaged upon the Work. He shall perform or cause Subcontractors to perform all cutting, fitting, adjusting and patching necessary to make the several parts of the Work come together properly and to fit the Work to receive or be received by that of other contractors.
- B. Project Supervision: The Construction Manager shall give his personal supervision to the Work and shall assign the following site staff for the Project:
 - 1. 1 Full-time Superintendent: Superintendent shall be licensed in the State the project is located in, with the authority to act on behalf of the Construction Manager. The Superintendent shall supervise the Work at all times throughout the duration of the Project.
 - 2. Quality Control Monitor: A member of Construction Manager's full-time on-site staff assigned to monitor the quality of the Work. The Quality Control Monitor may also be assigned to oversee and document construction waste removal.
 - 3. 1 Project Manager: The Construction Manager shall also provide an adequate project manager for the management, proper coordination, and expediting of the Work.
- C. Coordination with Subcontractors: The Construction Manager shall be in charge of the entire Work and shall be responsible for the prompt coordination of all trades, including his own forces and his various Subcontractors, as well as the Owner's separate contractors, if they are on the job during the Construction Manager's operations, and shall become fully familiar with all work required under the Contract.
 - 1. The above notwithstanding, each Subcontractor shall assume responsibility for the correctness and adequacy of his work. Each Subcontractor shall be responsible for and pay for all damage done by his work and his workers.
 - 2. No Subcontractor shall be permitted on the site without the Superintendent present to supervise the Work.
- D. Care shall be given to the proper scheduling, delivery, and installation of items to be built into rough construction which will affect the latter portions of the Work, such as anchors, pipe sleeves, inserts, conduit, pipes, lugs, clips, brackets, braces, hangers, bolts, miscellaneous metal, and similar items. These items are not necessarily specified under the trade Section under which they are to be installed. The Construction Manager shall ascertain that all are properly installed in their correct locations at the proper time, so as to prevent cutting and patching of finished work.
- E. The Construction Manager shall be fully responsible for coordination of general construction work with that of Subcontractors for PLUMBING, ELECTRICAL, HEATING AND VENTILATING and all other specialized trades. He shall investigate, together with the Subcontractors involved, the routing of pipe, ductwork, and conduit with particular attention to interference of structural members, other pipes, ducts, and conduit cuts, headroom conditions, door and window openings and swings, pipe chases, and similar features of the building which may affect installation and proper functioning of such items.
- F. Changes in design locations which may be necessary in the routing of pipes and ducts, or in the location of any mechanical, electrical or other equipment or in the location of other building elements, shall be anticipated and made prior to installation. Additional compensation will not be allowed for costs incurred as a result of the Construction Manager's failure to anti-

pate the necessity for such changes.

- G. There shall be no change or variation in ceiling height, wall layout, shaft, chase, furring or other dimensions shown on Drawings without the specific written approval of the Architect.
- H. The Construction Manager's responsibility for the coordination of all work under the Contract shall be complete, and shall extend to all modifications in the Work, whether or not such modifications entail a change in the Contract Price. Where the Contract Documents allow an optional material or method of performing a portion of the Work, or where the Construction Manager is ultimately allowed or directed to perform a part of the Work using a substitute material or method, the Construction Manager shall provide all other coordination and additional work that such change necessitates, without any additional cost to the Owner.

1.5 SURVEYING AND ENGINEERING, GENERAL

- A. The Construction Manager shall employ a project engineer who is a qualified land surveyor registered to practice in the State the project is located in, who shall establish and maintain grades and levels and permanent bench marks. In addition, the Construction Manager shall designate one person from within his organization, with engineering experience, who shall do the usual engineering work required, including leveling, checking, and verifying wall and partition lines, elevations, and other like items
- B. Prior to commencement of any excavation or filling work on the site, the project engineer shall check locations of all structures and other fixed items with regard to property lines and other existing conditions. The Construction Manager shall be fully responsible for reporting to the Architect discrepancies between the dimensions and/or locations indicated on the Contract Drawings and those as they actually exist on the site.
- C. After verification of all dimensions and locations, the Construction Manager shall submit to the Architect such verification in written form bearing the professional stamp of the surveyor. Failure to do so shall mean that the Construction Manager assumes responsibility for all corrective measures required at no addition to the Contract amount.
- D. The Construction Manager shall lay out the Work and shall be responsible for all lines, elevations, and measurements of the building, grading, paving and other work under the Contract. He shall exercise proper precaution to verify the dimensions shown on the Drawings before laying out the Work and will be held responsible for any error resulting from his failure to exercise such precaution.

1.6 FIELD ENGINEERING REQUIREMENTS

- A. General: Provide professional field engineering services, establish grades, lines and levels, by use of recognized engineering survey practices.
 - 1. Submit surveys and documentation as described herein.
- B. Scope of Field Engineering:
 - 1. Site features:
 - a. Existing grades, including grades immediately adjacent to existing building.
 - 2. Structural elements: For each column, a precise base plate elevation and horizontal location shall be established.

- a. Elevation of top surface of each leveling plate.
 - b. Precise position of the center of each anchor bolt in each leveling plate.
- C. Qualifications of Surveyor or engineer: Qualified engineer or registered land surveyor, acceptable to Architect and the Owner.
 - 1. Registered professional engineer of the discipline required for the specific service on the Project, licensed in the State the project is located in.
- D. Survey Reference Points:
 - 1. Datum: Location of control datum to be used as reference point for horizontal and vertical survey measurements is shown on Drawings.
 - 2. Locate and protect control and reference points prior to starting sitework, and preserve all permanent reference points during construction.
 - a. Make no changes or relocations of control points without prior written notice to Architect.
 - 3. In the event that any reference point is lost or destroyed, or requires relocation due to necessary changes in grades or construction, perform the following actions without delay:
 - a. Report change to Architect immediately.
 - b. Replacement of reference point shall be performed by surveyor, as directed by Architect.
 - 4. Project Survey Requirements:
 - a. Establish a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.
 - b. Establish lines and levels, locate and lay out by instrumentation and other appropriate means.
 - c. Verify layouts periodically using the same means as those by which they were established.
- E. Records:
 - 1. Maintain a complete, accurate log of all control and survey work as it progresses.
 - 2. Prepare and submit a survey of existing conditions and a final survey of as-built conditions containing all relevant horizontal and vertical dimensions and reference point data.

1.7 BUILDING ENVELOPE COORDINATION DRAWINGS

- A. Building Envelope Coordination Meeting: The CM shall coordinate a pre-construction meeting on site with all of the building envelope Subcontractors, the OPM, Clerk, Commissioning Agent, and Architect. Envelope systems and work includes, but is not limited to:
 - 1. Masonry, Air/ Vapor Barrier Systems, Waterproofing Systems, Windows, Curtainwall, Louvers, Storefront, Roofing Systems, Metal Siding Systems, Exterior Frame Systems.
- B. CM shall coordinate and produce color coded coordination drawings of each system showing interface between each building envelope system.
- C. Coordination drawings shall include, but not be limited to:
 - 1. Foundation Conditions
 - 2. Footing Conditions
 - 3. Edge of floor slab conditions
 - 4. Roof Edge Conditions

5. Roof to Wall Conditions
 6. Opening Conditions (i.e. Window, Curtainwall & Storefront & Vent)
 7. Expansion Joint Conditions
- D. Coordination drawings must be completed prior to system application on the mock-up(s).
- E. Coordination Drawings shall be reviewed and signed off by each building envelope trade.
- F. Refer to additional applicable requirements specified herein below for mechanical coordination drawings.

1.8 MECHANICAL COORDINATION DRAWINGS

- A. The Construction Manager shall be responsible for the coordination of all mechanical and electrical work with architectural requirements including ceiling layouts. Well in advance of commencing work in any area and before materials are fabricated or work begun, he shall submit to the Architect complete Coordination Drawings in the form of colorized PDF's, submitted electronically with 1 hard copy print to the Architect, and 1 hard copy print to the Engineer, in a scale not less than $1/4" = 1'-0"$. Congested areas and sections through shafts shall be at a scale not less than $3/8" = 1'-0"$.
1. Coordination Drawings are considered Informational Submittals. Refer to Section 013300 – SUBMITTALS for requirements for preparation and submittal of Informational Submittals.
- B. Coordination Drawings shall indicate the necessary offsets for all ductwork, piping, conduit, and other items to clear the work of all other trades, and structure, and to maintain the required ceiling height, ceiling layout and partition layout.
- C. Prepare Coordination Drawings as follows: Provide PDF's and 1 hard copy print to the Architect and Engineer concurrently with each trade's additions, and with clearly marked conflicts and questions on said PDF's and prints.
1. The background for coordination drawings shall show the reflected ceiling plan.
 2. Construction Manager shall require HEATING AND VENTILATING Subcontractor to prepare original Drawings showing all ductwork, hot water and other heating lines, based on approved Sheet Metal Fabrication Drawings and related mechanical submittals.
 3. Construction Manager shall distribute them to the Architect and the Plumbing Subcontractor for the next step.
 4. Construction Manager shall then require PLUMBING Subcontractor to indicate all his equipment and plumbing lines on these.
 5. Construction Manager shall then require FIRE PROTECTION Subcontractor to indicate his equipment and piping on these.
 6. Construction Manager shall require the ELECTRICAL Subcontractor to indicate his equipment and conduit lines on the same Drawings.
 7. Construction Manager shall resolve conflicts and then submit in PDF and 1 hard copy to the Architect for review.
 8. Submit complete final set of coordination drawings for record purposes in PDF and 1 hard copy.
- D. Coordination Drawings shall bear the signature of all subcontractors involved indicating that all space conditions have been satisfactorily resolved. In addition, the Drawings shall bear

the Construction Manager's stamp bearing the notation "Drawings Have Been Checked and Coordinated with all Trades". Drawings without these notations, or Drawings submitted more than 120 days after the execution of the Contract, will not be accepted or reviewed by the Architect.

- E. If any space conflicts cannot be resolved by the Construction Manager, he shall immediately notify the Architect.
- F. Coordination Drawings are for the Construction Manager's and Architect's use during construction and shall not be construed as replacing any Shop, "As-Built", or other Record Drawings required elsewhere in these Contract Documents.
- G. Architect's review of Coordination Drawings shall not relieve Construction Manager from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirements of the Contract.
- H. Access panel coordination: Show locations and sizes of all access panels for all trades on Coordination Drawings.
- I. Refer to Section 011400 – Work Restrictions for Project Electronic Files to be made available for use by the Construction Manager in the preparation of Coordination Drawings.

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 013119

PROJECT MEETINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Organizational meetings.
 - 2. Project meetings.
 - 3. Pre-Installation conferences
 - 4. Post-construction meetings
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Requirements for construction schedules: Section 013200 Construction Progress Documentation.

PART 2 - PRODUCTS

2.1 ORGANIZATIONAL MEETINGS

- A. General: The Owner's Project Manager will schedule pre-construction organizational meetings, periodic Project meetings, specially called meetings throughout the progress of the Work, and post-construction meetings. Representatives of the Construction Manager shall attend all such meeting. Subcontractors shall attend only if requested by the Architect or the Owner's Project Manager.
- B. Pre-Construction Meeting: Immediately following award of Contract, the Architect will call one or more preliminary organizational meetings, during which detailed procedures will be worked out for submission and review of Shop Drawings and samples, format and extent of the Progress Schedule and Schedule of Values, format and methods for progress payment requisitions, channels of communication between Owner, the Owner's Project Manager, Architect's and Construction Manager's personnel, and other routines to be followed during construction.

The Architect will then issue a directive summarizing such procedures.

2.2 PROJECT MEETINGS

- A. The Owner's Project Manager shall schedule and meet regularly with the Owner, the Architect and the Construction Manager at the site of the Work during the course of the Contract for the purpose of progress review, coordination of Shop Drawing schedules, sample submittals, and other items of work requiring such coordination. The dates of such meetings shall be as mutually agreed upon between the Owner, the Owner's Project Manager, Construction Manager and the Architect. Construction Manager shall require Subcontractors to attend such meetings if requested by the Architect.
- B. The Owner's Project Manager shall take minutes of such meetings and shall distribute copies of the minutes to all concerned.
- C. Construction Manager's and Subcontractor's representatives attending such meetings shall include the job superintendent or other responsible party approved by the Architect. Such representatives shall be empowered to make, at these meetings, definite decisions binding upon their respective employers regarding all matters pertaining to work under this Contract.
- D. The Construction Manager shall furnish the Owner, the Owner's Project Manager and the Architect, in writing, the names, addresses, and telephone numbers of Construction Manager's and principal Subcontractors' personnel to be contacted in the event of an out-of-hours emergency at the building site. He shall also maintain a similar list readily visible from the outside of the field office.

2.3 PREINSTALLATION CONFERENCES

- A. Pre-Installation Conferences: Conduct pre-installation conferences at site prior to construction activities that require coordination.
 - 1. Schedule the conference to occur after submittals have been approved for the materials or systems.
 - 2. Installers, manufacturer's representatives, and fabricators of materials or systems affected shall be required to attend. Advise Designer of scheduled meeting dates.
 - 3. Do not allow affected work to proceed if the conference cannot be successfully concluded. Initiate actions necessary to resolve impediments to performance of the work and reconvene the conference at the earliest feasible date.
 - 4. The Construction Manager shall take minutes of such meetings & shall distribute copies of the minutes to all concerned.
- B. Work for which pre-installation conferences will be required include the following. Additional pre-installation conferences may be required by specifications in Sections 2 through 50, and by the Owner or Architect during the progress of the Work:
 - 1. Concrete work including finishes.
 - 2. Building envelope.
 - 3. Roofing.
 - 4. Daylight dimming system.

- C. Refer to individual specifications sections for additional requirements.

2.4 POST-CONSTRUCTION MEETINGS

- A. Not less often than every three months, starting with the date of Substantial Completion and continuing for one year thereafter, representatives of the Construction Manager and the Subcontractors for FIRE PROTECTION, PLUMBING, HVAC, and ELECTRICAL Work shall meet with the Architect and Owner's Project Manager at the site in accordance with an agreed-upon schedule in order to inspect the Work and to plan correction of any deficiencies or failures discovered during this period.
- B. Representatives of the Construction Manager and Subcontractors attending such meetings shall be the same persons, or shall have the same powers and authority, as those attending job meetings prior to the date of Substantial Completion.
- C. Post-Warranty Meeting: Coordinate with Owner and attend meeting to be held with Commissioning Agent.
- D. The Construction Manager shall take minutes of such meetings & shall distribute copies of the minutes to all concerned.

END OF SECTION

SECTION 013200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Time for Completion and Liquidated Damages.
 - 2. Sequencing requirements.
 - 3. Phasing requirements.
 - 4. Requirements for scheduling closeout activities.
 - 5. Critical Path Method Schedule preparation and submission.
 - 6. Photographic documentation of construction.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Section 011100 – SUMMARY OF WORK: Hours of work and related scheduling criteria.
 - 2. Section 012400 – SCHEDULE OF VALUES: Allocation of portions of the Work as line items in applications for payment.
 - 3. Section 013100 – PROJECT MANAGEMENT AND COORDINATION: Construction Manager responsibility for coordinating the Work.
 - 4. Section 013119 – PROJECT MEETINGS: Scheduling construction-related meetings.
 - 5. Section 013300 – SUBMITTAL PROCEDURES: Coordination of submittal schedule with construction.
 - 6. Section 014000 – QUALITY REQUIREMENTS: Special sequencing requirements required for inspection of building components prior to concealment.
 - 7. Section 017700 – CLOSEOUT PROCEDURES: Requirements for Substantial Completion and Final Completion.

1.3 SUBMITTALS

- A. Preliminary Construction Schedule: Within 10 calendar days following receipt of the Notice to

Proceed, submit a CD containing an electronic copy (PRX) and two paper copies for review by the Owner, Project Manager and the Architect. This preliminary schedule shall include the project contract dates, milestones, long lead items, major work activities and a critical path to completion. (approximately 100 to 150 schedule activities)

1. Acceptance of the Preliminary Construction Schedule by the Owner, Project Manager and Architect shall be a prerequisite to certification of the first Application for Payment.
- B. Complete and Detailed Construction Schedule: Within 45 calendar days following receipt of the Notice to Proceed, and at least 15 calendar days prior to submitting the second Application for Payment, submit a CD containing an electronic copy (PRX) and two paper copies of the complete and detailed schedule, to show entire schedule for entire construction period.
1. Acceptance of the Complete and Detailed Construction Schedule by the Owner, Project Manager and Architect shall be a prerequisite to certification of the second Application for Payment.
- C. Monthly Schedule Update: With each monthly Application for Payment, submit a schedule update of the accepted Complete and Detailed Construction Schedule accompanied by a written narrative reporting on the progress of the Work and a CD containing an electronic copy (PRX) and two paper copies of the Monthly Schedule Update.
1. Acceptance of the Updated Schedule each month by the Owner, Project Manager and Architect shall be a prerequisite to certification of the monthly Application for Payment.
- D. Daily Construction Field Reports: Submit two copies of the current week's field reports to the Owner's Project Manager and the Architect at the end of each week. (Electronic submission is acceptable)
- E. Special Reports: Submit two copies of special reports of unusual events at the site directly to Owner's Project Manager and a copy to the Architect, on the day of the occurrence. Distribute additional copies of report to parties affected by the occurrence.
- F. Photographs:
1. Photographic documentation of construction as specified herein.
 2. Copies of prints:
 - a. Submit electronic prints of each photographic view within seven days of taking photographs.
 3. Identification: On each print file, provide the following information:
 - a. Name of Project.
 - b. Date photograph was taken if not date stamped by camera.
 - c. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - d. Unique sequential identifier.
 4. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same label information as corresponding set of photographs.

1.4 TIME FOR COMPLETION AND LIQUIDATED DAMAGES

- A. It is understood and mutually agreed, by and between the Construction Manager and the Owner, that the date of commencement and the time for completion for each phase are essential conditions of this Contract, and it is further mutually understood and agreed that the Work embraced in this Contract shall be commenced by the date specified therein.
- B. The Construction Manager agrees that said Work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Construction Manager and the Owner, that the time for the completion of the Work in each phase described herein is a reasonable time for the completion of the same, taking into consideration the usual industrial and climatic conditions prevailing in this locality.
- C. It is further agreed that time is of the essence of each and every portion of the Contract and of the Contract Documents wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new limit fixed by such extension shall be of the essence of this Contract. Provided, that the Construction Manager shall not be charged with liquidated damages for any excess cost when the delay in completion of the Work is due:
 - 1. To any preference, priority, or allocation order duly issued by the Government;
 - 2. To unforeseeable causes beyond the control and without the fault or negligence of the Construction Manager, including, but not restricted to: Acts of God, or of the public enemy; acts of the Owner; acts of another Construction Manager in the performance of a Contract with the Owner; fires, floods, epidemics, quarantine restrictions, strikes, and freight embargoes.
 - 3. To any delays of Subcontractors or suppliers occasioned by any of the clauses specified in subparagraphs 1. and 2. of this Paragraph.
- D. Provided, further, that the Construction Manager shall, within ten (10) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the Contract, notify the Owner, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the Construction Manager within a reasonable time of its decision in the matter.
- E. If the Construction Manager shall neglect, fail or refuse to substantially complete the Work within the time herein specified or any proper extension thereof granted by the Owner, the Construction Manager does hereby agree, as part of the consideration for the awarding of this Contract, to pay to the Owner the amount specified in the Agreement (or if not specified, then actual damages amount), not as a penalty but as liquidated damages for such breach of contract as herein set forth, for each and every calendar day that the Construction Manager shall be in default after the time stipulated in the Contract for completing the Work.
- F. The said amount is fixed and agreed upon by and between the Construction Manager and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodic estimates. This remedy to the Owner shall be cumulative to the remedies available to the Owner under law.
- G. Work Executed after Substantial Completion: The Architect will continue to execute their ad-

ministrative responsibilities for the Contract, as provided in the General Conditions, beyond the specified date of Final Completion.

1. If, due to delays on the Construction Manager's part in the completion of the Work, the Architect is required to continue in this role beyond the specified date for Final Completion, the Construction Manager shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional administration duties, until the Work is complete.
2. Refer to Section 011400 – Work Restrictions, for procedures required in cases where Construction Manager is responsible to the Owner for costs for Additional Services of the Architect.

- H. Liquidated Damages: Refer to Division 00 for provisions for, and amounts of, Liquidated Damages.

1.5 PHASING

- A. The project shall be phased in accordance with the phasing plans by the Construction Manager.

1.6 SEQUENCING REQUIREMENTS

- A. Exterior Envelope Construction and Inspection: Schedule the installation of materials comprising the exterior walls and roofs to minimize exposure of construction materials to damage by ultraviolet light, wind and weather. Notify the Architect prior to concealment of air barrier, to permit inspection and testing. Refer to Section 014000 – QUALITY REQUIREMENTS, and individual technical specification sections for specific requirements.
- B. Indoor Air Quality Provisions:
1. Sequencing required to minimize adsorption of airborne contaminants on new surfaces.
 2. Sequence of building flush-out with respect to completion, testing and balancing of mechanical systems. Flush-out shall be complete prior to substantial completion.
- C. Commissioning: Refer to the Owner's commissioning agent, for inspections, testing and related activities to be performed by Commissioning Agent during and after construction.

1.7 SCHEDULING REQUIREMENTS FOR CLOSEOUT

- A. General: Closeout scheduling shall be carefully coordinated with activities required for Commissioning and the approved Indoor Air Quality Management Plan. The following sequence of activities is a summary of requirements of many trades. Refer to other Division 1 Sections and Technical Sections for additional information as indicated.
- B. Initial Closeout Activities:
1. Commissioning Coordination Meeting: Schedule meeting well in advance of anticipated date for start-up of mechanical and electrical systems. At this meeting, the Commissioning Firm will distribute Pre-Functional Performance Test (PFPT) checklists, and schedul-

- ing requirements will be reviewed. Refer to Section 013119 – PROJECT MEETINGS.
2. Confirmation of Completion of Finishes, Casework and Cleaning: The Construction Manager submit a letter confirming that all major finishes have been applied, all case-work is installed and final cleanup has been completed.
- C. System Start-Up, Building Flush-out and Testing and Balancing.
1. The HVAC system shall be started up with new filters as specified in Section 230000 – Heating, Ventilating and Air Conditioning.
 2. Building Flush-Out: Comply with LEED requirements.
 3. Testing and Balancing: After the building flush-out is complete, replace HVAC system filters, adjust HVAC system for normal operation and conduct tests for balancing the system.
- D. Substantial Completion: When system start-up and the related activities specified above have been completed on all mechanical and electrical systems, notify the Architect that the Project is Substantially Complete. Refer to Section 017700 – PROJECT CLOSEOUT, for additional requirements for Substantial Completion.

PART 2 - PRODUCTS

2.1 CRITICAL PATH METHOD SCHEDULE (CPM) GENERAL

- A. The purpose of the Construction Schedule shall be to:
1. Assure adequate planning, scheduling and reporting during execution of the work by the Construction Manager;
 2. Assist the Construction Manager, Architect, Project Manager and Owner in monitoring the progress of the work and evaluating proposed changes to the Contract and the Construction schedule;
 3. Assist the Owner, Project Manager, Architect and the Construction Manager in the preparation and evaluation of the Construction Manager's monthly progress payments.
- B. The Construction Schedules shall employ the Critical Path Method (CPM) for the planning, scheduling and reporting of the work to be performed under the contract and shall meet the following requirements:
1. The schedule shall be produced utilizing the most current version of Primavera P3 Project Planner software system or equivalent and the data fully transferable to Primavera Project Planner.
 2. The type of schedule shall be time scaled Precedence Diagramming Method (PDM) with Finish to Start with zero (0) lag dependency relationship.
 3. Activity duration shall be in units of whole working days and shall be limited to a minimum of one (1) for each activity.
 4. The schedules and the corresponding completion dates shall meet the contract duration (remaining contract duration for the monthly updates) of the project. Failure by the Construction Manager to include any element of work required for performance of the Contract shall not excuse the Construction Manager from completing all work within the Contract Time. Under no circumstances, shall the Construction Manager be entitled to an equitable adjustment in the event of failing to achieve an early completion schedule.

5. The Construction Manager shall review the planned activity coding and activity ID format with the Project Manager prior to the development of the Detailed Construction Schedule. At a minimum, the Project Manager will require the following coding: Area, Location/Phase/Shift, Work Type/Trade, CSI Code, and a separate code for each subcontractor.
6. Proposed durations assigned to each activity shall be the Construction Manager's best estimate of time required to complete the activity considering the scope and resources planned for the activity, utilizing the appropriate workday calendar.
7. Seasonal weather conditions shall be considered and included in the planning and scheduling of all work influenced by high or low ambient temperatures and/or precipitation to ensure completion of all work within the Contract time. Seasonal weather conditions shall be determined by an assessment of average historical climatic conditions based upon the preceding ten (10) year records published for the locality by the National Ocean and Atmospheric Administration (NOAA).
8. The OPM's acceptance of the Construction Schedule shall not relieve the Construction Manager of responsibility for timing, planning and scheduling of the Work, nor impose any duty on the Architect or Owner with respect to the timing, planning or scheduling of the Work.

2.2 PRELIMINARY CONSTRUCTION SCHEDULE

- A. Within 10 calendar days following receipt of Notice to Proceed, prepare and submit for review prints and CD of the Preliminary Construction CPM Schedule covering the first 90 days of construction. The schedule shall be neatly organized and plotted, time-scaled from left to right on standard size sheets. The Preliminary Construction Schedule shall cover the following phases and/or activities:
 1. Proposed mobilization, procurement and planned construction within the first 90 days after Notice To Proceed.
 2. Include a summary bar for major areas of the remainder of the Work and a cash requirement prediction based on indicated activities.
- B. The Preliminary Schedule shall be incorporated into the Complete and Detailed Schedule including all revisions directed by the Owner, Project Manager and Architect.

2.3 COMPLETE AND DETAILED CONSTRUCTION SCHEDULE

- A. Prepare and submit a comprehensive, fully developed Complete and Detailed CPM Construction Schedule within 45 days after Notice to Proceed and at least 15 days prior to the second Monthly application.
 1. The Complete and Detailed schedule shall incorporate the accepted Preliminary Construction Schedule with the Owner/Project Manager/Architect's comments
 2. Schedule shall be neatly organized and plotted time scaled from left to right on Project standard size sheets with suitable notation relating the interface points among sheets.
 3. The Construction Manager's Schedule shall consist of, but not be limited to, the following:
 - a. Proposed procurement, submittal preparation, submittal review, fabrication & delivery, construction, testing, commissioning, and permitting activities.
 - b. Proposed durations for activities.

- c. Proposed sequencing of activities (predecessors & successors).
- d. Milestone events as required by the Contract Documents and Division 1 of the Specifications.
- 4. The following shall be depicted on the Schedule for each activity:
 - a. Concise description of the work represented by the activity (maximum forty-eight (48) characters). The work related to each activity shall be limited to one work trade and one area. All descriptions shall include area designations.
 - b. In developing the Schedule, the Construction Manager shall be responsible for assuring that subcontractor and supplier work at all tiers, as well as its own work, is included in the Schedule.
 - c. The Schedule as developed shall show the sequence and interdependence of activities required for complete performance of the work. The Construction Manager shall be responsible for assuring that all work sequences are logical and the Schedule shows a coordinated plan of the work.
 - d. Each activity shall have only one responsible party and will be coded accordingly.
 - e. For specific work activities where "Key Equipment" is required, such as crane(s) during steel erection, man-lifts or other critical equipment that is critical to phasing or sequencing of the work, the corresponding work activities in the schedule will be appropriately coded to allow for reasonable assessment and tracking of the adequacy of the planned "key equipment" and its movement through the project. (lifts may be a little too much)
- 5. For the purposes of utilizing schedule targets, activity id's shall not be modified.
- 6. The schedule shall employ retained logic.
- 7. Any float suppression techniques identified shall be corrected by the Construction Manager.
- 8. The Construction Manager shall utilize logic, durations, and appropriate calendar assignment to forecast dates, not activity constraints.

2.4 MONTHLY SCHEDULE UPDATE REPORTS

- A. Monthly Schedule Update Report: Evaluate the status of the work as of the 25th of each month to show actual progress and to identify problem areas. Update the Complete and Detailed Construction schedule and print a schedule summary. Include approved Change Orders and Construction Change Directives within the updated schedule
- B. The Construction Manager shall furnish sufficient forces, offices, facilities and equipment at no additional cost to the Owner, and shall work such hours as necessary, within any local restrictions or agreements incorporated into the Contract, to ensure the prosecution of the work in accordance with the current monthly Project Schedule Update. Should the monthly update show that the Construction Manager is fourteen (14) or more work days behind schedule, the Construction Manager shall prepare a Recovery Schedule at no additional cost to the Owner explaining and displaying how the Construction Manager intends to reschedule the work in order to regain compliance with the contract. The provision of this paragraph may include the Construction Manager increasing the hours of work, the number of shifts, overtime operations and/or the amount of construction plant and equipment or working on Saturdays, Sundays and holidays, within agreed working hours or variance granted, provided the Construction Manager gives reasonable notice to the Owner.

2.5 RECOVERY SCHEDULE

- A. When directed by the Project Manager/Architect, the Construction Manager shall develop a Recovery Schedule with a detailed narrative for all the remaining work based on the last accepted Monthly Schedule Update. The Recovery Schedule shall represent the Contractors current work sequence plan and shall forecast completion of the remaining work within remaining contract durations. The Recovery Schedule narrative shall enumerate the Construction Manager's work plan including increases to crew sizes and/or extended shifts to complete work within remaining contract durations. The Recovery Schedule shall conform to requirements set forth in Paragraph 1.04 (Complete and Detailed Construction Schedule).
- B. The Construction Manager shall be responsible to develop mitigation measures for all delays, regardless of the responsibility for the delays, and to identify all time and cost impacts to the work associated with those mitigation measures. Whenever it is possible for the Construction Manager to mitigate delay without added cost, the Construction Manager shall do so. The Construction Manager shall mitigate all delays as efficiently and economically as possible, with the objective of minimizing both the time and cost impact of the delay, regardless of the responsibility of the delay.
- C. Unless circumstances otherwise require, the Construction Manager shall not pursue mitigation action for which it expects the Owner/Architect to be liable, prior to notifying the Owner/Architect and receiving Owner/Architect authorization to proceed with the mitigation action. Any action taken by the Construction Manager prior to receiving approval from the Owner/Architect shall be at the Construction Manager's risk.

2.6 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording events at the site. Report the following information, as applicable.
 - 1. List of subcontractors at the site, and approximate count of personnel.
 - 2. High and low temperatures, general weather conditions (when exterior work is in progress)
 - 3. Meetings and significant decisions.
 - 4. Accidents, unusual events, and emergency procedures.
 - 5. Stoppages, delays, shortages, losses.
 - 6. Meter readings and similar recordings.
 - 7. Services connected, disconnected.
 - 8. Orders and requests of governing authorities.
 - 9. Change Orders received, implemented.
 - 10. Equipment or system tests and start-ups.
 - 11. Partial Completions, occupancies.
 - 12. Substantial Completions authorized.
 - 13. Copies of weight tickets collected for construction debris removal indicating percentage recycled by weight.
- B. At the end of each week, compile the daily reports for the preceding week. Have the Construction Manager's Superintendent sign the daily reports and prepare a brief outline of the Work anticipated for the coming work week. Submit 1 copy to the Owner/Owner's Project Manager and place 1 copy in the Project Record Documents file.

2.7 2 WEEK LOOK-AHEAD

- A. Provide a bar chart type, 2 week look-ahead schedule to review with the Owner's Project Manager and Architect during progress meetings.

2.8 CONSTRUCTION PHOTOGRAPHS

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
- D. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

PART 3 - EXECUTION

3.1 SCHEDULING THE WORK

- A. The Construction Manager shall perform the Work in accordance with the approved CPM Schedule.
 - 1. If during the progress of the job the Construction Manager misses a start date of an activity on the critical path, the Construction Manager shall, within five (5) calendar days, advise the Architect in writing of action proposed to bring the Work up to schedule, and shall submit a revised CPM Schedule indicating such action, together with a typed list of such revisions.
 - 2. If the Construction Manager fails to submit a revised schedule within the specified time

or if the Architect is not convinced of the efficacy of the measures proposed, the Owner may, at its option, require the Construction Manager to accelerate the progress of the Work, without additional cost to the Owner, by increasing the work force or the hours of work, or by other reasonable means approved by the Architect.

END OF SECTION

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Submittal schedule
 - 2. Product data
 - 3. Shop drawings
 - 4. Samples
 - 5. Colors and finishes
 - 6. Calculations
 - 7. Informational submittals
 - 8. Action on submittals.
 - 9. Substitution requests.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Availability and restrictions for use of electronic copies of Contract Document: Section 011400 – Work Restrictions.
 - 2. Specific requirements for submittal of construction schedules: Section 013200 Construction Progress Documentation.
 - 3. Specific requirements for submittal of schedule of values: Section 012400 – Schedule of Values.
 - 4. Requirements for submittal of coordination drawings: Section 013100 – Project Management and Coordination.
 - 5. Submittal of final record drawings and other documents: Section 017839 – Project Record Documents.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action. Action submittals include product data, shop drawings and samples.
- B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals of this kind may be required by the Architect to confirm the Construction Manager's compliance with submittal requirements. Submittals may be rejected for not complying with requirements. Informational submittals include calculations and other informational submittals described in this Section.
- C. Substitutions: Changes in products, materials, equipment and methods of construction from those required by the Contract Documents, as proposed by the Construction Manager and not considered "or equal".
- D. Or equal: Construction Manager proposed products, materials, and equipment that comply with specified material and performance requirements, but are not one of the named manufacturer's, suppliers, and distributors. Equal products, materials, and equipment shall identically match the physical appearance of specified items.

1.4 SUBMITTALS

- A. Submittal Schedule:
 - 1. Within 45 days after signing the Agreement, to be submitted with the CPM Schedule, prepare and submit for the Architect's approval a schedule of Shop Drawings, Product Data and Samples required to be submitted for the Work.
 - a. The schedule shall indicate by trade the date by which final approval of each item must be obtained, and shall be revised as required by conditions of work, subject to the Architect's approval.
 - b. The schedule shall be derived from the Construction Manager's CPM Schedule, but shall be submitted as a separate document, in addition to being part of the CPM line items.
 - 2. The Architect's review, including Consultant's review period, will not exceed 21 calendar days from the date on which the Architect receives the submission or the date that is provided on the Construction Manager's submittal schedule, whichever is the latest. Construction Manager shall strictly adhere to the established dates set forth by the Schedule of Submittals specified above in paragraph 2.01 A. On a weekly basis, the Construction Manager is responsible for identifying, in writing, priority submissions to assist the Architect in facilitating an efficient review process that is in accordance with the Construction Manager's CPM schedule.
 - 3. Each submittal shall be made no later than 60 calendar days prior to the time that the CPM shows requirement for incorporation of the item into the Work, or earlier under the following conditions:
 - a. As required to furnish and deliver to the site the specific item or items required, with sufficient time to allow proper examination and review of such submittals.
 - b. If the item in question is to be incorporated in the work prior to the expiration of 60 calendar days from the time of execution of the Contract, the aforesaid written notice shall be submitted to the Architect immediately following the execution of the

Contract.

- c. Substitutions/ Or Equal: Each request for a substitution shall be made no later than 90 calendar days prior to the time for incorporation of the item into the Work.
4. No item, material, article, system or piece of equipment requiring approval of the Architect shall be ordered or installed until such approval has been obtained.
- B. Product List for Color Selection: To facilitate the preparation of the color schedule, the Construction Manager shall, along with the CPM, submit within forty-five (45) calendar days following signing the Agreement, unless otherwise extended by the Architect, a list of the names of the manufacturers whose products he proposes to use.
 1. List products for which color, finish, pattern, texture, or other related information is a consideration, including, but not limited to the following:
 - a. Exterior materials: Face brick; exterior concrete masonry units; factory-finished metal siding; factory finish for doors, windows and louvers.
 - b. Casework finishes: Solid and veneer wood with transparent finish; plastic laminate.
 - c. Interior finishes: Ceramic tile, acoustical ceiling tile, resilient flooring, carpet, paint.
 - d. Specialties available in a choice of colors: Toilet partitions; lockers; operable panel finishes.
 - e. Other items for which the above properties affect the design.
 2. Products listed shall be as specified, unless substitution has been approved.
- C. Substitution and Or Equal Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 1. Substitution and Or Equal Request Form: Use facsimile of form provided at end of Section.
 2. Documentation: Show compliance with requirements for substitutions listed on the Substitution / Or Equal Request form, and additional requirements as may be requested by the Architect or as otherwise applicable. Submit specified product or system and clearly demonstrate in a side-by-side comparison the similarities and differences between the specified and proposed Substitution or Or Equal product or system. Absent this documentation, the request will not be reviewed by the Architect and be sent back rejected.
- D. Product Data, Shop Drawings, Samples, Schedules and other Submittals: Refer to individual Specification Sections for submittals required.
- E. Confirmation of contract between Construction Manager and printing company for reproduction of shop drawings as specified in this Section.

PART 2 - PRODUCTS

2.1 SUBMITTAL PREPARATION, GENERAL

- A. Preparation of Submittals:
 1. Submittal packages shall contain all required information in accordance with the submit-

tal requirements of each specification section. Incomplete submittals will be returned without review.

- B. Each submittal cover sheet shall contain a clear space approximately 80 square inches for stamps and Architect's comments. Each drawing shall contain a similar space as an additional border on the right or bottom.
- C. Distribution:
 - 1. CM shall electronically deliver submittals to the Architect and its consultants, OPM, and CxA (when applicable) in a format acceptable to the Architect.
 - 2. (For submittals that are 11x17 and larger) simultaneously, CM shall deliver 1 hard copy print each to the Architect and its consultants and one hard copy print to the OPM.
 - 3. Architect and consultants will review submittals, and the Architect will post reviewed submittals on web-based file transfer service specified herein.
 - 4. CM is responsible for distribution to all trades.
 - 5. CM to deliver 1 hard copy of "Reviewed" and "Approved and Furnish as Corrected" submittals to OPM.
 - 6. Drawings submitted directly from Subcontractors, manufacturers or vendors, or directly to the Architect's consultants, will be returned to the Construction Manager without action.
 - 7. CM shall meet with Architect and OPM to develop list of submittals, required to be sent to Town agencies (fire department, building inspector, engineering department, and submit required submittals and shop drawings to appropriate agencies at same time as submittals to other team members.
- D. Web-Based Construction Administration Database:
 - 1. For the entire Construction Period Construction Manager shall provide, manage and maintain a High-Band Width Electronic File Transfer Service that is accessible via the Internet by a Web Browser such as Internet Explorer or Mozilla Fire Fox. The Construction Manager shall process submittals electronically, through one of the three following web-based construction administration database services:
 - a. Prolog Converge.
 - b. Submittal Exchange.
 - c. Newforma.
 - d. Or equal.
 - 2. The Construction Manager shall provide licensed seats/access to, and training on said database, for all of the Architect's Consultant's and OPM's CA Team Members, to facilitate electronic transmittal of all of Construction Documentation including, but not limited to Project submittals, RFI's and Change Order Requests, Architect Directives, Sketches, Meeting Minutes, and Architect Field Reports.
 - 3. All of the Project documentation compiled in this CA database, shall be made completely accessible to the Architect & Owner, for the entire duration of the Project, and then be submitted (in PDF form) to, and become the property of the Owner, similar to all other Closeout documentation related to this Project.

2.2 PRODUCT DATA

- A. Manufacturers' Product Literature: For standard manufactured items, submit manufacturer's catalog sheets with illustrated cuts of the items to be furnished.
 - 1. Include scale details, sizes, dimensions, performance characteristics, capacities and

- other pertinent information.
 - 2. Each submittal of product data shall be accompanied by an appropriate transmittal form with specific reference to the applicable paragraph in the Specifications.
 - 3. Indicate clearly on such printed matter which of several items is being submitted for approval.
- B. If catalog cuts of standard manufactured items show different types, options, finishes, performance requirements, or other variations, those features that the Construction Manager proposes to furnish shall be clearly circled or otherwise indicated, and all irrelevant diagrams, notes, or other information deleted or canceled.
- 1. If any variations from the catalog description are proposed or required, such variations shall be clearly noted on the cut by the Construction Manager.
 - 2. Wiring diagrams shall be produced to address specific project requirements. Catalog cuts of wiring diagrams will not be acceptable.

2.3 SHOP DRAWINGS

- A. The Construction Manager shall prepare shop drawings showing such features as required by the Technical Specifications Sections, to demonstrate an understanding of the particular conditions unique to this Project.
- 1. Prepare shop drawings at a scale of at least twice the scale of contract drawings showing the same work.
 - 2. Reproduction of Contract Documents in any form will not be accepted for use as Shop Drawings, unless specifically allowed in writing by the Architect for a particular portion of the Work.
 - 3. Refer to Section 011400 –WORK RESTRICTIONS for permissible use of electronic documents for the purpose of preparation of shop drawings. Use of Project Electronic Files for shop drawing preparation will be subject to the requirements specified in that Section.
- B. Shop Drawings related to various units comprising a proposed assembly shall be submitted simultaneously so that such units may be checked individually and as an assembly.
- C. Each drawing shall have a clear space approximately 80 square inches as an additional border on the right or bottom for stamps and Architect's comments.
- D. Shop Drawings shall clearly indicate all details, sectional views, arrangements, working and erection dimensions, kinds and quality of materials and their finishes, and other information necessary for proper checking and for fabrication and installation of the items, and shall include all information required for making connections to other work and/or adjacent materials.
- E. If any information on previously submitted Shop Drawings, aside from notations made by the Architect is revised in any way, such revision shall be circled or otherwise graphically brought to the Architect's attention. If approved Drawings are subsequently revised, they shall be re-submitted to the Architect with all revisions clearly marked for the Architect's attention. Whenever drawings are revised, the latest revisions shall be circled or otherwise indicated to distinguish them clearly from all previous revisions (and from the information on the original drawing).

2.4 SAMPLES

- A. Submit samples as required under the various Sections of the Specifications. Each sample shall be accompanied by a transmittal and cover sheet as required for all submittals.
- B. Before submitting samples, consult with Architect to determine whether samples are to be submitted to Architect's office, field, or other location.
- C. Samples shall be submitted in triplicate, with a fourth sample to be submitted to the OPM for owner review, unless otherwise specified or directed by the Architect.
- D. Samples may be submitted to Architect directly from manufacturers, vendors, suppliers, Subcontractors, or others, but a separate transmittal letter shall be submitted through the Construction Manager in each such case.
- E. Approved samples of major or expensive items or assemblies, if in good condition and meeting all requirements of the Contract, may be properly marked for identification and used in the Work, provided that all shipping and handling charges are paid by the Construction Manager.
- F. Each sample shall have a label indicating the material represented, its place of origin, and the names of the producer, the Architect, the Construction Manager, the Subcontractor and the building or Work for which the material is intended. Samples shall be marked to indicate the Drawing numbers or Specification Paragraph requiring the materials represented.
- G. Approval of samples for color, texture, and other aesthetic qualities shall not be construed as approval of other characteristics.
- H. Approved samples, unless specifically stated by the Construction Manager as slated for incorporation in the Work, will be kept on file (and accessible for inspection) by the Architect until Final Acceptance of the Project. Any sample not reclaimed by the Construction Manager within thirty (30) days after Substantial Completion of the Project will be considered unclaimed material, and may be disposed of by the Architect.

2.5 COLORS AND FINISHES

- A. Color chips shall be submitted for all items having color unless otherwise directed or approved by the Architect. Upon the expiration of such 45-day period, the Architect will proceed with color selection and preparation of final color schedule.
- B. The Architect will select the colors and finishes of a manufacturer within the framework of the Specifications, for each item where the Construction Manager fails to submit the name of a specific manufacturer within the allotted time, and the Construction Manager shall provide such materials without additional compensation.

2.6 CALCULATIONS

- A. Calculations Based on Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Construction Manager by the Contract Documents, submit calculations demonstrating that products and systems comply with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Construction Manager to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents.
 2. Include list of codes, loads, and other factors used in performing these services

2.7 INFORMATIONAL SUBMITTALS

- A. General: Informational submittals comprise written information that does not require Architect's responsive action.
- B. Informational submittals required for the Work include, but are not limited to, the following:
 1. Storm Water Pollution Prevention Plan Documentation, as specified in Section 011400 – WORK RESTRICTIONS
 2. Calculations for Construction Manager-engineered work, as specified in particular specification sections in Divisions 2 through 50.
 3. Research/evaluation reports and test data as specified in particular specification sections in Divisions 2 through 50.
 4. Certifications and other qualification data, as specified in particular specification sections in Divisions 2 through 50.
 5. Maintenance data, as specified in particular specification sections in Divisions 2 through 50.
 6. Confirmation of contract with printing company as specified in this Section.

2.8 SUBMITTAL REQUIREMENTS FOR COMMISSIONING

- A. Submittals:
 1. Submit digital copy of applicable submittals for equipment to be commissioned to Commissioning Authority (CxA).
 2. CxA will review and approve submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with Architect's and Construction Manager's review.
 3. Provide copy of the Design Team's review comments to the CxA.
 4. Repeat this process for any resubmissions.
- B. Data for Commissioning: The following information shall be included in all submittals of commissioned equipment and systems.
 1. Detailed manufacturer's installation and start-up procedures.
 2. Operating, troubleshooting, and maintenance procedures.
 3. Fan and pump curves.
 4. Full warranty information, with responsibilities of Owner to keep warranty in force clearly

defined.

5. Installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms to be used by factory or field technicians.
- C. CxA will request specific information needed about each piece of commissioned equipment or system. Information requested includes, but is not limited to:
1. Full details of Owner-contracted tests, if any.
 2. Full factory testing reports, if any.
- D. CxA may request additional documentation necessary for commissioning process. Requests by CxA may precede, be concurrent with, or follow normal submittals.
- E. Construction Manager's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by CxA's review.

PART 3 - EXECUTION

3.1 CONSTRUCTION MANAGER ACTION ON SUBMITTALS

- A. Should the Architect in checking shop drawings or other submittals make changes which the Construction Manager deems will increase the Contract Price, the Construction Manager shall so inform the Architect and OPM in writing within fourteen (14) calendar days following receipt of the checked submittals and prior to starting fabrication of the item or items. Failing this, the Construction Manager shall be deemed to have waived all claims for extra compensation for the work involved.
- B. Notes or other information on submittals that are contrary to provisions of the Contract Documents shall be deemed to be addressed to the applicable Construction Manager, Subcontractor, material supplier or other parties involved, and shall have no force or effect with respect to this Contract, even though the Shop Drawing or Sample involved is approved by the Architect. In particular the terms "By Others", "N.I.C." or words of similar meaning and import on submissions shall not be deemed to imply that the referenced items are to be omitted from this Contract.
- C. The Construction Manager shall obtain and distribute copies of approved Shop Drawings and other Submittals to his subcontractors and material suppliers needing such information, at no additional cost to the Owner.
- D. The Construction Manager shall keep on the site, in good order, a complete up-to-date set of all approved Shop Drawings and other Submittals.
- E. Construction Manager shall assume full liability for delay attributed to insufficient time for delivery and/or installation of material or performance of the Work when approval of pertinent Shop Drawings is withheld due to failure of the Construction Manager to submit, revise, or re-submit Shop Drawings in adequate time to allow the Architect reasonable time, not to exceed twenty-one (21) calendar days for normal checking and processing of each submission and resubmission. The Architect will not be limited to twenty-one (21) calendar days when the Submittal Schedule has not been submitted or is not current.

3.2 ARCHITECT ACTION ON SUBMITTALS

- A. Product Data and Shop Drawings: After reviewing product data submittals, the Architect will mark each submittal with one of the following responses
1. The Architect will annotate all submittals digitally, applying a stamp including the following information: " Architect's review is only for general conformance with design concept and compliance with requirements of Contract Documents. Review is based on Contractor's representation that he has checked and approved this submittal and has verified dimensions, quantities, field dimensions, relation to existing work, coordination with work to be installed later, and coordination with information in previously approved submittals. Accuracy of all such information is responsibility of the Contractor. Approval does not authorize or relieve the Contractor of responsibility for deviations from drawings, specifications, supplementary documents furnished by the Architect, or previously approved submittals unless the Contractor has, in writing, called the Architect's attention to such deviations at the time of submittal. The Contractor is solely responsible for the accuracy of all information in the submittal and for details of fabrication and installation. Refer to Contract Documents for further submittal requirements and limitations on scope of the Architect's review.
 2. "Rejected". A digital copy of Rejected submittals will be uploaded into the CA Database. Rejected submittals shall be resubmitted in the same manner until approval is obtained.
 3. The stamp will also contain notes indicating possible actions, namely; "rejected"; "revise and resubmit"; and "furnish as corrected". Architect will check one of the actions.
 4. Corrections or comments made on the submittals during this review shall not relieve Construction Manager from compliance with requirements of the Contract Drawings and Specifications. This check is only for review of general conformance with the design concept of and general conformance with the information given in the Contract Documents. The Construction Manager is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.
 5. For all Submittals, the Construction Manager will have prints made from the annotated digital submittals at the Construction Manager's expense. Such prints shall be used for record purposes and for comparison with subsequent resubmissions. One will be retained by the Architect, one furnished to the applicable consultants. Such procedures shall be followed until the Shop Drawing is marked "Furnish as Corrected", or "Reviewed as required by the Construction Contract Documents and approved, but only for conformance to the design concept of the work, and subject to further limitations and requirements contained in the Contract Documents."
 6. Submittals marked "Furnish as Corrected" shall be treated in the same manner as Drawings marked "Reviewed as required by the Construction Contract Documents...and requirements contained in the Contract Documents." The Architect's comments shall be considered part of the original Drawings. Should the Construction Manager disagree with such comments, he shall so notify the Architect in writing within fourteen (14) days after receipt of such Drawings and before commencing work on the items in question. Failing this, the Construction Manager shall be deemed to have accepted full responsibility for implementing such comments at no additional cost to the Owner.
 7. For documents with the comment "Reviewed as required by the Construction Contract Documents..." or "Furnish as Corrected", the Construction Manager will have made at the Construction Manager's expense, four (4) prints of the corrected original for the

Architect's and Owner's use.

- B. Informational Submittals: Architect will review each informational submittal and will review it for general compliance with submittal requirements
 - 1. Architect will process and digitally distribute each informational submittal as for other submittals.
 - 2. Compliant informational submittals will be marked "Reviewed" and a stamped digital copy will be distributed to Owner's Project Manager, OPM, and Construction Manager.
 - 3. Informational submittals that do not comply with submittal requirements specified herein and in the section whose work they cover will be returned "rejected". Re-submittal will be required.
- C. Repeated Re-submittals: The Architect will review the initial submittal for each product, and one re-submittal if revisions are required.
 - 1. If the first re-submittal is rejected or requires further revision, the Construction Manager shall be responsible to the Owner for costs for Additional Services of the Architect to perform review of an extensive number of repeated submittals, until a submittal for that product is accepted by the Architect with no need for further revision.
 - 2. Refer to Section 011400 –WORK RESTRICTIONS, for procedures required in cases where Construction Manager is responsible to the Owner for costs for Additional Services of the Architect.

3.3 SUBSTITUTIONS/ OR EQUALS

- A. Conditions: Architect will consider Construction Manager's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - 1. Substitution is requested by completing a copy of Form 013301 – SUBSTITUTION / OR EQUAL REQUEST FORM, attached to the end of this Section.
 - 2. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 3. Requested substitution/ or equal does not require extensive revisions to the Contract Documents.
 - 4. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 5. Substitution request is fully documented and properly submitted.
 - 6. Requested substitution will not adversely affect Construction Manager's Construction Schedule.
 - 7. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 8. Requested substitution is compatible with other portions of the Work.
 - 9. Requested substitution has been coordinated with other portions of the Work.
 - 10. Requested substitution provides specified warranty.

11. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 calendar days of receipt of a request for substitution. Architect will notify Construction Manager of acceptance or rejection of proposed substitution within 21 calendar days of receipt of request, or 7 calendar days of receipt of additional information or documentation, whichever is later.
1. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Review of Substitution / Or Equal Requests: The Architect will review Substitution Requests that are submitted in accordance with the requirements of this section, and are shown to be of benefit to the Project.
1. If a request for substitution is incomplete, the Construction Manager shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional review, until the substitution has been either accepted with no need for further revision, or rejected.
 2. If a request for substitution is shown to be of benefit to the Construction Manager only and not to the Project, the Construction Manager shall be responsible to the Owner for costs for Additional Services of the Architect to perform review, redesign or coordination due to such substitution.
 3. Refer to Section 011400 –WORK RESTRICTIONS, for procedures required in cases where Construction Manager is responsible to the Owner for costs for Additional Services of the Architect.
- D. Form of Acceptance of Substitution: Change Order

END OF SECTION

Attachment:

Form 013301 – SUBSTITUTION REQUEST FORM

FORM 013301
SUBSTITUTION / OR EQUAL REQUEST FORM

Project: NORTHEAST METRO REGIONAL VOCATIONAL HIGH SCHOOL

To: **DRA**

We hereby submit for your consideration the following product as a substitution for the item specified for the above referenced project:

Drawing Number: _____ Drawing Title: _____

Specification Section: _____ Section Title: _____

Paragraph: _____ Specified Item: _____

Proposed Substitution /Or Equal: _____

Attach complete information on changes to Drawings and Specifications, including related work on other Drawings and under other Sections of the Specifications necessary for the proper installation of the proposed substitution, including proper coordination and finishing.

Submit with request complete Product Data, samples and other data necessary to substantiate that the proposed item is equal to or exceeds the specified item in all respects. Include a comparison chart showing material features and properties of the specified item and the proposed substitute, paying particular attention to requirements specifically mentioned in the Specifications or shown on the Drawings, and guarantee/warranty information. Clearly mark manufacturer's literature to indicate equality in performance. In the case of operating equipment or systems, provide information as to servicing and maintenance requirements, and anticipated service life in the indicated application.

Fill in the blanks below (attach additional sheets as necessary):

A. Does the substitute affect dimensions shown on the Drawings: Yes ☐ No ☐
(if yes, clearly indicate changes on enclosures)

B. Will the undersigned pay for changes to the building design, including architectural/engineering detailing costs caused by the requested substitution: Yes ☐ No ☐
(if no, please explain)

C. What effect does the substitution have on other Contracts or other trades? _____

D. What effect does the substitution have on construction schedule? _____

E. Manufacturer's warranties of the specified and proposed items are: Same ☐ Different ☐

Explain: _____

F. Itemized comparison of specified item with proposed substitute is attached.

G. This substitution will amount to a credit or extra cost to the Owner of: _____

_____ Dollars

(\$_____).

Notes:

Submission of this form by the Construction Manager will not require the Owner to accept the proposed substitution unless the substituted product or system is acceptable to the Architect.

The Owner's acceptance of any substitution will not change the Contract Price, unless the Owner, Construction Manager and any other required parties execute a Change Order in accordance with the terms and provisions of the Contract Documents.

Refer to Section 013300 – SUBMITTAL PROCEDURES, for additional requirements for the submittal and processing of substitution requests.

Submitted By: _____
(signature)

Title: _____

Firm: _____

END OF FORM

SECTION 014000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for
 - 1. Quality assurance
 - 2. Quality control
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Construction Manager of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Construction Manager's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Construction Manager to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement

activities performed by Architect.

- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.
- E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- J. Installer/Applicator/Erector: Construction Manager or another entity engaged by Construction Manager as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the min-

imum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Testing and Inspection Log: Submit updated copy of log each month with the Application for Payment.
- C. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Construction Manager responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Construction Manager. Interpret tests and inspections and state in each report whether tested and in-

spected work complies with or deviates from the Contract Documents.

- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Coordinate the work of multiple subcontractors as needed to build complete mockups of multi-component systems.
 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Perform field tests on mock-up panels to show compliance with requirements as specified in individual sections. At a minimum, perform air leakage and water infiltration testing.
 6. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 8. Demolish and remove mockups when directed, unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 2 through 50.

1.7 QUALITY CONTROL – OWNER RESPONSIBILITIES

- A. General: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Testing, inspections and commissioning performed by the Owner or the Owner's agents in no way reduce the responsibility of the Construction Manager to meet performance requirements, descriptive criteria and all other requirements of the specifications, nor do these activities on the part of the Owner relieve the Construction Manager from performing Quality Assurance and Quality Control measures specified.
- B. Tests and Inspections: The Owner reserves the right to employ consultants and testing agencies to test the performance of the Work and to inspect the Work for conformance with the Contract Documents.
1. Notice for Testing: The Construction Manager shall give the Owner a minimum 24-hour notice when installations that require testing are ready for testing or inspection.
 - a. Earlier notice shall be given where specified in a given technical section of the Specifications.
 - b. If the Owner's testing agency arrives at the site to test the performance of the work, and determines that the installation is not ready for testing or inspections, then the Construction Manager shall be responsible for the costs of the testing agency's site visit
 2. Availability of Test Results: The results of such tests and inspections will be made available to the Architect and Construction Manager.

3. Correction of Work:
 - a. Where results demonstrate deficiencies in the Work, the Construction Manager shall take all actions necessary to correct the Work in a timely manner at their own expense.
 - b. When the Construction Manager considers the Work to be corrected, further tests and inspections will be performed by the Owner's consultants and testing agencies at the Construction Manager's expense.
- C. Owner will furnish Construction Manager with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
- D. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Construction Manager, and the Contract Sum will be adjusted by Change Order.

1.8 QUALITY CONTROL – CONSTRUCTION MANAGER RESPONSIBILITIES

- A. Tests and inspections not explicitly assigned to Owner are Construction Manager's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Construction Manager by authorities having jurisdiction, whether specified or not.
 1. Where services are indicated as Construction Manager's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Construction Manager shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Construction Manager's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Construction Manager and not required by the Contract Documents are Construction Manager's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Construction Manager's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Construction Manager in performance of duties. Provide qualified personnel to perform required tests and inspections.
 1. Notify Architect and Construction Manager promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Construction Manager.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Construction Manager.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. Schedule times for tests, inspections, obtaining samples, and similar activities.
- G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
 2. Comply with the Contract Document requirements for Section 017329 – CUTTING AND PATCHING.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Construction Manager's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 45 23

TESTING AND INSPECTING SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The 9th Edition of the Massachusetts State Building Code, 780 CMR, under which this project is designed and will be built, requires the structural engineer of record (SER) to provide a program of structural tests and inspections for this project in accordance with 780 CMR 17.00. The SER is the structural engineer (an individual) who is in responsible charge of the preparation of the structural drawings and structural specifications for this project and whose Massachusetts professional engineering seal appears on said structural drawings.
- B. The SER has prepared a document entitled Statement of Special Inspections for Compliance with Chapter 17 of IBC 2015, which has been or will be submitted to the building official who has jurisdiction over this project, with the application for a building permit.
- C. The statement of structural tests and inspections shall not relieve the Construction Manager or its subcontractors of their responsibilities and obligations for quality control of the Work, their other obligations for supervising the work, for any design work which is included in their scope of services, and for full compliance with the requirements of the Contract Documents. Furthermore, the detection of, or failure to detect, deficiencies or defects in the Work during the testing and inspection conducted pursuant to the program shall not relieve the Construction Manager or its subcontractors of their responsibility to correct all deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents.
- D. The statement of structural tests and inspection does not apply to the Construction Manager's equipment, temporary structures used by the Construction Manager to construct the project, the Construction Manager's means, methods, and procedures, and job site safety.

1.2 CONSTRUCTION MANAGER'S RESPONSIBILITIES

- A. Where the document Statement of Special Inspections for Compliance with Chapter 17 of IBC 2015 indicates that a structural component or system is subject to structural tests and inspections by 780 CMR 17.00 and that the SER for the project has not been retained to design said component or system or to prepare a performance specification for said component or system, and the Architect has not otherwise provided for the structural design of said component or system, the Construction Manager shall retain, or require others under his aegis to retain, a professional engineer registered in Massachusetts to design said component or system and to provide the required program of structural tests and inspections for said component or system.
- B. This engineer shall visit the site and provide an affidavit to the SER addressed to the Building Inspector verifying that construction has been completed in accordance with the submitted documents.
- C. The Construction Manager shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or inspections. The Construction Manager shall provide all ladders, scaffolding, staging, and up-to-date safety

equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.

- D. The Construction Manager shall give reasonable notice to the SER, or to those performing inspections and tests under the SER's direction, of when the various parts of the Work will be ready for inspection. The Construction Manager shall obtain instructions from the SER as to what is reasonable notice for the various aspects of the work, and who is to be notified.
- E. The Owner reserves the right to back charge the Construction Manager for additional expense incurred by the Owner for the services of the SER or those under his direction when work is not reasonably ready for inspection in accordance with the notice provided by the Construction Manager.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following:
 - 1. Temporary facilities and services.
 - 2. Temporary water.
 - 3. Weather protection
 - 4. Temporary heating and ventilating
 - 5. Temporary humidity control.
 - 6. Temporary telephone
 - 7. Temporary sanitary facilities
 - 8. Temporary fire protection
 - 9. Temporary stairs and ladders
 - 10. Temporary hoists and chutes
 - 11. Staging and scaffolding
 - 12. Temporary use of elevators
 - 13. Temporary enclosures
 - 14. Protection of work, property and the public
 - 15. Security of the work
 - 16. Rodent control.
 - 17. Water control
 - 18. Snow and ice control
 - 19. Construction fence
 - 20. Project signs
 - 21. Temporary offices

1.3 RELATED WORK

- A. Division 26 – For temporary electricity and lighting.

1.4 SUBMITTALS

- A. General: Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
- B. Informational Submittals: Submit the following plans for temporary protection and facilities as specified in this Section:
 - 1. Weather protection plan
 - 2. Temporary humidity control procedures
 - 3. Temporary heating plan
 - 4. Temporary fire protection plan.

1.5 TEMPORARY FACILITIES AND SERVICES

- A. Construction Manager shall be responsible for arranging and providing temporary facilities and general services at the site as specified herein and as otherwise required for proper and expeditious prosecution of work. Except as otherwise specified, the Construction Manager shall pay costs for all temporary facilities and general services until Final Acceptance of the Work and shall remove same at completion of the Work.
- B. All such services and facilities shall comply with applicable Federal, State and local regulations.
- C. Construction Manager shall make all connections to existing services and sources of supply, shall provide all necessary installations, labor, materials, and equipment, in a manner subject to the approval of the Architect and the Owner, shall remove temporary installations and conditions when no longer required, and shall restore the services and sources of supply to proper operating condition as approved by the Architect.
- D. Discontinuance of any temporary service prior to the completion of any portions of the Work shall not render the Owner liable for any additional cost resulting therefrom.
- E. Should a change in location of any temporary equipment be necessary in order for the Work to progress properly, Construction Manager shall remove and relocate such equipment as required without additional cost to the Owner.
- F. Temporary Parking Lot: Construct temporary parking lot shown on approved Logistics Plan for temporary use of Owner and Construction Manager during construction. Demolish temporary parking lot and restore area for permanent use as shown on Drawings.
 - 1. Provide two hard surfaced parking spaces for use by Owner's Project Manager and Architect, connected to office by hard surfaced walk.

1.6 TEMPORARY WATER

- A. Furnish potable water for construction purposes for trades at a point within 10 feet of building being constructed. Make arrangements and pay charges for water service installation, maintenance, and removal thereof, and pay costs of water for all trades.

- B. After installation, permanent water supply and distribution system may be used as source of water for construction purposes, provided that the Construction Manager pays applicable municipal water costs and assumes responsibility for damage to water distribution system and pays costs of restoration of system where so damaged.
- C. Temporary pipe lines and connections from the permanent service line, either outside or within the building, necessary for the use of the Construction Manager and his Subcontractors shall be installed, protected and maintained at the expense of the Construction Manager.
- D. In addition to temporary lines and connections, the Construction Manager, if required by the Owner, shall at the Construction Manager's expense install a temporary meter in a frostproof box in such location and in such manner as may be approved by the Architect.
- E. Provide an adequate supply of drinking water from approved sources of acceptable quality, satisfactorily cooled, for Construction Manager's employees and those of his Subcontractors. Where required, furnish drinking water in suitable containers and provide single-service cups for use of employees. Drinking water dispensers shall be conveniently located in building where work is in progress.
- F. At completion of construction work, temporary water service equipment and piping shall be removed by Construction Manager.

1.7 WEATHER PROTECTION

- A. It is the intent of these Specifications to require the Construction Manager to provide temporary enclosures and heat to permit construction work to be carried on during the months of October through April and in compliance with Local General Laws. These Specifications are not to be construed as requiring enclosures or heat for operations that are economically infeasible to protect in the judgment of the Architect. Included in this category, without limitation, are such items as site work, excavation, pile driving, steel erection, erection of certain exterior wall panels, roofing, and similar operations.
- B. "Weather Protection" shall mean the temporary protection of that work adversely affected by moisture, wind and cold, by covering, enclosing and/or heating. This protection shall provide adequate working areas during the months of November through March as determined by the Architect and consistent with the approved construction schedule to permit the continuous progress of all work necessary to maintain an orderly and efficient sequence of construction operations. The Construction Manager shall furnish and install all "weather protection" material and be responsible for all costs, including heating required to maintain temperature of 40 degrees F. at the working surface. This provision does not supersede any specific requirements for methods of construction, curing of materials or to performance obligations of the Construction Manager.
- C. Within 30 calendar days after award of Contract, the Construction Manager shall submit in writing to the Architect for approval, three (3) copies of his proposed methods for weather protection.
- D. Installation of weather protection shall comply with all safety regulations including provisions for adequate ventilation and fire protection.
- E. Determination of extent of work to be performed during winter months shall be by the Con-

struction Manager, with Owner's approval provided that work shall proceed at such a rate as to insure Substantial Completion on or before the stipulated date in accordance with the Progress Schedule.

- F. Be responsible for providing protection against damage to materials and work installed in freezing weather by providing special heat and coverings to prevent damage by the elements, in a manner approved by the Architect. Protect the ground surfaces under footings, under pipelines, under masonry, under concrete and other work subject to damage, against freezing or ice formation. If low temperature makes it impossible to continue operations safely in spite of cold weather precautions, cease work, and so notify the Architect.

1.8 TEMPORARY HEATING AND VENTILATING

- A. Within thirty (30) calendar days after commencement of work under this Contract, the Construction Manager shall submit in writing to the Architect for approval, three (3) copies of his method and time schedule for heating during construction, which shall concur with his general Progress Schedule.
- B. Temporary weather-tight enclosures and temporary heating shall be provided by the Construction Manager as required during construction to make the building weather-tight and to protect work from freezing and frost damage. All costs of closing in buildings, and all costs of temporary heat shall be paid for by the Construction Manager until Substantial Completion.
- C. Construction Manager shall provide for temporary heating and shall pay fuel costs for heating directly to the utility company. Construction Manager may not tie into the Owner's permanent heating and ventilating system. In areas of building where work is being conducted, temperature shall be continuously maintained as specified in Sections of Specifications but not less than 50 degrees F. nor more than 75 degrees F.
- D. Furnish and install one accurate recording Fahrenheit thermometer at a place designated by the Owner, located as directed by the Owner in order to determine that the specified temperatures are being maintained.
- E. When work has progressed sufficiently for installation of glazing, Construction Manager may, if approved by Architect, use glazed windows in place of temporary enclosures. Permanent windows shall be protected against damage from mortar, cement, plaster, and other like items, and from damage by other trades; and upon completion of work shall be thoroughly cleaned, damaged component parts including glass shall be satisfactorily repaired or replaced, and windows left in perfect condition, prior to Substantial Completion.
- F. Where building systems are inoperable, temporary heating shall be by smokeless portable unit heaters, steam generators or forced warm air heaters (UL, Factory Mutual, Fire Marshall approved), located outside building or vented to the outside. Construction Manager shall pay for fuel, maintenance and attendance required in connection with temporary heat. Surfaces, interior or exterior, damaged by use of these space heaters shall be replaced by new materials or be refinished to the satisfaction of the Architect without additional cost to the Owner. Use of oil burning "salamanders" is forbidden and nonvented open flame heaters will not be permitted inside after the building is closed in. Do not use propane-fueled heaters inside building or near stockpiles of combustible materials.
- G. When new heating system, or suitable portion thereof, is in operating condition, such system

may not be used for temporary heating.

- H. Use of permanent air handling facilities for construction heating purposes will not be permitted.
- I. Make periodic inspections of the equipment and controls to insure proper operation of the system, as conditions require, and report any failings. Installation and operation of weather protection and heating devices shall comply with all safety regulations including provisions for adequate ventilation and fire protection.
- J. Upon conclusion of temporary heating period, Construction Manager shall remove temporary piping, temporary radiators, other equipment and pay costs in connection with repairing damaged caused by installation or removal of temporary heating equipment and shall thoroughly clean and recondition those parts of permanent heating system used for temporary service.
- K. Provide adequate ventilation as required to keep temperature of building within 10 degrees of ambient outdoor temperature when such ambient temperature exceeds 70 degrees F., and to prevent accumulation of excess moisture in building. Refer to Section for Indoor Air Quality Control, for additional requirements for ventilation during construction

1.9 TEMPORARY HUMIDITY CONTROL

- A. Humidity Control of Enclosed Building: The Construction Manager shall install the following equipment to monitor and regulate relative humidity as required for the installation of all interior products. Humidity control equipment shall include, but not be limited to, the following:
 - 1. Hygrometer: Provide one device to measure temperature and relative humidity in each construction area.
 - 2. Dehumidifier, as required to maintain humidity of enclosed areas below 70%:
 - 3. Fans: As required to eliminate significant variation in humidity levels within enclosed spaces.
- B. Schedule for Humidity Control: Relative humidity shall be maintained within the limits set by manufacturers of all interior materials and equipment. Refer to individual specification sections in Divisions 6, 9, 10, 11 and 12 for additional environmental requirements. No interior construction product shall be installed or applied prior to enclosure of building and installation of temporary humidity control measures.
- C. Within 30 calendar days after award of Contract, the Construction Manager shall submit in writing to the Architect for approval, three (3) copies of his proposed methods for humidity control.

1.10 TEMPORARY TELEPHONE AND HIGH SPEED INTERNET

- A. Arrange with local telephone company to provide direct line telephone service at each construction site. Provide:
 - 1. One direct line instrument in Field Office for the Construction Manager with electronic answering machine.
 - 2. Two direct line instruments in Field Office of the Clerk of the Works/OPM equipped with

- electronic answering machine; plus one direct line for facsimile machine in office. Turn over keys to Clerk of the Works, OPM and Architect.
3. High Speed internet access, 6.0 Mbps minimum downstream speed, modem to accept the appropriate service provided, and wireless router via DSL, Broadband, Cable, or equal with unlimited internet access to the Field offices of the Construction Manager and Clerk of the Works/OPM.
 4. Other instruments at the option of the Construction Manager, or as required by regulations.
 5. Each Subcontractor shall make his own arrangements for telephone service.
- B. Pay for installation and removal of temporary telephones and facsimile lines and for all calls and fixed charges in connection therewith; including unlimited long-distance calling.
- C. Temporary telephone services shall be maintained until Final Completion of the Work.

1.11 TEMPORARY SANITARY FACILITIES

- A. Construction Manager shall provide an adequate number of toilet facilities with chemical type toilets and temporary lighting rented from and serviced by an approved company, as necessary for all persons engaged on the Work. Provide separate facilities for male and female workers.
- B. Toilets shall be erected in location approved by the Architect, shall be maintained by the Construction Manager in a clean and orderly condition in compliance with all local and State health requirements, and shall be removed at Substantial Completion of the Work.
- C. Either existing or permanent toilet facilities shall not be used by the Construction Manager, Subcontractors or any persons engaged by them during the course of work under this Contract.

1.12 TEMPORARY FIRE PROTECTION

- A. Provide and maintain adequate temporary fire protection in the form of barrels of water with buckets, fire bucket tanks, fire extinguishers, or other effective means of extinguishing fire, ready for instant use, distributed around the Project and in and about temporary inflammable structures during construction of the Work.
- B. Within 30 calendar days after award of Contract, the Construction Manager shall submit in writing to the Architect, three (3) copies of his proposed methods for fire protection that have been reviewed and approved by the local Fire Department. Post a copy of the approved fire protection plan in the Field Office for reference.
- C. Gasoline and other flammable liquids shall be stored in and dispensed from UL listed safety containers in conformance with National Board of Fire Underwriter's recommendations. Storage shall not be within building.
- D. Make arrangements for periodic inspection by local fire protection authorities and insurance underwriter's inspectors. Cooperate with said authorities and promptly carry out their recommendations.

- E. Tarpaulins used during construction work shall be made of material that is resistant to fire, water, and weather. Tarpaulins shall have UL approval and comply with FS-CCC-D-746.
- F. Torch-cutting and welding operations performed by Subcontractors shall have approval of Construction Manager before such work is started and chemical extinguisher shall be available within sight and not over ten (10) feet from location where such work is in progress.
- G. Do not light fires in or about premises.

1.13 TEMPORARY STAIRS AND LADDERS

- A. Each trade shall provide its own ladders.
- B. All such apparatus, equipment and construction shall meet all requirements of Federal, State and local laws applicable thereto.

1.14 TEMPORARY LIFTS AND HOISTS

- A. Each trade shall provide its own lifts, hoists, including associated rigging, and conveyance apparatus.
- B. Construction, maintenance and operation of material hoists shall conform to applicable requirements of the "Standard Safety Code for Building Construction", ANSI; to AGC "Manual" requirements and to State and local regulations.
- C. Temporary lifts and hoists required for proper execution of work shall be properly maintained. Hoists shall be so constructed as to prevent damage, staining and marring of permanent work.
- D. Provide openings in slabs, roofs, walls and partitions, where required, for moving in large pieces of equipment. Close and restore openings and finish them after equipment is in place. Structural modification, if required, shall be subject to prior written approval by the Architect.

1.15 TEMPORARY CHUTES

- A. The Construction Manager shall provide chutes for use by all trades.
- B. Temporary chutes, and similar items required for proper execution of Construction Manager's work and that of his Subcontractors shall be properly maintained. Use of such facilities by other contractors, subcontractors and trades shall be permitted as required by construction schedule. Chutes shall be so constructed as to prevent damage, staining and marring of permanent work.
- C. No materials, rubbish or debris, shall be permitted to drop free, but shall be removed by the use of material hoist and/or fully enclosed rubbish chute.

1.16 STAGING AND SCAFFOLDING

- A. Responsibility for Staging:
 - 1. Each trade shall provide staging and scaffolding required for its work, except where noted otherwise.
- B. Construction Requirements for Staging: Each trade is responsible for safety of staging and scaffolding, including but not limited to the following requirements:
 - 1. Staging shall be of approved design, erected and removed by experienced stage builders, and shall comply with all applicable OSHA standards.
 - 2. Provide accident prevention devices required by State and local laws.

1.17 TEMPORARY USE OF ELEVATORS

- A. Trades shall make arrangements with Elevator Subcontractor for temporary use of elevators, if required, during construction period, and for normal use by all trades and Subcontractors.
- B. Make arrangements for provision of temporary cab enclosures, cars, car switches, gate contacts, power, signaling devices, temporary hoistway openings, protection of permanent hoistway entrances and other installed finished work, and pay for all such other items as are necessary to permit temporary operation in accordance with local, State and national codes.
- C. Arrange with Elevator Subcontractor for all necessary maintenance of elevators during period of temporary operation and for restoration of elevators to their original, perfect condition with guarantees as specified. All costs in connection with temporary operation of elevators shall be paid by the Construction Manager.
- D. Do not abuse, overload or otherwise damage elevators in temporary use for construction purposes.
- E. Elevator will be made available to the Owner for use during installation of FF&E, IT and Owner materials at no cost to the Owner.

1.18 TEMPORARY ENCLOSURES

- A. Provide temporary weathertight enclosure of exterior walls as necessary to provide acceptable working conditions, provide weather protection for interior materials, allow for effective temporary heating, and to prevent entry of unauthorized persons.
- B. Provide temporary exterior doors with self-closing hardware and padlocks. Permanent door enclosures shall not be used as temporary enclosures. Other enclosures shall be removable as necessary for work and for handling of materials.
- C. Refer to Section INDOOR AIR QUALITY CONTROL, for requirements for temporary interior partitions to enclose portions of the work where required for protection of indoor air quality.
 - 1. Provide sound attenuation batts and insulated, weather stripped doors in temp partitions to reduce sound transmission between occupied and unoccupied areas.

- D. Relocate temporary enclosures as required by progress of construction, by operations of the building, or work requirements, and to accommodate legitimate requirements of Owner and Subcontractors employed at the site.
- E. Completely remove temporary materials, equipment and services when enclosure needs can be met by use of permanent construction and at completion of the Project.

1.19 PROTECTION OF WORK, PROPERTY AND THE PUBLIC

- A. Furnish, erect, and maintain, until such time as removal is approved by the Architect, temporary fencing and barricades to extent recommended by OSHA and as otherwise required for the protection of life and property during operations under the Contract.
- B. Construct barricades and protective facilities in accordance with local and State regulations. Furnish and install all signs, lights, reflectors, and all such protection facilities as may be required.
- C. Construction Manager shall save the Owner harmless from all claims arising from the use of public streets, sidewalks, and adjoining premises for construction purposes.
- D. Keep all access roads and walks clear of debris, materials, construction plant and equipment during building operation. Repair streets, drives, curbs, sidewalks, fences, poles and the like where disturbed in building operation and leave them in as good condition after completion of the Work as before operations started.
- E. Protect all planting, landscaping, trees and site improvements to remain.
- F. The Construction Manager shall be responsible for the maintenance of construction barriers and traffic barriers in order to maintain traffic around the Work with the maximum of safety and practical convenience to such traffic during the life of the Contract, and whether or not work has been suspended temporarily. He shall take all precautions for preventing injuries to persons or damage to property on or about the Work.
- G. Work shall be carried on and barriers erected in such a manner as to provide safe passage at all times for public travel and with least obstruction to traffic. The Construction Manager shall provide and maintain at his own expense in a safe and passable condition such temporary bypasses created by the barriers as may be necessary to accommodate both pedestrian and vehicular traffic.
- H. Whenever gale or high winds are forecast, take proper measurements to secure all loose material, equipment or other items that could blow about and be damaged or cause damage to other work. No such loose items shall be left unsecured at end of working day. Particular attention shall be taken with scaffolding and items placed or stored on roofs or within the structure prior to being enclosed.
- I. Remove all snow and ice which may impede work, damage the finishes or materials, be detrimental to workers, or impede trucking, delivery, or moving of materials at the job site, or prevent adequate drainage of the site or adjoining areas.
- J. Be responsible for all breakage of glass from the time construction operations commence in each portion of the Project until each portion of the Project is occupied by the Owner. Unless

glass has been broken by the Owner or his representatives, or by other separate prime contractors, the cost of glass replacement shall be borne by Construction Manager.

1.20 SECURITY OF THE WORK

- A. The Construction Manager shall be responsible for providing any and all security precautions necessary to insure adequate protection of his and the Owner's interests.
- B. Take all required measures to protect the Work at all times against fire, storm, theft, vandalism and other losses.
- C. The Construction Manager shall be wholly responsible for patrolling and protecting the work under construction and the materials stored on the site; and shall reimburse the Owner for any losses, damage or injury not compensated by insurance, except those directly caused by the Owner, his agents or his employees.
- D. The Construction Manager shall rebuild, repair, restore and make good all damage to any portion of the Work occasioned by any of the above causes before completion and written acceptance of the completed Work, and shall bear the expense thereof. No extension of time will be allowed in such cases.
- E. Should the Construction Manager fail to take prompt action whenever conditions make it necessary, the Owner may make emergency repairs or cause the same to be made, with the stipulation that the costs for such repairs shall be charged against the Construction Manager and deducted from monies due to him.

1.21 RODENT CONTROL

- A. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents and to perform extermination and control procedures at regular intervals so Project will be free of rodents and their residues at Substantial Completion.
 - 1. Obtain extended warranty for Owner.
 - 2. Perform control operations lawfully, using environmentally safe materials.
 - 3. The Construction Manager's attention is brought to the fact that the building will be occupied by children. Every effort shall be made to avoid applications of materials that will in any way compromise their health.

1.22 WATER CONTROL

- A. Take over responsibility for site drainage in work areas upon entering the premises and maintain such drainage during the life of this Contract in a manner approved by the Architect and so as not to adversely affect adjacent areas or abutting property.
- B. During the progress of the Work, provide and maintain all required pumps, suction and discharge lines, and power in sufficient number and capacity to keep all excavations, pits, trenches, foundations, and the entire property area free from accumulation of water from any source whatsoever, at all times, and under any and all circumstances and contingencies that may arise.

1.23 SNOW AND ICE CONTROL

- A. De-icing Materials:
 - 1. General: Comply with state and local regulations.
- B. Snow Storage:
 - 1. General: Comply with state and local regulations.

PART 2 - PRODUCTS

2.1 CONSTRUCTION FENCE

- A. Furnish, install, maintain, and pay for temporary fencing and other protection required for the safety of the Work and of stored materials and equipment. Provide temporary construction fence as required for public safety and protection around entire construction area at the Limit of Work line, at each site as shown on Drawings. Fence shall be installed in a manner that will not impact wetlands.
- B. Construction fence shall be eight (8) feet high and of chain link construction with 6 gauge wire at the top and the bottom of the fencing material, erected in a substantial manner, straight, plumb and true.
- C. Gates shall be built into fence at such approved locations as are necessary, well cross-braced and hung on heavy strap hinges with proper post and hook for double gates. Provide heavy hasps and padlocks for each gate. Provide keys to Owner to facilitate emergency access by Owner's Security Forces and local Police and Fire Department.
- D. All fencing shall be in accordance with local ordinances and shall be removed at such time before Final Acceptance as the Architect directs. Restore site to acceptable condition after removing fence.
- E. Vehicular access to the site, and parking for Construction Manager's employees' vehicles shall be restricted to the specific areas designated by the Owner.

2.2 PROJECT SIGNS

- A. Provide in a location designated by the Architect one (1) sign, 4 feet by 8 feet in size, with three 4-inch by 4-inch post supports. Sign shall be fabricated from 3/4 inch thick medium density overlaid exterior plywood, edged continuously with 3/4 inch square pine banding. Apply one coat of exterior primer and two coats of exterior gloss enamel to all surfaces of sign and supports.
- B. Sign shall be professionally produced and shall match the sign graphic included in Section 015000a.
- C. Provide directional signs as required to properly control construction traffic at each site.
- D. No other signs or advertisements will be allowed on building or premises.

- E. Erect where required for DEP File No. in accordance with Wetland Regulations and the Order of Conditions where applicable.

2.3 TEMPORARY OFFICES

- A. Provide, maintain, and pay all costs in connection with temporary offices; including but not limited to office furniture, office equipment, and exhaustible office supplies.
- B. In addition to his own requirements, the Construction Manager shall provide and bear all costs for completely enclosed weathertight structure equal to Williams Scotsman Model MO6012; not less than 60'-0" x 12'-0" in area for use of the Owner's Project Manager, the Architect, and their representatives. The trailer shall have two offices and a conference room, a reasonable amount of natural light, adjustable natural ventilation, and two exterior doors with dead bolt locks accessible and keyed from the outside. The trailer shall also have separate toilet facilities built into trailer. In addition include the following equipment:
 - 1. Heat during cold weather below 55 degrees F.
 - 2. One layout table, approximately 36" x 84" with one drafting stool and two drafting lamps with bulbs.
 - 3. Two desks (30x60 standard double pedestal steel desks with plastic laminate tops, two-drawer letter hanging file on one side, three drawer pedestal on the other side, center pencil drawer. Drawers shall lock; furnish two keys per desk.) and desk chairs (swivel type upholstered chair with arms, fully adjustable seat heights and variable back rests; five caster bases with wheels) in separate offices. One desk and one desk chair in the main area. Include one spring-mounted desk light per desk.
 - 4. Four conference tables, each 72 by 30 inches, with plastic laminate top.
 - 5. Sixteen straight back folding chairs with cushioned seats.
 - 6. Six Fireproof metal file cabinets (4 drawers each) with locks, hanging frame inserts, hanging file holders and folders (50 per drawer). Drawers shall lock; furnish each cabinet with three keys.
 - 7. One hat shelf with room for 20 hard hats.
 - 8. One sloped surface plan review table, 42 by 72 inches, with raised lip at low edge.
 - 9. Six portable plan rack units on casters; 12 stick capacity each. Include twelve 3 knob sticks per unit.
 - 10. Two desk-type telephones with speakerphone feature.
 - 11. One electronic telephone answering machine.
 - 12. One coat rack, consisting of wall mounted panel equipped with eight coat hooks, six 20 gallon wastepaper baskets, three 30"x40" wall-mounted tackboards and three 36 by 48 inch whiteboards with tray. Furnish each whiteboard with four colored markers and one eraser.
 - 13. One exterior high quality mercury thermometer.
 - 14. Air conditioning during weather above 75 degrees F.
 - 15. 12-inch deep steel shelving, forty linear feet.
 - 16. Sufficient number of electric lights (50 fc at desk level over entire area) and outlets.
 - 17. One Dell MFP3115cn Printer Copier Scanner, or equal as approved by OPM. Provide letter, legal and 11 x 17 paper supply and required printer ink cartridges for the duration of the work. Include cable connections to USB port and service program with 3 years parts and labor warranty with 3 years onsite service with response time within 24 hours of notice. Provide technician to setup printer and printer capabilities (print, scan, fax, and other like items) on up to four owner/ rep/ clerk computers.
 - 18. One facsimile transmitting and receiving machine with dedicated telephone line.

19. Supplies: Office supplies, including toners for all equipment, ten hard hats, four safety glasses, four safety vests and raincoats.
 20. One water-cooler: Provide dispenser which holds bottled water and furnishes instant hot as well as cold water, supply with flat bottom paper cups, and weekly bottle replacement for the duration of the project.
 21. One refrigerator, two door, 3.3 cu ft capacity.
 22. One microwave, 0.9 cu ft capacity counter top model.
 23. One industrial quality wall-mounted first aid kit sized and supplied for 10 people.
 24. One automatic coffee machine equal to 2011-02 Keurig B140 Brewing System including coffee for the duration of the project.
 25. One UPS backup power unit, 20 minute capacity, auto shutdown on power failure.
 26. Power strip with surge protector, and dust covers for all equipment; provide three..
 27. Electronic labeling system: desktop model, Brother # PT2700 or equal. Furnish with tape and other supplies for duration of project.
 28. Provide 2 25" LED monitors, LG (Life's Good), or approved equal.
- C. Heat and Air Conditioning shall be maintained to provide an indoor air temperature of 76 degrees F at 72 inches above the floor and throughout the space during the cooling season and 70 degrees F at 30 inches above the floor during the heating season.
- D. Electrical Convenience Power: Provide convenience outlets for at least 2400 watts and at least 2 convenience circuits independent of the lighting, equipment power, and heating needs.
- E. Offices shall be located in location approved by the Architect, shall be maintained by the Construction Manager in a clean and orderly condition, and shall be removed at Substantial Completion. The Construction Manager shall provide a weekly cleaning service in each office, with monthly waxing. Construction Manager shall maintain pathways to trailers from construction site and parking area free of water, snow and ice.
- F. Provide routine emergency service for office equipment specified and reasonable quantities of expendable supplies as required for job related use. Consumables include:
1. Fax machine, copiers, printer: toner and paper.
 2. Drinking Water: Provide bottled spring water for water dispenser in 6 gallon bottles, delivered as necessary to avoid running out, coffee for machine, and continuous stock of flat bottom cups.
 3. Lamps: bulbs and fluorescent lamps of appropriate types and wattage for the trailer fixtures.
- G. All office equipment provided under this Section shall be new and unused and shall become the property of the Owner. Equipment and contents of the owner/representative/ clerk shall be relocated to within the school district by a professional moving company at the completion of the project at the expense of the Construction Manager.

PART 3 - EXECUTION



NORTHEAST METROPOLITAN REGIONAL VOCATIONAL SCHOOL DISTRICT Deborah P. Davis, School Committee Chair David DiBarri, Superintendent-Director Dr. Carla A. Scuzzarella, Deputy Director-Principal DISTRICT COMMUNITIES Chelsea, Malden, Melrose, North Reading, Reading, Revere, Saugus, Stoneham, Wakefield, Winchester, Winthrop & Woburn	NORTHEAST METROPOLITAN REGIONAL VOCATIONAL H.S. BUILDING COMMITTEE Theodore Nickole, SBC Chair Anthony Caggiano Joseph Capraro Brittany A. Carisella Patricia Cronin Deborah P. Davis David DiBarri	NORTHEAST METROPOLITAN REGIONAL VOCATIONAL H.S. BUILDING COMMITTEE Judith M. Dymont Melissa Elam Ward Hamilton James J. Holland Stephen Maio Robert S. McCarthy Larry Means	OWNERS PROJECT MANAGER PMA Consultants ARCHITECT Drummey Rosane Anderson, Inc. CONSTRUCTION MANAGER AT RISK Gilbane Building Company
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END OF SECTION

SECTION 017329
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for additional requirements that affect this Section whether or not specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section covers procedural requirements for cutting and patching, including but not limited to the following:
 - 1. Standard requirements for all cutting and patching to be done on the Project, whether by the Construction Manager, Trade-Contractors or other subcontractors.
- B. Refer to the following Sections for related work:
 - 1. Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for temporary protection, shoring and construction aids.
 - 2. Section 017400 – CONSTRUCTION WASTE MANAGEMENT, for disposal of demolished materials.
 - 3. Divisions 2 through 12 Sections, for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 4. Section 033000 – CAST-IN-PLACE CONCRETE, for cutting, patching and repair of concrete.
 - 5. Section 042000 – UNIT MASONRY, for cutting and patching of masonry for the work of all trades, unless otherwise provided herein.
 - 6. Section 042000 – UNIT MASONRY, for installation of lintels where required for all penetrations through new masonry.
 - 7. Section 055000 – METAL FABRICATIONS, for furnishing of lintels where required for all penetrations through new masonry.
 - 8. Section 078410 – PENETRATION FIRESTOPPING, for patching fire-rated construction.
 - 9. Division 9 – FINISHES, for all patching of new construction, except for masonry and concrete.
 - 10. Section 092110 – GYPSUM BOARD ASSEMBLIES, for cutting and patching gypsum wallboard construction.
 - 11. Section 099000 – PAINTING AND COATING, for final preparation of new and patched surfaces as required for application of paint, and for paints and coatings applied to patched surfaces..
 - 12. Division 21,22,23 – MECHANICAL and Division 26 – ELECTRICAL, for coring and drill-

ing for all items to be installed by mechanical and electrical trades, except as otherwise indicated.

13. Division 21,22,23 – MECHANICAL and Division 26 – ELECTRICAL, for items to be installed by mechanical and electrical trades, except as otherwise indicated.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.
- C. Coring: Any new penetration cut through existing or new construction using core drill and measuring no more than 6 inches in diameter, or 6 inches by 6 inches. Larger cores are considered under cutting.

1.4 RESPONSIBILITY FOR CUTTING AND PATCHING

- A. General: All cutting and patching shall conform to the requirements of this Section, whether or not the work is to be done by the Construction Manager, a Trade contractor or other Sub-contractor.
 - 1. Patching shall be performed so as to maintain the integrity of acoustical rating of adjacent construction.
 - 2. Refer to Section 078410 – PENETRATION FIRESTOPPING, for requirements for maintaining the integrity of fire-rated construction at penetrations.
- B. Coordination: The Construction Manager shall be responsible for the following:
 - 1. Obtain locations and dimensions of penetrations required through walls and floors from trades requiring penetrations.
 - 2. Coordinate those penetrations with the requirements of other trades.
 - 3. Forward locations and dimensions of requested penetrations to the trades responsible for performing the cutting and patching work.
- C. Modifications with Structural Implications:
 - 1. Non-masonry construction: Provide new penetrations and other work where modification to existing structural elements is shown on the Drawings.
 - 2. Masonry construction: Coordinate the work of Subcontractors as required where modification to existing load-bearing masonry is shown on the Drawings.
 - 3. Do not perform any work that will alter existing structural elements unless it is shown on the Drawings or proposed alterations have been approved in writing by the Architect.
 - 4. Structural elements include, but are not limited to, the following: Steel beams and columns, structural masonry walls, reinforced concrete slabs.
- D. Coring: All coring shall be performed by the trade requiring the new penetration.
- E. New Penetrations in Masonry Construction:
 - 1. Exposed masonry and all masonry bearing walls: All cutting and patching shall be performed under Section 042000 – UNIT MASONRY, with lintels furnished under Section 055000 – METAL FABRICATIONS where required.

2. Concealed portions of non-bearing masonry walls:
 - a. Small penetrations where no lintel will be required shall be provided under Section 042000 – UNIT MASONRY.
 - b. Larger penetrations requiring a lintel shall be provided under Section 042000 – UNIT MASONRY, with lintels furnished under Section 055000 – METAL FABRICATIONS.
 3. Structural criteria for new openings in masonry walls: Bring the following conditions to the attention of the Structural Engineer for determination of whether a lintel or other reinforcement will be required.
 - a. Non-load-bearing masonry walls: Any opening wider than one block or 16 inches.
 - b. Load-bearing masonry walls: Any opening wider than 6 inches.
- F. New Penetrations in Non-Masonry Construction:
1. Exposed locations: Cutting and patching shall be provided by the trade(s) responsible for surrounding construction.
 2. Concealed locations: Cutting and patching shall be provided by the trade(s) responsible for surrounding construction.
 3. Locations at roof: Cutting and patching of roof deck and substrate shall be coordinated with the work of Section 075400 – THERMOPLASTIC MEMBRANE ROOFING.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio. Structural elements include but are not limited to the following:
1. Reinforced concrete columns and beams. Coring of concrete foundation walls and slabs will be permitted where shown on drawings or required for mechanical and electrical work.
 2. Reinforced masonry bearing walls.
 3. Steel columns, beams, joists and connections.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include but are not limited to the following:
1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Partitions and other construction required to provide acoustical separation.
 4. Fire-suppression systems.
 5. Mechanical systems piping and ducts.
 6. Control systems.
 7. Communication systems.
 8. Conveying systems.
 9. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include but are not limited to the following:
1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.

3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Piping, ductwork, vessels, and equipment.
 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
- Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations. Refer to Section 015000 – Temporary Facilities and Controls for additional requirements.

- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
 - 2. Cutting of openings in roofs shall be delayed as long as feasible, and preferably until the Roofing Subcontractor is at the site and can provide permanent roof covering immediately. Otherwise, protect roof openings so made in a weathertight manner until permanent roof is installed. Protect existing roofing to remain. Do not damage or alter in-place roofing and flashing to remain when doing work under this Section. Refer to Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for additional requirements for protection from the weather.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces, in such a manner as to ensure a minimal difference between the cut area and new materials when patched..
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Use extreme care when cutting through construction containing concealed mechanical and electrical lines. Coordinate cutting and patching work with the following work to be performed under Division 230000 and 260000 Sections.
 - a. Cut off pipe or conduit in walls or partitions to be removed.
 - b. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

- a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
3. Restore damaged pipe covering to its original condition.
4. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
5. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

3.4 DEBRIS REMOVAL AND CLEANING

- A. Dispose of all materials under Section 017400 – CONSTRUCTION WASTE MANAGEMENT.
- B. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

SECTION 017400
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for the following waste handling operations for the Work of the Construction Manager and all Subcontractors:
 - 1. Salvaging nonhazardous construction and demolition waste.
 - 2. Recycling nonhazardous construction and demolition waste.
 - 3. Disposing of nonhazardous construction and demolition waste.
- B. Related Sections include the following:
 - 1. Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for environmental-protection measures during construction.
 - 2. Section 042000 – UNIT MASONRY, for disposal requirements for masonry waste.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of minimum 90 percent by weight of total non-hazardous Construction and Demolition waste generated by the Work, not including land-clearing and associated debris.
- B. Diverted materials must include at least five material streams.

1.5 SUBMITTALS

- A. Waste Management Plan: Submit 3 copies of plan within 7 days of date established for the Notice to Proceed.
- B. Waste Management Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include separate reports for demolition and construction waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons (tonnes).
 - 4. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
 - 5. Quantity of waste recycled, both estimated and actual in tons (tonnes).
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Final Waste Management Report: Before request for Substantial Completion, submit three copies of a summary of all weight tickets collected for demolition and construction debris removal. The summary shall include the following information, by line item:
 - 1. Type of debris
 - 2. Date(s) of load disposal
 - 3. Name of facility to which debris was taken
 - 4. Ticket number(s)
 - 5. Number of loads, yards and total pounds for each type of debris
 - 6. Number of pounds recycled or salvaged for each type of debris
 - 7. Percentage of material recycled or salvaged for each type of debris
 - 8. Total quantity of waste in tons (tonnes)
 - 9. Total quantity of waste salvaged, both estimated and actual in tons (tonnes)
 - 10. Total quantity of waste recycled, both estimated and actual in tons (tonnes)
 - 11. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes)
 - 12. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

Note: For material that is removed from the site and does not generate a waste ticket, provide an estimate of the weight and volume of materials removed.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. Qualification Data: For Waste Management Coordinator and refrigerant recovery technician.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: 5 years minimum experience.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste management plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Management Plan: Construction Manager will develop a Waste Management Plan that details the following:
 - 1. Deconstruction, salvage, and recycling/reuse strategies and processes, e.g., scheduling of different stages of deconstruction to best remove recyclable or salvageable materials intact.
 - 2. Methods of on-site communication directing the contractors and subcontractors regarding what, when, how and where to recycle.
 - 3. Documents needed to show waste diversion - e.g., weight tickets for all wastes removed

- from the site, including recycled and salvaged materials. If items are removed, and no weight tickets are generated, document the materials and date, estimate the weight and volume of the materials, and add them into the overall total for waste and/or salvaged/recycled material removed from the site.
4. A method for collecting all recycling and waste data and organizing it for an audit of the recycling rates on the project.
 5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
 6. List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - a. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - b. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - c. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - d. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - e. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in hauling and tipping fees by donating materials.
 7. Savings in hauling and tipping fees that are avoided.
 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.
- E. Forms: Prepare waste management plan on forms acceptable to the Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Architect. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste man-

agement plan during the entire duration of the Contract.

1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 2. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Weight Tickets: Construction Manager shall collect weight tickets for all wastes removed from the site, including recycled and salvaged materials. If items are removed, and no weight tickets are generated, document the materials and date, estimate the weight and volume of the materials, and add them into the overall total for waste and/or salvaged/recycled material removed from the site.
- F. Final Summary: At Substantial Completion, Construction Manager shall provide a summary of all weight tickets collected for demolition and construction debris removal. The summary shall include the following information, by line item:
 1. Date of load disposal
 2. Name of facility to which debris was taken
 3. Ticket number
 4. Type of debris
 5. Number of loads, yards and total pounds for each line item
 6. Number of pounds recycled for each line item
 7. Percentage of material recycled for each line item
 8. Totals for each figure listed above.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
 1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items until installation.
 4. Protect items from damage during transport and storage.
 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

- B. Salvaged Items for Owner's Use:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Construction Manager.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving for Off-Site Disposal: Break up and transport paving to asphalt-recycling facility.
- B. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 017700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Final cleaning
 - 2. Temporary and trial usage
 - 3. Warranties and bonds
 - 4. Closeout requirements
 - 5. Inspection and Submittals for Substantial Completion
 - 6. Monetized Punch List Inspections
 - 7. Final Inspection and Submittals
 - 8. Final application and certificate for payment
 - 9. Post-construction inspection
- B. Related Work includes, but is not limited to, the following Work under other Sections:
 - 1. Dates for Substantial Completion and Final Completion: Division 00.
 - 2. Procedures related to Architect's additional services if required to complete closeout of Project: Section 011400 – WORK RESTRICTIONS
 - 3. Construction schedule requirements: Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION.
 - 4. Temporary facilities to be removed at the end of the Project: Section 015000 – TEMPORARY FACILITIES AND CONTROLS.
 - 5. Documents to be submitted as part of Closeout Requirements: Section 017839 – PROJECT RECORD DOCUMENTS

1.3 SUBMITTALS

- A. Warranties and Bonds: As specified herein.
- B. Punch Lists: As specified herein.
- C. Submittals for Substantial Completion: As specified herein.
- D. Final Submittals: As specified herein.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

- A. Refer to Section 011400 WORK RESTRICTIONS for cleaning materials.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. Before final inspection, thoroughly clean the entire exterior and interior areas of the building where construction work has been performed, the immediate surrounding areas, and corridors, stairs, halls, storage areas, temporary offices, and toilets.
 - 1. Allow adequate time in Construction Schedule to perform thorough final cleaning of entire Project for each phase.
- B. Refer to Section 011400 WORK RESTRICTIONS for general requirements for cleaning and for cleaning products, and refer to individual specification sections for cleaning requirements for particular products.
- C. Employ professional cleaners for final cleaning operations.
- D. Remove all construction facilities, debris, and rubbish from the Owner's property and legally dispose of same beyond site limits.
- E. Broom clean exterior paved surfaces, and rake clean other surfaces of the grounds.
- F. Sweep, dust, wash, and polish all finished surfaces. This includes cleaning of the Work of all finished trades where needed, whether or not cleaning for such trades is included in their respective Sections.
- G. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.
- H. Leave pipe and duct spaces, chases, and furred spaces thoroughly clean.

- I. Wash and polish all new glass on both sides, such Work shall be performed by a contractor specializing in a window cleaning work.
- J. Clean all ceilings, wall surfaces, floors, window and door frames, hardware, metal work, glass, glazing, enameled metals, and the like.
- K. Repair, patch and touchup marred surfaces to specified finish, to match adjacent surfaces.
- L. Each Subcontractor for mechanical and electrical work, including Plumbing, HVAC, Fire Protection, and Electrical Work shall clean materials and equipment for which they are responsible, leaving the Work in a finished and clean state.
- M. For each mechanical unit that has been in operation during construction, Construction Manager shall clean permanent filters and replace disposable filters with new filters as specified for that mechanical unit, and shall also clean ducts, blowers and coils associated with that unit.
- N. Prior to final completion, Construction Manager shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas, to verify that the entire Work is clean.
- O. Owner will assume responsibility for cleaning as of time designated on Certificate of Substantial Completion for Owner's acceptance of Work or portion thereof.
- P. Include stripping, sealing, and waxing per Owner's requirements. Refer to technical specifications for additional requirements.

3.2 TEMPORARY AND TRIAL USAGE

- A. Temporary or trial usage by Owner of any mechanical device, machinery, apparatus, equipment, or any Work or materials supplied under the Contract before final completion and written acceptance by the Architect shall not be construed as evidence of acceptance as same.
- B. The Owner reserves the privilege of such temporary or trial usage for such reasonable time as required to properly test such item. Claims for damages due to injury to or breaking of any parts of such Work, when the determined cause is weakness or inaccuracy of structural parts, defective material or workmanship, will not be allowed.
- C. If the Owner so requests, place an approved person or persons to instruct and assist in such trial usage and bear the costs thereof. Trials shall be made under the Architect's supervision.

3.3 WARRANTIES AND BONDS

- A. Compile specified warranties and bonds, review to verify compliance with Contract Documents, and submit to Architect for review and subsequent transmittal, if approved, to the Owner.
- B. Assemble two original signed copies of warranties, bonds and service and maintenance contracts executed by Officers of each of the respective manufacturers, suppliers and subcontractors.

- C. Neatly type Table of Contents in orderly sequence. Provide complete information for each item:
1. Product or work item identification.
 2. Manufacturing or supplying firm, with name of principal, address and telephone number.
 3. Scope of work and of warranty provided.
 4. Date of beginning of warranty, bond or service and maintenance contract. Commence upon date of Substantial Completion for each phase.
 5. Duration of warranty, bond or service maintenance contract. (In no case less than one (1) year).
 6. Information for Owner's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances which might affect validity of warranty or bond.
 7. Construction Manager, name of responsible principal, address and telephone number.
- D. Form of Submittals: Prepare in duplicate packets and in the following format:
1. Size: 8-1/2" x 11". Punch sheets for 3-ring binder. Z-Fold larger sheets to fit into binders.
 2. Cover: Identify each packet with types or printed title "WARRANTIES AND BONDS". List Title of Project, Date and Name of Construction Manager.
 3. Binders: Commercial quality, three-"D"-ring, with durable and cleanable plastic covers.
- E. Time of Submittals:
1. For equipment or component parts of equipment put into service during progress of construction, submit documents within ten (10) days after inspection and acceptance. Otherwise, make submittals before Date of Substantial Completion.
 2. For items of Work where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing the date of acceptance as the start of the warranty period.
- F. Submittals Required: Submit warranties, bond, service and maintenance contracts as specified in the respective Sections of the Specifications.

3.4 CLOSEOUT REQUIREMENTS

- A. Punch List For Each Phase: When the Construction Manager submits a complete list of items to be completed or corrected in accordance with subparagraph 9.8.2 of the GENERAL CONDITIONS and the Architect receives the list, the Architect will make an inspection to determine whether the Work or designated portion is substantially complete, for each phase. The Construction Manager shall submit a schedule indicating when each item will be completed.
- B. If the Architect determines that the Construction Manager's list is not complete, the Architect will notify the Construction Manager. The Construction Manager shall provide a complete list before the Architect will complete his inspection.
- C. If the Architect's inspection discloses any item whether or not included on the Construction Manager's list, which is not in accordance with the requirements of the Contract Documents,

the Architect will add the item to the list and will issue a punch list of items to be completed or corrected before final payment will be made. Such punch list shall not be construed as all-inclusive of the work which the Construction Manager will be required to perform before final payment.

- D. Substantial Completion for Each Phase: Architect will prepare and issue a Certificate of Substantial Completion, AIA G704, complete with signatures of Owner and Construction Manager, accompanied by list of items to be completed or corrected, as verified and amended by the Architect. Architect will not issue certificates of Substantial Completion until the items listed below in Articles 3.05 and 3.06 have been completed and submitted.

3.5 INSPECTION FOR SUBSTANTIAL COMPLETION

- A. In preparation for Substantial Completion, the Construction Manager shall submit written certification that:
1. Contract Documents have been reviewed.
 2. Work has been inspected for compliance with Contract Documents.
 3. Work has been completed in accordance with Contract Documents.
 4. Equipment and systems have been tested in presence of Owner's Representative and are operational.
 5. Work is completed, and ready for inspection.
- B. Architect will begin inspection within seven (7) days after receipt of above referenced Construction Manager's Certification.
- C. Should the Architect consider the Work is substantially complete in accordance with requirements of Contract Documents, the Architect will request Construction Manager to make Project Closeout submittals.
- D. Should the Architect consider that the Work is not substantially complete:
1. The Architect will notify Construction Manager, in writing, stating reasons.
 2. Construction Manager shall take immediate steps to remedy the stated deficiencies, and send second written notice to the Architect certifying that the Work is complete.

3.6 SUBMITTALS FOR SUBSTANTIAL COMPLETION

- A. Construction Manager shall submit the following items at Substantial Completion:
1. Operating and Maintenance Data.
 2. Schedule for training and instruction on new mechanical and electrical systems.
 3. Guarantees and Warranties.
 4. Keys and keying schedule.
 5. Spare Parts and Maintenance Materials.
 6. Roofing Guarantee and Flashing Endorsement.
 7. Evidence of Compliance with requirements of governing authorities.
 8. Punch list with schedule.
 9. Final Record Documents.

10. Flush-out documentation including ATC hourly trending reports.

B. Evidence of compliance with authorities' requirements shall include:

1. Certificates of compliance for flame and smoke, and fire rating.
2. Certificates of Inspection:
 - a. Mechanical
 - b. Electrical
3. Certificate of Occupancy

C. Submit Certificate of Insurance for products and completed operations.

D. Instructions: Instruct Owner's personnel in the operation of all systems, mechanical, electrical and other equipment.

3.7 MONETIZED PUNCHLIST INSPECTIONS

A. Within 30 days of Substantial Completion, the Architect will produce a Monetized Punch List that assigns a monetary value to each item remaining incomplete or incorrect.

B. The Construction Manager may request two inspections by the Architect after receipt of the Monetized Punch List, for the purpose of documenting progress toward completion of items on the List.

1. If the Architect is required to inspect the Work more than three times prior to establishment of Final Completion, the Construction Manager shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional inspections, until the Work is considered Finally Complete.
2. Refer to Section 011400 WORK RESTRICTIONS, for procedures required in cases where Construction Manager is responsible for costs for Additional Services of the Architect.

3.8 FINAL INSPECTION

A. The Construction Manager shall complete or correct all remaining items on the Monetized Punch List in accordance with the time limits stated in the General Conditions.

B. Certification of Final Completion: When the Construction Manager considers that all of the items on the Monetized Punch List have been completed or corrected, the Construction Manager shall submit written certification that the items on the Monetized Punch List have been completed and corrected. This certification shall include a copy of the Monetized Punch List with the following information added:

1. Indicate beside each item the date when the item was completed or corrected and,
2. In the case of items completed by subcontractors or sub-subcontractors, the name of the Subcontractor or Sub-subcontractor.

C. The Architect will begin inspection within seven (7) days after receipt of such certification, to determine whether items on the Punch List have been completed.

1. Should the Architect determine that the Work is not complete after receipt of the certification of Final Completion, the Construction Manager shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional inspections, until all items on the Punch List are completed.
2. Refer to Section 011400 WORK RESTRICTIONS, for procedures required in cases where Construction Manager is responsible for costs for Additional Services of the Architect.

3.9 FINAL SUBMITTALS

- A. Construction Manager's Affidavit of Payment of Debts and Claims, AIA G706.
- B. Construction Manager's Affidavit of Release of Liens, AIA G706A, with:
 1. Consent of Surety to Final Payment: AIA G707.
 2. Construction Manager's release or waiver of liens.
 3. Separate releases or waivers of liens for subcontractors, suppliers and others with lien rights against property of Owner, together with list of those parties.
- C. All submittals shall be duly executed before delivery to the Architect.

3.10 FINAL APPLICATION AND CERTIFICATE FOR PAYMENT

- A. Construction Manager shall submit final application for payment in accordance with requirements of the GENERAL CONDITIONS.
- B. Architect will issue final certificate in accordance with provisions of Conditions of the Contract.
- C. Prior to issuance of the Certificate for Final Payment by the Architect, all requirements contained in this Paragraph entitled "Closeout Requirements" and other requirements of the Conditions of the Contract shall be executed, received and approved by the Architect.

3.11 POST-CONSTRUCTION INSPECTION

- A. 10 months after Date of Substantial Completion, the Owner's Project Manager will make visual inspection of Work in company with Owner and Construction Manager to determine whether correction of Work is required, in accordance with provisions of GENERAL CONDITIONS AND SUPPLEMENTARY GENERAL CONDITIONS.
- B. For guarantees beyond one year, the Owner's Project Manager will make inspection at request of Owner after notification to Construction Manager.
- C. Owner's Project Manager will promptly notify Construction Manager in writing of any observed deficiencies.

END OF SECTION

SECTION 017839
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Record prints
 - 2. Final record drawings
 - 3. Operations and maintenance submittals and instructions.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Availability and restriction for use of project electronic files: Section 011400 Work Restrictions.
 - 2. Photographic documentation of construction: Section 011400 Work Restrictions.
 - 3. Availability of electronic files for preparation of record documents: Section 011400 Work Restrictions.
 - 4. Surveying and field engineering: Section 013100 Project Management and Coordination.
 - 5. General requirements for submittals: Section 013300 Submittal Procedures.
 - 6. Other submittals required at the completion of the Work: Section 017700 Closeout Procedures.

1.3 DEFINITIONS

- A. Record Prints are full sets of black-line of Contract Drawings, kept at the Project Site and marked regularly to record as-built conditions as specified herein.
- B. Final Record Drawings: Electronic files in DWG format prepared from completed and approved Record Prints.
- C. Final Record Coordination Drawings: Electronic files in DWG format prepared from updated

prints of approved coordination drawings, to record as-built conditions.

1.4 SUBMITTALS

- A. Record Prints: Periodic submittal of prints of Drawings marked to indicate Work completed and changes in the Work, as specified in this Section:
 - 1. Record Prints
 - 2. Coordination Drawing Record Prints
- B. Final Record Drawings: Reproducible drawings, as specified in this Section:
 - 1. Final Record Drawings
 - 2. Final Record Coordination Drawings
- C. Operations and Maintenance Submittals:
 - 1. Maintenance Manuals
 - 2. Schedule of Training and Instruction for mechanical and electrical systems.

PART 2 - PRODUCTS

2.1 RECORD DOCUMENTS, GENERAL

- A. The Construction Manager shall maintain Record Prints of site plans, landscape drawings, architectural drawings, and structural drawings.
- B. Trade-Contractors shall maintain Record Prints of the Work of the following Sections:
 - 1. Section 210000 - Fire Protection.
 - 2. Section 220000 – Plumbing.
 - 3. Section 230000 – Heating, Ventilating, and Air Conditioning.
 - 4. Section 260000 – Electrical Work.
 - 5. Section 270000 – Communications.
 - 6. Section 280000 – Electronic Safety and Security.

2.2 RECORD PRINTS

- A. During the progress of the Work, the Construction Manager shall keep on file at all times one (1) complete set of black line prints of the entire set of Contract Drawings. The set shall be updated daily to record the following information:
 - 1. Status of Work: The set shall be used to indicate the progress of the Work installed by coloring in the various pipelines, ducts, and apparatus as erected.
 - 2. Revisions: Accurately and promptly update with colored inks, daily as the Work progresses, to accurately record all revisions to the Work, including, but not limited to, the following:
 - a. Fire Protection, Plumbing, Heating and Ventilating, and Electrical Work, wherever Work was installed other than as shown on the Contract Drawings or de-

- scribed in the Specifications
 - b. Locations, elevations, sizes, and other like items of all concealed and buried utilities, ducts, and services, including exterior utility and storm drainage lines.
 - c. The Construction Manager shall be responsible for assuring that the various revisions are delineated by the specific trades involved.
 - 3. The set shall be kept available at all times for use and inspection by the Architect and the Owner.
 - 4. Schedule monthly meetings to review the progress of record prints with the Architect. The progress set must be approved by the Architect in order to be included in the monthly pay application.
- B. Refer to Section 011400 Work Restrictions for Project Electronic Files to be made available for use by the Construction Manager in the preparation of Final Record Drawings.
- C. Transfer all information from the updated Record Prints to the electronic files at least once every three months.
- 1. For each submission, submit a preliminary electronic set for the Architect's review. Once approved, submit three prints of each updated drawing to the Architect at least three times during construction: when the work is approximately 1/4, 1/2, and 3/4 complete.
 - 2. When roughing in for any particular area is completed, it shall be shown on the Record Prints and a copy submitted for Architect's review.

2.3 FINAL RECORD DRAWINGS

- A. Before completion of the Work, and when directed by the Architect, the Construction Manager and all indicated subcontractors shall perform the following:
- 1. Transcribe all previously recorded information from Record Prints onto the electronic files.
 - 2. Make all final changes and corrections to the electronic files for the Final Record Drawings.
 - 3. Signatures Required: The Construction Manager or Trade-Contractor shall sign each drawing for which they are responsible, as certification that the work was installed as shown.
 - 4. Deliver signed, completed Final Record Drawings to Architect.
- B. Acceptance by the Architect of the completed Final Record Drawings shall be a prerequisite for Substantial Completion.
- C. Shop Drawings will not be acceptable as Final Record Drawings for the Project.
- D. The Architect shall be the sole judge of the acceptability of Final Record Drawings.
- E. Special Requirements for Final Record Drawings of Site Work:
- 1. Record Drawings for exterior utilities and other items below grade shall include accurate locations of the following:
 - a. The points where such items enter the building and property lines.
 - b. All turns, offsets, and other changes in direction below grade.
 - c. All valves and other appurtenances.

2. Indicate locations of these items using dimensions to adjacent permanent benchmarks or structures as approved by the Architect. Reliance on scale only to locate any temporary or concealed construction will not be acceptable.
3. Final Record Drawings for work below grade shall be submitted immediately upon completion of utility line installation and prior to concealment of the work
4. Refer to Division 31/32/33 Sections for additional requirements for Final Record Drawings of site work.

2.4 RECORD COORDINATION DRAWINGS

- A. Record progress of the Work and modifications and corrections on a set of prints of approved coordination drawings. Follow procedures as for Record Prints.
- B. Final Record Coordination Drawings shall be prepared using information from approved record copies of coordination drawings as for Final Record Drawings.

2.5 MAINTENANCE MANUALS

- A. Upon Substantial Completion of the Work, submit maintenance schedules, maintenance manuals, and all approved Shop Drawings, presenting full details for care and maintenance of visible surfaces and all equipment furnished and installed under the Contract.
- B. Maintenance manuals shall consist of manufacturer's catalog cuts with descriptive information, lubricating and maintenance instructions, parts lists, usage instructions, names, addresses and telephone numbers where replacement parts and service can be quickly obtained, and all other information required for the Owner to use, maintain, and service the items properly.
- C. Upon Architect's approval of drafts, submit two (2) corrected copies properly bound in a logical and well arranged order, with index, to the Architect for transmittal to the Owner.

PART 3 - EXECUTION

3.1 TRAINING AND INSTRUCTIONS

- A. The Construction Manager shall arrange for instruction for the Owner's employees, to insure proper operation of the equipment furnished.
 1. It is the intent of this paragraph to require the Construction Manager and the applicable Subcontractors to furnish as much detailed instruction as is necessary to educate the Owner's on-site personnel in the proper use of the equipment.
 2. This instruction shall be provided by a qualified trainer who is also a manufacturer's certified technician with expertise with the specific system or equipment for which training is required. In some cases, this may require more than one visit to the Project by those responsible for the instruction.
 3. The Construction Manager and, in particular, the Plumbing, Heating and Ventilating, and Electrical Subcontractors shall not assume that the Owner's employees possess special expertise or have had any previous experience whatsoever in the operation and maintenance of the equipment.

- nance of sophisticated mechanical and electrical equipment.
4. Submit the schedule and draft agenda for instructional sessions to the Owner. Do not proceed with instruction until Owner has approved schedule.
 5. Refer to specific technical sections for additional requirements specific to particular equipment and systems.
- B. For major items of mechanical and electrical equipment, instructions and demonstrations shall be performed during the initial start-up period and, if necessary, during one or more return visits as may be required.
- C. Videotape: Instruction sessions and demonstrations shall be video-recorded by professional videographers in DVD format, using tripods, broadcast-quality video cameras and proper lighting. Close-ups of items being demonstrated shall be included. Sound recording shall be clear and perfectly intelligible. Video shall be edited as required to provide a permanent reference. Each session and demonstration shall be included, except where waived by the Architect, and all DVDs shall be properly labeled as to date, subject, and presenter. Provide two (2) copies of each DVD.

END OF SECTION

SECTION 018110

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. LEED prerequisite and credit compliance and documentation requirements
- B. LEED-S v4.1 Reference Standards for materials and products

1.2 SUMMARY

- A. This Section includes general requirements and procedures for achieving LEED Certification.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve a LEED-S v4.1.1 Silver Rating, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council (USGBC).
 - 1. Comply with LEED (Leadership in Energy and Environmental Design) Green Building Rating System for Building Design and Construction Schools version 4.1 (LEED-S v4.1.1)
 - 2. Refer to LEED Project Checklist included in Section 018110a.
 - 3. Refer to individual Specification Sections for additional requirements.
- C. Contractor is responsible for submitting specified LEED-S v4.1.1 documentation in support of achieving LEED-Sv4.1 credits as shown in LEED Checklist.. See Administrative Requirements section for additional requirements.
- D. Additional prerequisite and credit compliance requirement information is available from the USGBC LEED-S v4.1.1 credit library: <http://www.usgbc.org/credits>

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect the work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 013200, Construction Progress Documentation.
 - 2. Section 013300, Submittal Procedures.
 - 3. Section 017400, Construction Waste Management.
 - 4. Section 018120, Construction Indoor Air Quality (IAQ) Management.
 - 5. Section 019113 General Commissioning Requirements
 - 6. Individual Specifications Sections identifying sustainable requirements.

1.4 DEFINITIONS

- A. Refer to USGBC LEED v4.1 Reference Guide for Building Design and Construction for definitions of terms specific to LEED-S v4.1 rating system.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Work of this project includes completed building and application for LEED-S certification. Work is not complete until Owner has accepted USGBC's final review of LEED-S certification. Certification is to attain LEED-S "Silver" level.
 - 1. Provide documentation required by LEED-S and LEED-S review.
- B. Provide materials and procedures necessary to obtain LEED-S prerequisites and credits required in this Section. Other Sections may specify requirements that contribute to LEED-S prerequisites and credits. Refer to other sections for additional materials and procedures necessary to obtain LEED-S prerequisites and credits.
- C. Respond to questions and requests for additional information from Architect and the USGBC regarding LEED-S credits until the USGBC has made its determination on the project's LEED-S certification application.
- D. LEED-S Online Submittals: Upload LEED-S documentation submittal data directly to USGBC project "LEED Online" website. Complete online forms at least monthly prior to submitting monthly Application for Payment and as necessary to document LEED-S credits for submittals required in this Section.
- E. Provide schedule of documentation and forms submitted to LEED online with monthly application for payment, schedule to include percentage complete for each prerequisite and credit.
- F. LEED Conferences: Schedule and conduct a conference at a time convenient to Owner and Architect within 21 days prior to commencement of the work. Advise Architect, Owner's Commissioning Authority, and Owner's Project Manager of scheduled meeting dates. Schedule and conduct subsequent conference(s) after subcontractors are hired after the initial conference.
 - 1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Owner's Project Manager, Architect, and their consultants; CM'S LEED Accredited Designated LEED Coordinator, Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: LEED-S goals for the project, Contractor's action plans, and discussion of targeted LEED-S Prerequisites and Credits. Review requirements of 1.6.C.
 - 3. Minutes: Record and distribute minutes to attendees and other entities with responsibilities for obtaining LEED-S Credits.

1.6 SUBMITTALS

- A. General: Additional Sustainable Design submittal requirements may be included in technical sections of the Specifications
- B. Sustainable Design Applicable Reference Standards
- International Standard ISO 14021-1999, Environmental labels and declarations – Self Declared Claims (Type II Environmental Labeling):iso.org
 - International Standard ISO 14025-2006, Environmental labels and declarations – Self Declared Claims (Type III Environmental Declarations – Principles and Procedures):iso.org
 - International Standard ISO 14040-2006, Environmental management, Life cycle assessment principles, and frameworks:isg.org
 - International Standard ISO 14044-2006, Environmental management, Life cycle assessment requirements, and guidelines:iso.org
 - International Standard ISO 2193-2007 Sustainability in building construction-Environmental Declaration of building products:iso.org
 - Federal Trade Commission, Guides for the Use of Environmental Marketing Claims, 16 CFR 26.7 (e): ftc.gov/bcp/gnrule/guide980427.htm
 - Forest Stewardship Council: ic.fs.org
 - Health Product Declarations: hpdcollaborative.org/
 - Cradle-to-Cradle Certified Product Standard: c2ccertified.org/product_certification
 - GreenScreen: cleanproduction.org/Greenscreen.vi-2.php
- C. Submittal requirements
1. General, Sustainable Materials Attributes Form: Project submittals must be accompanied by a completed Sustainable Materials Attributes Form. Submittal packages must also include highlighted documentation supporting the sustainability claims made on the Sustainable Materials Attributes Form.
 - a. Provide location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.
 2. General. Submit additional LEED submittals required by other Specification Sections.
 3. General. Submit each LEED submittal simultaneously with applicable product submittal.
 4. General. Photographic Documentation: Photographically document per LEED-S the installation of work to provide a record of compliance with LEED-S prerequisites and credits per LEED-S credit documentation.
 5. EAp3, Building-Level Energy Metering: Product data for meters, sensors, and data collection system used to provide continuous metering of building energy-consumption performance.
 6. MRp2/MRc5, Construction and Demolition Waste Management: Comply with submittal requirements of Section 017400 "Construction Waste Management and Disposal."
 7. MRc2, Building Product Disclosure and Optimization: Environmental Product Declarations complying with LEED requirements.
 8. MRc3, Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices.

- a. Extended Producer Responsibility: Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - b. Bio-Based Materials: Product data and certification for bio-based materials, indicating that they comply with requirements. Include statement of costs.
 - c. Certified Wood: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - d. Materials Reuse: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs.
 - e. Recycled Content: Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
 - 9. EQp2/EQc3/EQc4, Indoor Air Quality: Comply with submittal requirements of Section 01 57 31, "Indoor Air Quality Management."
 - 10. EQc2, Low-Emitting Materials: Product data, indicating VOC content and emissions testing documents showing compliance with requirements for low-emitting materials, for the following materials:
 - a. Paints and coatings.
 - b. Adhesives and sealants.
 - c. Flooring.
 - d. Products containing composite wood or agrifiber products or wood glues.
 - e. Ceilings, walls, thermal, and acoustic insulation.
 - f. Exterior applied materials.
 - g. Furniture.
- D. Additional submittal requirements
- 1. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:
 - a. Not more than 60 days after the Preconstruction Meeting, the General Contractor shall provide to the Owner and Architect a preliminary master schedule of materials costs for all materials used for the Project organized by specification section. Exclude onsite labor costs and all mechanical, electrical, and plumbing (MEP) systems materials and labor costs broken down by classification as an interior component or an exterior building component. The breakdown of material costs are to be derived from each product submittal with the required Sustainable Materials Attributes Form, which is to include material costs.
 - b. Update cost data tracking information monthly.
 - c. Provide final versions of the above spreadsheets to the Owner and Architect not more than 14 days after Substantial Completion.

1.7 QUALITY ASSURANCE

- A. General: Perform the work of this Section as a supplement and in accordance with applicable requirements of Section 014000 – Quality Requirements.

- B. Preconstruction Meeting: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner, Architect, and all Subcontractors to discuss the Construction Waste Management Plan, the required Construction Indoor Air Quality (IAQ) Management Plan, and all other Sustainable Design Requirements. The purpose of this meeting is to develop a mutual understanding of the Project's Sustainable Design Requirements and coordination of the General Contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.
- C. Construction Job Conferences: The status of compliance with the Sustainable Design Requirements of these specifications will be an agenda item at all regular job meetings conducted during the course of work at the site.
- D. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS

- A. Provide products and procedures necessary to obtain LEED-S credits required in this Section. Although other Sections may specify some requirements that contribute to LEED-S credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED-S credits indicated. Contractor to determine a combination of credit options best suited for achieving credits required.
 - 1.Exclusions: Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from the credit calculations. Also excluded are products purchased for temporary use on the project, like formwork for concrete.
- B. Unauthorized Products: Materials and products required for work of this section shall not contain asbestos, lead, mercury, polychlorinated biphenyls (PCBs), or other hazardous materials identified by the Owner.

2.2 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION

- A. MRc2, Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Option 1. Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria:
 - 1. Product-Specific Declaration: Valued as one quarter (1/4) of a product.
 - 2. Industry-Wide (Generic) EPD: Valued as one half (1/2) of a product.
 - 3. Product-Specific Type III EPD: Valued as one whole product.
- B. MRc3, Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices. Provide products that meet at least one of the responsible extraction criteria below for at least 25%, by cost, of the total value of permanently installed building products in the project:

1. Extended producer responsibility program.
2. Bio-based materials.
3. Certified Wood: Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 - a. Rough carpentry.
 - b. Miscellaneous carpentry.
 - c. Heavy timber construction.
 - d. Wood decking.
 - e. Metal-plate-connected wood trusses.
 - f. Structural glued-laminated timber.
 - g. Finish carpentry.
 - h. Architectural woodwork.
 - i. Wood paneling.
 - j. Wood veneer wall covering.
 - k. Wood flooring.
 - l. Wood lockers.
 - m. Wood cabinets.
 - n. Furniture.
4. Recycled content.
 - a. Exceptions: Do not include furniture, fire protection, operational plumbing, operational mechanical, and operational electrical components, and specialty items, such as elevators and equipment, in the calculation.

2.3 LOW-EMITTING MATERIALS

- A. EQc2, Low-Emitting Materials, General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
1. 0.5mg/m³ or less,
 2. between 0.5 and 5.0 mg/m³ or,
 3. 0.50 mg/m³ or more.
- B. EQc2, Low-Emitting Materials, Paints and Coatings: For field applications that are inside the weatherproofing system, use paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.

Product Type:	Allowable VOC Content (g/L):
Bond Breaker	350
Clear wood finishes - Varnish	275
Clear wood finishes – Sanding Sealer	275
Clear wood finishes - Lacquer	275

Colorant – Architectural Coatings, excluding IM coatings	50
Colorant – Solvent Based IM	600
Colorant - Waterborne IM	50
Concrete – Curing compounds	100
Concrete – Curing compounds for roadways & bridges	350
Concrete surface retarder	50
Driveway Sealer	50
Dry-fog coatings	50
Faux finishing coatings - Clear topcoat	100
Faux finishing coatings – Decorative Coatings	350
Faux finishing coatings - Glazes	350
Faux finishing coatings - Japan	350
Faux finishing coatings – Trowel applied coatings	50
Fire-proof coatings	150
Flats	50
Floor coatings	50
Form release compounds	100
Graphic arts (sign) coatings	150
Industrial maintenance coatings	100
Industrial maintenance coatings – High temperature IM coatings	420
Industrial maintenance coatings – Non-sacrificial anti-graffiti coatings	100
Industrial maintenance coatings – Zinc rich IM primers	100
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-color coatings	250
Non-flat coatings	50
Pre-treatment wash primers	420
Primers, sealers and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Roof coatings	50
Roof coatings, aluminum	100
Roof primers, bituminous	350
Rust preventative coatings	100
Stone consolidant	450
Sacrificial anti-graffiti coatings	50
Shellac- Clear	730
Shellac – Pigmented	550
Specialty primers	100
Stains	100
Stains, interior	250
Swimming pool coatings – repair	340
Swimming pool coatings – other	340
Traffic Coatings	100
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100

Wood preservatives	350
Low solids coatings	120

- C. EQc2, Low-Emitting Materials, Paints and Coatings: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. EQc2, Low-Emitting Materials, Adhesives and Sealants: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005:

Architectural Applications:	Allowable VOC Content (g/L):
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Dry wall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single ply roof membrane adhesives	250
Specialty Applications:	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Computer diskette manufacturing	350
Contact adhesive	80
Special purpose contact adhesive	250
Tire retread	100
Adhesive primer for traffic marking tape	150
Structural wood member adhesive	140
Sheet applied rubber lining operations specialty	850
Top and Trim adhesive	250
Substrate Specific Applications:	
Metal to metal substrate specific adhesives	30
Plastic foam substrate specific adhesives	50
Porous material (except wood) substrate specific adhesives	50
Wood substrate specific adhesives	30
Fiberglass substrate specific adhesives	80

Sealants:	
Architectural sealant	250
Marine deck sealant	760
Nonmember roof sealant	300
Roadway sealant	250
Single-ply roof membrane sealant	450
Other sealant	420
Sealant Primers:	
Architectural non-porous sealant primer	250
Architectural porous sealant primer	775
Modified bituminous sealant primer	500
Marine deck sealant primer	760
Other sealant primer	750
Other	
Other adhesives, adhesive bonding primers, adhesive primers or any other primers	250

1. Exception: The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.

- E. EQc2, Low-Emitting Materials, Adhesives and Sealants: For field applications that are inside the weatherproofing system, 90 percent of adhesives and sealants shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. EQc2, Low-Emitting Materials, Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- G. EQc2, Low-Emitting Materials, Composite Wood: Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- H. Additional Low-Emitting Requirements:
 - 1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
 - 2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
- I. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

PART 3 - EXECUTION

3.1 NONSMOKING SITE

A. EQp2, Environmental Tobacco Smoke Control: Smoking is not permitted on site.

1. Refer to Section 018119, "Indoor Air Quality Requirements."

3.2 CONSTRUCTION WASTE MANAGEMENT

A. MRp2 MRc5, Construction and Demolition Waste Management: Comply with Section 017400 "Construction Waste Management."

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. EQc3/EQc4, Construction Indoor Air Quality Management Plan: Comply with Section 018119, "Indoor Air Quality Requirements."

END OF SECTION



LEED v4 for BD+C: Schools

Project Checklist

Y ? N

1		Credit	Integrative Process	1
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1	0	14	Location and Transportation	15
		Credit	LEED for Neighborhood Development Location	15
		1	Credit Sensitive Land Protection	1
		2	Credit High Priority Site	2
		5	Credit Surrounding Density and Diverse Uses	5
		4	Credit Access to Quality Transit	4
		1	Credit Bicycle Facilities	1
		1	Credit Reduced Parking Footprint	1
1		Credit	Green Vehicles	1

4	0	8	Sustainable Sites	12
Y		Prereq	Construction Activity Pollution Prevention	Required
Y		Prereq	Environmental Site Assessment	Required
1		Credit	Site Assessment	1
		2	Credit Site Development - Protect or Restore Habitat	2
1		Credit	Open Space	1
		3	Credit Rainwater Management	3
		2	Credit Heat Island Reduction	2
1		Credit	Light Pollution Reduction	1
		1	Credit Site Master Plan	1
1		Credit	Joint Use of Facilities	1

5	1	6	Water Efficiency	12
Y		Prereq	Outdoor Water Use Reduction	Required
Y		Prereq	Indoor Water Use Reduction	Required
Y		Prereq	Building-Level Water Metering	Required
1		1	Credit Outdoor Water Use Reduction	2
3	1	3	Credit Indoor Water Use Reduction	7
		2	Credit Cooling Tower Water Use - NB:swap CT for WE pc 94 "No Cooling Tower"	2
1		Credit	Water Metering	1

22	4	5	Energy and Atmosphere	31
Y		Prereq	Fundamental Commissioning and Verification	Required
Y		Prereq	Minimum Energy Performance	Required
Y		Prereq	Building-Level Energy Metering	Required
Y		Prereq	Fundamental Refrigerant Management	Required
6		Credit	Enhanced Commissioning	6
14	1	1	Credit Optimize Energy Performance	16
		1	Credit Advanced Energy Metering	1
		2	Credit Demand Response	2
2	1	Credit	Renewable Energy Production	3
		1	Credit Enhanced Refrigerant Management	1
1		1	Credit Green Power and Carbon Offsets	2

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6	0	7	Materials and Resources	13
Y		Prereq	Storage and Collection of Recyclables	Required
Y		Prereq	Construction and Demolition Waste Management Planning	Required
2		3	Credit Building Life-Cycle Impact Reduction	5
1		1	Credit Building Product Disclosure and Optimization - Environmental Product Declarations	2
		2	Credit Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
1		1	Credit Building Product Disclosure and Optimization - Material Ingredients	2
2		Credit	Construction and Demolition Waste Management	2

9	1	6	Indoor Environmental Quality	16
Y		Prereq	Minimum Indoor Air Quality Performance	Required
Y		Prereq	Environmental Tobacco Smoke Control	Required
Y		Prereq	Minimum Acoustic Performance	Required
2		Credit	Enhanced Indoor Air Quality Strategies	2
2		1	Credit Low-Emitting Materials	3
1		Credit	Construction Indoor Air Quality Management Plan	1
2		Credit	Indoor Air Quality Assessment	2
		1	Credit Thermal Comfort	1
2		Credit	Interior Lighting	2
		3	Credit Daylight	3
		1	Credit Quality Views	1
		1	Credit Acoustic Performance	1

3	1	2	Innovation	6
2	1	2	Credit Innovation	5
1		Credit	LEED Accredited Professional	1

3	0	1	Regional Priority	4
1		Credit	Optimized Energy Performance	1
1		Credit	Building Life-Cycle Impact Reduction	1
1		Credit	Renewable Energy Production	1
		1	Credit Regional Priority	1

53	8	49	TOTALS	Possible Points:	110
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Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110

SECTION 018120

CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. EQ Prerequisite, Environmental Tobacco Smoke Control: Prevent exposure of building systems to environmental tobacco smoke during construction.
 - 2. EQ Credit, Construction Indoor Air Quality Management Plan: Requirements for minimum indoor air quality (IAQ) performance standards during the construction period.
 - 3. EQ Credit, Indoor Air Quality Assessment: Requirements for assessment of minimum indoor air quality (IAQ) performance standards through either building flush-out or air testing before occupancy
 - 4. With regard to these goals the Contractor shall develop, for Owner and Architect review, a Construction Indoor Air Quality Management Plan for this Project.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 013300 - SUBMITTAL PROCEDURES for general submittal requirements.
 - 2. Section 015000 - TEMPORARY FACILITIES AND CONTROLS for temporary construction facilities and controls.
 - 3. Section 017400 - CONSTRUCTION WASTE MANAGEMENT for demolition and construction waste management.
 - 4. Division 23 - HVAC.
 - 5. Divisions 02 through 33 Specification Sections; Specific requirements relating to indoor air quality for each Section.

1.3 PERFORMANCE REQUIREMENTS

- A. EQ Prerequisite, Environmental Tobacco Smoke Control: Prevent exposure of building systems to environmental tobacco smoke during construction. At a minimum, take the following measures:

CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT

1. Smoking is not permitted on project site.
 - a. This prohibition includes electronic cigarettes.
- B. During construction meet or exceed the minimum requirements of the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, Second Edition, November 2007, Chapter 3; and SMACNA 008-2008, Ch. 3.
- C. Protect absorptive materials from moisture damage when stored on-site and after installation.
- D. EQ Credit, Construction Indoor Air Quality Management Plan: During construction, comply with the following requirements:
 1. If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of at least 13 shall be used at each return air grille, as determined by ASHRAE 52.2-2007. Replace filtration media immediately prior to occupancy.
- E. EQ Credit, Indoor Air Quality Assessment: Comply with the following requirements:
 1. Perform a building flush-out with outside air, either before occupancy or during occupancy.

1.4 SUBMITTALS

- A. Construction Indoor Air Quality (IAQ) Management Plan: With the completed Form of Bidder's Proposal, the Contractor shall submit a preliminary Construction IAQ Management Plan.
 1. Within 21 calendar days after receipt of Notice to Proceed, the Contractor shall submit to the Owner a finalized Construction IAQ Management Plan.
 2. The proposed Plan shall comply with Division 23 – HVAC requirements.
 3. The proposed Plan shall include, but not be limited to, the following:
 - a. Protection of ventilation system components during construction.
 - b. Cleaning and replacing contaminated ventilation system components after construction, including filtration media.
 - c. Temporary ventilation.
 - d. Protection of absorptive materials from moisture damage when stored on-site and after installation, including exterior wall rain protection.
 - e. Sequence of finish installation plan.
 - f. Selection of cleaning products and procedures to be used during construction and final cleaning.
 - g. Other items as required by SMACNA IAQ Guidelines for Occupied Buildings under Construction, Chapter 3.
 4. Coordinate Construction IAQ Management Plan with Owner's current IAQ management plans and procedures.
 5. Comply with the requirements of LEED EQ Credits.
- B. Indoor Air Quality (IAQ) Data: Submit emission test data as required, with testing laboratory and date clearly identified.

- C. Material Safety Data Sheets (MSDS): Submit for materials as required, with date clearly identified. MSDS must contain specific chemical content data identifying the percent of the total product mass represented by each listed chemical.
- D. Product Data: Submit for each type of filtration media used during construction and installed immediately prior to occupancy, with MERV values clearly identified.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Take special care to prevent accumulation of moisture on materials and within packaging during delivery, storage, and handling to prevent development of mold and mildew inside packaging and on products.
- B. Immediately remove from site and properly dispose of materials showing signs of mold and mildew, including materials with moisture stains.

PART 2 - PRODUCTS

2.1 FILTRATION MEDIA

- A. Filtration Media: Comply with LEED V4 and ASHRAE 52.2-current version and provide MERV filters as required.

PART 3 - EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT PLAN IMPLEMENTATION

- A. IAQ Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Construction IAQ Management Plan for the Project.
- B. Distribution: The Contractor shall distribute copies of the Construction IAQ Management Plan to the Job Site Foreman, each subcontractor, the Owner, and the Architect.
- C. Instruction: The Contractor shall provide on-site instruction of appropriate procedures and methods to be used by all parties at the appropriate stages of the Project.
- D. Preconditioning: Allow products, which have odors and significant VOC emissions, to off-gas in a dry, well-ventilated space for sufficient period to dissipate odors and emissions prior to delivery to Project.
 - 1. Remove containers and packaging from materials prior to conditioning to maximize off-gassing of VOCs.
 - 2. Condition products in ventilated warehouse or other building.
- E. Coordinate Construction IAQ Management Plan with final cleaning as indicated in Section 011000 -GENERAL REQUIREMENTS.

END OF SECTION

SECTION 019113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods and services referenced in or related to this Section shall also be bound by the Related Documents identified in Division 01 Section "Summary."

1.2 SECTION INCLUDES

- A. Commissioning Scope
- B. Systems to be Commissioned
- C. Responsibilities
- D. Commissioning Team
- E. Pre-Functional and Functional Check List Sample

1.3 RELATED SECTIONS

- A. Division 1 – General Conditions and Requirements
- B. Division 07 – Thermal and Moisture Protection
- C. Division 08 – Openings
- D. Division 21 – Fire Suppression
- E. Division 22 - Plumbing
- F. Division 23 – Heating, Ventilating and Air Conditioning
- G. Division 26 – Electrical
- H. Division 27 – Communications
- I. Division 28 – Electronic Safety and Security

1.4 SCOPE

- A. The work under this Section is subject to requirements of the Contract Documents including the Owner's General Conditions, Supplementary Conditions, and Division 1 – General Requirements.

1.5 DESCRIPTION OF WORK

- A. The objective of commissioning is to provide documented confirmation that a facility fulfills the functional and performance requirements of the building owner, occupants, and operators. To reach this goal, it is necessary for the commissioning process to establish and review the owner's criteria for system function, performance, and maintainability (Design Intent); and to also verify and document compliance with these criteria at start-up, and the initial period of operation. In addition, complete operation and maintenance (O&M) manuals, as well as training on system

operation, should be provided to the building operators to ensure the building continues to operate as intended.

- B. The Commissioning Agent (CA) shall be involved throughout the warranty phase. During construction, the CA develops and coordinates the execution of a testing plan, which includes observing and documenting all systems' performance to ensure that the systems are functioning in accordance with the owner's Design Intent (DI) requirements and the contract documents. The CA is not responsible for design or general construction scheduling, cost estimating, or construction management, but may assist with problem-solving or resolving non-conformance issues or deficiencies. The installing Contractors, TAB Sub and ATC Sub shall be required to provide support of the commissioning under their base Contracts.
- C. The following is a summary of services provided for commissioning:
1. Develop commissioning plan
 2. Develop pre-functional and functional test procedures
 3. On-site reviews to confirm that systems are ready for commissioning
 4. Witness piping and ductwork tests
 5. Witness system flushing
 6. Review system start-up reports
 7. Maintain master deficiency and resolution log
 8. Perform prefunctional and functional testing
 9. Ensure O&M and commissioning documentation requirements are complete.
 10. Coordinate Owner staff training
 11. Final report and presentation to Owner
 12. Follow up visits after occupancy to review building operations
- D. Commissioning does not reduce responsibility of installing contractors to provide a finished and fully functioning product.
- E. This section shall in no way diminish the responsibility of the Divisions 07, 08, 21, 22, 23, 26, 27, 28 Contractors, Sub-contractors and Suppliers in performing all aspects of work and testing as outlined in the Contract Documents. Any requirements outlined in this section are in addition to requirements outlined in those divisions.

1.6 ABBREVIATIONS

- A. The following are common abbreviations used in the Specifications. Definitions are found further in this Section.
1. A/E - Architect and Design Engineers
 2. BAS - Building Automation System
 3. CA - Commissioning Agent
 4. CM - Construction Manager
 5. CT - Commissioning Team
 6. Cx - Commissioning
 7. Cx Plan - Commissioning Plan
 8. CC - Controls Contractor
 9. EC - Electrical Contractor
 10. FPT - Functional Performance Test
 11. MC - Mechanical Contractor
 12. OR - Owner's Representative
 13. PC - Pre-functional Checklist
 14. TAB - Test, Adjust and Balance
 15. O&M - Operations & Maintenance
 16. RFI - Request for Information
- B. The following Standards shall be used where referenced by the following abbreviations:
1. AABC Associated Air Balance Council
 2. ACGIH American Conference of Governmental Industrial Hygienists
 3. ADC Air Diffusion Council

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4. AGA American Gas Association
5. AIA American Institute of Architects
6. AMCA Air Moving and Conditioning Association
7. ANSI American National Standards Institute
8. API American Petroleum Institute
9. ARI Air Conditioning and Refrigeration Institute
10. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
11. ASME American Society of Mechanical Engineers
12. ASPE American Society of Plumbing Engineers
13. ASSE American Society of Sanitary Engineers
14. ASTM American Society of Testing and Materials
15. NIST National Institute of Standards and Technology
16. SBI Steel Boiler Industry (Division of Hydronics Institute)
17. SMACNA Sheet Metal and Air Conditioning Contractors National Association
18. UL Underwriters' Laboratories

1.7 DEFINITIONS

- A. Acceptance Phase: Phase of construction after start-up and initial checkout when Functional Performance Tests, O&M documentation review and training occur.
- B. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in tested modes according to the Contract Documents.
- C. Architect/Engineer (A/E): Prime consultant (architect) and subconsultants who comprise the design team, generally HVAC Mechanical Designer/Engineer and Electrical Designer/Engineer.
- D. Basis of Design: Documentation of primary thought processes and assumptions behind design decisions made to meet design intent. Describes systems, components, conditions and methods chosen to meet intent.
- E. Commissioning Agent (CA): Contracted to Owner. CA directs and coordinates day-to-day commissioning activities. CA reports directly to Owner.
- F. Commissioning Plan: Overall plan developed after bidding that provides structure, schedule and coordination planning for commissioning process.
- G. Construction Manager (CM): The prime contractor for this project. Generally refers to the CM's subcontractors as well. Also referred to as the Contractor in some contexts. The CM is hired by the Owner and is authorized to oversee fulfillment of all requirements of the Contract Documents.
- H. Contract Documents: Documents binding on parties involved in construction of this project (drawings, specifications, change orders, amendments, contracts, etc.).
- I. Control System: System and components associated with building automation system.
- J. Deferred Functional Tests: Functional tests performed after substantial completion due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow test from being performed.
- K. Deficiency: Condition of a component, piece of equipment or system that is not in compliance with Contract Documents (that is, does not perform properly or is not complying with design intent).
- L. Functional Performance Test Procedures: Commissioning protocols and detailed test procedures and instructions that fully describe system configuration and steps required to determine if the

system is performing and functioning properly. These procedures shall be used to document Functional Performance Tests.

- M. Functional Performance Test (FPT): Test of dynamic function and operation of equipment and systems. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are run through all specified sequences of operation. Components are verified to be responding in accordance with Contract Documents. Functional Performance Tests are executed after pre-functional checklists and start-ups are complete.
- N. Monitoring: Recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or trending capabilities of control systems.
- O. Overridden Value: Writing over a sensor value in control system to see response of a system (e.g., changing outside air temperature value from 72° F to 52° F to verify economizer operation). See also "Simulated Signal".
- P. Pre-Functional Checklist (PC): A list of static inspections and elementary component tests that verify proper installation of equipment (e.g., belt tension, oil levels, labels affixed, gauges in place, sensors calibrated, etc.).
- Q. Seasonal Performance Tests: Functional Performance Tests deferred until system(s) ambient conditions are closer to design conditions.
- R. Simulated Condition: Condition created for testing component or system (e.g., applying heat to space temperature sensor to monitor response of VAV box).
- S. Simulated Signal: Disconnecting sensor and using signal generator to send amperage, resistance or pressure transducer and/or DDC system to simulate value to BAS.
- T. Specifications: Construction specifications of Contract Documents.
- U. Start-up: The activities where systems or equipment are initially tested and operated. Start-up is completed prior to functional testing.
- V. Sub-contractor: Contractors of CM, and their sub-contractors, who provide and install building components and systems.
- W. Test Procedures: Step-by-step process, which must be executed to fulfill test requirements.
- X. Test Requirements: Requirements specifying what modes and functions will be tested. Test requirements are not detailed test procedures and are identified in the Cx Plan.
- Y. Trending: Monitoring using building control system.
- Z. Vendor: Supplier of equipment.
- AA. Warranty Period: Warranty period for entire project, including equipment components.

1.8 COORDINATION

- A. Commissioning Team: Members of Commissioning Team (CT) will consist of:
 - 1. Commissioning Agent (CA)
 - 2. Owner's Representative(s) (OR)
 - 3. Construction Manager (CM)
 - 4. Architect and Design Engineers (A/E)
 - 5. Mechanical Contractor (MC)
 - 6. Electrical Contractor (EC)

7. Test and Balance Agency (TAB Agency)
 8. Controls Contractor (CC)
 9. Equipment Suppliers and Vendors
- B. Management: Owner will contract services of the CA. The CA directs and coordinates commissioning activities and reports to OR. All members of the Commissioning Team shall cooperate to fulfill responsibilities and objectives of the Contract Documents.
- C. Kick-off Meeting: Within 90 days of commencement of construction, CA will plan, schedule and conduct a commissioning kick-off meeting. Membership and responsibilities of the commissioning team will be clarified at this meeting. CA will distribute meeting minutes to all parties.
- D. Scheduling:
1. A/E will work with commissioning team to establish required commissioning activities to incorporate in preliminary commissioning schedule. The CM will integrate commissioning activities into master construction schedule. Representatives of the commissioning team will address scheduling problems. Necessary notifications are to be made in a timely manner in order to expedite commissioning.
 2. The CA will provide initial schedule of primary commissioning events at commissioning kick-off meeting. As construction progresses, more detailed schedules are developed by the commissioning team.

1.9 SUBMITTALS

- A. Contractor shall provide CA with documentation required for commissioning work. At minimum, documentation shall include: Full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details, start-up reports. In addition, installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by factory or field technicians shall be submitted to CA.
- B. CA shall review submittals for conformance as it relates to commissioning. Review is primarily intended to aid in development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The CA shall not be part of the A/E's submittal approval process.

1.10 START-UP PLAN

- A. Sub-contractor responsible for purchase, installation and start-up of equipment develops and submits start-up plan by combining manufacturer's detailed start-up and checkout procedures with normally used field checkout sheets. Plan shall include checklists and procedures with specific boxes or lines for recording and documenting inspections of each piece of equipment.
- B. A/E reviews submitted start-up plan for content and format. Primary role of A/E is to substantiate written documentation for each manufacturer-recommended procedure.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

- A. Division contractors shall provide all specialized tools, test equipment and instruments required to execute start-up, checkout and functional performance testing of equipment under their contract.
- B. Test equipment shall be of sufficient quality and accuracy to test and/or measure system performance with tolerances specified. A testing laboratory shall have calibrated test equipment within the previous 12 months. Calibration shall be NIST traceable. Equipment shall be

calibrated according to manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 EXECUTION

3.1 COMMISSIONING OVERVIEW

- A. The following provides a brief overview of typical commissioning tasks during construction and general order in which they occur:
1. Commissioning prior to construction (where applicable) begins with the review of the pre-determined DD and CD sets of plans. The CA will review the respective plans, comment on them and return the comments to the appropriate parties and wait for a response.
 2. Commissioning during construction begins with a kick-off meeting conducted by CA where membership of commissioning team is established and responsibilities reviewed.
 3. A Commissioning Plan is written up based on the project requirements.
 4. CA schedules subsequent meetings as necessary to plan, coordinate and schedule commissioning activities. Deficiencies and problem resolution will also be discussed at these meetings.
 5. Sub-contractors develop and submit detailed start-up plans to Cx team.
 6. CM develops, with cooperation of Sub-contractor/vendor, detailed training plan. Training plan is reviewed and approved by commissioning team.
 7. CA develops specific pre-functional checklists and equipment and system Functional Performance Test procedures. Commissioning team members review procedures.
 8. Sub-contractors inform CA when the pre-functional items are complete by phase. The CA executes and documents pre-functional checklists in phases such as setting equipment, piping equipment, insulating it, making up electrical connections, etc. The purpose is to execute the process as the work is being completed.
 9. The Sub-contractors perform start-up and initial checkout. CA collects documentation completed according to approved plans. CA will witness start-up of selected equipment.
 10. Functional Performance Tests are executed by Sub-contractors, under supervision of and documented by CA.
 11. Items of non-compliance in material, installation or set-up will be corrected at Sub-contractors expense and system shall be retested.
 12. CM coordinates training sessions and executes training plan. Specific training to be provided as specified in Divisions 07, 08, 21, 22, 23, 26, 27, 28 by Sub-contractor/vendor. CA will witness and document selected training sessions.

3.2 SYSTEMS TO BE COMMISSIONED

Please note that while some equipment/systems will be commissioned in full (100%) most will be commissioned by a percentage of equipment. A representative sample will be chosen for inspection/testing for most equipment. Specific percentages have been noted in the respective Commissioning Work Order. The commissioning process shall include but shall not be limited to the following disciplines and components. However, component types shall be according to the latest contract documents.

1. HVAC Systems (to be clearly identified in next submission)
2. Building Automation and Controls
3. Plumbing Systems
4. Electrical Systems
5. Voice Data Video Systems
6. Life Safety Systems
7. Building Envelope Systems

3.3 RESPONSIBILITIES

- A. Responsibilities of commissioning team members are:
1. Architect/Engineer (A/E):
 - a. Document design intent of systems

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- b. Witnesses first run of primary equipment as necessary
 - c. Review test documentation
 - d. Review functional performance trend log data
 - e. Review training plan
 - f. Review O&Ms and record documents
 - g. Attend commissioning kick-off meeting
2. Commissioning Agent (CA):
- a. Identify commissioning activities for inclusion into the project schedule by the CM.
 - b. Develop detailed project specific pre-functional performance tests and Functional Performance Test procedures.
 - c. Provide progress reports of commissioning status.
 - d. Spot Check pre-functional checklists filled out by sub contractors
 - e. Witness FPTs. Document test results and recommend system for acceptance.
 - f. Review, track and coordinate resolution of non-compliance and deficiencies identified by commissioning team. Maintain records of all issues submitted by commissioning team.
 - g. Review completed TAB reports.
 - h. Review training plan developed by CM.
 - i. Monitor completion and accuracy of project closeout documents and training.
 - j. Provide final commissioning report, summarizing final disposition of building systems after functional testing.
 - k. Oversee, review and aid in the development of systems manual for provision to owner and for final upload to LEED online.
 - l. Facilitate cooperation of CT in commissioning work.
 - m. Attend and conduct commissioning team meetings.
 - n. Witness seasonal or deferred testing and modify or update commissioning report as required.
 - o. Participate in a warranty review of system/equipment performance.
3. Construction Manager (CM):
- a. Incorporate commissioning activities into the construction schedule.
 - b. Periodically update commissioning activities in the construction schedule.
 - c. Develop, with cooperation of A/E and Sub-contractor/vendor, detailed training plan.
 - d. CM coordinates training sessions and executes training plan through his sub-contractors.
 - e. Facilitate cooperation of Sub-contractors in commissioning work.
 - f. Submit copies of approved submittals, with manufacturer start-up criteria, contractor start-up checklists and operating and maintenance criteria to CA.
 - g. Verify equipment and systems are ready for execution of pre-functional checklists by the CA. Assures CA at each phase of installation equipment and systems are ready.
 - h. Insures resolution of non-compliance and deficiencies of construction related items identified by commissioning team. Obtains written documentation of completion from the appropriate Sub-contractors.
 - i. Coordinate Sub-contractor/vendor participation in training sessions. Provide workspace or conference room as needed. Ensure attendance at training is documented.
 - j. Schedule, coordinate and assist CT in seasonal or deferred testing.
 - k. Participate in warranty review of system/equipment performance.
4. Sub-contractors/Vendors:
- a. Review commissioning plan, pre-functional checklists, and FPT procedures.
 - b. Ensure installation work and pre-functional test sheets are completed and that work is complete and is in compliance with Contract Documents and is ready for Functional Performance Testing.
 - c. Develop and submit detailed equipment start-up procedures to CT. Procedures shall include checklist to be completed by Sub-contractor/vendor.

- d. Perform testing in accordance with specification requirements and/or per the requirements of the local authority
 - e. Notify CT that equipment and systems are ready for functional performance testing.
 - f. Execute FPTs developed by CA as described in Contract Documents and commissioning plan, under direction of CA.
 - g. Provide certified and calibrated instrumentation required to take measurements of system and equipment performance during functional performance testing.
 - h. Assist CT with developing a comprehensive commissioning schedule.
 - i. Attend commissioning kick-off meeting and other commissioning team meetings.
 - j. Prepare training plans with CM and execute training as specified in Division 07, 08, 21, 22, 23, 26, 27, 28 of these specifications.
 - k. Execute seasonal or deferred functional performance testing as necessary.
 - l. Make necessary amendments to O&M manuals and as-built drawings for applicable issue identified in season/deferred testing.
 - m. Provide CA with individually tabbed binder which includes maintenance procedures, trouble shooting charts, maintenance logs and exploded parts lists per each type of equipment. Intent of this maintenance binder is to provide building Owner with quick reference guide for maintenance procedures.
 - n. Participate in a warranty review of system/equipment performance.
5. Controls Contractor (CC):
- a. Completely install and thoroughly inspect components, thoroughly start-up, test, adjust, calibrate and document systems and equipment under Building Automation/Controls Contract.
 - b. Provide laptop computer, software and training to accommodate TAB Contractor in system balancing.
 - c. Install software on CA's laptop and provide training to CA for off-site trend logging and monitoring "BMS".
 - d. Maintain database of control parameters submitted by TAB Contractor subsequent to field adjustments and measurements.
 - e. Provide on-site technician skilled in software programming and hardware operation to exercise sequences of operation and to correct control deficiencies identified during functional performance testing.
 - f. Provide instrumentation, computer, software and communication resources necessary to demonstrate total operation of building systems during functional performance testing of control system equipment.
 - g. Attend commissioning kick-off meeting and other commissioning team meetings.
 - h. Prepare training plans with CM and execute training as specified in Division 07, 08, 21, 22, 23, 26, 27, 28 of these specifications.
 - i. Maintain comprehensive system calibration and checkout records. Submit records to CT.
 - j. Set up trend logs as requested by CT to substantiate proper systems operation.
 - k. Participate in a warranty review of system/equipment performance.
 - l. Provide computer generated reports and signed documentation indicating the commands listed below function as intended:
 - 1) All installed points receive and transmit the correct information prior to loading/activating the system software.
 - 2) ON/OFF commands from the workstation shall be performed in order to verify each binary output.
 - 3) Each binary input point is to be tested using the HOA (hand/off/automatic) selector switch on the associated motor control panel or by manually completing the circuit across the field device contacts.
 - 4) Each analog output points providing control shall be tested using a command from the workstation confirming the signals are properly sent and received
 - 5) Each analog input point is to be tested by comparing the reading obtained through the workstations to the value of an independent testing meter.

- 6) All equipment programmed with a Sequence of Operations is to be verified; all heating/cooling modes, valves hot and chilled water, dampers, fans, energy recovery wheels, sensors, mechanical cooling, and all other associated equipment components are to be tested and checked out prior to CA functional testing.
6. Test, Adjust and Balance (TAB) Agency:
 - a. Attend commissioning kick-off meeting and other commissioning team meetings.
 - b. Submit TAB plan and forms describing methodology for execution of test and balance procedures specific to this project to CT for review.
 - c. Cooperate with CC with execution of required work.
 - d. Rebalance deficient areas identified during commissioning.
 - e. Provide on-site technician, as necessary, skilled in TAB procedures to provide verification of equipment and system performance and TAB reading during functional performance testing.
 - f. Participate in a warranty review of system/equipment performance.

3.4 COMMISSIONING TEAM (CT) MEETINGS

- A. CT meetings will be held periodically as determined by CA with frequency increasing as construction advances and systems become operational. Attendance is mandatory. CA will record minutes and attendance. CA will chair CT meetings.
- B. Discussions held in CT meetings shall include, but not be limited to system/equipment start-up, progress, scheduling, testing, documentation, deficiencies and problem resolution.

3.5 REPORTING

- A. CA will provide regular status reports to CM and Owner, with increasing frequency as construction and commissioning progresses.
- B. CA will regularly communicate with members of commissioning team, keeping them apprised of commissioning progress.
- C. CA shall submit non-compliance and deficiency reports to Owner and CM.
- D. CA shall provide a final summary report to Owner.

3.6 START-UP AND INITIAL CHECKOUT

- A. Sub-contractor shall schedule equipment start-up with Commissioning Team. Sub-contractor shall execute equipment start-up.
- B. CA reserves the right to witness any start-up or equipment testing.
- C. Pre-functional checklists are provided and executed by CA. Prototypical examples of PFCs are included at the end of this specification section. Final copies of PFCs will be developed after issuance the Construction Documents and issued to the CT as part of the Commissioning Plan. CM and Sub-contractor shall review final construction documentation for applicable details and specifications related to equipment to be commissioned in order to fully ascertain all of the pre-functional checklist requirements.

3.7 FUNCTIONAL PERFORMANCE TESTING

- A. Objectives and Scope:
 1. The objective of Functional Performance Testing is to demonstrate each system is operating according to documented design intent and Contract Documents. Functional Performance Testing facilitates bringing system from a state of substantial completion to full dynamic operation. Additionally, during Functional Performance Testing, areas of

deficient performance are identified and corrected, improving operation and functioning of systems.

2. Each system shall be operated through all modes of operation (occupied, unoccupied, warm-up, cool-down, etc.) where there is a specified system response. Verifying each sequence in the sequences of operation is required.

B. Development of Test Procedures:

1. The purpose of any given specific test is to verify and document compliance with stated criteria of acceptance given on test form. CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Sub-contractor responsible to execute test will provide assistance to CA in developing procedure (i.e., answering questions about equipment, operation, sequences, etc.) Prior to execution, CA shall provide a copy of test procedures to Sub-contractor. Sub-contractor will review tests for feasibility, safety and equipment warranty protection. CA shall submit tests to Owner, CM and A/E and other Commissioning Team members for review.
2. Test procedure forms developed by the CA will include (but not be limited to) the following information:
 - a. System and equipment or component name(s)
 - b. Date
 - c. Project name
 - d. Specific sequence of operation or other specified parameters being verified
 - e. Specific step-by-step procedures to execute test, in a clear, sequential and repeatable format
 - f. A Yes/No checkbox to allow for clearly marking whether or not proper performance of each part of the test was achieved
 - g. Section for comments
3. Prototypical examples of Functional Performance Test Checklists are included at the end of this specification section. Final copies of FPTs will be developed after issuance the Construction Documents and issued to the CT as part of the Commissioning Plan. CM and Sub-contractors shall review final construction documentation for applicable details and specifications related to equipment to be commissioned in order to fully ascertain all FPT requirements.

C. Coordination and Scheduling:

1. CM will provide sufficient notice to CA regarding completion of schedule for equipment and systems. CM will schedule Functional Performance Test with CT. CA shall witness and document functional testing of equipment and systems. Sub-contractor shall execute test under direction of CA.
2. Functional Performance Testing is conducted after system operation and checkout is satisfactorily completed. Air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems.

3.8 DOCUMENTATION, NON-COMFORMANCE AND APPROVAL OF TESTS

A. Documentation:

1. CA will witness and document results of FPT using specific Functional Performance Test developed for that purpose. Prior to testing, FPTs are provided to the Commissioning Team for review and approval. CA will include filled out FPTs in Commissioning Turnover Package.

B. Non-Conformance:

1. CA will record results of functional testing. Deficiency or non-conformance issues will be noted and reported to CM and Owner on standard non-compliance FPT form.
2. Corrections of minor deficiencies identified may be made during tests at discretion of CA. In such cases, deficiency and resolution will be documented on FPT form.
3. Every effort will be made to expedite testing and minimize unnecessary delays, while not comprising integrity of tests. CA shall not overlook deficient work or relax acceptance criteria to satisfy scheduling or cost issues unless directed to do by the Owner.

4. Deficiencies are handled in the following manner:
 - a. When there is no dispute on deficiency and Sub-contractor accepts responsibility for remedial action:
 - 1) CA documents deficiency and Sub-contractors response and intentions and they go on to another test or sequence. CA submits deficiency report to CM and Owner. Copy is provided to Sub-contractor. Sub-contractor corrects deficiency, and verifies correction to CM. CM forwards response to CA.
 - 2) CM reschedules test with Sub-contractor.
 - b. When there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - 1) CA documents deficiency and Contractors response and they go on to another test or sequence. CA submits deficiency report to CM and Owner. Copy is provided to Sub-contractor.
 - 2) CM facilitates resolution of deficiency. Other parties are brought into discussions as needed. Final interpretive authority is A/E. Final acceptance authority is with the Owner.
 - 3) CM documents resolution process.
 - 4) Once interpretation and resolution has been decided, appropriate party corrects deficiency, and verifies correction to CM. CM forwards response to CA. CM reschedules test and test is repeated until satisfactory performance is achieved.
- C. Cost of Retesting:
 1. Sub-contractor shall retest FPT, if they are responsible for deficiency at no additional cost.
 2. Time for CA to direct any retesting required because a specific pre-functional checklist or start-up test items reported to have been successfully completed, but determined during Functional Performance Testing to be faulty, may be backcharged to Sub-contractor.
- D. Approval:
 1. CA notes each satisfactorily demonstrated function on test form. CA, A/E and Owner provide formal approval of FPT. CA recommends acceptance of each test to Owner.

3.9 COMMISSIONING DOCUMENTATION

- A. Commissioning Turnover Package
 1. CA is responsible to compile and organize commissioning records. CA shall deliver Cx records to the Owner in Commissioning Binders. Turnover Package to include the following:
 - a. Commissioning Plan
 - b. Commissioning Observation Reports
 - c. Pre-functional Checklists
 - d. Completed Functional Performance Test records
 - e. Deficiency Reports
 - f. Final Commissioning Report
- B. Final Report Details
 1. Final Commissioning Report will include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and general description of testing and verification methods. Recommendations for improvement to equipment or operations, future actions, etc., will also be listed. Each non-compliance issue will be referenced to specific FPT where deficiency is documented.

3.10 TRAINING OF OWNER PERSONNEL

- A. Sub-contractors will provide complete training in start-up, operation and maintenance of all equipment under contract.

- B. CM and Sub-contractors will be responsible for developing Owner training plan, scheduling of Owner training, execution of Owner training and documentation of completed Owner training.
- C. A/E will be responsible for approving content and adequacy of Owner training.
- D. CA will be responsible for monitoring completion of Owner training.
- E. Sub-contractor will submit a written training plan to A/E and CA for review and approval with submission of shop drawings. Plan will cover the following elements:
 - 1. Equipment (included in training)
 - 2. Intended audience
 - 3. Location of training
 - 4. Objectives
 - 5. Subjects covered
 - 6. Duration of training on each subject
 - 7. Instructor for each subject
 - 8. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
 - 9. Instructors and qualifications
- F. CM and sub-contractors schedule training with CA and Owner. CA develops criteria to determine training satisfactorily completed.
- G. Professional videotaping shall be provided for training sessions as required by Division 1 and respective contractor.

3.11 SYSTEMS MANUAL

- A. The CxA with other project team members shall develop a systems manual that gives future operating staff the information needed to understand and optimally operate the project's commissioned systems.

3.12 DEFERRED TESTING

- A. Deferred Seasonal Testing:
 - 1. During warranty period, seasonal testing (test delayed until weather conditions are closer to system's design) will be completed as part of this contract. CM will coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate sub-contractor(s), with CA witnessing. CA will incorporate final updates to Turnover Package as necessary.
- B. Unforeseen Deferred Tests:
 - 1. Any check or test not completed due to building structure, required occupancy condition, or other deficiency, may be delayed upon approval of Owner. These tests will be rescheduled as soon as possible.

NOTE: The prototypical Pre-Functional Checklists and Functional Performance Test procedures are enclosed.

END OF SECTION 019113

SAMPLE ONLY

Contractor Checklist and Functional Test Procedures

AIR HANDLING UNITS

1. Participants

Discipline	Name	Company
CxA		
Mechanical		
Controls		
TAB		
Plumbing		
Electrical		
Date Returned to CxA		

2. Prerequisite Checklist

Check	Description
☐	The above equipment and systems integral to them are complete and ready for functional testing.
☐	All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with debugging, loop tuning and sensor calibrations completed.
☐	Test and balance completed and approved for the hydronic systems and terminal units connected
☐	All A/E punchlist items for this equipment corrected.
☐	Safeties and operating ranges reviewed.
	Schedules and reviewed
	- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures. - Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others). - Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.

3. Installation Checks

Check		Comments
Cabinet and General Installation		
Permanent labels affixed, including for fans	☐	
Casing condition good: no dents, leaks, door gaskets installed	☐	
Access doors close tightly - no leaks	☐	
Boot between duct and unit tight and in good condition	☐	
Vibration isolation equipment installed & released from shipping locks	☐	
Maintenance access acceptable for unit and components	☐	
Thermal insulation properly installed and according to specification	☐	
Instrumentation installed according to specification (thermometers, pressure gages, flow meters, etc.)	☐	
Clean up of equipment completed per contract documents	☐	

Check		Comments
Filters installed and replacement type and efficiency permanently affixed to housing--construction filters removed	☐	
Unit Configuration is correct	☐	
Valves, Piping and Coils		
Pipe fittings complete and pipes properly supported	☐	
Pipes properly labeled	☐	
Pipes properly insulated	☐	
Strainers in place and clean	☐	
Piping system properly flushed	☐	
No leaking apparent around fittings	☐	
All coils are clean and fins are in good condition	☐	
Condensate drains with P-trap or capped where appropriate	☐	
Valves properly labeled	☐	
Valves installed in proper direction	☐	
OSAT, MAT, SAT, RAT, hot water, chilled water supply sensors properly located and secure (related OSAT sensor shielded)	☐	
Sensors calibrated	☐	
Isolation valves installed per drawings	☐	
Fans and Dampers		
Supply fan and motor alignment correct	☐	
Supply fan belt tension & condition good	☐	
Supply fan area clean	☐	
Supply fan and motor properly lubricated	☐	
Return fan and motor aligned	☐	
Return fan belt tension & condition good	☐	
Return fan area clean	☐	
Return fan and motor lube lines installed and lubed	☐	
Filters clean and tight fitting	☐	
Filter pressure differential measuring device installed and functional (magnahelic, inclined manometer, etc.)	☐	
All dampers close tightly	☐	
All damper linkages have minimum play	☐	
Low limit freeze stat sensor located to deal with stratification & bypass	☐	
Ducts		
Ducts properly insulated	☐	
Duct joint sealant properly installed	☐	
No apparent severe duct restrictions	☐	
Turning vanes in square elbows as per drawings	☐	
OSA intakes located away from pollutant sources & exhaust outlets	☐	
Balancing dampers installed as per drawings and TAB's site visit	☐	
Electrical and Controls		
Power disconnects in place and labeled	☐	
Safeties in place and operable	☐	
Control system interlocks hooked up and functional	☐	

Check		Comments
Smoke detectors in place	☐	
All control devices wiring complete	☐	
Service light if provided is operational	☐	

4. Operational Checks

Check		Comments
General Findings		
Operation of Dampers and Valves		
Dampers stroke fully without binding and spans calibrated and BAS reading site verified.	☐	
Valves stroke fully and easily and spanning is calibrated.	☐	
Valves verified to not be leaking through coils when closed at normal operating pressure.	☐	
Operator Station Display to read as follows:		
System graphic	☐	
System On/Off indication	☐	
System Occupied/Unoccupied mode	☐	
System supply fan On/Off indication	☐	
Return exhaust fan status On/Off indication	☐	
Outside air temp indication	☐	
Outside air humidity indication	☐	
Outside air enthalpy calculation	☐	
Supply air temperature	☐	
Supply air temperature setpoint	☐	
Return air temperature	☐	
Damper positioning (%)	☐	
Supply static pressure setpoint	☐	
Supply static pressure	☐	
Hot water coil valve position	☐	
Chilled water coil valve position	☐	
Space/average space temperature	☐	
CO2 indication and setpoint	☐	
All alarm indications	☐	

5. Functional Testing Record

Air Handling Units

Test #	Mode ID	Test Procedure	Expected Response	Pass Y/N	Note
1	Unoccupied Mode	Using BMS put unit into unoccupied mode. Using the trend log features ensure the following occurs	OA temp is above 40°F. - Verify Outside Air and Exhaust Dampers are Closed and return air damper is open, HW/CHW coil valves are closed		
			OA temp is below 40°F – The HW heating coil valve is 25% open subject to safeties.		
		Unit in unoccupied with a call for heat – If Average temperature drops 2 degrees below the unoccupied heating setpoint of 60°F (adj)	OA damper shall remain closed. Subject to safeties, supply fan shall cycle and 3-way valve shall open based on call for heat from space sensor. Once space temp is 1°F above unoccupied setpoint, the supply fan shuts down. Ensure areas with perimeter radiation use radiant heat as 1 st stage if applicable		
2	Morning Warm-up	Set up trends for morning warm up status, heating control valve temperature, discharge air temperature and supply fan status	Check trending to verify that the warm up cycle is occurring prior to the occupied mode enable. OA dampers remain closed, SF starts, and HW valve opens 100%. The supply fan VFD shall modulate to maintain static pressure setpoint.		
3	Occupied, Fan On	Return unit to occupied mode using BMS.	Outside, return and relief damper opens to minimum position, supply fan and return fan start (once OA damper is proven open), RA damper modulates inverse of OA damper.		
4	Supply Fan and Return Fan Control	Using BMS set unit to occupied mode	Supply fan starts and runs continuously during occupied times. Return fan VFD shall track the supply fan by an adjustable offset as determined by the balancer.		
		Manually fail the supply fan and return fan	Verify an alarm is generated at the BMS		
5	Economizer Control	Simulate a situation, using the BMS controls where the unit is looking for cooling and the OA enthalpy is less than 22 btu/lb.	HW valve closed, OA damper modulates to 100% open.		
6	Chilled Water Cooling Coil	With a need for cooling, set the enthalpy setpoint below the actual OA enthalpy	The Chilled water cooling coil shall open and cool air shall be delivered		
		Create a situation where there is a need for cooling, the economizer damper is at 100% open and the cooling setpoint is not satisfied	The economizer damper shall remain 100% open and the chilled water cooling coil valve shall open. Cool air shall be delivered.		
7	Hot Water Heating Coil	In occupied mode, with fan running, raise the space temperature setpoint	Verify the hot water coil valve modulates to satisfy the heating requirement. (Ensure the system resets Supply air temperature to maintain space temp (adj.))		
8	Smoke Control	Simulate a smoke condition	Verify the duct smoke detectors will send a signal to stop the fans and close the OA dampers		

9	Freeze Condition	Manually simulate a freeze condition at the low limit duct thermostat	Verify the supply fan stops, OA dampers close, heating coil valve opens (when temp falls below 40°F) and an alarm is sent to the BMS		
		Manually reset the alarm	The alarm shall be cleared and the units shall be capable of restarting		
10	Filter Switch	Simulate a dirty filter condition	Ensure that the BMS reports an alarm		
11	Demand Control Ventilation (CO ₂ Override)	Simulate a CO ₂ level beyond the adjustable setpoint	The outside air damper shall be allowed to modulate past minimum position until the CO ₂ concentration has fallen below setpoint		

SECTION 023000

SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUBSURFACE INVESTIGATION

- A. Information Not Guaranteed: Information on the Drawings and in the Project Manual relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.
- B. Foundation Engineering Report: Refer to the Geotechnical Report in the Appendices.

1.3 CONFIRMATION OF GRADES AND UTILITIES

- A. Prior to commencement of site excavating operations, the Contractor shall compare existing site grading and proposed new site grading. Where existing utilities are indicated but their inverts or depths are not, exploratory excavating shall be performed to assure that sufficient earth coverage will be attained during the course of new site grading.
 - 1. Utilities existing on the site shall be carefully protected from damage and relocated or removed as required by the work. When an active utility line is exposed during construction, its location and elevation shall be plotted on the record drawings and the Architect, Owner and the utility owner notified in writing.
- B. If exploratory excavating confirms that the depth of existing utilities will be negatively impacted by proposed new grades (i.e., will be too shallow or become exposed), immediately notify the Architect and the Owner. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

1.4 CONFIRMATION OF INTEGRITY OF ADJACENT STRUCTURES

- A. Prior to commencement of site excavating operations, the Contractor shall compare foundation depths of existing structures and proposed depths of new utilities. Where existing structures are indicated but their foundation depths are not, exploratory excavating shall be performed to assure that proposed new excavations adjacent to them, or in near proximity of them, will not undermine the structural integrity of the existing structures.
- B. If exploratory excavating confirms that the footing depths of existing structures may be negatively impacted or undermined by proposed new excavations, immediately notify the

Architect and the Owner. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION [Not Used]

END OF SECTION

SECTION 024100

DEMOLITION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included:
1. Demolition and removal of selected portions of buildings and structures and as required for new work. Refer to the Drawings for additional requirements.
 2. Demolition and removal of selected site elements and as required for new work. Refer to the Drawings for additional requirements.
 3. Salvage of existing items to be reused or turned over to the facility.
 4. Removal and legal disposal of demolished materials off site. Except those items specifically designated to be relocated, reused, or turned over to the facility, all existing removed materials, items, trash and debris shall become property of the Contractor and shall be completely removed from the site and legally disposed of at their expense. Salvage value belongs to the Contractor. On-site sale of materials is not permitted.
 5. Maintenance, watering and care of trees designated to remain by a certified arborist during the construction period.
 6. Demolition and removal work shall properly prepare for alteration work and new construction to be provided under the Contract.
 7. Scheduling and sequencing operations without interruption to utilities serving occupied areas. If interruption is required, obtain written permission from the utility company and the Owner.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Document 003100 – Available Project Information
 2. Division 01 - GENERAL REQUIREMENTS for temporary facilities and controls, for maintenance of access, for cleaning during construction, and for dust and noise control.
 3. Section 017400 - CONSTRUCTION WASTE MANAGEMENT for waste management and recycling.
 4. Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT for indoor air quality control procedures.
 5. Division 21 - FIRE PROTECTION:

- a. Disconnecting, capping and otherwise making inactive existing fire protection services in areas where demolition and removal work is required.
 - b. Disconnect and reinstallation of fire protection equipment temporarily interrupted during construction.
- 6. Division 22 - PLUMBING:
 - a. Disconnecting, capping and otherwise making inactive existing plumbing services in areas where demolition and removal work is required.
 - b. Disconnection and reinstallation of plumbing equipment temporarily interrupted during construction.
- 7. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:
 - a. Disconnecting, capping and otherwise making inactive existing HVAC services in areas where demolition and removal work is required.
 - b. Disconnect and reinstallation of HVAC equipment temporarily interrupted during construction.
- 8. Division 26 - ELECTRICAL WORK:
 - a. Disconnecting, capping and otherwise making inactive existing electrical services in areas where demolition and removal work is required.
 - b. Disconnect and reinstallation of electrical equipment temporarily interrupted during construction.
- 9. Section 311000 – SITE CLEARING:
 - a. Excavating and removal of existing pavement, sub-surface building and utility structures and lines, appurtenances, and other elements indicated on the Drawings.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to the Owner ready for reuse, at a location designated by the Owner. Protect from weather until accepted by Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated. Protect from weather until reinstallation.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain property of the Owner as applicable.

Carefully remove each item or object in a manner to prevent damage and deliver promptly to a location acceptable to the Owner.

1.5 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal work, with early and late starting and finishing dates for each activity. Ensure Owner's on-site operations are uninterrupted if applicable.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs.
 5. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other occupants affected by selective demolition operations.
 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 7. Means of protection for items to remain and items in path of waste removal from building.
- B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged, and turned over the Owner.
- C. Predemolition Video and Pictures: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01 requirements. Submit before Work begins.

1.6 QUALITY ASSURANCE

- A. Examination of Existing Conditions: The Contractor shall examine the Contract Drawings for demolition and removal requirements and provisions for new work. Verify all existing conditions and dimensions before commencing work. The Contractor shall visit the site and examine the existing conditions as he finds them and shall inform herself/himself of the character, extent and type of demolition and removal work to be performed. Submit any questions regarding the extent and character of the demolition and removal work in the manner and within the time period established for receipt of such questions during the bidding period.
- B. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Section 011000 - GENERAL REQUIREMENTS, Project Meetings. Review methods and procedures related to selective demolition including, but not limited to, the following:
1. Inspect and discuss condition of construction to be selectively demolished.
 2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 SALVAGING

- A. Salvaged for Reinstallation: Materials indicated on the Drawings to be salvaged and reinstalled shall be carefully removed and stored at a location acceptable to the Architect and Owner.
- B. Salvaged for Storage: Materials indicated on the Drawings or designated in the field by the Owner to be salvaged and stored shall be carefully removed and delivered to the Owner at locations determined by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Engage a professional engineer registered in the state that the project is located to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction videotapes.
 1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

- G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies and Owner.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.
 - 4. Prior to commencing cutting work in existing surfaces, take all precautionary measures to assure that mechanical and electrical services to the particular area have been made inactive. Coordinate with Fire Suppression, Plumbing, HVAC, and Electrical subcontractors. Only licensed tradesmen of that particular trade shall disconnect and cap existing mechanical and electrical items that are to be removed, abandoned and/or relocated.
 - 5. If, during the process of cutting work, existing utility lines are encountered which are not indicated on the Drawings, regardless of their condition, immediately report such items to the Architect. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Section 011000 - GENERAL REQUIREMENTS, Temporary Facilities and Controls.
 - 2. Maintain adequate passage to and from all exits at all times. Before any work is done which significantly alters access or egress patterns, consult with the Architect and obtain approval of code required egress. Under no condition block or interfere with the free flow of people at legally required exits, or in any way alter the required condition of such exits.
- B. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
 - 2. Remove temporary shoring, bracing and structural supports when no longer required.
 - 3. Post warning signs and place barricades as applicable during placement and removal of temporary shoring.
- C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area(s).

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction. Provide temporary barricades as required to limit access to demolition areas.
2. Protect existing site improvements, appurtenances, and landscaping to remain.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Maintain clear unimpeded passage through the work area for safety and emergency egress.
10. Saw cut overruns in concrete and masonry for new door, window and other finish openings is not permitted. Core drill corners and finish square to match required opening.
11. Dispose of demolished items and materials promptly.

a. Comply with requirements in Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by the Owner.
5. Protect items from damage during transport and storage.

C. Removed Items for Reinstallation by the Respective Trade.

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.
 4. Transport items to storage area designated by the Owner.
 5. Protect items from damage during transport and storage.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- E. Items for Re-use and Preservation of Existing Surfaces to Remain:
1. The Contractor shall inspect closely each item specifically designated to be relocated, re-used, or turned over to the Owner prior to its removal, and immediately report damages and defects to the Architect and the Owner. The Contractor shall be responsible for any subsequent damage to the same other than latent defects not readily apparent from close inspection, and shall bear responsibility for its repair or same replacement as directed by the Architect, to the satisfaction of the Owner.
 2. Unless special surface preparation is specified under other Specification Sections, leave existing surfaces that are to remain in a condition suitable to receive new materials and/or finishes.

3.5 PROTECTION OF PUBLIC AND PROPERTY

- A. Provide all measures required by federal, state and municipal laws, regulations, and ordinances for the protection of surrounding property, the public, workmen, and Owner's employees during all demolition and removal operations. Measures are to be taken, but not limited to installation of sidewalks, sheds, barricades, fences, warning lights and signs, trash chutes and temporary lighting.
- B. Protect all walks, roads, streets, curbs, pavements, trees and plantings, on and off premises, and bear all costs for correcting such damage as directed by the Architect, and to the satisfaction of the Owner.
- C. Demolition shall be performed in such a manner that will insure the safety of adjacent property. Protect adjacent property from damage and protect persons occupying adjacent property from injuries which might occur from falling debris or other cause and so as not to cause interference with the use of other portions of the building, of adjacent buildings or the free access and safe passage to and from the same.
- D. Every precaution shall be taken to protect against movement or settlement of the building, of adjacent buildings, sidewalks, roads, streets, curbs and pavements. Provide and place at the Contractor's own expense, all necessary bracing and shoring in connection with demolition and removal work.
- E. Remove portions of structures with care by using tools and methods that will not transfer heavy shocks to existing and adjacent building structures, both internal and external of the particular work area.
- F. Provide and maintain in proper condition, suitable fire resistive dust barriers around areas where interior demolition and removal work is in progress. Dust barriers shall prevent the dust migration to adjacent areas. Remove dust barriers upon completion of major demolition and removal in the particular work area.

3.6 DISCOVERY OF HAZARDOUS MATERIALS

- A. If hazardous materials, such as chemicals, asbestos-containing materials, or other hazardous materials are discovered during the course of the work, cease work in affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.
- B. If unmarked containers are discovered during the course of the work, cease work in the affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Take immediate precautions to prohibit endangering the containers integrity. Continue work in other areas.

3.7 CUTTING

- A. Perform all cutting of existing surfaces in a manner which will ensure a minimal difference between the cut area and new materials when patched. Use extreme care when cutting existing surfaces containing concealed utility lines which are indicated to remain and bear full responsibility for repairing or replacement of all such utilities that are accidentally damaged.
- B. Provide a flush saw cut edge where pavement, curb and concrete removals abut new construction work or existing surfaces to remain undisturbed.
- C. All slurry and water shall be contained and managed to avoid damage to existing conditions when using a wet saw or wet core driller.
- D. Obtain and pay for a hot work permit and arrange to have on-site a Fire Watch when using a cutting torch or similar item.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Comply with requirements of Section 017400 - CONSTRUCTION WASTE MANAGEMENT and the following:
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.9 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Premises shall be left in a clean condition and ready to accept alteration work and new construction.

END OF SECTION

SECTION 028213

ASBESTOS ABATEMENT

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. Remove, encapsulate, or otherwise abate asbestos-containing materials (ACM) as described herein.
- B. Dispose all ACM in accordance with governing laws and regulations; pay costs of permits and disposal.
- C. Caution: asbestos-containing materials quantities as presented in Section 3.09 and as detailed in Table of Asbestos-Containing Materials to be Abated are for reference purposes only. It is the explicit responsibility of the Contractor to fully review the Site Plans and determine actual quantities and base the bidding on Contractor's verified quantities. Based on the Consultant's limited survey methods, no allowances for additional materials will be granted, except for materials that are clearly hidden behind fixed walls, above fixed ceilings, under fixed floors or otherwise were not or could not have been identified, e.g.; no visible pipe or conduit penetrations into said structure giving indication of a continuation of hazardous materials.

1.3 RELATED WORK

- A. Related Sections:
 - 1. Section 02 83 13, Hazardous Materials Handling and Removal
 - 2. Section 00 31 00b, Hazardous Materials Summary Report
- ##### 1.4 CODES, REGULATIONS, AND STANDARDS - ASBESTOS ABATEMENT

- A. Federal Requirements that govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:
 - 1. OSHA: U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to:
 - a. Respiratory Protection: Title 29, Part 1910, Section 134 of the Code of Federal Regulations
 - b. Construction Industry: Title 29, Part 1926, of the Code of Federal Regulations
 - c. Hazard Communication: Title 29, Part 1910, Section 1200 of the Code of Federal Regulations
 - 2. DOT: U.S. Department of Transportation, including but not limited to:
 - a. Hazardous Substances: Title 29, Part 171 and 172 of the Code of Federal Regulations
 - 3. EPA: U.S. Environmental Protection Agency (EPA), including but not limited to:

ASBESTOS ABATEMENT

- a. Asbestos Abatement Projects; Worker Protection Rule: Title 40 Part 763, Sub-part G of the Code of Federal Regulations
 - b. Asbestos Hazard Emergency Response Act (AHERA) Regulation: Asbestos Containing Materials in Schools Final Rule & Notice, Title 40, Part 763, Sub-part E of the Code of Federal Regulations
 - c. Training Requirements of (AHERA) Regulation: Asbestos Containing Materials in Schools Final Rule & Notice, Title 40, Part 763, Sub-part E, Appendix C of the Code of Federal Regulations
 - d. National Emission Standard for Hazardous Air Pollutants (NESHAPS): National Emission Standard for Asbestos, Title 40, Part 61, Sub-part A, and Sub-Part M (Revised Sub-Part B) of the Code of Federal Regulations
- B. State Requirements that govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:
 1. Department of Environmental Protection (310 CMR 7.00) Latest Version
 2. Department of Labor Standards (453 CMR 6.00—The Removal, Containment or Encapsulations of Asbestos
 3. Department of Transportation
- C. Local requirements that govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:
 1. Wakefield Building Inspector (project notification)
 2. Wakefield Police Department (project notification)
 3. Wakefield Fire Department (project notification)
- D. Standards:
 1. General Applicability of Standards: Except to the extent that more explicit or more stringent requirements are written directly into the Contract Documents, all applicable standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies are bound herewith. All work under this contract shall be done in strict accordance with all applicable Federal, State, and local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
 2. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.
 3. Contractor Responsibility: The Contractor shall assume full responsibility and liability for the compliance with all standards pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records,

personal protective equipment (PPE) including respiratory protection including respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the Owner and consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors.

4. Standards that apply to asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following ANSI and ASTM standards.
 5. American National Standards Institute (ANSI), 1430 Broadway, New York, New York 10018, (212) 354-3300
 - a. Fundamentals Governing the Design and Operation of Local Exhaust Systems, Publication Z9.2-79
 - b. Practices for Respiratory Protection Publication Z88.2-80
 6. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103, (215) 299-5400
 - a. Safety and Health Requirements Relating to Occupational Exposure to Asbestos, ASTM E 849-82
 7. Occupational Safety and Health Administration (OSHA)
 1. Title 29 CFR 1926 - Construction Standard Requirements - Demolition Work
 2. Title 29 CFR 1910.38(a);(b) - Emergency Action Plan
 3. Title 29 CFR 1910.132 - Personal Protective Equipment
 4. Title 29 CFR 1910.20 - Access to Employee Exposure and Medical Records
 5. Title 29 CFR 1910.1200 - Hazard Communication
 6. Title 29 CFR 1910.151 - Medical and First Aid
- E. EPA Guidance Documents: Discuss asbestos abatement work or hauling and disposal of asbestos waste materials listed below for the Contractor's information only. These documents do not describe the work and are not a part of the work of this contract. EPA maintains an information number (800) 334-8571, publications can be ordered from (800) 424-9065 (554-1404 in Washington, DC):
1. Guidance for Controlling Asbestos-Containing Materials in Buildings (Purple Book) EPA 560/5-85-024.
 2. Title 40 CFR 61 Subpart A and M (Revised Subpart B) - National Emission Standard for Hazardous Air Pollutants - Asbestos.
 3. Title 40 CFR 763 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos School Hazard Abatement Reauthorization Act (ASHARA).
 2. Asbestos in Buildings: Guidance for Service and Maintenance Personnel. EPA 560/5-85-018.
 3. Asbestos Waste Management Guidance. EPA 530-SW-85-007.
 4. A Guide to Respiratory Protection for the Asbestos Abatement Industry. EPA-560-PTS-86-001.
- F. Posting and Filing of Regulations: Post all notices required by applicable federal, state and local regulations. Maintain two (2) copies of applicable federal, state and local regulations and

standard. Maintain one copy of each at job site. Keep on file in Contractor's office one copy of each.

1.5 DEFINITIONS AND STANDARDS - ASBESTOS ABATEMENT

Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

- A. Air Lock: A mechanism or system of enclosures within the decontamination facility that does not allow air movement between clean and contaminated areas. Consists of three-foot wide space between each of the sections of the decontamination chamber segregated by full polyethylene barriers.
- B. Amended Water: Water to which a surfactant has been added to decrease the surface tension to 35 or less dynes.
- C. Asbestos: The asbestiform varieties of serpentine (Chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite. For purposes of determining respiratory and worker protection both the asbestiform and non-asbestiform varieties of the above minerals and any of these materials that have been chemically treated and/or altered shall be considered as asbestos.
- D. Asbestos-Containing Material (ACM): Any material containing 1% or greater asbestos by weight of asbestos of any type or mixture of types.
- E. Asbestos-Containing Waste Material: Means any ACM removed during a demolition or renovation project and anything contaminated with asbestos in the course of a demolition or renovation project including, but not limited to, asbestos waste from control devices, bags or containers that previously contained asbestos, contaminated clothing, materials used to enclose the work area during the demolition or renovation operation, and demolition or renovation debris. This definition shall also include ACM on and/or in facility components that are inoperable or have been taken out of service and any ACM that is damaged or deteriorated to the point where it is no longer attached as originally applied or is no longer serving the intended purpose for which it was originally installed.
- F. Asbestos debris: Pieces of ACM or ACBM that can be identified by color, texture, or composition, or means dust, if the dust is determined by an accredited inspector to be ACM.
- G. Authorized Visitor: The Owner, the Owner's Technical Representative, testing lab personnel, the Architect/Engineer, emergency personnel or a representative of any federal, state and local regulatory or other agency having authority over the project.
- H. Barrier: Any surface that seals off the work area to inhibit the movement of fibers.
- I. Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches.
- J. Ceiling Concentration: The concentration of an airborne substance that shall not be exceeded.

- K. Decontamination Facility: A series of interconnected chambers, typically segregated by polyethylene barriers, that is used as the only means of worker ingress/egress to the work area. Interlocking barriers prevents contamination of areas outside the work area.
- L. Disposal Bag: A properly labeled 6-mil thick leak-tight plastic bags used for transporting asbestos waste from work and to disposal site.
- M. Encapsulant: A material that surrounds or embeds asbestos fibers in an adhesive matrix, to prevent release of fibers.
 - 1. Bridging Encapsulant: An encapsulant that forms a discrete layer on the surface of an in-situ asbestos matrix.
 - 2. Penetrating Encapsulant: An encapsulant that is absorbed by the in-situ asbestos matrix without leaving a discrete surface layer.
- N. Encapsulation: Treatment of asbestos-containing materials, with an encapsulant.
- O. Equipment Room: A contained room or chamber positioned immediately contiguous to the contaminated work area environment used for removal of protective clothing and decontamination of equipment.
- P. Friable Asbestos-Containing Material: Any ACM, that, when dry, can be crumbled, shattered, pulverized or reduced to powder by hand pressure or any non-friable ACM that has been subject to sanding, grinding, cutting, or abrading or has been crumbled, shattered or pulverized by mechanical means such as, but not limited to, the use of excavators, bull dozers, heavy equipment or power and or hand tools.
- Q. HEPA Filter: A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97% of asbestos fibers greater than 0.3 microns in diameter.
- R. HEPA Filter Vacuum Collection Equipment (or vacuum cleaner): High efficiency particulate air filtered vacuum collection equipment with a filter system capable of collecting and retaining asbestos fibers. Filters should be of 99.97% efficiency for retaining fibers of 0.3 microns or larger.
- S. Negative Pressure Respirator: A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.
- T. Negative Pressure Ventilation System: A pressure differential and ventilation system.
- U. Personal Monitoring: Sampling of the asbestos fiber concentrations within the breathing zone of an employee.
- V. Pressure Differential and Ventilation System: A local exhaust system, utilizing HEPA filtration capable of maintaining a pressure differential within the inside of the Work Area at a lower pressure than any adjacent area, and which cleans recirculated air or generates a constant air flow from adjacent areas into the Work Area.
- W. Protection Factor: The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer.

- X. Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.
- Y. Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.
- Z. Time Weighted Average (TWA): The average concentration of a contaminant in air during a specific time period.
- AA. Visible Debris: Any visually detectable particulate residue such as dust, dirt, or other extraneous material that may or may not contain asbestos.
- BB. Visible Emissions: Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.
- CC. Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning utensils which have been dampened with amended water or diluted removal encapsulant and afterwards thoroughly decontaminated or disposed of as asbestos-contaminated waste.
- DD. Work Area: The area where asbestos-related work or removal operations are performed which is defined and/or isolated to prevent the spread of asbestos dust, fibers or debris, and entry by unauthorized personnel. Work area is a Regulated Area as defined by 29 CFR 1926.

1.6 STOP WORK

- A. If the Owner's Technical Representative presents a written stop work order signed by the Owner, stop abatement work immediately. Do not recommence work until authorized in writing by the Owner.

1.7 SUBMITTALS

Submit the following for the Owner's Technical Representative's Information:

- A. Telephone numbers and location of emergency services.
- B. Develop an Alternate Work Practices Plan for exterior vapor barrier behind brick façade and roofing.
- C. The Contractor shall notify in writing, the local fire and police departments of proposed asbestos abatement work. Advise the fire department of the nature of the asbestos abatement work, and the necessity that all firefighting personnel who may enter the work site in the case of fire wear self-contained breathing apparatus (SCBA). In writing, provide one copy of the notices to the Owner prior to commencing the project.
- D. Resume of Supervisor for asbestos abatement.
- E. Submit to the Asbestos Project Designer required permits, site location, and arrangements for transport and disposal of ACM or asbestos-contaminated materials.
- F. Submit current certifications required under MGLC.149 S 44D and 453 CMR Part 6.00 to the Asbestos Project Designer for approval at least 10 business days prior to the project start.
- G. Submit a valid copy of the Contractor's Commonwealth of Massachusetts's Asbestos Abatement Contractor's License.
- H. Submit a copy of the written respirator program to the Asbestos Project Designer.
- I. Submit manufacturer's information that vacuums, ventilation equipment, and other equipment required to contain airborne asbestos fibers conform to ANSI Z9.2.
- J. Submit a detailed plan of the work procedures to be used in ACM abatement. Such plan shall include location of asbestos control areas, decontamination units, layout of decontamination units, location of access routes to asbestos control areas, interface of other trades involved in the building construction, sequencing of asbestos-related work, disposal plan, type of wetting agent and asbestos encapsulant to be used, air monitoring, and a detailed description of the method to be employed to control air or water pollution. Expand upon the use of portable HEPA ventilation system, closing out of the building's HVAC system, method of removal to prohibit visible emissions in work area, and packaging of removed asbestos debris. This plan must obtain written approval from the Architect prior to the start of asbestos work.
- K. Permit: Submit evidence that asbestos waste transporter maintains a current "Industrial waste hauler permit" specifically for asbestos-containing materials, as required for transporting of asbestos-containing materials waste to a disposal site.
- L. Waste disposal: Submit name, address, telephone number and asbestos waste permit information for landfill where asbestos waste will be disposed.
- M. Submit to the Asbestos Project Designer and Owner's Project Manager the design of the negative pressure system. Do not begin work until the submittal is approved by the Asbestos Project Designer. Include in the submittal at a minimum:
 - (a) Number of negative air machines required and the calculations necessary to determine the number of machines required to provide four air changes per hour.
 - (b) Description of projected airflow within the work area and methods required providing adequate airflow in all portions of the work area.

- (c) Manufacturer's product data and certifications for the machines to be used.
- (d) Location of machines in the work area.
- N. Accreditation and Certification: submit evidence in form of training course certificate of accreditation of Supervisor as an asbestos abatement supervisor and Workers as asbestos abatement workers. Also, submit applicable Massachusetts Department of Labor Standards (MA DLS) personnel certifications. All personnel must carry certifications on-site. Personnel without such certificates may not perform any functions related to asbestos abatement. Provide proof of training compliance with requirements as specified US EPA and OSHA.
- O. Submit to the Asbestos Project Designer a description of the plans for decontamination enclosure system construction and for work area isolation in compliance with this technical specification and applicable regulations.
- P. Submit a copy of a valid insurance certificate to conduct asbestos abatement work in the Commonwealth of Massachusetts.
- Q. Five days before removing asbestos materials, contractor shall inventory the quantity of asbestos materials in each area of work and submit the quantity for written approval to the Owner's Technical Representative. It shall include the location, date, quantity of asbestos material, and name of the authorized person conducting the quantification. The Owner's Air Monitoring Technician shall verify all asbestos material quantification before work is begun. No claims for additional materials will be considered without performing this inventory and submitting it within the proper time to the Owner's Technical Representative.

1.8 NOTIFICATIONS

- A. Notify other entities at the job site of the nature of the asbestos abatement activities, location of asbestos-containing materials, requirements relative to asbestos set forth in these specifications and applicable regulations.
- B. Notify emergency service agencies including fire, ambulance, police or other agency that may service the abatement work site in case of an emergency. Notification is to include methods of entering work area, emergency entry and exit locations, modifications to fire notification or fire fighting equipment, and other information needed by agencies providing emergency services.
- C. Notifications of Emergency: Any individual at the job site may notify emergency service agencies if necessary, without effect on this Contract or the Contract Sum.
- D. Notify federal, state, and local agencies having jurisdiction over the work including:
 - 1. Environmental Protection Agency: In Massachusetts, the notification sent to the Massachusetts Department of Environmental Protection for asbestos removal will be sufficient to meet the EPA notification requirement under the National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61 Subpart M).
 - 2. State and Local Agencies: Send written notification and pay fees, as applicable, as required by state and local regulations prior to beginning any work on asbestos-containing materials. In Massachusetts, notify the Department of Environmental Protection and MA DLS within 10 working days of beginning any asbestos abatement.

Notify the local Building Inspector, Fire Department and Police Department within 10 days of beginning any asbestos abatement.

1.9 QUALITY ASSURANCE

- A. Licenses: The Contractor conducting asbestos abatement activities must maintain current licenses as required by applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the work of this contract, including a MA DLS license as an Asbestos Abatement Contractor.
- B. Certifications: All personnel conducting asbestos abatement activities shall be certified by the MA DLS as Asbestos Abatement Workers and Asbestos Abatement Supervisors, as applicable, to their role on the project. AHERA Accreditation: workers who conduct asbestos abatement work on friable ACM, are to be accredited as Abatement Workers as required by the AHERA regulation 40 CFR 763 Appendix C to Subpart E, April 30, 1987.
- C. Continuously monitor and record the pressure differential between the Work Area and the building outside of the Work Area with a monitoring device.

1.10 PROJECT/SITE CONDITIONS

- A. The disturbance or dislocation of ACM may cause asbestos fibers to be released into the building's atmosphere, thereby creating a potential health hazard to workers and building occupants. Thus, to prevent ACM from becoming a hazard, the Contractor shall abate the ACM in the proper sequence of the project before the materials are disturbed by any renovation or demolition. Apprise all workers, supervisory personnel, subcontractors and consultants who will be at the job site of the seriousness of the hazard and of proper work procedures that must be followed.
- B. Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified asbestos-containing materials, take appropriate precautionary measures as necessary to protect all building occupants from the potential hazard of exposure to airborne asbestos. Do not allow asbestos or suspect asbestos materials to be disturbed or cause dust to be created. Stop work activities immediately if any suspect material is encountered and notify the Owner's Technical Representative so testing may be conducted, if necessary, to determine the material's asbestos content. Additional measures shall include the procedures and methods described herein, and compliance with regulations of applicable federal, state and local agencies.

1.11 SCHEDULING

- A. Asbestos abatement schedule shall be determined at a later date. Contractor shall assume that all work will be conducted during normal business hours unless otherwise indicated.

1.12 OWNER'S TESTING

- A. The Owner's Technical Representative will perform area air monitoring specified in this Article to verify that the engineering controls and work practices are not eliciting airborne asbestos fibers.
 - 1. This Article also sets forth airborne fiber levels both inside and outside the work area as action levels, and describes the action required by the Contractor if an action level is met or exceeded.

2. Analytical Methods: The following method will be used by the Owner's Testing and Inspection Agency in analyzing filters used to collect area air samples. Sampling rates may be varied from printed standards to allow for high volume sampling.
 - a. Phase Contrast Microscopy (PCM) will be performed using the NIOSH 7400 method. This analysis will be carried out at the job site.
 - b. Transmission electron microscopy (TEM), if timelier.
- B. Air monitoring required by OSHA is work of the Contractor and is not covered in this section.
- C. Area Air Monitoring: The purpose of the Owner's Technical Representatives area air monitoring during abatement work is to detect faults in the engineering controls and or work practices.
 1. Schedule of Air Samples: The number and volume of air samples taken and analytical methods used by the Owner's Technical Representative will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical instruments used. Owner's Technical Representative shall collect area air samples adjacent to the exclusion zone at roof level, 1 sample at ground level and 1 sample within the building on the upper floor directly below the work area. Samples shall be collected every 4 hours and analyzed immediately on site to determine for elevated airborne fiber concentrations.
 - 1) Analysis: Fibers on each filter will be measured using the NIOSH Method 7400 entitled "Fibers" published in the NIOSH Manual of Analytical Methods.
 - 2) Fibers referred to in this section include fibers regardless of composition as counted by the phase contrast microscopy method used.
 2. Area Air Samples: If any area air sample taken outside of the Work Area exceeds 0.01 fibers/cc, immediately and automatically stop work to initiate corrective action. The Owner's Technical Representative will determine the source of the high reading and so notify the Contractor.
 - a. If the high reading was the result of a failure of Work Area isolation measures initiate the following actions:
 - 1) Decontaminate the affected area in accordance with the requirements of Part 3.06 of this Section.
 - 2) Collect and package all affected polyethylene sheeting for disposal as ACM waste. Then HEPA vacuum general area and place new polyethylene sheeting at base of wall extending outward 10' to 15'
 - b. If the high reading was the result of other causes initiate corrective action as determined by the Owner's Technical Representative.

PART 2 - PRODUCTS

2.1 SHEET PLASTIC

- A. Polyethylene Sheet: Provide flame-resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-Resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mil thick, frosted or black as indicated.

- B. Reinforced Polyethylene Sheet: Where plastic sheet constitutes the only barrier between the work area and the building exterior, provide translucent, nylon reinforced or woven polyethylene, laminated, flame resistant, polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mil thick, frosted or black as indicated.

2.2 MISCELLANEOUS MATERIALS

- A. Duct Tape: Provide duct tape in 2" or 3" widths as indicated, with an adhesive that is formulated to stick aggressively to sheet polyethylene.
- B. Spray Glue: Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.
- C. Wetting Materials: For wetting prior to disturbance of Asbestos-Containing Materials use either amended water or a removal encapsulant:
 - 1. Amended Water: Provide water to which a surfactant has been added. Use a mixture of surfactant and water which results in wetting of the Asbestos-Containing Material and retardation of fiber release during disturbance of the material equal to or greater than that provided by the use of one ounce of a surfactant consisting of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with five gallons of water.
 - 2. Removal Encapsulant: Provide a penetrating type encapsulant designed specifically for removal of Asbestos-Containing Material. Use a material which results in wetting of the Asbestos-Containing Material and retardation of fiber release during disturbance of the material equal to or greater than that provided by water amended with a surfactant consisting of one ounce of a mixture of 50% polyoxyethylene ester and 50% polyoxyethylene ether in five gallons of water.
- D. Disposal Bags: Provide 6 mil thick leak-tight polyethylene bags labeled as required by Article 3.08 of this Section.
- E. Fiberboard Drums: Provide heavy-duty leak tight fiberboard drums with tight sealing locking metal tops.
- F. Paper board Boxes: Provide heavy-duty corrugated paperboard boxes coated with plastic or wax to retard deterioration from moisture. Provide in sizes that will easily fit in disposal bags.

2.3 PROTECTIVE CLOTHING:

- A. Coveralls: Provide disposable full-body coveralls and disposable head covers (Tyvek or approved equal) and require that workers in the Work Area wear them. Provide a sufficient number for required changes, for workers in the Work Area.
- B. Boots: Provide work boots with non-skid soles, and where required by OSHA, foot protection, for workers. Provide boots at no cost to workers. Paint uppers of boots red with waterproof enamel. Do not allow boots to be removed from the Work Area for any reason, after being contaminated with asbestos-containing material. Dispose of boots as asbestos-contaminated waste at the end of the work.
- C. Hard Hats: Provide head protection (hard hats) as required by OSHA for workers, and provide 4 spares for use by Owner's Technical Representative, Project Administrator, and Owner.

Label hats with same warning labels as used on disposal bags. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury. Provide hard hats of type with plastic strap type suspension. Require hats to remain in the Work Area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from Work Area at the end of the work.

- D. Goggles: Provide eye protection (goggles) as required by OSHA for workers involved in scraping, spraying, or any other activity which may potentially cause eye injury. Thoroughly clean, decontaminate and bag goggles before removing them from Work Area at the end of the work.
- E. Gloves: Provide construction grade work gloves to workers and require that they be worn at all times in the Work Area. Do not remove gloves from Work Area and dispose of as asbestos-contaminated waste at the end of the work.

2.4 AIR PURIFYING RESPIRATORS

- A. Filter Cartridges: Provide, at a minimum, HEPA type filters labeled with NIOSH and MSHA Certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.
- B. Do not use single use, disposable or quarter face respirators.

2.5 ADDITIONAL PROTECTIVE EQUIPMENT

- A. Respirators, disposable coveralls, head covers, and footwear covers shall be provided by the Contractor for the Owner's Technical Representative, Project Administrator, and other authorized representatives who may inspect the job site. Provide two respirators and six complete coveralls and, where applicable, six respirator filter changes per day.

2.6 FALL PROTECTION EQUIPMENT

- A. All fall hazards should be identified at work sites with the potential for elevated work. Once an elevated fall hazard has been recognized, an appropriate control measure must be selected. Priority should be given to elimination of the fall hazard over the use of fall protection equipment. Approved safety harnesses and shock-absorbing lanyards or self-retracting lifelines (SRLs) shall be worn by employees whose work exposes them to falls of greater than six (6) feet. Anchorage points for lanyards or SRLs should be located at a level no lower than the employee's waist to limit the free fall distance to a maximum of 4 feet and to not allow the employee to contact the next lower work level, where practical. All fall protection devices should be used only in accordance with manufacturer's recommendations. All fall protection devices shall be inspected daily before use. Any lifeline, harness, or lanyard actually subjected to in-service loading (a fall) should be immediately removed from service and not used again for employee fall protection. Anchor points and lanyards capable of supporting a minimum force of 5,400 pounds should be used. Employees who are required to wear fall protection must be trained in the use of the equipment, as well as in fall protection work practices.

PART 3 – EXECUTION

3.1 SCOPE OF WORK:

Material to be removed: materials previously-identified are located in the below table. The subject building was not vacant at time of inspection, therefore latent materials may exist. The Contractor shall be responsible for selective demolition to locate hidden and inaccessible materials and providing unit prices for abatement of such materials prior to abatement.

3.2 MEASUREMENT AND PAYMENT

The Asbestos Project Monitor and Contractor shall record daily the ACM quantities abated. At the completion of the project, if quantities removed are less than those listed in the below table, the Contractor is to issue a credit to the Owner, based on Unit Prices listed in the Bid Form, or will be paid at the same Unit Prices should the quantities abated be greater than the quantities listed in the below table.

Material Description	Location	Est. Quantity	Units
Pipe Insulation and Fittings >6-Inches in Diameter	Pipe Trench, Behind Wet Walls, Boiler Room, Fixed Walls, Tunnels	3,500	LF
Pipe Insulation and Fittings < 6-Inches in Diameter	Pipe Trench, Behind Wet Walls, Boiler Room, Fixed Walls, Tunnels	14,000	LF
Thermal System Insulation	Breeching in Boiler Room, Generator Exhaust Insulation	1,200	SF
Vinyl Floor Tiles and Mastic, Various Colors	Classrooms and Offices	94,000	SF
Doors with Fire Insulation	Majority of Classroom Doors with Windows, Doors Without Windows, Ten Doors in Cafetorium and Metal Doors at Electric and Transformer Room	245	EA
Wood Door Window Glaze	Majority of Classroom Doors with Windows	200	EA
Pink and Black Sink Coating	Science, Art, Break Rooms, Various Rooms	50	EA
Interior Window Glaze	Doors and Sidelights in Hall Assemblies	25	EA
Interior Window Glaze	2'x3' Windows Above Doors to Classrooms and Other to Hallways and Some Divider	200	EA
Interior Window Glaze	Admin Area, Offices in Kitchen Areas, Locker Rooms, Tech Areas. Majority 4'x4'	80	EA
Interior Vertical Caulking	Room 162	100	LF

Material Description	Location	Est. Quantity	Units
Slate Window Sills Including Grout	Classrooms, Offices, Some Tech	2,200	LF
Black Mastic	Under Wood Floor In Gym	8,200	SF
Slate Boards With Glue Daubs	Classrooms	100	EA
Old Flex Connectors	On HVAC Near Ceiling in Technical Classrooms (HVAC, Auto Shop, Etc.), Gym, Other Areas in Tunnel or Fixed Walls	50	EA
Gaskets	Located on Piping Connections, Valves, Ts	500	EA
Walk In Refrigerator and Freezer Mastic	Cafeteria Kitchen and Kitchen for Foodservice	4	EA
Boilers	Interior Components, Boiler Room and Pool Area	3	EA
Vault Door Fireproofing	Admin Area	1	EA
Dry Transformer Transite	Noted on Walls in Tech Shops	20	EA
Transite in Switch Gear	In Electric Room, Typical Panels are 12"x6" with 20 Per Switch	100	EA
Fire Brick	Chimney Lining	1	EA
Transite Fume Hood	Science, Chemistry	1	EA
Gray Caulk *also assumed to contain PCBs	On Metal Flashing, Wood Shop to Low Roof	200	LF
Expansion Joint Caulk * assumed to contain PCBs	Non-ACM Caulk at Exterior Gym, Pool, Tech Shops, Interior Gym, Pool, Hall Near Gym	2,600	LF
Gray Window Glaze *also assumed to contain PCBs	On Fiberglass Frosted Windows, Tech Shops, Gym, Pool. Approximate Sizes 10'x4', 20'x10', 6'x4'	190	EA

Material Description	Location	Est. Quantity	Units
Gray Window Caulk *also assumed to contain PCBs	Non-ACM Exterior Window Caulk, Assumed to Contain PCBs	6,500	LF
Gray Window Glaze *also assumed to contain PCBs	On Exterior Windows, Various Sizes, Approximately 15'x4', 8'x4', 6'x4', 10'x4', 4'x4', other various sizes. Quantity includes any old caulk under new.	250	EA
Gray Caulk *also assumed to contain PCBs	Around Exterior Univents	480	LF
Dark Brown Caulk * also assumed to contain PCBs	Exterior of Chimney	40	LF
Roofing Asphaltic Type	Sloped Roof on Main School Building, Outbuilding with Football Training Gear and Wood Sheds Outside of Wood Shop	11,600	SF
Exterior Vapor Barrier	Black Coating on Copper Behind Brick Façade, Lower Courses Only	8,500	SF
Exterior Door Caulk *also assumed to contain PCBs	Exterior Doors, Old Under New	600	LF
Subsurface Transite	Subsurface	1,000	LF

The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 5%) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contract. Suspect materials that were sampled and do not contain ACM are listed in the Hazardous Materials Summary Reports.

All quantities are approximate. The survey was conducted in an occupied building, thus the Contractor must investigate all areas prior to abatement. The Contractor shall also be responsible for the review of the demolition drawings, notes and phasing configurations. The contractor must include in their bid the entire scope of work listed in the above table.

1. The Contractor shall provide limited demolition of walls, ceilings to access hidden spaces that may contain suspect ACM prior to abatement. The asbestos contractor shall remove identified ACM. Asbestos abatement shall be done with negative pressure enclosures. Contractor shall locate all and abate all ACM before removing containment. If Contractor fails to abate all ACM, then new containment will be set up at no cost to owner.
2. Fiberglass and non-ACM pipe insulation was identified at various locations at the Site. The Contractor shall protect the fiberglass and non-ACM insulations at no additional cost to the owner.
3. Multiple layers of floor tiles may exist, the unit price shall include floor tile, mastic, floor leveling compound, wood floor, hydraulic topping layer, carpet and carpet glue. Some floor tile is located under wood floors in select classrooms. All flooring to be removed to a clean substrate.
4. Contractor shall remove and properly dispose the windows, curtain wall system, including, but not limited to, screens, windows, plywood, doors, metal panels, glass, glass blocks, frames, sashes, metal frames, casings, sills, louvers, unit vents grills, shims, fasteners, anchors, sealants, flashings (window wall system). Remove and properly dispose caulk/debris identified on the floor of the building exterior. A single windowpane is not a window. Windows are defined by all within the opening.
5. Residual ACM window caulk abatement shall be performed using HEPA attachments or wet removal methods. No visible emissions or residual debris shall be permitted.
6. ACM debris identified shall be abated and disposed as ACM at no additional cost to the Owner. If soil is impacted, Contractor shall remove up to 2" of soil within an area delineated by the Asbestos Project Monitor beyond depth of visible debris.
7. Dismantle, clean, remove and dispose of all boilers under full containment conditions due to likelihood of interior ACM such as millboard, packings, gaskets.
8. Contractor shall deliver the waste shipment records to the Owner within 35 days of when the waste leaves the Site, in accordance with NESHAPS.
9. The Contractor is responsible for ALL analytical testing for disposal. The analytical shall only be of the waste stream after removal from the building. No sampling of any medium for PCBs or other compounds is allowed.
10. The contractor is responsible for all containments, whether poly, wood, or other material as project conditions require.
11. Limitations during the survey prevented access to some rooms. Contractor shall investigate and locate all unforeseen ACM (behind walls or fixed ceilings) before air clearance and containment breakdown is initiated.

3.3 PREPARATION

- A. Sequence of Work: Carry out work of this section sequentially. Complete each activity before proceeding to the next.
- B. General:
1. The work of this part is required for the removal of all types of ACM, including both friable and nonfriable materials, unless otherwise noted.
 2. Work Area: The location where asbestos-abatement work occurs. It is a variable of the extent of work of the Contract. It may be a portion of a room, a single room, or a complex of rooms. A "Work Area" is considered contaminated during the work and must be isolated from the balance of the building and decontaminated at the completion of the asbestos-control work.
 3. Completely isolate the Exclusion Zone at roof level by erecting barrier warning tape and attaching asbestos warning signs every 50' to exclude unauthorized personnel from inadvertently entering the work area.
 4. Erect barrier warning tape with asbestos warning signs every 50' directly below the work area. In addition, secure 6 mil polyethylene sheeting at the base of the building directly below the work area(s) extending out 15' to catch any debris that may fall from the roof level.
 5. Seal the exterior side of all windows and vents at the upper level with 6 mil polyethylene sheeting, secured with duct tape. In addition, seal any openings, vents, skylights at the roof level with 6 mil polyethylene sheeting.
 6. Provide warning signs at each roof hatch or door leading to the roof reading as follows:

Legend	Notation
KEEP OUT	3" Sans Serif Gothic or Block
BEYOND THIS POINT	1" Sans Serif Gothic or Block
ASBESTOS ABATEMENT WORK	1" Sans Serif Gothic or Block
IN PROGRESS	1" Sans Serif Gothic or Block
BREATHING ASBESTOS DUST MAY BE HAZARDOUS TO YOUR HEALTH	14 Point Gothic

At exclusion zone barrier tape post an approximately 20-inch by 14-inch manufactured caution sign every 50' displaying the following legend with letter sizes and styles of a visibility required by 29 CFR 1926:

LEGEND
DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED
ASBESTOS ABATEMENT
028213 - 1

IN THIS AREA

- E. Alternate Methods of Enclosure: Alternate methods of containing the Work Area may be submitted to the Owner's Technical Representative for approval. Do not proceed with any such method(s) without approval of the Owner's Technical Representative.
- F. Prepare Area:
 - 1. Protect building and other surfaces in the Exclusion Zone from damage from water and high humidity and from contamination from asbestos-containing debris, slurry or high airborne fiber levels by covering with a primary barrier as described below.
 - 2. Sheet Plastic: Utilize 6 mil reinforced fire-retardant polyethylene sheeting to cover surfaces in the exclusion zone.
 - a. Cover **roof** from base of parapet wall extending out 10' with 2 layers of 6 mil reinforced fire-retardant polyethylene sheeting.
 - b. Repair of Damaged Polyethylene Sheeting: Remove and replace plastic sheeting that has been damaged by removal operations or where seal has failed allowing water to seep between layers. Remove affected sheeting and wipe down entire area. Install new sheet plastic only when area is completely dry.

3.4 WORKER PROTECTION AND DECONTAMINATION PROCEDURES

- A. The work of this part is required for the removal or other abatement of all types of ACM, including both friable and nonfriable materials unless otherwise noted.
- B. Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work. The following procedures are minimums to be adhered to regardless of fiber count in the Work Area.
- C. Each time Work Area is entered remove street clothes in the Changing Room of the Personnel Decontamination Unit and put on new disposable coverall, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.
- D. Require workers to adhere to the following personal decontamination procedures whenever they leave the Work Area:
 - 1. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the equipment room.
 - 2. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:
 - 3. Thoroughly wet body including hair and face. If using a Powered Air-Purifying Respirator (PAPR) hold blower unit above head to keep canisters dry.
 - 4. With respirator still in place thoroughly wash body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR. Pay attention to seal between face and respirator and under straps.

5. Take a deep breath, hold it and/or exhale slowly, completely wet hair, face, and respirator. While still holding breath, remove respirator and hold it away from face before starting to breath.
 6. Carefully wash face piece of respirator inside and out.
 7. If using PAPR, shut down in the following sequence, first cap inlets to filter cartridges, then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.
 8. Dispose of wet filters from air purifying respirator.
 9. Rinse thoroughly.
 10. Rinse shower room walls and floor prior to exit.
 11. Proceed from shower to Changing Room and change into street clothes or into new disposable work clothes.
- E. Within Work Area: Require that workers NOT eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the Work Area. To eat, chew, drink or smoke, workers shall follow the procedure described above, and then dress in street clothes before entering the non-Work Areas of the building.

3.5 RESPIRATORY PROTECTION

- A. Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.
- B. Require that a respirator be worn by anyone in a Work Area at all times, regardless of activity, during a period that starts with any operation which could cause airborne fibers until the area has been cleared for re-occupancy in accordance with Article 1.10 of this Section.
- C. Regardless of Airborne Fiber Levels: Require that the minimum level of respiratory protection used be half-face air-purifying respirators with high efficiency filters.
- D. Do not allow the use of single-use, disposable, or quarter-face respirators for any purpose.
- E. Fit Testing:
 1. Initial Fitting: Provide initial fitting of respiratory protection during a respiratory protection course of training set up and administered by a Certified Industrial Hygienist. Fit types of respirator to be actually worn by each individual. Allow an individual to use only those respirators for which training and fit testing has been provided.
 2. On a Weekly Basis, check the fit of each worker's respirator by having irritant smoke blown onto the respirator from a smoke tube.
 3. Upon Each Wearing: Require that each time an air-purifying respirator is put on it be checked for fit with a positive and negative pressure fit check in accordance with the manufacturer's instructions or ANSI Z88.2 (1980).

- F. Type of Respiratory Protection Required: Provide respiratory protection as indicated in accordance with OSHA requirements. In the event that an initial exposure assessment has previously been conducted, determine the proper level of protection by dividing the expected or actual airborne fiber count in the Work Area by the appropriate "protection factors" specified by OSHA for various types of respirators. The level of respiratory protection that supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below the permissible exposure limit (PEL) is the minimum level of protection allowed.
- G. Permissible Exposure Limit (PEL):
1. 8-Hour Time Weighted Average (TWA) of asbestos fibers to which any worker may be exposed shall not exceed 0.1 fiber/cc.
 2. 8-Hour Time Weighted Average (TWA) and Ceiling Concentration of asbestos fibers based on a 30-minute period to which any worker may be exposed shall not exceed 1.0 fiber/cc.
 3. Contractor shall assess asbestos operations for their potential to generate airborne fibers. Contractor shall use exposure-monitoring data to assess worker exposures.
 4. Fibers: For purposes of this section, fibers are defined as all fibers regardless of composition as counted in the OSHA Reference Method (ORM), or NIOSH 7400 procedure.
- H. Air Purifying Respirators:
1. Negative pressure - half or full-face mask: Supply a sufficient quantity of respirator filters approved for asbestos, so that workers can change filters during the workday. Require that respirators be wet-rinsed, and filters discarded, each time a worker leaves the Work Area. Require that new filters be installed each time a worker re-enters the Work Area. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use.
 2. Powered air purifying - half or full-face mask: Supply a sufficient quantity of high efficiency respirator filters approved for asbestos so that workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement. Require that regardless of flow, filter cartridges be replaced after 40 hours of use. Require that HEPA elements in filter cartridges be protected from wetting during showering. Require entire exterior housing of respirator, including blower unit, filter cartridges, hoses, battery pack, face mask, belt, and cords be washed each time a worker leaves the Work Area. Caution should be used to avoid shorting battery pack during washing. Provide an extra battery pack for each respirator so that one can be charging while one is in use.
- I. Type "C" Respirator: Continuously monitor the air system operation including compressor operation, filter system operation, backup air capacity and warning and monitoring devices at all times that system is in operation. Assign an individual, trained by manufacturer of the equipment in use or by a Certified Industrial Hygienist, in the operation and maintenance of the system to provide this monitoring. Assign no other duties to this individual that will take him away from monitoring the air system.

3.6 REMOTE DECONTAMINATION UNITS

- A. Remote Personnel Decontamination Unit: Provide a Remote Personnel Decontamination Unit to be constructed as close to the exclusion zone as practical and consisting of a serial arrangement of connected rooms or spaces, Clean Room, Shower Room, Equipment Room with airlocks between spaces. Require all persons without exception to pass through this Decontamination Unit for entry into and exiting from the Work Area for any purpose. Do not allow parallel routes for entry or exit. Do not remove equipment or materials through Personnel Decontamination Unit. Provide temporary lighting within Decontamination Units as necessary to reach a lighting level of 100-foot candles.
1. Changing Room (clean room): Provide a room that is physically and visually separated from the rest of the building for the purpose of changing into protective clothing.
 - a. Construct using polyethylene sheeting, at least 6 mil in thickness, to provide an airtight seal between the Changing Room and the rest of the building.
 - b. Locate so that access to Work Area from Changing Room is through Shower Room.
 - c. Separate Changing Room from the building by a sheet plastic flapped doorway.
 - d. Require workers to remove street clothes in this room, dress in clean, disposable coveralls, and don respiratory protection equipment. Do not allow asbestos-contaminated items to enter this room. Require Workers to enter this room either from outside the structure dressed in street clothes, or naked from the showers.
 - e. An existing room may be utilized as the Changing Room if it is suitably located and of a configuration whereby workers may enter the Changing Room directly from the Shower Room. Protect surfaces of room with sheet plastic as set forth in Temporary Enclosures. Authorization for this must be obtained from the Owner's Technical Representative in writing prior to start of construction.
 - f. Maintain floor of changing room dry and clean at all times. Do not allow overflow water from shower to wet floor in changing room.
 - g. Damp wipe surfaces twice after each shift change with a disinfectant solution.
 - h. Provide posted information for emergency phone numbers and procedures.
 2. Airlocks: Provide an airlock between Clean Room and Shower Room and an airlock (3' minimum) between shower room and equipment room.
 3. Shower Room: Provide a completely watertight operational shower to be used for transit by cleanly dressed workers heading for the Work Area from the Changing Room, or for showering by workers headed out of the Work Area after undressing in the Equipment Room.
 - a. Construct room by providing a shower pan and 2 shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wooden floor in shower pan at elevation of top of pan.
 - b. Separate this room from the rest of the building with airtight walls fabricated of two layers of 6-mil polyethylene.
 - c. Provide showerhead and controls.
 - d. Provide hot and cold water.
 - e. Provide temporary extensions of existing hot and cold water and drainage, as necessary for a complete and operable shower.
 - f. Provide a soap dish and a continuously adequate supply of soap and maintain in sanitary condition.
 - g. Arrange so that water from showering does not splash into the Changing or Equipment Rooms.

- h. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the Work Area.
 - i. Provide flexible hose shower head.
 - j. Pump waste water to drain or to storage for use in amended water. If pumped to drain, provide 20 micron and 5 micron wastewater filters in line to drain or waste water storage. Change filters daily or more often if necessary. Locate filters inside shower unit so that water lost during filter changes is caught by shower pan.
 - k. Provide hose bib.
- 4. Equipment Room (contaminated area): Require work equipment, footwear and additional contaminated work clothing to be left here. This is a change and transit area for workers.
 - a. Separate this room from the rest of the building with airtight walls fabricated of two layers of 6-mil polyethylene.
 - b. Provide a drop cloth layer of sheet plastic on floor in the Equipment Room for every shift change expected. Roll drop cloth layer of plastic from Equipment Room into Work Area after each shift change. Replace before next shift change. Provide a minimum of two (2) layers of plastic at all times. Use only clear plastic to cover floors.

B. Signs:

- 1. Post an approximately 20-inch by 14-inch manufactured caution sign at each entrance to the Exclusion Zone displaying the following legend with letter sizes and styles of a visibility required by 29 CFR 1926.1101.

LEGEND

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED
IN THIS AREA

- a. Provide signs in both English and Spanish.
 - b. Provide spacing between respective lines at least equal to the height of the respective upper line.
- 2. Post an approximately 10-inch by 14-inch manufactured sign at each entrance to each Work Area displaying the following legend with letter sizes and styles of a visibility at least equal to the following:

LEGEND	NOTATION
NO FOOD, BEVERAGES OR TOBACCO PERMITTED	3/4" Block
ALL PERSONS SHALL DON PROTECTIVE CLOTHING (COVERINGS) BEFORE ENTERING THE WORK AREA	3/4" Block
ALL PERSONS SHALL SHOWER IMMEDIATELY AFTER LEAVING WORK AREA AND BEFORE ENTERING THE CHANGING AREA	3/4" Block

3.7 ASBESTOS REMOVAL

A. Pre-work inspection

1. Do not begin any work in any abatement work area until the Owner's Technical Representative has performed a pre-work inspection. It is the Contractor's responsibility to notify the Owner's Technical Representative of their schedule and anticipated dates for the pre-work inspection.
2. Inspection will be performed to assure all work area preparations are in place, as described herein. Any deficiencies in work area preparations will be corrected at this time. Work may not proceed until the Contractor receives written authorization from the on-site representative of the Owner's Technical Representative.

B. Wet Removal:

1. Thoroughly wet to satisfaction of Owner's Technical Representative Asbestos-Containing Materials to be removed prior to stripping to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet to the substrate without causing excess dripping. Allow time for amended water or removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions.
2. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
3. Remove intact, saturated Asbestos-Containing Material in small sections from all areas. Do not allow material to dry out. For roofing or ceilings, lower ACM to ground—do not drop ACM from any height. As it is removed, simultaneously package material while still wet into disposal bags or other appropriate waste container. Twist neck of bags bend over and seal with minimum three wraps of duct tape.
4. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.

C. Clean substrate from which ACM was removed by wet wiping and using a HEPA vacuum until no visible debris remains.

- D. Encapsulation of Substrate: Perform encapsulation of substrate to lockdown any nonvisible fibers that may be remaining.

3.8 WORK AREA DECONTAMINATION

- A. General: Decontamination of the Work Area following asbestos abatement.
1. Once the affected substrates are deemed clean by Owner's Technical Representative, Contractor shall collect all polyethylene sheeting to be disposed of as ACM waste and HEPA vacuum the general area.
 2. In both cases operation of the pressure differential system is used to remove airborne fibers generated by the abatement work.

3.9 DISPOSAL OF ASBESTOS WASTE

- A. Disposal Bags or Polyethylene Sheet Wrapping: Provide 12 mil thick, in total, leak-tight polyethylene bags or sheet wrapping, to contain all waste. On outermost layer, apply three labels with text as follows:

1. First Label:

CAUTION
CONTAINS ASBESTOS FIBERS
AVOID OPENING OR BREAKING CONTAINER
BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH

2. Second Label: Provide in accordance with 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING AIRBORNE ASBESTOS, TREMOLITE, ANTHOPHYLLITE, OR
ACTINOLITE FIBERS IS HAZARDOUS TO YOUR HEALTH

3. Third Label: Provide in accordance with U.S. Department of Transportation regulation on hazardous waste marking. 49 CFR parts 171 and 172. Hazardous Substances: Final Rule. Published November 21, 1986 and revised February 17, 1987:

RQ HAZARDOUS
SUBSTANCE,
SOLID, NOS,
ORM-E, NA 9188
(ASBESTOS)

4. Fourth Label: Provide in accordance with U.S. Department of Environmental Protection Regulation of the National Emission Standards for Hazardous Air Pollutants 40 CFR Part 61.150(v) Asbestos NESHAP Revision, Final rule.

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- B. Carefully load containerized waste in fully enclosed dumpsters, trucks or other appropriate fully enclosed vehicles for transport. Exercise care before and during transport, to ensure that no unauthorized persons have access to the material.
 - 1. Do not store containerized materials outside of the Work Area. Take containers from the Work Area directly to a sealed truck or dumpster.
 - 2. Do not transport disposal bagged materials on open trucks. Label drums with same warning labels as bags. Uncontaminated drums may be reused. Treat drums that have been contaminated as asbestos-containing waste and dispose of in accordance with this specification.
- C. Employ a waste hauler with required licenses from state and local authority with jurisdiction to haul the waste from the abatement work.
- D. Dispose of waste in a landfill that accepts asbestos waste materials. Advise the landfill operator or processor, at least ten days in advance of transport, of the quantity of material to be delivered. All waste shall be delivered to only **one** landfill.
- E. At disposal site unload containerized waste. At a disposal site, sealed plastic bags may be carefully unloaded from the truck. If bags are broken or damaged, repair or re-bag materials. Clean entire truck and contents, as appropriate.
- F. Retain receipts from landfill or processor for materials disposed.
- G. At completion of hauling and disposal of each load, submit copy of waste shipment record (WSR) and landfill receipt to the Owner's Technical Representative. The WSR must be returned to the Building Owner in no more than 35 days.

3.10 REMOVAL OF WORK AREA ISOLATION:

- A. Perform work specified in this article only after all requirements of this Section and Work Area Visual Clearance have been met:
- B. Remove the warning barrier tape and asbestos warning signs separating the exclusion zone from adjacent spaces.
- C. Remove equipment, materials, and debris from the work site.
- D. Dispose of asbestos-containing waste material as specified in Article 3.07 of this Section.

3.11 SCHEDULE OF REMOVALS

- A. Conduct asbestos abatement work as specified in accordance with lettered line items and Asbestos Abatement Summary Tables. Use appropriate engineering tools for exterior work such as windows, roofs, coping tar.
- B. Contractor shall carefully pry up wooden floors in select classrooms prior to removing floor tile underneath.
- C. Because there is no way to guarantee that all ACM were identified during the building inspection conducted by CDW and dated April and June and December 2017, it is possible that additional ACM is present other than that identified herein. If any suspect materials are

uncovered during abatement activities or demolition work that are not detailed in this design, these materials shall be removed under unit pricing, after testing.

END OF SECTION 028213

SECTION 028313

HAZARDOUS MATERIALS HANDLING AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. Comply with the United States Environmental Protection Agency (USEPA) Renovation, Repair, and Painting (RRP) Rule Title 40 CFR, Part 745 and the Occupational Safety and Health Administration (OSHA) Demolition Involving Lead-Based Paint regulation (Title 29 CFR, Part 1926.62).
- B. Comply with USEPA Resource Conservation and Recovery ACT (RCRA) regulations located at Title 40 CFR, Part 263 for disposal of hazardous wastes.
- C. Conduct the work as described herein, including but not limited to, the following:
1. Handling, containerizing, packaging, re-handling, documentation, permits, health and safety, transportation and disposal of all items identified.
 2. Removal, characterization and disposal of containers, drums, and unknown materials.
 3. File necessary notices, obtain all permits and licenses, prepare USEPA-required PCB Abatement Work Plans, and pay all governmental taxes, fees, and other costs associated with the Work. Obtain necessary approvals of governmental departments having jurisdiction of the Work.
- D. Develop and implement a Health and Safety Plan.
- E. Demolition, handling, transportation, and disposal of hazardous materials and building materials which are coated with lead-based paint (LBP).
1. Personnel who disturb LBP shall be properly trained and qualified; use appropriate personal protection; use methods that do not create lead dust, chips, or fumes; and properly dispose or recycle components that are coated with LBP.
 2. Dispose of LBP wastes in accordance with governing laws and regulations; pay costs of permits and disposal.
- F. Identify, sample for disposal, package, label, document, remove, transport and dispose of containerized waste, refrigerants, oils, lubricants, paints, coatings, cleaners, lighting ballasts and fluorescent lamps, mercury switches, transformers, thermostats and any discovered items behind fixed walls or buried vaults.

G. Related Sections:

1. Section 028213, Asbestos Abatement.
2. Section 003100b, Hazardous Material Summary Report

1.3 SUBMITTALS

- A. The Contractor shall be made aware that LBP exists on painted surfaces throughout the building.
- B. The Contractor is required to ensure the protection of workers performing asbestos abatement and any related demolition work that will affect surfaces coated with LBP, as well as protecting the public and the environment from exposure to lead-containing dusts.
- C. Contractor is responsible to either sample and analyze painted surfaces or assume that all existing painted surfaces are coated with LBP. Contractor is responsible for costs for sampling and analysis, at no additional cost to the Owner.
- D. The responsibilities of the Contractor in this Section include the furnishing of labor, materials and equipment required to remove, contain, recover, and dispose lead coatings and associated waste.
1. Removal of paint from surfaces to facilitate demolition;
 2. Removal of temporary containment system structures daily, or as allowed by the Architect;
 3. Hazardous waste characterization sampling and analysis and disposal of abatement or demolition debris generated as a result of LBP removal and demolition in accordance with requirements of this section and Federal and State regulations pertaining to hazardous and solid wastes;
 4. Personal air sampling as required by OSHA for Contractor's employees that have the potential for exposure to airborne lead dusts as outlined in this section.
- E. The Work of this Contract shall conform to the standard set by the applicable Federal, State and Local laws, regulations, ordinance and guidelines as they exist at the time of the Work and as may be required by subsequent regulations.
- F. The Contractor and their subcontractors shall, at their own cost and expense, comply with laws, ordinance, rules and regulations of Federal, State, Regional and Local authorities during demolition, work preparations, sanding, cutting, burning, scraping, painting over, grinding and regarding handling, storing, transporting and disposing LBP and lead-contaminated waste materials.
- G. The Contractor shall submit to the Owner's representative prior to commencing the Work the following:
1. Written respiratory and notification program
 2. Written lead compliance program in accordance with OSHA regulations including:

- a. Current training requirements, state certifications.
 - b. Supervisor qualifications.
 - c. Written compliance program specific to this project
 - d. Current (within 12 months) respirator fit test records.
 - e. Current medical monitoring and surveillance certificates.
- 3. Insurance certificates.
- H. Work Plan: Site-specific OSHA compliant plan with sequencing with identification of temporary storage areas.
- I. Permits for Transport and Disposal of Waste and Debris: Submit copies of manifests and receipts within 30 days of completion of the Work.
- J. Laboratory analytical results for waste disposal characterization.
- K. Personnel protection plan.

1.4 REGULATORY REQUIREMENTS

- A. The following references are cited as current applicable publications. The Work is subject to compliance with all regulations including but not limited to:
 - 1. OSHA Title 29 CFR 1910.1025 and 29 CFR Part 1926.62.
 - 2. USEPA, Resource Conservation and Recovery Act (RCRA).
 - 3. Commonwealth of Massachusetts, Department of Labor Standards 454 CMR 11.00, Structural Painting Safety Code, as currently amended.
 - 4. Commonwealth of Massachusetts, Department of Labor Standards 454 CMR 22.00.
 - 5. Commonwealth of Massachusetts, Department of Environmental Protection, Hazardous Materials Regulations at 310 CMR 30.00 as currently amended.
 - 6. Commonwealth of Massachusetts, Department of Environmental Protection, 310 CMR 6.0-8.0.

1.5 OTHER HAZARDOUS MATERIALS

- A. The Contractor is hereby informed that equipment, switches or transformers containing PCBs, and mercury-containing lamps, thermostats or switches may exist within the building. Equipment and fixtures containing hazardous materials must remain intact for proper disposal.
- B. Responsibility for Hazardous Material Identification: The Contractor shall be responsible for taking necessary measures, methods or procedures appropriate to safeguard the health and safety of workers, visitors, and members of the public with respect to identification and of previously unidentified hazardous materials during the Work.

- C. Contractor shall be solely responsible for means and methods, and techniques used in the identification, sampling, collection, segregation, transportation and disposal of Hazardous Materials. Contractor is responsible for all sampling for laboratory sampling and analysis for disposal.
- D. Contractor shall at their own cost and expense comply with the Federal, State, and local laws, ordinance, rules and regulations during dismantling, demolition, and cutting of equipment containing hazardous materials, and the handling, storing, transportation and disposal of hazardous materials.
- E. Contractor shall be responsible for immediately notifying the Owner of evidence of a release of hazardous materials into the building or to the environment.
- F. Limited sampling was conducted for poly-chlorinated biphenyls (PCBs) in building materials such as caulk, paint and expansion joint. No PCBs were detected in building materials sampled. NO sampling by the Contractor or affiliates of the Contractor (subcontractors or sub consultants) for total PCBs shall be performed at any point during the performance of the work specified herein. If disposal facilities require PCB analytical testing of the waste stream, then Contractor is responsible for said testing at no cost to owner.

PART 2 - EXECUTION

2.1 EXECUTION

- A. Prior to the commencement of work that may cause employees to be exposed to an airborne concentration of lead above the Permissible Exposure Limit (PEL), isolate the work area.
- B. Provide personnel monitoring, air sampling, recording and reporting in accordance with OSHA standards when work involving a potential exposure to airborne lead is in progress.
- C. Dispose of hazardous wastes and materials contaminated by lead-based paint in accordance with applicable regulations and guidelines, including the requirements of the Resource Conservation and Recovery Act (RCRA). Lead containing materials must be tested for Toxicity Characteristic Leaching Procedure (TCLP) analysis to determine appropriate disposal requirements.

2.2 SCHEDULE OF REMOVALS

- A. Hazardous Material Locations – Any painted surfaces to be affected during building renovation. The Contractor is responsible for verifying final quantities prior to start of work. Contractor is responsible for characterizing via laboratory analysis all materials for disposal at no cost to owner. The following areas contain LBP:

Description	Lead Concentration (% Weight)
White Paint on Wood-Sloped Roof Under Soffit	2.5
White Paint on Wood Main Roof	6.7
Gray Paint on Roof Stair Rail	12
Brown Over Red Stair Rail Paint	20
Silver Paint on Bleachers Football Field	0.71

B. Other Materials:

Material Description	Location	Est. Quantity	Units
Compact Fluorescent Bulbs	Throughout	200	EA
Fluorescent Bulbs (Mercury)	Throughout	12000	Tubes
Electric Light Ballasts	Throughout	6000	Each
Thermostats and Switches (Mercury)	Throughout	500	Ampules
Emergency Light Batteries (Lead)	Throughout	80	EA
Refrigerants Associated With HVAC, Bubblers, HVAC Shop, Kitchen, Cooling Unit	Throughout	10000	Gallons
Fire Extinguishers (Compressed Gas)	Throughout	250	EA
Lead-Based Paint	Metal	NA	NA
Dark Room Chemicals	Dark Room	10	Gallons
Exit Signs (Tritium)	Throughout	80	EA
Chemicals in Sludge	Science Sink Traps, Drainage in Floor Trench, Science, Cosmetology, Xray, Auto Shop	50	Gallons
Laboratory Chemicals	Science Labs	Reuse	Reuse
Waste Oil and Other Fluids (Brake, Antifreeze, Etc.).	Automotive	20	Drums

Material Description	Location	Est. Quantity	Units
Fuel Oil UST	Subsurface	1	Each
Lead Backed Wall and Door	Dental Shop	Reuse	Reuse
Xray	Dental Shop	Reuse	Reuse
Old Door Retractors	Remnant-Classrooms, Main Doors, Offices, Assemblies	50	Each
Hydraulic Fluid	Old Hydraulic Reservoirs	200	Gallons
PCB Fluid	Transformers	200	Gallons

2.3 WORK PROCEDURE

- A. The work practices listed below are restricted during lead paint abatement activities:
1. Open-flame burning or torching is prohibited.
 2. Machine sanding or grinding or abrasive blasting or sandblasting is prohibited unless used with High Efficiency Particulate Air (HEPA) exhaust control which removes particles of 0.3 microns or larger from the air at 99.97 percent or greater efficiency.
 3. Dry scraping is permitted only in conjunction with heat guns or around electrical outlets or when treating defective paint spots totaling no more than 2 square feet in any one room, hallway or stairwell or totaling no more than 20 square feet on exterior surfaces.
 4. Operating a heat gun is permitted only at temperatures below 1100 degrees Fahrenheit.

2.4 WORK AREA CLEARANCE

- A. The work is complete when the work area is visually clean and the Contractor is to notify the Project Monitor that the area is ready for visual inspection. The visual inspection is performed to determine if deteriorated painted surfaces and/or visible amounts of dust or residual paint are still present.
- B. The visual inspection and clearance sampling are to be conducted by the Contractor's Certified Inspector.
- C. Following the visual inspection, clearance sampling for lead in dust shall be conducted. The clearance sampling shall be in accordance with 40 CFR 745.227(e)(8).

- D. Upon completion of the work area clearance the Contractor shall submit to the Owner's representative an abatement report prepared by the Certified Supervisor in accordance with 40 CFR 745.227(e)(10).

END OF SECTION 028313

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work in this Section includes the cast-in-place concrete work as shown on the Contract Drawings and specified herein, including, but not limited to, the following:

1. Furnishing, placing, finishing, curing and protection of all plain and reinforced concrete (normal weight and light weight), above and below grade, for buildings and site-related cast-in-place concrete.
2. Furnishing and erection of formwork, and removal of same.
3. Furnishing and placing of reinforcing steel, including dowels into masonry walls, welding to structural steel and related positioning and securing of all embedded accessories.
4. Furnishing and installation of admixtures, concrete surface conditioners, wedge inserts, masonry and dovetail anchors, flashing reglets and similar items in conjunction with concrete work.
5. Furnishing and installation of approved non-shrink cement grout under base and leveling plates.
6. Furnishing and installation of vapor barriers/retarders under slabs cast on grade.
7. Furnishing and installation of insulation under slabs cast on grade per the requirements in Section 07 21 00 – THERMAL INSULATION.
8. Furnishing and installation of pea-stone concrete fill at depressed slab areas and metal pan stairs and landings as indicated in the drawings.
9. Installation of items furnished by other Sections such as anchors, bolts, plates and embedded items required to be cast into concrete.
10. Make provisions in forms for proper location and installation of pipe sleeves, duct openings, keys, chases and electric boxes, as required by other trades.
11. Accessories as needed for a complete installation.

- B. Intent of Work

1. Except as specified otherwise herein, concrete shall be batched, mixed, placed, tested and cured in accordance with the American Concrete Institute's "Specifications for Structural Concrete for Buildings" ACI 301.
2. Subcontractor shall schedule his Work and notify all trades in ample time so that provisions for their Work can be made without delaying the progress of the Project.
3. It is the intention of the Drawings and Specifications to produce concrete which will present an acceptable finished appearance. Imperfections of material or Workmanship shall be corrected as directed by the Engineer's direction, at no additional cost to the Owner.
4. All of the Work that is to be inserted in the forms for attachment of other work is not described in detail. Sub-Contractor shall carefully examine all drawings and other Sections of these specifications for the extent and detail of all such work and coordinate this work with other trades.
5. The Construction Manager shall be responsible to insure that all concrete surfaces are completely free of any conditions which will adversely affect its finished appearance or the application of a specified finish.
6. Failure to comply with these requirements will require removal of sufficiently large Section of the Work, as determined by the Architect and Engineer, in order to properly integrate

CAST-IN-PLACE CONCRETE

the Section to be replaced with the architectural and structural requirements of the total project. All such removal and replacement shall be made at the expense of the Subcontract at no additional cost to the Owner.

7. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System of the US Green Building Council. Refer to Division 01 Section "LEED v4 BD+C REQUIREMENTS" for certification level and certification requirements.
8. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to the Owner's LEED v4 BD+C certificate goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
9. Section 01 81 13.40 – SPEC MATERIALS TRACKING MATRIX.

1.2 RELATED REQUIREMENTS

- A. The Conditions of the Contract and General Requirements of the Project Manual apply to this subcontractor, material suppliers and all other persons furnishing labor and materials under this Section. The General Conditions, Construction Manager's Supplementary Conditions, and applicable parts of Division 01 are included as part of this Section.
- B. Carefully examine all of the Contract Documents for requirements which affect the Work of this Section.
- C. Work described in other Sections which contain requirements applicable to the work of this Section, or with which this subcontractor must coordinate the Work of this Section include, but are not limited to the following:
 1. Section 00 31 00a – GEOTECHNICAL REPORT
 2. Section 01 45 23 – TESTING AND INSPECTING SERVICES.
 3. Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
 4. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
 5. Section 03 30 05 – WATER VAPOR REDUCING ADMIXTURE FOR CAST-IN-PLACE CONCRETE.
 6. Section 04 20 00 – UNIT MASONRY: reinforcing placement for CMU partitions.
 7. Section 05 12 00 – STRUCTURAL STEEL FRAMING
 8. Section 05 15 00 – STUD SHEAR CONNECTORS
 9. Section 05 21 00 – STEEL JOIST FRAMING
 10. Section 05 31 00 – STEEL DECKING
 11. Section 05 50 00 – METAL FABRICATIONS: for trench frames and covers, cast stair nosings and other items for embedment in concrete.
 12. Section 05 51 00 – METAL STAIRS
 13. Section 07 21 00 – THERMAL INSULATION: requirements for insulation furnished and installed by this Section under concrete slabs on grade.
 14. Section 09 30 00 - TILING
 15. Section 09 65 00 – RESILIENT FLOORING
 16. Section 09 65 66 – RESILIENT ATHLETIC FLOORING
 17. Section 11 40 00 – FOODSERVICE EQUIPMENT – coordination of depressed slabs for foodservice equipment.
 18. Section 11 66 23 – GYMNASIUM EQUIPMENT – coordination of sleeves to be cast in to concrete slabs for equipment posts.
 19. Section 12 48 13 – ENTRANCE FLOOR MATS AND FRAMES – coordination of recesses required for entry mat / grate recesses.

20. Section 14 24 00 – HYDRAULIC ELEVATORS – coordination of pit depth and sump requirements.
21. Section 21 00 10 – FIRE PROTECTION – coordination of housekeeping curbs required and sleeve penetrations of concrete slabs.
22. Section 22 00 10 – PLUMBING– coordination of housekeeping curbs required and sleeve penetrations of concrete slabs.
23. Section 23 00 10 – HEATING, VENTILATING AND CONDITIONING (HVAC) – coordination of housekeeping curbs required and sleeve and duct penetrations of concrete slabs.
24. Section 26 00 10 – ELECTRICAL – coordination of housekeeping curbs required and sleeve penetrations of concrete slabs.
25. Section 31 20 00 - EARTH MOVING
26. Section 31 20 13 - RAMMED AGGREGATE PIER SOIL REINFORCEMENT
27. Section 32 13 16 – CONCRETE PAVEMENT
28. Section 32 31 00 - CHAIN LINK FENCES AND GATES: Site features requiring cast-in-place concrete footings

1.3 REFERENCE STANDARDS

- A. Except as modified by the requirements specified herein and/or the details on the Drawings, all Work included in this Section shall conform to the applicable provisions of the following codes, standards and references as well as those specified in Section 01 41 00 – REGULATORY REQUIREMENTS and in the latest edition of the Massachusetts State Building Code (MSBC):

1. ASTM International; www.astm.org
 - a. A1064/A1064M-17 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - b. A615/A615M-07 – Standard Specification for Deformed and Plain Billet-steel Bars for Concrete Reinforcement
 - c. A706/A706M-06a – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
 - d. C33-03 – Standard Specifications for Concrete Aggregates
 - e. C94/C94M-06 – Standard Specification for Ready Mix Concrete
 - f. C150-05 – Standard Specification for Portland Cement
 - g. C171-92 – Standard Specification for Sheet Materials for Curing Concrete
 - h. C260-06 – Standard Specification for Air-entraining Admixtures for Concrete
 - i. C309-93 – Standard Specification for Liquid Membrane-forming Compounds for Curing Concrete
 - j. C330-05 – Lightweight Aggregates for Structural Concrete
 - k. C494/C494M-05a – Standard Specification for Chemical Admixtures for Concrete
 - l. C618-05 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - m. C685/C685M-01 – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
 - n. C989/C989M-12a – Standard Specification for Slag Cement for Use in Concrete and Mortars
2. ACI. American Concrete Institute; www.concrete.org
 - a. ACI 117-90 (Reapproved 2002) – Specifications for Tolerances of Concrete Construction and Materials
 - b. ACI 121R-04 – Quality Management System for Concrete Construction

- c. ACI 207.1R-96 – Mass Concrete
 - d. ACI 211.5R-01 – Guide for Submittal of Concrete Proportions
 - e. ACI 212.3R-04 – Chemical Admixtures for Concrete
 - f. ACI 212.4R-04 – Guide for the Use of High-Range Water-Reducing Admixtures (Superplasticizers) in Concrete
 - g. ACI 213R-03 – Guide for Structural Lightweight Aggregate Concrete
 - h. ACI 224R-01 – Control of Cracking in Concrete Structures
 - i. ACI 224.3R-95 (Reapproved 2001) – Joints in Concrete Construction
 - j. ACI 233R-03 – Slag Cement in Concrete and Mortar
 - k. ACI 301-05 – Specifications for Structural Concrete for Buildings
 - l. ACI 302.1R-04 – Guide for Concrete Floor and Slab Construction
 - m. ACI 302.2R-06 – Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials
 - n. ACI 303R-04 – Guide to Cast-In-Place Architectural Concrete Practice
 - o. ACI 303.1-97 – Standard Specification for Cast-In-Place Architectural Concrete
 - p. ACI 304R-00 – Guide for Measuring, Mixing, Transporting and Placing Concrete
 - q. ACI 304.2R-96 – Placing Concrete by Pumping Methods
 - r. ACI 304.5R-91 (Reapproved 1997) – Batching, Mixing, and Job Control of Lightweight Concrete
 - s. ACI 305R-88 (Reapproved 2002) – Hot Weather Concreting
 - t. ACI 306R-88 (Reapproved 2002) – Cold Weather Concreting
 - u. ACI 308R-01 – Standard Practice for Curing Concrete
 - v. ACI 309R-96 – Guide for Consolidation of Concrete
 - w. ACI 309.3R-92 (Reapproved 1997) – Guide to Consolidation of Concrete in Congested Areas
 - x. ACI 315 – ACI Detailing Manual - 2004
 - y. ACI 318-14 – Building Code Requirements for Structural Concrete
 - z. ACI 336.3R-93 (Reapproved 1998) – Design and Construction of Drilled Piers
 - aa. ACI 347-04 – Guide to Formwork for Concrete
 - bb. ACI 351.1R-99 – Grouting between Foundations and Bases for Support of Equipment and Machinery
 - cc. ACI 355.2-04 – Evaluating the Performance of Post-Installed Mechanical Anchors in Concrete
 - dd. ACI 503R-93 (Reapproved 1998) – Use of Epoxy Compounds with Concrete
 - ee. ACI 503.4-92 (Reapproved 2003) – Standard Specification for Repairing Concrete with Epoxy Mortars
 - ff. ACI 504R-90 (Reapproved 1997) – Guide to Sealing Joints in Concrete Structures
 - gg. ACI 544.3R-93 (Reapproved 1998) – Guide for Specifying, Proportioning, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete
 - hh. ACI 546R-04 – Concrete Repair Guide
- B. ANSI – American National Standards Institute
- 1. ANSI/ASCE 9-91 – Standard Practice for the Construction and Inspection of Composite Slabs
- C. AWS – American Welding Society
- 1. AWS D1.1-04 – Structural Welding Code-Steel
 - 2. AWS D1.4-98 – Structural Welding Code-Reinforcing Steel
- D. CRSI (MSP) – Manual of Standard Practice (28th edition)
- E. MSBC – The latest currently enforced edition of the Massachusetts State Building Code

- F. IBC – International Building Code, 2015, as amended by the MSBC.
- G. ADA – Americans with Disabilities Act 2010.
- H. MAAB – Massachusetts Architectural Access Board.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination per Section 01 30 00 – ADMINISTRATIVE REQUIREMENTS, and as follows:
 - 1. Coordinate concrete testing with Independent Testing Agency.
 - 2. Coordinate concrete inserts with all trades providing them to this subcontractor for installation.
- B. Pre-installation Meetings required per Section 01 30 00 – ADMINISTRATIVE REQUIREMENTS for foundations and slabs, and as follows: Installer of the Work of this Section is also required to attend pre-installation conference specified under Section 04 20 00 – UNIT MASONRY.

1.5 SUBMITTALS

- A. Refer to Section 01 30 00 – ADMINISTRATIVE REQUIREMENTS for submittal provisions and procedures.
- B. General
 - 1. Review of submittals is for general conformance with the design concept of the project and information shown on the contract documents only. The Construction Manager is responsible for conforming, correlating and coordinating dimensions in the field for tolerance, clearances, quantities, fabrication and installation processes, means and methods of construction, coordination of this work with other trades and performing work in a safe and satisfactory manner.
 - 2. Prior to final approval of Shop Drawings for exposed architectural concrete surfaces the Mock-up specified herein shall be completed and approved. Any modifications of the Mock-up formwork shall be incorporated into the Shop Drawings and other submittals.
- C. Shop Drawings: Comply with ACI 315 for reinforcement detailing, fabricating, bending and placing concrete reinforcement. Show bar schedules, stirrup spacing, bent bar diagrams and arrangement of concrete reinforcement.
 - 1. All reinforcing Shop Drawings for concrete and masonry walls shall be shown on wall elevations with a scale of 1/4 in. = 1 ft. 0 in.
 - 2. Include special reinforcing required for openings through concrete structures including but not limited to duct banks, conduits, waste water pipes, rain leaders.
 - 3. Submit shop drawings of all formwork for architecturally exposed concrete (Concrete Exposed to View) showing cone tie patterns.
 - 4. Submit Drawings of formwork design for review of form types, location of joints and ties, details of reveals, chamfers, textured surfaces and other visual aspects of concrete.
 - 5. Submit detailed drawings showing locations of all concrete joints (construction, contraction and expansion), curbs, depressions, sleeves and openings.
 - 6. Submit plans and other details showing sequence of concrete pours. This will be reviewed only for impact on the performance of the completed structure.

7. Submit detail drawings indicating position of waterstops and details to be used for all water tight construction.
8. Submit shop drawings detailing Mock-up if a Mock-up has been specified.
9. Submit shop drawings that include wall elevations, section details and dimensions for all walls, footings and any other concrete element.
10. Submit shop drawings that include saw-cut patterns on slab-on-grade and joint details at columns.

D. Concrete Curing and Protection:

1. Submit to the Architect/SER in accordance with the requirements of the Contract Documents, detailed methods proposed for use for curing and protection prior to commencement of concrete work, including
2. Cold and Hot Weather protection plan
3. Curing protection plan for footings, walls, slabs-on-grade, slabs-on-deck, beams, columns, etc.

E. Concrete Mix Design: Submit proposed mix designs for each class of concrete indicated in section 2.2. Include the following:

1. Copies of mix designs: Mix designs shall be prepared by an independent testing laboratory.
2. The mix design submittal shall list:
3. All materials, admixtures and their proportions.
4. Water and cement content, water cementitious material ratio, slump and combined aggregate gradation (percent retained on every sieve size).
5. Compressive Strength: Documentation of how the strength was determined.
6. Information on concrete materials as per paragraph 4.1.2.3 of ACI 301.
7. Whether mix is appropriate for pumping.
8. Indicate where each mix will be used.
9. This submittal shall include the results of all testing performed to qualify the materials and to establish the mix design. Include all calculations and tests required by ACI 318 Section 5.3.
10. Test results of total chloride in content.
11. Where shrinkage limit is specified, submit shrinkage test results.
12. For lightweight aggregate used, submit test results per ASTM C330-03.
13. For normal weight aggregate, submit test results per ASTM C33-05.

F. Product Data:

1. Submit product data for proprietary materials, the following products and those requested by the Architect and/or SER showing compliance with project specifications, manufacturer's recommendations, as well as known limitations. Provide certification that the following materials conform to the standards referenced in this section including, but not limited to:
2. Reinforcement
3. Form work and accessories
4. Admixtures
5. Cementitious materials used in mix design
6. Patching compounds
7. Water-stops
8. Joint systems
9. Curing materials
10. Dry-shake finish materials

11. Non-shrink grout
- G. Certifications: Submit certification by the manufacturers that each admixture conforms to requirements specified in this section and that the admixtures are compatible with one another.
- H. Submit cement mill tests.
- I. Upon completion of the concrete Work, deliver the records of concrete placement and the concrete batch tickets to the Architect and/or SER.
- J. Warranty:
 1. Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions and time periods for the coverage thereof.
- K. Samples:
 1. Submit samples and/or descriptive literature of materials, products and methods as noted herein and as otherwise requested by the architect and/or the SER.
 2. Prepare a 4 ft. – 0 in. x 4 ft. – 0 in. x 0 ft. – 6 in. thick sample on the site for the polished concrete flatwork using the approved concrete mix design, admixtures, sealers and joint sealers, a minimum of one month prior to casting the slabs, for approval by the Architect.
 3. Submit three representative samples of each concrete constituent including, but not limited to:
 4. Admixtures and topical treatments
 5. Form ties (including cones) and spreaders
 6. Accessories for reinforcement
 7. Reglets
 8. Form release agent
 9. Pre-molded joint filler
 10. Dovetail anchors
 11. Vapor retarder
 12. Under-slab rigid insulation board
 13. Non-shrink cement grout
 14. Threaded, Wedge, and Slotted inserts
 15. Bulkhead or control joint breakaways
 16. Control joint pull out reglets
- 1.6 LEED SUBMITTALS
 1. This subcontractor shall provide all documentation indicating applicability of products of this Section to potential LEED credits to the Project LEED Administrator for submission to LEED-Online: <https://leedonline.usgbc.org>. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS for all requirements; and Section 01 81 13.40 – SPEC MATERIALS TRACKING MATRIX.
- 1.7 QUALITY ASSURANCE
 - A. Qualification of Workmen:
 1. Provide one or more persons who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly trained and experienced in the types of concrete specified and who shall direct all work performed under this Section.

2. The individual directing this work shall have at least five years of foreman experience with 'As-cast' Architectural concrete.
3. For finishing of exposed surfaces of the exposed concrete, use only thoroughly trained and experienced journeymen concrete finishers.
4. Product(s) Technical Representative: Provide services of a qualified technical representative approved by reinforcement manufacturer to instruct concrete supplier in proper batching and mixing procedures.

B. Mock-ups per SECTION 01 40 00 – QUALITY REQUIREMENTS, and as follows: Architectural Concrete exposed-to-view

1. Provide full scale three-dimensional assemblies utilizing final specified materials and final production techniques, constructed to be fully tested to ensure that the systems meet the performance requirements of the Specification by application of the maximum applied loads, in-situ conditions and structural movements.
2. Build Mock-up in location and size acceptable to Architect of type specified.
3. Notify design professional seven days in advance of time when mock-up will be installed for approval viewing.
4. Demonstrate the anticipated range of materials, workmanship and finish expected.
5. Obtain approval in writing before commencing work. Mock-up may not be included as a part of the finished project.
6. Protect the approved mock-up during construction period as it will be used to comparatively judge the finished installation

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ACI, concrete plant's instructions and recommendations, Section 01 60 00 – PRODUCT REQUIREMENTS, and as follows:

1. Handle and store materials separately in such manner as to prevent intrusion of foreign matter, segregation, or deterioration.
2. Do not use frozen materials or those containing ice.
3. Store bags of concrete or grout indoors.
4. Remove improper and rejected materials immediately from point of use.
5. Cover materials, including steel reinforcement and accessories, during construction period.
6. Stockpile concrete constituents properly to assure uniformity throughout project.

PART 2 - PRODUCTS

2.1 CONCRETE CONSTITUENTS

A. Cement: Shall be American-made Portland Cement; and conform to chemical and physical requirements of ASTM C150 for Type I for exposed concrete and Type II, low alkali, standard gray color for all other work.

1. 30% replacement of cementitious materials with fly ash or slag is to be used to comply with the sustainable design requirements, except for all slabs.
2. Fly ash or slag used in interior concrete slab-on-grade or elevated slab construction shall be 15% replacement of cement.
3. High early strength cement conforming to ASTM C150 Type III may only be used with permission of the SER given in writing.
4. Do not use air-entraining cements.

- B. Normal Weight Fine Aggregate: Shall be washed, inert, natural sand conforming to ASTM C33.
- C. Normal Weight Coarse Aggregate: Shall be well-graded crushed stone or washed gravel conforming to ASTM C33.
- D. Light Weight Fine and Coarse Aggregate: Shall conform to ASTM C330.
- E. Water: Shall be from approved source, potable, clean and free from oils, acids, alkali, organic matter and other deleterious material.
- F. Admixtures:
 - 1. Normal Range Water-reducing Agent: ASTM C494, Type A. Water-reducing agent shall be by same manufacturer as air-entraining agent.
 - a. Acceptable Products and Manufacturers:
 - 1) "Eucon WR-91" by Euclid Chemical Company
 - 2) "ZYLA610" by W. R. Grace & Co.
 - 3) "Pozzolith" Series by BASF Corporation
 - 4) Substitution Limitations: See Section 01 25 00 – SUBSTITUTION PROCEDURES.
 - 2. Mid-Range Water Reducing Agent: ASTM C494, Type A Water-reducing agent shall be by same manufacturer as air-entraining agent.
 - a. Acceptable Products and Manufacturers:
 - 1) "Eucon MR" by Euclid Chemical Co.
 - 2) "MIRA62" by W.R. Grace & Co.
 - 3) "PolyHeed" Series by BASF Corporation
 - 4) Substitution Limitations: See Section 01 25 00 – SUBSTITUTION PROCEDURES.
 - 3. High Range Water Reducing Agent / Retarder: ASTM C494, Type F or Type G Water-reducing agent shall be by same manufacturer as air-entraining agent.
 - a. Acceptable Products and Manufacturers:
 - 1) "Eucon-37 (F)" or "Eucon-537 (G)" by Euclid Chemical Co.
 - 2) "WRDA (F)" or "Daracem-100" by W.R. Grace & Co.
 - 3) "Glenium" Series or "Rheobuild 1000" by BASF Corporation
 - 4) Substitution Limitations: See Section 01 25 00 – SUBSTITUTION PROCEDURES.
 - 4. Air-entraining agent: ASTM C260. In no instance shall air percent content exceed five percent (5%) by volume.
 - a. Acceptable Products and Manufacturers:
 - 1) "Eucon Air Mix" by Euclid Chemical Co.
 - 2) "Darex AEA" by W. R. Grace & Co.
 - 3) "Micro Air" by BASF Corporation

4) Substitution Limitations: See Section 01 25 00 – SUBSTITUTION PROCEDURES.

2.2 CONCRETE MIXTURES

- A. Footings and Foundation Walls: Proportion structural normal weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 PSI at 28 days.
 2. Maximum water – cementitious material ratio: 0.45.
 3. Slump Limit: 4 in., plus or minus 2 in.
 4. Air Content: 6 percent, plus or minus 1 1/2 percent at point of delivery for 3/4 in. nominal maximum aggregate size.
- B. Site Concrete including Walls and Site Retaining Walls (all concrete exposed to weather): Proportion structural normal weight concrete mixture as follows:
1. Minimum Compressive Strength: 5000 PSI at 28 days.
 2. Maximum water – cementitious material ratio: 0.40.
 3. Slump Limit: 4 in., plus or minus 1 in.
 4. Air Content: 6 percent, plus or minus 1 1/2 percent at point of delivery for 3/4 inch nominal maximum aggregate size.
- C. Slabs-on-Grade: Proportion structural normal weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 PSI at 28 days.
 2. Maximum water – cementitious material ratio: 0.45.
 3. Slump limit: 4 in., plus or minus 1 in.
 4. Air Content: 5 percent, plus or minus 1 1/2 percent at point of delivery for 3/4 in. nominal maximum aggregate size. Do not allow air content of trowel-finished floors to exceed 3 percent.
- D. Slabs on Steel Deck: Proportion structural normal weight and light weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 PSI at 28 days.
 2. Maximum water – cementitious material ratio: 0.45.
 3. Slump Limit: 4 in., plus or minus 2 in.
 4. Air Content: 5 percent, plus or minus 1 1/2 percent at point of delivery for 3/4 in. nominal maximum aggregate size.
- E. Exterior Paving Concrete: Proportion structural normal weight concrete mixture as follows:
1. Minimum Compressive Strength: 5000 PSI at 28 days.
 2. Maximum water – cementitious material ratio: 0.40.
 3. Slump Limit: 4 inches, plus or minus 2 inch.
 4. Air Content: minimum 6 percent, plus or minus 1 1/2 percent at point of delivery for 3/4 inch nominal maximum aggregate size.
- F. Concrete Fill in Metal Pan Stairs: Proportion structural normal weight concrete mixture with 3/8 in. aggregate as follows:
1. Minimum Compressive Strength: 4,500 PSI at 28 days.
 2. Maximum Water – cementitious material ratio: 0.45.

3. Slump limit: 4 inches, plus or minus 2 inch.
 4. Air Content: 6 percent, plus or minus 1 1/2 percent at point of delivery.
- G. Water reducing and air-entraining agents shall be used in all concrete. Total entrapped air plus entrained air in freshly mixed concrete shall be four percent (Plus or minus one percent) of volume of concrete with required strengths maintained.
1. Use a high range water reducing agent for all concrete for slabs-on-grade and slabs-on-metal deck.
 2. Use a mid-range water reducing agent in all pumped concrete with a water/cement ratio greater than 0.40.
 3. Use a high range water reducing agent in concrete with a water cement ratio of 0.40 or less.
- H. Calculated Equilibrium Unit Weight of dry normal weight concrete shall be 147 pcf, plus or minus 3 lbs. / cu. ft. as determined by ASTM C 567.
- I. Calculated Equilibrium Unit Weight of all dry light weight concrete shall be 113 pcf, plus or minus 3 lbs. / cu. ft. as determined by ASTM C 567.
- J. In lieu of preparing mix design in laboratory, a production mix may be proposed provided a record of at least 30 consecutive strength tests is submitted to the Architect and SER for review. Tests shall be from similar mix used in last 12 months and average compressive strength shall be consistent with standard deviation of compressive strengths permitted in ACI 318, Chapter 4, paragraph 4.3, "Proportioning on the basis of field experience".
- K. Any deviation from approved mix design, which the Construction Manager deems desirable under certain project conditions, will not be allowed without examination and written review by the SER.
1. Costs of additional testing by the SER and/or the Testing Agency shall be paid for by the Construction Manager, at no additional cost to the Owner.

2.3 FORM MATERIALS

- A. Exposed Concrete Surfaces: Shall conform to ACI-301, Chapter 13.
- B. Forms for concrete flat surfaces exposed to view in finished work shall be new Class I High Density Overlay Plyform, exterior grade, not less than five ply nor less than 5/8 in. thick conforming to U.S. Product Standard P-1-66.
1. All form joints shall be sealed with approved non-staining sealant to be watertight.
- C. Concrete Surfaces Not Exposed to View: Forms for concrete surfaces not exposed to view in finished work shall be made of wood, metal or other materials subject to review of the Architect and the SER, and shall conform to ACI 301, Chapters Four and Ten.
- D. Form Ties and Spreaders: Ties for walls in areas exposed to view in finish work.
1. Basis-of-Design Product and Manufacturer: Type SPCH - Stainless Steel "Snap-Ties" by Richmond Screw Anchor Co., or a SER acceptable equivalent subject to compliance with requirements from one of the following manufacturers:
 2. Superior Concrete Accessories, Inc.
 3. Dayton Sure-Grip and Shore Co.

4. Substitution Limitations: See Section 01 25 00 – SUBSTITUTION PROCEDURES.
 5. Wire ties shall not be used.
 6. Where concrete is to be left exposed, painted or plastered, ties shall have removable tapered, plastic cones 1 in. outside diameter.
 7. Ties for walls below grade and in areas not exposed to view in finished work shall be snap ties with removable cones, and shall incorporate water seal washer.
- E. Form Release Agent: Shall be of a non-staining and non-emulsifiable type, or equal approved by the SER. Form release agent shall not impart any stain to concrete nor interference with adherence of any finish material to be applied to any concrete surface.

2.4 REINFORCEMENT AND ACCESSORIES

- A. Recycled Content of Steel: Use maximum available percentage of recycled steel. Reinforcing steel incorporated into the work shall contain not less than 95 percent of recycled scrap steel.
- B. Reinforcing Steel Bars: Shall be newly rolled billet steel conforming to ASTM A 615 (Grade 60 unless noted). Bars shall be bent cold as required. Reinforcing bars being welded shall conform to ASTM A 706, Grade 60.
- C. Welded Wire Fabric ASTM A 185: All welded wire reinforcement shall be supplied in sheets and is to be used in slabs on grade and on deck as noted. No fiber mesh substitutes will be permitted.
- D. Reinforcement Accessories: Shall conform to Product Standard PS7-766, National Bureau of Standards, Department of Commerce, Class C. Reinforcement accessories shall include spacers, chairs, ties, slab bolsters, slips, chair bars, and other devices for reinforcement.
1. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 2. Hohmann & Bernard, Inc.
 3. Superior Concrete Accessories, Inc.
 4. Dayton Sure-Grip and Shore Co.
 5. R.K.L. Building Specialties Co., Inc.
 6. Substitution Limitations: See Section 01 25 00 – SUBSTITUTION PROCEDURES.
 7. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete bricks may be used to support reinforcing steel where application allows.

2.5 MISCELLANEOUS MATERIALS

- A. Under-slab Vapor Retarder:
1. Non-woven plastic geo-membrane sheet product meeting or exceeding the requirements of an ASTM E-1745 vapor retarder.
 2. Performance Requirements:
 3. Permeance of less than 0.01 Perms [grains / (ft² – hr – inHg)] as tested in accordance with ASTM E 1745 Section 7.
 4. Other performance criteria:
 5. Strength: Meet ASTM E 1745 Class A requirements.
 6. Tensile Strength: 45 pound-feet / in per ASTM D-882 or E-154
 7. Puncture Resistance: 2200 grams per ASTM D-1709
 8. Thickness: 15 mils. Minimum
 9. Manufacturer:

- a. Basis of Design: Stego Wrap Vapor Barrier (15 –mil.) by Stego Industries LLC, (877) 464-7834; www.stegoindustries.com.
10. Other acceptable products:
 - a. Perminator (15 mil) by W. R. Meadows, Inc. (800) 342-5976; www.wrmeadows.com.
 - b. Barrier-Bac VB-350 (16 mil) by Inteplast Group, (877)535-0555, www.BarrierBac.com.
 - c. Vapor Block (15 mil) manufactured by Raven Industries, (800) 635-3456; www.ravenind.com.
 - d. Griffolyn (15 mil) manufactured by Reef Industries, (800) 231-6074; www.reefindustries.com.
 - e. Viper II (15 mil) manufactured by Insulation Solutions, Inc. www.insulationsolutions.com.
 - 1) Other manufacturer's products accepted by the Awarding Authority as equal to the specified products. Submit as substitutions: See Section 01 25 00 – SUBSTITUTION PROCEDURES.
11. Accessories:
12. Seam tape, mastic, piping boots, termination strips and other accessory items as recommended by the manufacturer.
- B. Curing Mediums:
 1. Absorptive Cover: Burlap cloth made from jute or Kenaf, weighing approximately nine ounces per square yard complying with AASHTO M182, Class 2.
 2. Moisture Retaining Cover: One of the following complying with ASTM C171:
 3. Waterproof paper,
 4. Polyethylene film,
 5. Polyethylene-coated burlap.
- C. Floor Hardener: Hardener to be used at exposed concrete surfaces where no beddings or adhesive will be applied.
 1. Chemical Hardener by Sonneborn Building Products, Inc. / BASF,
 2. Construction Chemicals by Building Systems or approved equal.
 3. Concrete Floor Hardener by Sweeney Materials, Inc.
- D. Non-shrink Cement Grout: Shall be ready-to-use non-metallic aggregate product requiring only addition of water at job site. Grout shall be easily workable and shall have no drying shrinkage at any age. Compressive strength of grout (2 x 2 in. cubes) shall not be less than 5000 psi at seven days and 7500 psi at 28 days.
 1. Manufacturer List. Subject to compliance with requirements, provide products by one of the following:
 2. W. R. Grace & Co
 3. Sonneborn Building Products, Inc. / BASF
 4. Sakrete Company
 5. Substitution Limitations: See Section 01 25 00 – SUBSTITUTION PROCEDURES.
- E. Threaded Inserts and Dowels: Shall be structural concrete insert of type shown on Drawings. Galvanize all components in accordance with ASTM A 153, unless indicated to be stainless steel.

1. Manufacturer List. Subject to compliance with requirements, provide products by one of the following:
 2. Hohmann and Barnard, Inc.
 3. Richmond Screw Anchor Co.
 4. Superior Concrete Accessories Inc.
 5. Substitution Limitations: See Section 01 25 00 – SUBSTITUTION PROCEDURES.
- F. Waterstops: Provide flat, dumbbell type or center bulb type waterstops at construction joints, or other joints as indicated on the Drawings.
1. Waterstops shall be constructed of thermoplastic in accordance with The Corps of Engineers CRD-C572.
 2. Waterstops shall be continuous using splices as recommended by the manufacturer so as to prevent the passing of water through the joint.
- G. Preformed Joints: Install as per the manufacturer's instruction the following material to form the control joint at all slabs on grade.
1. Acceptable Products and Manufacturers:
 2. Keyed Kold Joint by The Burke Co., San Mateo, California.
 3. Kold Seal Zipper Strip by Vinylex Corporation, Knoxville, Tennessee
 4. Preformed Control Joints by W. R. Meadows.
 5. Substitution Limitations: See Section 01 25 00 – SUBSTITUTION PROCEDURES.
- H. Under-slab Rigid Insulation: As specified at Section 07 21 00 – THERMAL INSULATION.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examination and Acceptance of Conditions per Section 01 40 00 - QUALITY REQUIREMENTS, and as follows:
1. Carefully examine installation areas with Installer/Applicator present, for compliance with requirements affecting Work performance.
 2. Verify that field measurements, substrates, structural support, utility connections, tolerances, levelness, plumbness, humidity, moisture content level, cleanliness and other conditions are as required by each manufacturer, and ready to receive Work.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION OF FORMWORK

- A. Use forms for all concrete, including footings, except as otherwise permitted in writing by Architect and/or the SER. Design and construct concrete forms to withstand all forces, including construction live loads imposed upon them during placing and curing of concrete, and with adequate bracing to hold them within specified tolerances for lines and grades shown on Drawings as specified under ACI 347.
- B. Before reinforcement is placed on or against formwork, formed surfaces coming in contact with fresh concrete shall be cleaned and then treated with approved form release agent.

- C. Before form materials can be re-used, surfaces that will be in contact with freshly cast concrete shall be thoroughly cleaned, damaged areas repaired and projecting nails withdrawn. Re-use of form material shall be subject to review by the Architect and/or the SER.
- D. Tolerances for formed surfaces: Produce formed concrete work to the dimensions shown on the Drawings within the tolerances given in ACI 347.78, Article 3.31. The tolerances are the maximum allowable dimensional departure from the planes and points established by the Drawings, subject to the maximum rate of change in plane equal to the tolerance dimension and distance first stated in Article 3.3.1 for each category of work.
- E. Tolerances for Architecturally exposed concrete formed surfaces: Surfaces permanently exposed to view shall be considered "Class A" finish, with no abrupt or gradual surface irregularity in excess of 1/8 inch within a 5 foot measured dimension.
 - 1. Abrupt irregularities are defined to include offsets and fins resulting from displaced, mismatched or misplaced forms, surface defects in form materials, sheathing or liners, and voids within concrete due to improper vibrating.
 - 2. Gradual irregularities are defined to include those resulting from warping, deflection or bending of formwork or similar variations from planeness. Gradual irregularities will be measured with a straightedge for flat surfaces.
 - 3. Rejection of Exposed Formed Concrete: Any Architectural Concrete that does not conform to the requirements of ACI 347, Article 5.2 for appearance and quality or the requirements stated herein, when forms are removed, is subject to rejection by the Architect and/or the SER. Rejected work shall be removed and replaced at the Construction Manager's expense.

3.3 PLACING OF REINFORCEMENT

- A. Reinforcement shall be placed in accordance with requirements of CRSI (MSP) "Placing Reinforcing Bars" and with further requirements below.
- B. Heating, bending, tack welding, curing or substituting reinforcement in field is prohibited, other than as shown on Drawings.
- C. Reinforcement shall be continuous through construction joints, unless otherwise indicated on Drawings.
- D. Reinforcement shall be spliced only in accordance with requirements of Contract Documents. Splices of reinforcement at points of maximum stress shall generally be avoided. Welded wire reinforcement shall lap 12 in. or two spaces, whichever is larger, and shall be wired together.

3.4 VERTICAL JOINTS

- A. Construction and control joints indicated on Drawings are mandatory and shall not be omitted.
- B. Construction joints shall be continuously bevel keyed, 2 x 4 in. nominal, except as noted, and first placed surface shall be treated as specified under "Placing Concrete" in this Section.
- C. Joints not indicated or specified shall be placed to least impair strength of structure and shall be subjected to review of the SER.

3.5 INSTALLATION OF EMBEDDED ITEMS

- A. Conform to requirements of ACI 318, Chapter 6, paragraph 6.3, "Conduits and Pipes Embedded in Concrete", and as specified below.
- B. Installation of inserts required by other trades, shall be coordinated with, or shall be installed prior to, placing of reinforcing steel. All inserts shall be supplied by respective trades and installed by the Construction Manager.

3.6 INSTALLATION OF UNDER-SLAB VAPOR RETARDERS OR BARRIERS AND INSULATION

- A. Install insulation in conformance with the manufacturer's printed instructions specific to the application, accepted shop drawings, and Section 07 21 00 – THERMAL INSULATION.
- B. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.
- C. Install vapor retarder or barrier in conformance with manufacturer's printed instructions and these specifications.
 - 1. Overlap edges of sheets 6 in. and tape joints using manufacturer's sealing tape.
 - 2. Seal all penetrations by piping, conduits, rebar or other penetrant items with manufacturer's mastic and/or sealing tape.
 - 3. Seal vapor barrier sheet to surrounding vertical surfaces as shown on Drawings.
 - 4. Protect installed vapor retarder from damage and perforation following installation. Sequence installation so that sheet will not be exposed to traffic without protection for extended periods of time.
 - 5. Prior to concealing vapor barrier, notify the Architect to arrange for evaluation of the in-place material for damage including perforations.
 - 6. Repair all damaged areas per the manufacturer's recommendations, or replace products if repair is not acceptable, as identified by the Architect.

3.7 SLAB ON GRADE JOINTS

- A. Control joints in the slab on grade shall be made by either of the following methods:
 - 1. Saw Cutting: Saw cutting shall be accomplished using a "Soff-Cutt" saw or approved equal.
 - 2. Saw cutting shall begin immediately after final finishing.
 - 3. Where saw cut joints may read through floor finishes, fill joint with grout prior to installing proposed finish.
 - 4. When slab curl occurs at saw-cut joints that will be visible through floor finishes or is unacceptable to the manufacturer or installer of applied finishes, grind, fill or repair slabs per corrective work requirements of this section.
 - 5. Preformed Joints: Install as per the manufacturers instruction material to form the control joint at all slabs on grade.

3.8 MIXING, CONSISTENCY, AND DELIVERY OF CONCRETE

- A. Concrete shall be ready-mixed and produced by a plant acceptable to the SER and the Testing Agency. Hand or site mixing shall not be done. Constituents, including mixture, shall be batched at the central batch plant. Admixtures shall be premixed in a solution form and dispensed as recommended by the manufacturer.

- B. Concrete shall arrive at the job site at a slump of 2 – 3 in., and at the time of deposit shall be as follows:
1. Portion of Structure, Slump, Recommended Max. Range
 2. Pavements, Slabs on Grade and Metal Decks, 4 inch, 3 - 5 inch
 3. Footings, Grade Beams, Pile Caps, 4 inch, 3 - 5 inch
 4. Site Concrete and Site Retaining Walls, 4 inch, 2 - 6 inch
 5. Reinforced Walls, 4 inch, 2 - 6 inch
 6. Metal Pan Stairs, 3 inch, 1 – 3 inch
 7. If a high range water reducing admixture (super-plasticizer) is used, it may be added at the job site after verifying that the delivery slump is 2 to 3 in. The maximum slump, after adding the HRWR admixture, shall be 8 in.
 8. For normal weight concrete, water may be added to the concrete at the site only to make up water withheld at the plant. Batching plant shall document on the driver's delivery ticket any water withheld at the plant. When water has not been withheld and slump is too low for proper handling of concrete, use the HRWR admixture to bring slump within specified range.
- C. Ready-mix concrete shall be transported to site in watertight agitator or mixer trucks loaded not in excess of rated capacities.
1. Discharge at site shall be within one and one-half hours after cement was first introduced into mix.
 2. When air temperature is between 85 to 90 deg F, discharge at site shall be within 75 minutes and when air temperature is above 90 deg F, discharge site shall be within 60 minutes.
 3. Concrete with a temperature greater than 90 deg F shall not be placed.
 4. Central mixed concrete shall be plant mixed a minimum of five minutes.
- D. Re-tempering of concrete that has partially hardened, that is, mixing with or without additional cement, aggregates, or water, will not be permitted.

3.9 PLACING CONCRETE

- A. Remove water and foreign matter from forms and excavations. Except in freezing weather or as otherwise directed, thoroughly wet wood forms just prior to placing concrete. Place no concrete on frozen soil, ice or standing water, and provide adequate protection against frost action during freezing weather.
- B. Soil bottom for slabs and footings, reinforcing, inserts, and forms shall be reviewed by Architect or his designate and/or the SER before placing concrete.
- C. To secure full bond at construction joints, surfaces of concrete already placed, including vertical and inclined surfaces, shall be thoroughly cleaned of foreign materials and laitance, roughened with suitable tools such as chipping hammers or wire brushed, and re-cleaned by stream of water or compressed air.
1. Well before new concrete is deposited, joints shall be saturated with water.
 2. After free or glistening water disappears, joints shall be given thorough coating of neat cement slurry mixed to consistency of very heavy paste.
 3. Surface shall receive coating of at least 1/8 in. thick; this shall be scrubbed in by means of stiff bristly brushes.
 4. New concrete shall be deposited before neat cement dries.

- D. Do not place concrete having a slump outside of allowable slump range.
- E. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcement and which void re-handling. Deposit no partially hardened concrete. When concrete is conveyed by chutes, equipment shall be of such size and U-shaped design as to insure continuous flow in chute. Flat (coat) chutes shall not be employed.
- F. During and immediately after depositing, concrete shall be thoroughly consolidated by means of internal type mechanical vibrators.
- G. Vertical lifts shall not exceed 18 in. Vibrate through successive lifts to avoid pour lines. Vibrate first lift thoroughly until top of lift glistens to avoid stone packets, honeycomb, and segregation.
- H. Concrete shall be deposited continuously and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within section.
 - 1. If section cannot be placed continuously between planned construction joints, as specified, field joint and additional reinforcement shall be introduced so as to preserve structural continuity.
 - 2. Notify Architect and/or the SER of each such case.
- I. Cold Weather Placement – comply with ACI 306.1 and as follows:
 - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing conditions or low temperatures.
 - 2. Follow ACI cold weather placement procedures when concrete is placed at or below an ambient air temperature of 40 deg F; or, whenever, in the opinion of the National Weather Service five-day weather forecast, the temperatures are likely to be below 40 deg F within 24 hours after placement of concrete. Maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 3. Do not use frozen materials or materials containing ice or snow.
 - 4. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 5. Do not use calcium chloride, salt or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- J. Hot Weather Placement – Comply with ACI 305 and as follows:
 - 1. Maintain concrete temperature below 90 degrees Fahrenheit at time of placement. Chilling mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is the Construction Manager's option.
 - 2. Fog-spray forms, steel reinforcement and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots or dry areas.
- K. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of the construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or derbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
6. During placement of concrete on slabs-on-deck, do not pile concrete. Place concrete uniformly to prevent excessive deflection of the deck and the beams.

3.10 FINISHING OF UNFORMED CONCRETE SURFACES

- A. Required concrete finishes shall conform to ACI 301 and ACI 302 as follows:
 1. Concrete slabs-on-grade shall be finished with floor flatness and levelness tolerances in accordance with ACI 302-8.15 with an Ff = 35 for Specified Overall Value (SOV) and Ff = 25 for Minimum Local Value (MLV) and FI = 25 for Specified Overall Value (SOV) and FI = 20 for Minimum Local Value (MLV).
 2. Concrete slab-on-deck shall be finished with floor flatness tolerances in accordance with ACI 302-8.15 with an Ff=30 minimum.
 3. When another finish is to be added or applied to a concrete slab, refer to the manufacturer and sub-contractor for required floor flatness, levelness, and/or tolerance. If these requirements are different from those specified, the more stringent requirements shall apply.
- B. Scratched Finish: Shall be provided on concrete slabs, which required bond for subsequent topping, or second slab cast over the first. Location: (see Drawings) Method: per ACI 301-5.3.4.2a (steel rakes).
- C. Steel Trowelled Finish - Location: All interior slabs, tops of equipment pads. Method: Per ACI 301-5.3.4.2c.
- D. Floated Finish: Location - All depressed slabs receiving another finish. Method: Per ACI 301-5.3.4.2b.
 1. Light Broom Finish: Location – entrance frost pads.

3.11 CURING AND PROTECTION

- A. When concrete is placed at or below an ambient air temperature of 40 deg F, or, whenever, in the opinion of the National Weather Service five-day weather forecast, the temperatures are likely to be below 40 deg F within 24 hours after placement of concrete, cold weather concreting procedures, according to ACI 306 and as specified herein, shall be followed.
 1. To this end, the entire area affected shall be protected by adequate housing or covering and heating.
 2. No salt, chemicals, or other foreign materials shall be used in mix to lower freezing point of concrete.
- B. Protect concrete work against injury from heat, cold, and defacement of any nature during construction operations.
- C. Concrete shall be treated immediately after concreting or cement finishing is completed, to provide continuous moist curing above 50 deg F for at least six days, regardless of ambient air temperatures, unless noted otherwise.

- D. Keep permanent temperature record, showing date and outside temperature for concreting operations.
 - 1. Thermometer readings shall be taken at start of work in morning, at noon, and again late in afternoon. Locations of concrete placed during such period shall likewise be recorded, in such manner as to show any affect temperatures may have had on construction.
 - 2. Copies of record shall be distributed daily to the SER and the Testing Agency.
- E. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
 - 2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
 - 3. In order to avoid plastic or drying shrinkage cracks during warm, dry or windy weather, ACI 302 and ACI 309 shall be followed using wind breaks and sun shades when recommended. Evaporation retardant shall be as specified in Part 2 above.
- F. Curing Methods – Provide moisture cover curing as follows:
 - 1. Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.12 REMOVING FORMWORK

- A. The Construction Manager shall be responsible for proper removal of formwork.
- B. Forms shall be removed only after concrete has attained 40 percent of the specified 28 day design strength. Construction loads and lateral loads should be placed without damage to the structure or cause any excessive deflection.

3.13 FINISHING OF ARCHITECTURALLY EXPOSED FORMED CONCRETE

- A. Concrete that will be exposed in the completed work shall receive smooth form finish conforming to ACI 301, and sandblast treatment.
 - 1. Apply sandblasted finish to exposed concrete surfaces at least 72 hours after placement of concrete. Coordinate with concrete placement schedule and formwork removal to ensure that surfaces to be blast finished are blasted at the same age for uniform results.
 - 2. Use an abrasive grit of proper type and gradation to provide brush sandblast finish – do not expose aggregates.
 - 3. Perform sand blast finishing in as continuous an operation as possible utilizing the same work crew to maintain continuity of finish on each surface or within each area.

3.14 FIELD QUALITY CONTROL

- A. Field Tests and Inspections per Section 01 40 00 – QUALITY REQUIREMENTS, and as follows:

1. A Program of Inspection and Testing of cast-in-place concrete work will be established by the Structural Engineer of Record (SER) who will direct the implementation of tests as carried out by an independent Testing Agency, under a separate contract with the Owner.
 2. Materials and workmanship shall be subjected to inspection and testing in mill, shop, and/or field by the SER and/or the Testing Agency.
 3. Such inspection and testing shall not relieve the Construction Manager of his responsibility to provide his own inspection, testing and quality control as necessary to furnish materials and workmanship in accordance with requirements of Contract Documents.
 4. Construction Manager shall notify the SER and the Testing Agency prior to start of any phase of concrete work so as to afford them reasonable opportunity to inspect work. Such notification shall be made at least 24 hours in advance.
 5. Compression tests shall consist of one set of five cylinders for each test made, cured, and tested by the Testing Agency during progress of job as a minimum. One cylinder will be tested at seven days and three cylinders will be tested at 28 days. One cylinder shall be retained to be tested at 56 days if the 28 day results are not acceptable and this cylinder may be discarded if not tested. One set of cylinders shall be taken for every 50-cubic yards of concrete or fraction thereof and furthermore shall be taken from batch with highest slump.
 6. Material and/or workmanship that is rejected by the SER and/or the Testing Agency either at the plant or at the job site shall be replaced promptly by the Construction Manager to the satisfaction of the SER at no expense to the Owner.
- B. Construction Manager shall hire a testing agency to prepare and test concrete cylinders, as required, for their use and certification of foundations prior to steel erection.
- C. Non-Conforming Work per General and Supplementary Conditions, and as follows: Remove, Repair and Reinstall or Restore in Place damaged items prior to inspection for Substantial Completion.
1. Finish touch-up damaged surfaces.
 2. Replace damaged materials or items with new if repair not acceptable to Architect.
- D. Manufacturer Services per Section 01 40 00 – QUALITY REQUIREMENTS, and as follows: Manufacturer's or Fabricators' field representative(s) shall give product use recommendations, and perform site visits to inspect product installation in accordance with instructions and warranty requirements.
- E. Test and Evaluation Reports - submit to the Architect and SER:
1. Batching and mixing procedure report.
 2. Copies of concrete placement temperature records.
- 3.15 CORRECTIVE WORK AND CRACK SEALING
- A. Provide crack sealing for exposed concrete surfaces that develop cracks beginning at placement and through the one year correction period beginning on the date of Final Completion.
1. Seal material shall be non-staining and resilient, matching the concrete color.
 2. Corrective work on defects and crack seal shall be performed subject to review of the Architect and/or the SER.
 3. Corrective work and crack sealing shall include all required labor, materials, and equipment.

3.16 CLEANING AND PROTECTION

- A. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
- B. Concrete surfaces shall be cleaned of all form release agent stains in one complete operation in the manner indicated by the manufacturer and reviewed by the Architect and/or SER.
 - 1. Caution to be exercised to avoid staining from work overhead.
 - 2. Concrete cleaning shall commence when concrete is at least 28 days old, unless otherwise directed by Architect and/or SER.
- C. Protect concrete slab surfaces scheduled to be exposed in finished spaces, including slabs indicated to be polished immediately after curing.
 - 1. Do not permit the following activities to take above concrete surfaces to be polished:
 - 2. ANY type of storage within 28 days of concrete placement.
 - 3. Vehicle parking
 - 4. Pipe cutting operations
 - 5. Ferrous metals storage
- D. Protect installed work from construction operations until date of Final Completion or Owner occupancy, whichever occurs first.

END OF SECTION

SECTION 033300

ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Cast-in-place architectural concrete including form facings, reinforcement accessories, concrete materials, concrete mixture design, placement procedures, and finishes.
 - 2. The requirements of this Section complement Section 033000, CAST-IN-PLACE CONCRETE; and apply to architectural concrete as specified and as indicated on Drawings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for formwork; material, fabrication, and installation requirements for steel reinforcement; and field quality control.
 - 2. Section 079200 - JOINT SEALANTS for elastomeric joint sealants in contraction and other joints in cast-in-place architectural concrete.

1.3 DEFINITIONS

- A. Cast-in-Place Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.
- B. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- C. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.

- D. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Description of Methods and Sequence of Placement. For each type of specially-finished concrete provide description of methods and sequence of placement.
- C. Certificates: Prior to installation submit copies of a signed affidavit from the manufacturer of the coloring product stating that coloring product to be used in concrete is compatible with the concrete mix and type to which it will be combined, and that no adverse affects will occur to the workability, setting, or strength of concrete.
- D. Manufacturer's Review: Submit written signed statement, that Contract Documents have been reviewed by qualified representatives of the materials manufacturer, and that materials and system to be used for floor finish are proper and adequate for the applications shown.
- E. Manufacturer's Data: Submit manufacturer's specifications and installation instructions for all products in concrete floor finish, including certifications and other data as may be required to show compliance with the Contract Documents.
- F. Substrate Acceptability: Submit a certified statement issued by the manufacturer of concrete floor finish materials and countersigned by installer, attesting that surfaces designated to receive concrete floor finish are satisfactory warranty requirements. Application of materials will be construed as acceptance of surfaces.
- G. Statement of Supervision: Submit signed statement signed that field supervision by manufacturer's representative was sufficient to ensure proper application of materials and that the installation is acceptable to manufacturer.
- H. Samples for Verification: Architectural concrete samples, cast vertically, approximately 18 by 18 by 2 inches, of finishes, colors, and textures to match design reference sample. Include Sample sets showing the full range of variations expected in these characteristics.

1.5 QUALITY ASSURANCE

- A. Finish Objective Samples. If samples are placed on display in the office of the Architect, to describe finish objectives, such samples are hereby made part of these Specifications to the degree that the samples exhibit the required color, texture and surface finish requirements. Such samples, if provided, are provided for bidding purposes only; the actual mix components, forming, placing, and finishing procedures and requirements shall be as determined by acceptable preconstruction mock-ups.
- B. Preconstruction Conference. Attend a preconstruction conference prior to the start of architectural concrete construction as directed by the Architect. Discussion will include the following:
 - 1. The Contractor's program to obtain the specified quality of architectural concrete.

2. The procedures and methods for construction of preconstruction mock-ups specified herein.

C. Preconstruction Mock-up Panels or Areas:

1. General:
 - a. Schedule mock-up casting for acceptance 30 days prior to casting of architectural concrete surfaces represented by the mock-ups.
 - b. Locate mock-up panels in non-public areas acceptable to the Architect. Brace panels as required for safety.
 - c. Continue to cast mock-ups until acceptable mock-ups are produced. Accepted mock-ups shall be the standard for color, texture, and workmanship for the work.
 - d. Mock-up sequence of forming, placing, form removal, curing and finishing shall be reviewed and accepted by the Architect.
 - e. Mock-up formwork shall be inspected and accepted by the Architect before placing of concrete.
 - f. Use the same concrete mixes and placement procedures, accepted in mock-ups, in the final work, unless otherwise directed by the Architect.
 - g. Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-up.
 - h. Remove mock-up panels from site at completion of Project, as directed by the Architect.
2. Construct mock-up panels or areas as indicated to demonstrate the ability to cast architectural concrete to achieve shapes, color, and textured finishes required. Mock-ups shall include or meet the following requirements:
 - a. Provide full scale mock-up panels and areas.
 - b. Provide mock-ups simulating actual design and execution conditions for concrete mix materials, reinforcement, formwork, placing sequence, form removal, curing, finishing, and methods and materials of stain removal and correction of defective work.
 - c. On mock-ups where directed by the Architect, provide minimum of five variation of mix color to be used in the repair of defective work, in order to determine acceptable color and texture match.
 - d. Demonstrate, on the mock-ups, materials and methods of plugging tie-holes unless tie holes are indicated to be left in place.
 - e. Demonstrate in the construction of the mock-up formwork the sealer material, form release agent, and curing materials and methods to be used.

- D. Source of Materials. Utilize the same source, stock or brand of concrete materials for each class or mix of architectural concrete. Do not interchange materials or mixes until an additional mock-up shows that uniformity in finish, texture, and color, as compared to original mock-up will be maintained. If necessary, obtain and stockpile materials in sufficient quantity to ensure continuity and uniformity.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's unopened containers identified with brand, type, grade, date of manufacture, class, lot number, and other qualifying information.

- B. Store materials in original sealed containers, in dry enclosed storage area, within temperature range recommended by manufacturer.

1.7 JOB CONDITIONS

- A. Maintain manufacturer's current installation instructions at Project site.
- B. Maintain interior building area above 50oF before, during, and after installation of architectural concrete until structure and subfloor temperatures are stabilized.
- C. Provide and maintain adequate ventilation until concrete cures completely.

1.8 PROTECTION

- A. Protect adjacent surfaces and repair, restore, or replace soiled or damaged in performance of special architectural concrete finish work.

1.9 GUARANTEE

- A. Warrant work of this Section for five years from date of Substantial Completion; correct defects upon written notice at no additional cost to Owner. Warranty shall be signed by installer and materials manufacturer.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. Except as otherwise indicated, concrete materials including aggregates, Portland cement, and water shall conform to Section 033000, CAST-IN-PLACE CONCRETE.

2.2 ARCHITECTURAL CONCRETE FOR VERTICAL WALLS

- A. Concrete: Color of concrete shall be normalweight concrete without color additive; color for architectural concrete shall be uniform throughout area designated.
- B. Formwork Ties: Formwork tie spacing and location of ties shall be in a consistent pattern or layout acceptable to the Architect. Tie design shall be acceptable to the Architect.
- C. Formwork Materials: Steel faced or fiberglass faced formwork as required to produce a smooth form finish acceptable to the Architect.

1. Architectural Concrete Finish No. 2 - Smooth Form Finish with Grout Cleaned Finish:

- a. Formwork: Smooth form concrete using steel forms or fiberglass forms.
- b. Finish Description/Procedure: Smooth form finish with grout cleaned finish. No cleaning operations shall be undertaken until all adjoining surfaces to be cleaned are completed and accessible. Cleaning as the work progresses shall not be permitted. Mix 1 part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint. White portland cement shall be substituted for a part of the gray portland cement in order to

produce a color matching the color of the surrounding concrete, as determined by a trial patch. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with brushes or a spray gun. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, sack, or other means. After the surface whitens from drying, rub vigorously with clean burlap. Keep the finish damp for at least 36 hours after burlap rubbing.

PART 3 - EXECUTION

3.1 PLACING CONCRETE

- A. Except as modified herein, concrete shall be placed in accordance with Section 033000, CAST-IN-PLACE CONCRETE.
 - 1. Consolidate vertical colored concrete in lifts 1 ft. or less in depth and vibrate twice that normally required by decreasing the spacing, depth, and time to ensure uniform color.
 - 2. There shall be no honeycombing or segregated aggregates in concrete exposed to view in areas identified as Architectural Concrete.

3.2 PROTECTION FROM AND REMOVAL OF STAINS

- A. On mock-up where directed by the Architect, demonstrate methods of rust stain removal in accordance with recommendations of ACI 303 Chapter 10, Section 10.4.
- B. Comply with requirements of Section 033000, CAST-IN-PLACE CONCRETE, and procedures used in construction of accepted mock-ups.

END OF SECTION

SECTION 03 41 13

PRECAST AND PRESTRESSED CONCRETE PLANK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work under this Section shall include all labor materials, services and equipment and accessories necessary to furnish and install Precast Plank, complete, as indicated on the Drawings and/or as required by the Specifications, which without limiting the generality thereof include the following:
 - 1. Precast Plank, Fillers, End Stops, and Weld Plates.
 - 2. Grouting of plank.
 - 3. SUSTAINABLE DESIGN INTENT: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System of the US Green Building Council. Refer to Division 01 Section "LEED v4 BD+C Requirements" for certification level and certification requirements.

1.2 RELATED REQUIREMENTS

- A. The Conditions of the Contract and General Requirements of the Project Manual including the Construction Manager's Scoping documents apply to this subcontractor, material suppliers, and all other persons furnishing labor and materials under this Section. General Conditions, Supplementary Conditions, Construction Manager's Scoping documents, and applicable parts of Division 01 are included as part of this Section.
- B. Work being performed by others, but related to this Section, and with which this contractor must coordinate with and/or accommodate the Work of, or which contain requirements that affect the Work of this Section include the following:
 - 1. Section 01 45 23 – TESTING AND INSPECTING SERVICES
 - 2. Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
 - 3. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
 - 4. Section 03 30 00 – CAST IN PLACE CONCRETE;
 - 5. Section 04 20 00 - UNIT MASONRY
 - 6. Section 05 31 00 - STEEL DECKING
 - 7. Section 05 15 00 - STUD SHEAR CONNECTORS
 - 8. Section 05 50 00 - METAL FABRICATIONS; steel lintels and light steel framing provided by those sections and connecting to work of this section.
 - 9. Section 05 51 00 – METAL STAIRS; connection of metal stairs to structural steel, and reactions imposed.
 - 10. Section 07 21 19 – FOAMED-IN-PLACE INSULATION; surface preparation of steel scheduled to receive foam insulation.
 - 11. Section 07 81 00 – APPLIED FIREPROOFING; surface preparation of steel scheduled to receive fireproofing.
 - 12. Section 07 92 00 – JOINT SEALANTS;
 - 13. Section 14 24 10 – HYDRAULIC ELEVATORS; requirements and coordination for hoisting safety beam.

PRECAST AND PRESTRESSED CONCRETE PLANK

14. Section 23 00 10 – HVAC; coordination and requirements of steel-framed floor and roof openings for HVAC ducts and equipment.
15. Section 26 00 10 – ELECTRICAL; grounding of electrical system to steel frame.

1.3 SUBMITTALS

- A. Shop Drawings for Precast and Prestressed Concrete Plank shall include the name of the manufacturer and all physical properties.
 1. Show complete plank layout including all openings to be cast into slab lengths, anchorage details, and all information necessary for the complete installation of this work. Coordinate all openings in planks with the contract drawings.
 2. Plank shall be laid out and anchored as shown on the structural drawings. Any proposed changes shall be brought to the attention of the Architect. Plank tolerance as required on structural drawing shall be maintained.
- B. Submit calculations, stamped by a registered Professional Engineer in the Commonwealth of Massachusetts, indicating all reinforcing necessary to support all design live loads and dead loads including partition loads as shown on the structural and architectural drawings.
- C. LEED Submittals – refer to Division 01 Section “LEED v4 BD+C Requirements”.
 1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
 2. Project Materials Cost Data: Provide statement indicating total cost for materials used for the Project.
 3. LEED Action Plans: Provide preliminary submittals indicating how the following requirements will be met:
 - a. Construction Waste Management: in compliance with Division 01 Section “Construction Waste Management.”
 - b. List of proposed materials with recycled content: manufacturers’ certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.
 - c. Local/Regional Materials:
 - 1) Sourcing location(s): Indicate location of extraction, harvesting and recovery of raw materials used in the products’ manufacturing; indicate the distance between extraction, harvesting and recovery and the project site.
 - 2) Manufacturing locations(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Follow manufacturer's instructions for handling and transporting.
- B. Lift members at designated points only, and use lifting inserts if provided.
- C. Do not place members in positions that will cause overstress, warp, or twist.
- D. Handle members to protect from dirt and damage.

- E. Place stored members so that identification marks are discernible.
- F. Separate stacked members by battens across full width of each bearing point.
- G. Stack members so that lifting devices are accessible and undamaged.
- H. Store plank so that no water can enter voids in plank.

1.5 QUALITY ASSURANCE

- A. Codes & Standards: The latest edition of the following specifications, standards, and codes shall govern with modifications as specified herein.
 - 1. American Concrete Institute, ACI 318 Building Code Requirements for Reinforced Concrete.
 - 2. Prestressed Concrete Institute MNL, 118 Manual for Inspection of Prestressed Concrete, MNL - 116 Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cement: Portland Cement (ASTM C-150) High early strength Portland Cement (Type III).
- B. Aggregates: Conform to specifications for concrete aggregates (ASTM C-330).
- C. Water: Water shall be clean, potable fresh, free from acids, alkalies, oils, organic materials and shall be from public mains.
- D. Air Entraining Admixtures: Conform to ASTM C-2600. All concrete in this section shall have 3-5% air entrainment. Admixtures shall be allowed in concrete provided they are chemically compatible with all other admixtures used.
- E. Calcium Chloride: Do not use calcium chloride in work of this section.
- F. Concrete shall have a minimum strength of 5,000 p.s.i. at 28 days and a strength of 3,500 p.s.i. at time of strand release.
- G. Prestressed Steel: Prestressed steel shall be high tensile strength uncoated seven wire strand which has been stress relieved as a unit after the wires have been formed into a strand. It shall be manufactured and tested in accordance with ASTM A-416. Grade 250 K or 270K strand may be used.
- H. Reinforcing Bars: All reinforcing bars shall conform to the requirements of ASTM A-615. Grade 40 or 60 as required.
- I. Welded Wire Fabric: Welded wire fabric shall conform to the requirements of ASTM A-185.
- J. Bearing Pads: Pads shall be multipolymer plastic bearing strip unless otherwise noted and shall be supplied and installed based on approval of manufacturer by the Architect.

- K. Grout: Grout shall consist of one part Portland Cement to three parts of clean mason sand.

2.2 MIXES

- A. Concrete Mix - Manufacturer's standard resulting in a minimum compressive strength at time of initial prestress of 3,500 psi and 5,000 psi at 28 days and slump 4" + 1".

2.3 FABRICATION

A. Formwork:

1. Construct forms to withstand tensioning and detensioning operations.
2. Construct forms to maintain units within specified tolerances with radius or chamfer at corners.

B. Pretension tendons by single strand tensioning method.

C. Consolidate placed concrete by external vibration without dislocation or damage to reinforcement and built-in items.

D. Provide permanent markings in units to identify pick-up points and location in structure.

E. Detensioning:

1. Delay detensioning of prestressed units until corresponding concrete test cylinder has attained 60 percent of ultimate compressive strength.
2. Perform detensioning while concrete is still warm and moist.
3. Detension pretensioned tendons by saw cutting tendons in sequence and pattern to prevent shock or unbalanced loading.

F. Finishes:

1. Unexposed areas: As cast.
2. Top surface: Roughened finish. Underside: Steel form.
3. Remove irregularities, fins, and other projections.
4. Prime exposed carbon steel anchors.

2.4 CONDITIONS OF SURFACES

- A. Prior to the work of this Section, inspect all areas for conformance to requirements for installation of precast units. Notify Contractor, in writing, of any conditions that would adversely affect installation. Do not proceed with work until these conditions have been satisfactorily remedied.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before installation of plank, check cores for any standing water and remove same.

- B. Coordinate with all other trades to permit insertion of any anchors, hangers, or other work required to be set in conjunction with precast prestressed slabs.
 - C. Do not do any field cutting of slabs, except for adjusting length or levels, under this Section unless specifically approved in writing by the Architect.
 - 1. All openings required in this Section of work are to be cast into slabs or headed: No field cut openings will be allowed, except approved core drillings of circular holes 6 inches or less in diameter.
 - D. Install units carefully on bearing strips to prevent cracking or chipping, in strict compliance with manufacturer's printed instructions and approved shop drawings.
 - 1. Lay units with tight joints, smooth surfaces, at right angles to bearing walls, except where angular placement is indicated on Drawings.
 - 2. Grout all joint keys and ends of planks with mix specified in Section 2.1K.
 - E. Coordinate installation of hangers for all suspended utilities where shown or scheduled.
- 3.2 PATCHING
- A. Repair all damaged spots to Architect's satisfaction.

END OF THIS SECTION

SECTION 040001

MASONRY WORK

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Trade Bids:
 - 1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 040001 – MASONRY WORK

- 2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 8 of Chapter 149A of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority.
 - 3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.
- C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
To be issued with final documents.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. All Work of Section 042000 - UNIT MASONRY.
 2. All Work of Section 044313 - CALCIUM SILICATE MASONRY VENEER (CAST STONE).

END OF SECTION

SECTION 042000

UNIT MASONRY

(Part of Work of Section 040001 - MASONRY WORK, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Concrete masonry units.
 2. Face brick.
 3. Embedded flashing.
 4. Mortar and grout.
 5. Reinforcing steel, masonry joint reinforcement, ties and anchors.
 6. Hoisting Equipment: The Masonry subcontractor shall furnish, install, and maintain in safe and adequate condition, all mechanical hoisting equipment, operating personnel, and rigging that is necessary for the proper execution of the Work of this Section. The requirements of Section 010000 – GENERAL REQUIREMENTS, Temporary Facilities and Controls, in relation to hoisting and rigging being the responsibility of the General Contractor, do not apply to the work of this Section.
 7. Staging, Planking and Scaffolding: The Masonry subcontractor shall furnish, install and maintain in safe and adequate condition, all staging, planking and scaffolding up to eight feet in height that is necessary for the proper execution of the Work in this Section. The General Contractor shall furnish, install, and maintain in safe and adequate condition all staging, planking, and scaffolding above eight feet in height.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Installed Only:
1. Section 055000 - METAL FABRICATIONS:
 - a. Lintels, miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
 2. Section 055100 - METAL STAIRS AND RAILINGS:

- a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
 - 3. Section 061000 - ROUGH CARPENTRY:
 - a. Wood nailers and blocking built into masonry.
 - 4. Section 083110 - ACCESS DOORS AND FRAMES
 - a. Access doors and frames in masonry openings.
 - 5. Section 142150 - GEARLESS MACHINE ROOMLESS TRACTION ELEVATORS:
 - a. Elevator rail bracket inserts.
 - D. Items To Be Furnished Only:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Dovetail slots for masonry anchors.
 - 2. Section 051200 - STRUCTURAL STEEL FRAMING:
 - a. Anchor sections of adjustable masonry anchors for connecting to structural frame.
 - E. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 044313 - CALCIUM SILICATE MASONRY VENEER (CAST STONE) for calcium silicate units.
 - 2. Section 061600 - SHEATHING for gypsum sheathing on cold-formed metal framing.
 - 3. Section 072100 - THERMAL INSULATION for cavity wall insulation.
 - 4. Section 072700 - AIR BARRIERS for membrane air barrier.
 - 5. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joint systems openings in masonry walls and at heads of masonry walls.
 - 6. Section 079200 - JOINT SEALANTS for sealing control and expansion joints in unit masonry.
- 1.3 SUBMITTALS
- A. Product Data: For each type of product indicated.
 - B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For steel reinforcements (rebars), submit industry-wide EPDs.
 - C. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
- D. Samples for Verification: For each type and color of the following:
1. Exposed concrete masonry units.
 2. Face brick, in the form of straps of five or more bricks.
 3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
 4. Weep holes/vents.
 5. Accessories embedded in masonry.
- E. Qualification Data: For testing agency.
- F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units:
 - a. Include material test reports substantiating compliance with requirements.
 - b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
 - d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.
- G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780 for mortar mixes required to comply with property specification.
 2. Include test reports, per ASTM C 1019 for grout mixes required to comply with compressive strength requirement.
- H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.
- 1.4 QUALITY ASSURANCE
- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated.

- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Preconstruction Testing Service: The Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by the Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
 - 1. Prism Test: For each type of construction required, per ASTM C 1314.
- E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 for mockups.
 - 1. Build sample panels for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness.
 - 2. Clean one-half of exposed faces of panels with masonry cleaner indicated.
 - 3. Protect approved sample panels from the elements with weather-resistant membrane.
 - 4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- G. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Agenda shall include protection of air barrier membrane during construction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

- A. Protection of Air Barrier Membrane: During construction, protect air barrier membrane from penetrations which allow air to pass through air barrier assemblies. Engage original installer to repair damage promptly using identical materials and methods of installation, and to the satisfaction of the Architect.
- B. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- C. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- E. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS (CMUS)

- A. Regional Materials: Provide CMUs that have been manufactured within 500 miles of Project site, from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Concrete Masonry Units: ASTM C 90, normal weight unless indicated otherwise manufactured to dimensions 3/8 inch less than nominal dimensions.
- C. Shapes: Provide standard shapes indicated and as required for building configuration. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- D. Decorative Concrete Masonry Units: ASTM C 90.
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi
 2. Weight Classification: Normal weight.
 3. Size (Width): Manufactured to dimensions specified in "Concrete Masonry Units" Paragraph above.
 4. Pattern and Texture: As indicated.
 5. Colors: As selected by Architect from manufacturer's full range.
 6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.
 7. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A Jandris & Sons
 - b. Trenwyth Industries.
 - c. Westbrook Concrete Block Co.
 8. Basis of Design:
 - a. 4"x24" Block - High Trendstone by Echelon Masonry - Trenwyth. Solid ground faced concrete masonry unit
 - b. 16"x24" Block - Mesastone by Echelon Masonry - Trenwyth. Solid textured concrete masonry units.
 - c. 8"x16" Split-face.

- E. Integral Water Repellent: Provide units made with integral water repellent for exterior exposed units.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen. Available products include:
 - a. ACM Chemistries: RainBlock
 - b. Addiment Incorporated, a Div. of Grace Construction Products; Block Plus W-10.
 - c. GCP Applied Technologies (formerly W.R. Grace); Dry-Block.
 - d. BASF Construction Chemicals; Masterpel.

2.2 BRICK

- A. Regional Materials: Provide brick that has been manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Face Brick: ASTM C 216, Grade SW, Type FBS.
1. Trade Reference and Color (Basis of Design): Belden Brick as selected by Architect, or approved equal.
 2. Size (Actual Dimensions): Norman
 3. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
- C. Building (Common) Brick where Concealed: ASTM C 62, Grade SW.
- D. General: Provide shapes indicated and as follows:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 5. Units which are sawn and less than one-half full size shall not be used.

2.3 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

- B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Available Products:
 - a. LanXess; Bayferrox Iron Oxide Pigments.
 - b. Davis Colors; True Tone Mortar Colors.
 - c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
- E. Aggregate for Mortar: ASTM C 144. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- F. Aggregate for Grout: ASTM C 404.
- G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer. Available products include:
 - 1. Addiment Incorporated, a Div. of Grace Construction Products; Mortar Tite.
 - 2. GCP Applied Technologies (formerly W.R. Grace); Dry-Block Mortar Admixture.
 - 3. BASF Construction Chemicals; MasterPel Mortar Admixture.
- H. Water: Potable.

2.4 REINFORCEMENT

- A. Environmental Product Declarations (EPD): Industry-wide EPDs for steel reinforcements (rebars) are available from the Concrete Reinforcing Steel Institute (CRSI).
- B. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- C. Masonry Joint Reinforcement, General: ASTM A 951.
 - 1. Interior Walls: Mill-galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size and Spacing: As required by Code.
 - 4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
 - 1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches in width, plus 1 side rod at each wythe of masonry 4 inches or less in width.

2.5 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
 - 3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 316.
 - 4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
 - 5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 6. Stainless Steel Bars: ASTM A 276 or ASTM A 666, Type 304.
- B. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
- C. Partition Top Anchors: 0.097-inch-thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- D. Adjustable Masonry-Veneer Anchors – Thermally-Broken:
 - 1. General: Provide thermally-broken anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, with structural performance capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 - 2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Anchor Section: Stainless steel barrel section, polymer coated screw with hex head with plastic-encapsulated steel wing and corrosion-resistant, self-drilling screw. Wing designed to receive wire tie. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
 - b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch-diameter, hot-dip galvanized steel wire.
 - c. Basis-of-Design: 2-Seal Thermal Wing Nut Anchor by Hohmann & Barnard or approved equal by Posi-Tie (thermally broken), or equal.

2.6 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.7 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Section 076200 - SHEET METAL FLASHING AND TRIM and as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
 - 2. Configuration: Provide continuous flashing including preformed outside, inside corners, and end dams with smooth uninterrupted soldered seams and hemmed edges to maintain continuity. See drawings for profiles required.
- B. Flexible Laminated Stainless Steel Flashing:
 - 1. Available Products:
 - a. Hohmann & Barnard, Inc.; Mighty-Flash Stainless Steel Fabric Flashing.
 - b. Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing.
 - c. STS Coatings, Inc.; Gorilla Flash Stainless Fabric.
 - d. TK Products, Inc.; TK TWF.
 - e. York Manufacturing, Inc.; Multi-Flash SS.
 - 2. Materials:
 - a. Type: Stainless steel core with polymer fabric laminated to one stainless steel face with non-asphalt adhesive.
 - b. Stainless steel type: 304, ASTM A666.
 - c. Fabric: Polymer fabric; laminated back face of stainless steel core.
 - 3. Accessories:
 - a. Sealant: Provide sealants as recommended by flashing manufacturer.
 - b. Splice Tape: Provide minimum 4" wide self-adhering strips and as recommended by flashing manufacturer.
 - c. Termination Bar: Provide stainless steel termination bars with sealant catch lip.
 - d. Preformed Shapes: Provide Type 304, 0.016 inch (0.40 mm) thick stainless steel preformed end dams, outside and inside corners.
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 – SHEET METAL FLASHING AND TRIM.
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates. Verify compatibility between flashing materials and substrates.
- E. Transition Strips: Provide long-term compatible 6" wide transition strips to seal embedded flashing terminations to air barrier membrane.
- F. Drip Edge: Provide type 316, 0.016 inch (0.40 mm) thick stainless steel drip edge plates with factory applied adhesive strip for all through-wall flashing conditions. Provide preformed outside and inside corner drip plate corners with smooth uninterrupted soldered seams and hemmed drip edges to maintain continuity. Custom sizes will be required see drawings for profiles required.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Provide strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings or equivalent. Available products:
 - 1. Advanced Building Products Inc.; Mortar Break II.
 - 2. Archovations, Inc.; CavClear Masonry Mat.
 - 3. Hohmann & Barnard; MortarTrap.
 - 4. Mortar Net USA, Ltd.; Mortar Net.

2.9 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Available Manufacturers:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Limit cementitious materials in mortar to portland cement and lime.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type S.
 3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
- C. Pigmented Mortar: Use colored cement product. Pigments shall not exceed 10 percent of portland cement by weight.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed. Do not use units cut to less than one-half size.

- E. Do not install concrete masonry units with more than 5 percent damage to the face. Do not install brick units which will show defects after installation.
- F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- G. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
 - 6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs. Prior to installation review bond pattern with Architect.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- G. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078440 – FIRE-RESISTIVE JOINT SYSTEMS.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and concrete masonry units as follows:
 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.5 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 1. Masonry Joint Reinforcement: Installed in horizontal mortar joints. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 2. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Coordinate and allow access for air and vapor barrier membrane installed in cavity under Section 072700 - AIR BARRIERS.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches. Space reinforcement not more than 16 inches o.c.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through insulation and sheathing to wall framing and to concrete and masonry backup as applicable with metal fasteners of type indicated.
 - 2. Embed tie sections in masonry joints. Provide air space indicated on the Drawings between back of masonry veneer and face of insulation.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as required by Code.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.

3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick made from clay or shale as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 - JOINT SEALANTS.

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 - JOINT SEALANTS but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows, unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
 3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge covered with elastomeric membrane, lapping at least 4 inches.
 4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 5. Install air barrier transition strips to seal embedded flashings in masonry to air barrier membrane in accordance with Section 072700 – AIR BARRIERS.

- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install metal drip edge plate in accordance with architectural details and manufacturer's requirements.
- E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products to form weep holes.
 - 2. Space weep holes 24 inches o.c., unless otherwise indicated.
- F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
- G. Install vents in head joints in exterior wythes at spacing indicated.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.13 FIELD QUALITY CONTROL

- A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof. Test types as determined by the independent testing and inspection agency.

3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, around penetrations and where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
 - 6. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

3.15 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 - EARTHWORK.
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off the Site.

END OF SECTION

SECTION 044313

CALCIUM SILICATE MASONRY VENEER (CAST STONE)

(Part of Work of Section 040001 - MASONRY WORK, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Calcium silicate masonry veneer units.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 054000 - COLD-FORMED METAL FRAMING for metal framing at exterior wall.
 - 2. Section 061600 - SHEATHING for substrate.
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM for metal flashing.

1.3 SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.
- B. Samples:
 - 1. For each stone type indicated.
 - 2. For each color of mortar required.

1.4 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.

- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried.
- C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: Subject to compliance with requirements, furnish either calcium-silicate-based manufactured stone units or quarried limestone from one of the following manufacturers:
 - 1. Arriscraft International.
 - 2. Approved equal.
- B. Basis of Design: Arriscraft - Driftwood Shadow Stone
 - 1. Provide custom shapes required for design and building configurations.
 - 2. Typical Thickness: 4".

2.2 CALCIUM SILICATED UNITS

- A. Calcium Silicate Masonry Units: ASTM C73, Grade SW; solid units that have been pressure formed and autoclaved; and then cut to thickness indicated; special shapes as indicated; and as follows:
 - 1. Compressive Strength: 6600 psi, to ASTM C170.
 - 2. Absorption: 8.8 percent, to ASTM C97.
 - 3. Density: 120 lbs/ft³, to ASTM C97.
 - 4. Modulus of Rupture: 770 psi, to ASTM C99.
 - 5. Color: Arriscraft #18-0915.
- B. Fabricate Calcium Silicate Units to the following tolerances:
 - 1. Unit Length: plus or minus 1/16".
 - 2. Unit Height: plus or minus 1/16".
 - 3. Deviation From Square: plus or minus 1/16", with measurement taken using the longest edge as the base.
 - 4. Bed Depth: plus or minus 1/8".
 - 5. Custom Dimensions: plus or minus 1/8".
 - 6. Unit Face Deviations: plus or minus 3/8".

2.3 MATERIALS AND ACCESSORIES

- A. Air and Water Barrier Membrane: Laticrete Air & Water Barrier to be thin, cold applied, single component liquid and load bearing. Waterproofing Membrane to be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured:
1. Air Barrier Test (AC 212): Pass.
 2. Air Permeance (ASTM E2178): Pass.
 3. Elongation @ break (ASTM D751): 20-30%.
 4. 7 day Tensile Strength (ANSI A118.10): >265 psi (1.8 MPa).
 5. 7 day Shear Bond Strength (ANSI A118.10) >200 psi (1.4 MPa).
 6. 28 Day Shear Bond Strength (ANSI A118.4): >214 psi (1.48 – 2.4 MPa).
 7. Service Rating (TCA/ASTM C627): Extra Heavy.
 8. Total VOC Content: < 0.05 mg/m³.
- B. Epoxy Waterproofing Flashing Mortar: Latapoxy Waterproof Flashing Mortar to be 3 component epoxy, trowel applied specifically designed to be used under adhered masonry veneer:
1. Breaking Strength (ANSI A118.10): 450-530 psi (3.1-3.6 MPa).
 2. Waterproofness (ANSI A118.10): No Water penetration.
 3. 7 day Shear Bond Strength (ANSI A118.10): 110-150 psi (0.8-1 MPa).
 4. 28 Day Shear Bond Strength (ANSI A118.10): 90-120 psi (0.6–0.83 MPa).
 5. 12 Week Shear Bond Strength (ANSI A118.10): 110-130 psi (0.8-0.9 MPa).
 6. Total VOC Content: <3.4 g/L.
- C. Slip Sheet Material: 15 pound asphalt saturated, non-perforated roofing felt complying with ASTM D226, 15 pound coal tar saturated, non-perforated roofing felt complying with ASTM D227 or 4.0 mils (0.1 mm) thick polyethylene plastic film complying with ASTM D4397.

2.4 MORTAR MATERIALS

- A. Latex-Portland Cement Mortar for leveling beds and scratch/plaster coats: Laticrete Premium Mortar Bed to meet the following physical requirements:
1. Compressive Strength (ANSI A118.4 Modified): >4000 psi (27.6 MPa).
 2. Water Absorption (ANSI A118.6): ≤ 5%.
 3. Service Rating (TCA/ASTM C627): Extra Heavy.
 4. Smoke & Flame Contribution (ASTM E84 Modified): 0.
 5. Total VOC Content: < 0.05 mg/m³.
- B. Latex Portland Cement Mortar: LATICRETE Hi Bond Masonry Veneer Mortar to be weather, frost, shock resistant, non-flammable and meet the following physical requirements:
1. Compressive strength (ANSI A118.4): >2500 psi (17.2 MPa).
 2. Bond strength (ANSI A118.4): >450 psi (3.1 MPa).
 3. Smoke & Flame Contribution (ASTM E84 Modified): 0.
 4. Total VOC Content: < 0.05 mg/m³.
- C. Latex Portland Cement Pointing Mortar / Grout: Laticrete Premium Masonry Pointing Mortar to be weather, frost and shock resistant, as well as meet the following physical requirements:

1. Compressive Strength (ANSI A118.7): 4500 psi (31 MPa).
2. Tensile Strength (ANSI A118.7): >500 psi (3.45 MPa).
3. Flexural Strength (ANSI A118.7): >1250 psi (8.6 MPa).
4. Water Absorption (ANSI A118.7): < 5%.
5. Linear Shrinkage (ANSI A118.7): < 0.05 %.
6. Smoke & Flame Contribution (ASTM E84 Modified): 0.
7. Total VOC Content: < 0.05 mg/m³.

D. Water: Potable.

PART 3 - EXECUTION

3.1 CUTTING OF THIN CALCIUM SILICATE UNITS

- A. Cut thin Calcium Silicate Units with a wet-saw.
- B. Pre-soak units using clean water prior to cutting.
- C. Clean cut units using a stiff fiber brush and clean water. Allow units to surface dry prior to placement.
- D. Thin calcium silicate units shall be cut accurately to shape and dimensions and full to the square, with jointing as shown on drawings
- E. Any miscellaneous cutting and drilling of thin calcium silicate units necessary to accommodate other trades will be the responsibility of the installer.
- F. Incidental cutting such as for window frame clips, etc., which is normally not considered to be the responsibility of the thin calcium silicate unit supplier, will be provided only by arrangement by the Contractor with the thin calcium silicate units supplier.

3.2 INSTALLATION OF MASONRY VENEER

- A. Comply with manufacturer's recommendations.
- B. Install flashing over sheathing and behind weather-resistant sheathing paper by fastening through sheathing into framing.
- C. Coat backs of units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and scratch coat.
- D. Rake out joints for pointing with mortar to depth of not less than 3/4 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.3 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.
- B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - 1. Joint Profile: As indicated.

3.4 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.

3.5 EXCESS MATERIALS AND WASTE

- A. Excess Units: Stack excess units where directed by Owner for Owner's use.

END OF SECTION

SECTION 050001

MISCELLANEOUS AND ORNAMENTAL IRON

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Time, Manner and Requirements for Submitting Trade Bids:
 - 1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 050001–MISCELLANEOUS AND ORNAMENTAL IRON

- 2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority.
 - 3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.
- C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
To be inserted with final documents.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work in Section 055000 - METAL FABRICATIONS.
2. All Work of Section 055100 - METAL STAIRS AND RAILINGS.
3. All Work of Section 055300 - METAL GRATING.
4. All Work of Section 057300 - DECORATIVE METAL RAILINGS.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All materials and labor required for the completion of the work of this Section including but not limited to:
 - 1. Furnishing of leveling plates, bearing plates, columns, beams, base plates, bracing, and connections (bolted angles, channels, stiffeners, separator plates, clips, supports for steel deck at columns, connections, welding filler metal, and electrodes anchor bolts, connection bolts, and erection bolts).
 - 2. Items of structural steel required to be built into concrete or masonry as indicated or specified shall be furnished to the respective trades at the proper time with complete instruction and templates to facilitate inspection.
- B. Unless specifically excluded, furnishing and installation of all other items for structural steel work indicated on the Drawings, specified, or required to make the work of this Section complete.
- C. Items to be furnished only:
 - 1. Furnish the following items for installation under designated Sections:
 - a. Anchor Bolts: Furnish to Section 03 30 00 and 04 20 00
 - b. Leveling Plates: Furnish to Section 03 30 00 and 04 20 00
 - c. Embedded Plates: Furnish to Section 03 30 00 and 04 20 00
- D. Sustainable Design Intent: comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System of the US Green Building Council. Refer to Division 01 Section "SUSTAINABLE DESIGN REQUIREMENTS" for certification level and certification requirements.
- E. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to the Owner's LEED v4 BD+C Certificate goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- F. Section 01 81 13.40 – SPEC MATERIALS TRACKING MATRIX.

1.2 RELATED REQUIREMENTS

- A. The Conditions of the Contract and General Requirements of the Project Manual including the Construction Manager's Scoping documents apply to this subcontractor, material suppliers, and all other persons furnishing labor and materials under this Section. General Conditions, Supplementary Conditions, Construction Manager's Scoping documents, and applicable parts of Division 01 are included as part of this Section.

- B. Work being performed by others, but related to this Section, and with which this contractor must coordinate with and/or accommodate the Work of, or which contain requirements that affect the Work of this Section include the following:

1. Section 01 45 23 – TESTING AND INSPECTING SERVICES
2. Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
3. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
4. Section 04 20 00 - UNIT MASONRY
5. Section 05 31 00 - STEEL DECKING
6. Section 05 15 00 - STUD SHEAR CONNECTORS
7. Section 05 50 00 - METAL FABRICATIONS; steel lintels and light steel framing provided by those sections and connecting to work of this section.
8. Section 05 51 00 – METAL STAIRS; connection of metal stairs to structural steel, and reactions imposed.
9. Section 07 21 19 – FOAMED-IN-PLACE INSULATION; surface preparation of steel scheduled to receive foam insulation.
10. Section 07 81 00 – APPLIED FIREPROOFING; surface preparation of steel scheduled to receive fireproofing.
11. Section 14 24 10 – HYDRAULIC ELEVATORS; requirements and coordination for hoisting safety beam.
12. Section 23 00 10 – HVAC; coordination and requirements of steel-framed floor and roof openings for HVAC ducts and equipment.
13. Section 26 00 10 – ELECTRICAL; grounding of electrical system to steel frame.

1.3 GENERAL REQUIREMENTS

- A. Examine all other Sections of the specifications and drawings for the relationship of the work under this section and the work of other trades. Cooperate with all trades and coordinate all work under Section therewith.

1.4 PRE-INSTALLATION CONFERENCE

- A. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 04 20 00 – UNIT MASONRY.

1.5 QUALITY ASSURANCE

- A. The Construction Manager shall have available one copy of each of the following literature including latest revisions, which are hereby included in and made part of these specifications:
- B. Commonwealth of Massachusetts State Building Code
- C. AISC: "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".
- D. AISC: "Code of Standards Practice for Steel Bridges and Buildings".
- E. AISC: "Specification for Structural Joints using High-Strength Bolts".
- F. AWS: "Code for Welding in Building Construction", with Addenda.

- G. Any material or operation specified by reference to the published specifications of a manufacturer, the American Society for Testing and Materials (ASTM), the American Institute of Steel Construction (AISC), the American Welding Society (AWS), the Industrial Fasteners Institute (IFI), the Steel Structures Painting Council (SSPCV), the American National Standards Inst. (ANSI), or other published standard, shall comply with the standard listed. In case of conflict between the referenced specifications, etc., the one having the most stringent requirement shall govern. In case of conflict between the referenced specifications, etc., and the project specifications, the project specification shall govern.

1.6 SUBMITTALS

- A. Samples and shop drawings are to be submitted to the Architect for approval in accordance with Section 01 30 00 – ADMINISTRATIVE REQUIREMENTS.
- B. Shop drawings, erection drawings, certifications, and schedules, properly checked and coordinated with other parts of the construction, are to be submitted to the Architect for approval.
- C. Without limiting the generality of the items mentioned below, shop drawings shall be complete and shall include all information necessary for the fabrication and erection of the component parts of the structure.
- D. These drawings shall show: Type of steel for each member; location and identification mark of each member; dimensions, size and weight of members; connection load, type and identification mark and camber; location and size of cuts, copes, slots, holes and openings required by other trades; type, size, and extent of all welds; joint welding procedures; welding sequence; and painting requirements (The welding symbols used shall be as adopted by the American Welding Society).
- E. These drawings shall show all requirements such as (1) temporary members required for erection including connections.
- F. Submit shop drawings in electronic PDF format. The documents have to be searchable and resolution independent. The PDF documents should be created directly from the detailing software and cannot be scanned from printed or hand-drawn sketches.
- G. Along with the searchable PDF erection plans for each submission, provide a 3D, searchable model showing all of the structural members that are required to be reviewed. The model should be provided with a free viewer. The common detailing programs that have a free viewer available are: SDS/2, Tekla BIM sight and SOLIBRI.
- H. Except as otherwise noted the approval of shop drawings will be for size and arrangement of principal and auxiliary components and strength of connections. Any error in dimensions shown on the shop drawings shall be the responsibility of the Construction Manager.
- I. Fabrication of any material, cutting of any holes or performance of any work shall not proceed until shop drawings have been reviewed by the Architect.
- J. Certified copies of mill test reports including names and locations of mills and shops and analysis of chemical and physical properties, of steel to be used on this project shall be submitted to the Architect before delivery to the job site.
- K. Manufacturer's certification of bolts, nuts, and filler metal for welding shall be submitted to the Architect.

- L. The Construction Manager shall maintain records of test results of welding procedures and records of welders employed, date of qualification, and identification symbol or mark. Such records shall be available for examination by the SER and Testing Agency or certified copies submitted upon request to the SER and the Testing Agency.
- M. Methods of Erection: Prior to starting work the Construction Manager shall submit to the Architect a description of the methods, sequence of erection, and type of equipment he proposes to use for erecting the structural steel work. This submission or approval shall not relieve the Construction Manager of his responsibility for providing the proper methods, equipment, workmanship, or safety precautions.

1.7 LEED SUBMITTALS

- A. This subcontractor shall provide all documentation indicating applicability of all products of this section to potential LEED credits to the Project LEED Administrator for submission to LEED-Online: <https://leedonline.usgbc.org>. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS for all requirements; and Section 01 81 13.40 – SPEC MATERIALS TRACKING MATRIX.

1.8 DELEGATED CONNECTION DESIGN

- A. Design structural steel connections indicated in the contract documents per AISC 303, Option Three, using the connection loads indicated. Submit design calculations for steel connections signed and sealed by a registered professional engineer.

1.9 TESTING AND INSPECTION

- A. Inspection, Testing, and Quality Control:
- B. A program of Inspection and Testing of structural steel work will be established by the Structural Engineer of Record (SER) who will direct the implementation of tests as carried out by an independent testing agency. All costs for initial inspection and testing shall be borne by the Owner. This subcontractor shall be responsible for re-inspection or retesting of defective work.
- C. The materials and workmanship to be furnished under this Section shall be subject to inspection and testing in the mill, shop, and field by the SER and/or the Testing Agency. Such inspection and testing shall not relieve the Construction Manager of his responsibility to provide his own inspection and quality control and to furnish materials and workmanship in accordance with the requirements of the contract documents.
- D. The Construction Manager and Testing Agency shall examine the contract documents and become thoroughly acquainted with detailed inspection and testing requirements as outlined by the SER.
- E. The Construction Manager shall cooperate with and facilitate inspection and testing by the SER and/or the Testing Agency. The Construction Manager shall furnish, at his own expense, the SER and/or the Testing Agency upon request, with the following:
 - 1. A complete set of reviewed erection drawings, detailed shop drawings, schedules, and corrective work procedures at the fabricating shop or shops in the field.
 - 2. Cutting list, order lists, material bills, and shipping lists.
 - 3. Information as to time and place of all rollings and shipment of material to shops

4. Representative sample pieces requested for testing.
 5. Assistance for testing materials and proper facilities for inspection of the work, in the mill, shop, and field.
- F. The Testing Agency shall inspect and test, as required by the SER, all welded and bolted work.
- G. Weldments and bolted connections that are required by the SER and/or the Testing Agency to be corrected shall be corrected without delay at the Construction Manager's expense and to the satisfaction of the SER and/or the Testing Agency. The SER or the Testing Agency shall require drawings showing proposed corrective work to be submitted for review.
- H. The Construction Manager shall notify the SER and/or the Testing Agency five days prior to the shipment of any structural steel so that a paint inspection can be made. At these inspections, the dry mill thickness of the paint film will be checked and steel containing mill scale that can easily be removed with the blade of a pocketknife will be subject to re-cleaning and repainting at the expense of the Construction Manager.
- I. Any material or workmanship which is rejected by the SER and/or the Testing Agency either in the mill, shop, or field shall be replaced promptly by the Construction Manager to the satisfaction of the SER and/or the Testing Agency.
- J. The fact that steel work has been accepted at the shop shall not prevent its final rejection at the job site, even after it has been erected, if it is found to be defective in any way.

1.10 QUALIFICATIONS

- A. The Construction Manager shall submit conclusive evidence to the Owner that the fabricator and the erector has satisfactorily completed projects of similar scope and have adequate fabrication facilities to meet production requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All steel is to consist of a minimum of 95 percent recycled steel with over 80 percent post-consumer and 15 percent pre-consumer recycled content as defined in the USGBC LEED for Schools v4 credit descriptions.
- B. All wide flange shapes shall be newly rolled steel conforming to ASTM A992, $F_y = 50$ KSI. unless noted otherwise on drawings.
- C. All bars, plates, channels, and angles shall conform to ASTM A36 unless otherwise indicated on the drawings.
- D. Structural tubing shall conform to ASTM A500, Grade C with minimum yield strength $F_y = 50$ KSI.
- E. Structural pipe shall conform to ASTM A53, Grade B.
- F. Anchor bolts shall conform to ASTM A307 or ASTM F1554 $F_y = 105$ KSI as noted or otherwise shown on the drawings.

- G. High strength bolts ASTM F3125 with ASTM A563, Grade A Hex style nuts, and compatible washers. Bolts shall be cold forged with rolled threads. Bolts with torque control snap-off ends may be used.
- H. Hot Dip Galvanizing shall conform to the latest ASTM specification as specified in Section 2.04 below.
- I. Filler metal for welding shall conform to AISC Code, 2010 Edition, Section I.4.5.

2.2 FABRICATION

- A. Applicable Standards: Except as otherwise noted on the drawings or specified, the fabrication of structural steel shall be in accordance with the AISC specifications, such as will permit proper erection.
- B. Provision for attachment of other materials: Punch and drill steel for attachment of other materials indicated on the drawings or noted in the specifications to be attached to the steel.
- C. Connections: Weld or bolt shop connections as indicated. Bolt field connections except where welded connections are indicated.
 - 1. Provide high strength threaded fasteners for principal bolted connections except where unfinished bolts are indicated.
 - 2. Provide shear tab connections for all beam to column connections where the column width is 6 in. or less.
 - 3. For columns that are 7 in. or wider, provide a double angle connection.
- D. High strength bolted construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using High-Strength bolts."
- E. Welding:
 - 1. Quality control and qualification of welding procedures and operations shall be as specified under Paragraph 1.04 H and 2.03 of this section.
 - 2. Shop welding shall be done by either shielded metal-arc welding or submerged arc-welding.
 - 3. All groove welds shall have complete penetration unless otherwise noted on the drawings.
 - 4. Where structural joints are required to be welded, the details of all joints, the technique of welding employed, the appearance and quality of welds made and the methods used in correcting defective work shall conform to the applicable requirements of the specifications under "QUALITY ASSURANCE" in this Section.
 - 5. The Construction Manager shall prepare joint welding procedures for all welded joints which shall be approved by the SER or the Testing Agency before any welding is done. After approval, these welding procedures shall be followed without deviation unless specific approval for change is obtained from the Architect. The SER may require re-qualification of any of these welding procedures by tests prescribed in the AWS "Standard Qualification Procedure".
- F. Oxygen cutting: Manual Oxygen cutting shall be done only with a mechanically-guided torch. Alternatively an unguided torch may be used provided the cut is not within a ½ in. of the finished dimension and the final removal is completed by chipping or grinding to produce a surface quality equal to that of the base metal edges. The use of oxygen-cut holes for bolted connections will not be permitted; components prepared in this manner will be rejected.

- G. Corrective Work: Structural steel members or assemblages having fabrication errors, which exceed permissible tolerances, shall be corrected only if permitted by the SER. All corrective work shall be in accordance with AISC and AWS requirements. When requested by the SER or the Testing Agency, the Construction Manager shall submit to the Architect and/or SER for approval, drawings showing details of proposed corrective work and shall receive approved drawings prior to performing the corrective work. All corrective work shall be solely at Construction Manager's expense.
- H. Identification: All structural steel members shall have assigned positions and identification marks or symbols, plainly indicated thereon near one end. Marks shall agree with those given on the shop drawings and erection drawings relating to or calling for the member.
- I. Special care used in the handling and fabricating of exposed steel indicated on the drawings and as follows:
 - 1. Locate field joints at concealed locations if possible.
 - 2. Fabricate with exposed surfaces smooth, square and free of surface blemishes including pitting, rust, scale and roughness.
 - 3. Grind sheared, punched and flame-cut edges to remove burrs and provide smooth surfaces and edges.
 - 4. Fabricate steel with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
 - 5. Fabricate steel with exposed surfaces free of seams to maximum extent possible.
 - 6. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating and shop priming.
 - 7. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.

2.3 SOURCE QUALITY CONTROL

- A. The Construction Manager shall maintain his own quality control and inspection of all shop and field work. Quality control and inspection of all welding work shall consist of meticulous supervision by the Construction Manager's own welding inspector using non-destructive spot testing, at the rate of at least one test per 50 linear feet of weld by each welder, except that full penetration welds shall be tested 100 percent. Non-destructive testing shall be done by the radiographic-magnetic particle or ultrasonic method; whichever is most effective for the joint to be tested.
- B. The fact that steel work has been accepted at the shop shall not prevent its final rejection at the job site, even after it has been erected, if it is found to be defective in any way.

2.4 GALVANIZING

- A. Any items so noted or specified.
- B. Galvanizing shall be hot dip galvanized after fabrication in compliance with ASTM specifications A123, A153, or A386 where applicable. All galvanized materials must be inspected for compliance with these specifications and marked with a stamp indicating the ASTM number and the weight of the zinc coating in ounces per square foot. Galvanizer shall furnish a notarized statement of compliance with all specifications.
- C. Reference Standards:

1. ASTM A153 for galvanizing iron and steel hardware.
 2. ASTM A123 for galvanizing rolled, pressed and forged steel shapes, plates, bars, and strips one-eighth of an inch (1/8") thick and heavier.
 3. ASTM A386 for galvanizing assembled steel products.
 4. AHDGA Publication, "Inspection Manual for Hot Dip Galvanized Products"
 5. ASTM A563 for tapping nuts after galvanizing.
 6. ASTM F3125 for galvanizing high strength bolts.
- D. Grade Stamps and Certifications: Each piece of galvanized metal shall be inspected and stamped with ASTM number and weight in ounces per square foot applied. Furnish Certificates of Compliance signed by Construction Manager and galvanizer stating that galvanizing complies with these specifications.
- E. Packaging and Handling after Galvanizing: Suitable to prevent damage to galvanized surfaces and distortion of steel. Avoid wet stain by ensuring free circulation of air around stored material.
- F. Fabricator's Responsibilities: Furnish to Galvanizer shop drawings of non-standard fabrications to coordinate fabrication with galvanizing and to avoid problems with warpage due to improper provisions for hot-dipping.
- G. Touch-Up: Touch-up abraded surfaces adjacent to weldments section using 95 percent (by weight) organic zinc-rich paint over wire brush preparation per ASTM A780. DFT shall equal thickness required for galvanized coating in the reference standards.

2.5 SURFACE PREPARATION AND PAINTING

- A. Applicable Standards: Except as otherwise indicated on the drawings or specified, the painting of structural steel shall be in accordance with the Structural Steel Painting Council (SSPC) specifications under "Requirements of Regulatory Agencies".
- B. Steel to be left unpainted - Thoroughly clean all steel of all loose mill scale in accordance with SSPC SP-3. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter. Oil and grease deposits shall be removed:
1. Contact surfaces including high-strength bolted connections.
 2. Steel indicated on the drawings to be encased in concrete.
 3. Top flange of beams to receive metal decking or steel shear studs.
 4. Steel to receive spray fireproofing.
 5. All other steel to receive primer or paint.
- C. Steel to be painted - Thoroughly clean all steel of all loose mill scale in accordance with SSPC SP-3. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter. Oil and grease deposits shall be removed. At exposed steel to receive High Performance Coatings – prepare surfaces in accordance with SSPC SP-6 Commercial Blast Clean. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of one and one half – three mils.
1. Unless specifically excluded, all structural steel shall receive one shop coat of primer paint. Refer to the Drawings for locations of steel to receive High Performance Coatings.
 2. Surfaces requiring paint shall be painted only to within two in. of any field weld. If for any reason the surface to be field welded is painted, such paint shall be completely removed in the shop to within the stated limits before field welding.

3. Surfaces, inaccessible after assembly, excluding bolted, finished, or welded surfaces at connections. Surfaces encased in exterior building insulation shall receive two coats of primer paint.
- D. Shop Primer: All ferrous metal surfaces, except pre-finished galvanized items and those obviously not to be painted shall, before leaving the shop or manufacturing plant, be cleaned of all scale, rust, grease, and other foreign matter and shall be given one thorough shop coat, on all surfaces of a metal primer, ready and compatible for finish painting at the building site. Primer shall be Tnemec Co. #1009 Gray Metal Primer or approved equal by manufacturer listed under FINISHES, and shall be compatible with materials to be used in field painting and shall be used directly from factory labeled containers. Touchup damaged and abraded spots after installation using same paint.
1. After steel has been properly prepared as specified above, apply primer paint to dry steel surfaces by brush, spray, or roller assuring no running or sagging in accordance with manufacturer's directions. Cleaned surfaces shall be primed within 8 hours of cleaning and prior to any surface rusting.
 2. The coverage rate per coat shall not be more than 400 square feet per gallon resulting in a wet film thickness of two mils.
 3. Inspection of shop painting shall be specified under "Inspection, Testing and Quality Control" in this Section.
- E. Steel to be galvanized - Thoroughly clean all steel of all loose mill scale in accordance with SSPC SP-3. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter. Oil and grease deposits shall be removed.

2.6 PRODUCT HANDLING

- A. Handle, transport, and stack all materials carefully to prevent deformation or damage. Store all structural steel members carefully on substantial timbers and blocking, so arranged that the steel will not be in contact with the earth and properly drained, preventing any spattering with dirt or accumulation of water in or about the steel. Take care to prevent the accumulation of mud or other foreign matter on the steel.

PART 3 - EXECUTION

3.1 ERECTION

- A. The Construction Manager shall survey the anchor rods prior to the erection of structural steel and shall notify the design team of any misplaced anchor rods that require remedial work.
- B. Applicable Standards: Except as otherwise indicated on the drawings or specified, the erection of structural steel shall be in accordance with the AISC Specification listed under "Requirements of Regulatory Agencies".
- C. All beams shall be installed web normal. Add shims or other accessories, as required, to support pitched deck.
- D. Methods of Erection: Prior to starting work the Construction Manager shall submit to the Architect a description of the methods, sequence of erection, and type of equipment he proposes to use for erecting the structural steel work. This submission or approval shall not relieve the Construction

Manager of his responsibility for providing the proper methods, equipment, workmanship, or safety precautions.

- E. Temporary Floors: All temporary flooring, planking, and scaffolding necessary in connection with the erection of the structural steel or the support of erection machinery shall be provided as a part of the erection work. The temporary floors shall be as required by state and municipal laws and governing safety regulations.
- F. Field Connection: Unless otherwise indicated, shall be welded or bearing-type (N) high strength bolts tightened to provide the minimum tension shown in Table J3.7 of AISC "Manual of Steel Construction". Unless otherwise indicated, beams shall have framed double angle connections using $\frac{3}{4}$ in. diameter (minimum) high strength bolts in accordance with the requirements of the AISC "Manual of Steel Construction".

3.2 WELDING:

- A. Field welding shall be executed in accordance with all the requirements under "Fabrication Welding" in this Section, excepting those requirements that manifestly apply to shop conditions only.
- B. All field welding shall be performed by manual shielded metal-arc welding only.
- C. Oxygen cutting in the field will not be permitted without prior approval of the SER.

3.3 GUARANTEE

- A. The Construction Manager shall furnish to the Owner a written guarantee covering all defects in materials and workmanship that occur within a period of one year from the date final of completion of the building. Should any defects in materials and workmanship develop within this time, all necessary repairs and replacements shall be made at no additional cost to the Owner.

END OF SECTION

SECTION 05 15 00

STUD SHEAR CONNECTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide all labor, materials, equipment, and services to furnish and install all steel stud shear connectors, as shown on the drawings.
- B. Sustainable design intent: comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System of the US Green Building Council. Refer to Division 01 Section "SUSTAINABLE DESIGN REQUIREMENTS" for certification level and certification requirements.
- C. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to the Owner's LEED v4 BD+C certificate goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- D. Section 01 81 13.40 – SPEC MATERIALS TRACKING MATRIX.

1.2 RELATED REQUIREMENTS

- A. The conditions of the contract and general requirements of the project manual including the Construction Manager's scoping documents apply to this subcontractor, material suppliers, and all other persons furnishing labor and materials under this section. The General Conditions, supplementary conditions, Construction Manager's scoping documents, and applicable parts of Division 01 are included as part of this section.
- B. Work being performed by others, but related to this section, and with which this contractor must coordinate with and/or accommodate the work of, or which contain requirements that affect the work of this section include the following:
 - 1. Section 01 45 23 – TESTING AND INSPECTING SERVICES.
 - 2. Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: procedural and administrative requirements for construction and demolition recycling.
 - 3. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
 - 4. Section 03 30 00 - CAST-IN-PLACE CONCRETE.
 - 5. Section 05 12 00 - STRUCTURAL STEEL FRAMING.
 - 6. Section 05 31 00 - STEEL DECKING.

1.3 SUBMITTALS

- A. Submit complete layout shop drawings drawn no smaller than 1/8 in. equal to 1 ft. – 0 in. All special conditions shall be indicated. Size and length of studs shall be indicated, as well as welding information and layout of all studs. Shop drawings will not be reviewed without all the above information clearly indicated. Shop drawings for the studs shall be coordinated with the deck drawings required in Section 05 31 00 – STEEL DECKING.
- B. Manufacturer's catalogue shall be submitted with the shop drawings

1.4 LEED SUBMITTALS

- A. This subcontractor shall provide all documentation indicating applicability of products of this Section to potential LEED credits to the Project LEED Administrator for submission to LEED-Online: <https://leedonline.usgbc.org>. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS for all requirements; and Section 01 81 13.40 – SPEC MATERIALS TRACKING MATRIX.

1.5 CODES AND STANDARDS

- A. Except as modified by the requirements of other governing codes and by this specification, conform to the provisions and recommendations of the following codes and standards:
 - 1. Manual of Steel Construction by the American Institute Of Steel Construction, latest edition.
 - 2. Requirements of The American Welding Society for arc and gas welding in building construction.
 - 3. International Building Code (IBC) 2015, with Massachusetts amendments.
 - 4. MSBC – Massachusetts State Building Code, 9th Edition. 780 CMR.

1.6 TESTING AND INSPECTION

- A. Inspection, testing, and quality control: A program of inspection and testing of stud shear connector work will be established by the structural engineer of record (SER), who will direct the implementation of tests as carried out by an independent testing agency. All costs for initial inspection and testing shall be borne by the owner. This subcontractor shall be responsible for costs associated with re-inspection or retesting of work identified as defective.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The stud shear connectors shall be made of cold finished carbon steel bars conforming to ASTM A-108 requirements. The steel shall have a minimum tensile strength of 60,000 p.s.i. The studs shall be $\frac{3}{4}$ in. diameter, and shall also conform to the requirements of Articles 429 and 430, "Code for Welding in Building Construction" AWS D1.0069 of the American Welding Society. If flux-retaining caps are used, the steel for the caps shall be of a low carbon grade suitable for welding complying with ASTM A-109 requirements. Note that steel beams are made from steel conforming to ASTM A-572, Grade 50.
- B. All steel is to consist of a minimum of 95 percent recycled steel with over 80 percent post-consumer and 15 percent pre-consumer recycled content as defined by the USGBC LEED for Schools v4 credit descriptions.

PART 3 - EXECUTION

3.1 QUALITY CONTROL

- A. Before beginning work, inspect all conditions to receive work and notify the Owner in writing of any condition that might prevent a satisfactory installation.

- B. The starting of work of this Section will be construed as acceptance of the conditions to which this work is to be applied, as suitable to properly receive the work, and any defects resulting from such accepted conditions shall be corrected at no additional cost to the Owner.
- C. A minimum of two studs shall be welded at the start of each production period in order to determine proper generator, control unit, and stud welder settings. These studs shall then be bent 45 degrees from the vertical, without weld failure, to test installation procedures.
- D. If, after welding, visual inspection reveals that a sound weld or full 360-degree fillet has not been obtained for a particular stud, the stud shall be hammer bent approximately 15 degrees off perpendicular to the nearest end of the beam or bent away from the opening in the fillet.
- E. Three working-days' notice shall be given to the Owner when materials are to be inspected.
- F. Studs meeting this test will be considered acceptable and shall be left in the bent position. Studs failing this test shall be replaced.
- G. When the temperature is below 32 degrees Fahrenheit, one stud in each 100 shall be tested after cooling. Studs shall not be welded when temperature is below zero degrees Fahrenheit or when the surface is wet.

3.2 ERECTION

- A. The surface of the beam flange that will receive the centering and the stud shear connectors shall be free of mill scale, heavy rust, dirt, debris, snow, ice, water, or any other material that would adversely affect stud welding. Any water in the valleys of the decking shall be released or blown out.
 - 1. It shall be noted that the studs may be used to attach the steel decking specified in Section 05 31 00 – STEEL DECKING.
 - 2. The metal decking shall be held in intimate contact with itself at laps and with the supporting steel when the studs are installed.

END OF SECTION

SECTION 05 21 00

STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install the following items required to complete the work of this Section as shown on the drawings and specified herein:
 - 1. Open web steel joists, designed, fabricated, and erected in conformance with the Steel Joist Institute (SJI) and American Institute of Steel Construction (AISC).
 - 2. All bridging, bracing, and accessories
 - 3. Bottom & top chord extensions
 - 4. Shop painting of all steel joists and field touch up after erection.
 - 5. Coordinate bridging with mechanical.
- B. Sustainable Design Intent: comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System of the US Green Building Council. Refer to Division 01 Section "SUSTAINABLE DESIGN REQUIREMENTS" for certification level and certification requirements.
- C. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to the Owner's LEED v4 BD+C certificate goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- D. Section 01 81 13.40 – SPEC MATERIALS TRACKING MATRIX.

1.2 RELATED REQUIREMENTS

- A. The Conditions of the Contract and General Requirements of the Project Manual including the Construction Manager's Scoping documents apply to this subcontractor, material suppliers, and all other persons furnishing labor and materials under this Section. General Conditions, Supplementary Conditions, Construction Manager's Scoping documents, and applicable parts of Division 01 are included as part of this Section.
- B. Work being performed by others, but related to this Section, and with which this contractor must coordinate with and/or accommodate the Work of, or which contain requirements that affect the Work of this Section include the following:
 - 1. The Conditions of the Contract and General Requirements of the Project Manual including the Construction Manager's Scoping documents apply to this subcontractor, material suppliers, and all other persons furnishing labor and materials under this Section. General Conditions, Supplementary Conditions, Construction Manager's Scoping documents, and applicable parts of Division 01 are included as part of this Section.
 - 2. Work being performed by others, but related to this Section, and with which this contractor must coordinate with and/or accommodate the Work of, or which contain requirements that affect the Work of this Section include the following:
 - 3. Section 01 45 23 - TESTING AND INSPECTING SERVICES.

4. Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
5. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
6. Section 03 30 00 - CAST-IN-PLACE CONCRETE.
7. Section 05 12 00 - STRUCTURAL STEEL FRAMING.
8. Section 04 20 00 - UNIT MASONRY.
9. Section 05 31 00 - STEEL DECKING.
10. Section 05 50 00 - METAL FABRICATIONS.
11. Section 07 54 00 – THERMOPLASTIC MEMBRANE ROOFING.
12. Section 11 66 23 – GYMNASIUM EQUIPMENT: gym equipment suspended from and imposing point loads on joist framing.
13. Section 21 00 10 – FIRE PROTECTION: piping and equipment suspended from and imposing point loads on joist framing.
14. Section 22 00 10 – PLUMBING: piping and equipment suspended from and imposing point loads on joist framing.
15. Section 23 00 10 – HVAC: piping and equipment suspended from and imposing point loads on joist framing, coordination of framed openings at roof for penetrations.

1.3 SUBMITTALS

- A. Submit complete shop drawings in accordance with the provisions of Section 01 30 00 – ADMINISTRATIVE REQUIREMENTS.
- B. Shop drawings shall include information necessary for complete fabrication and erection of component parts of structure.
 1. Shop drawings shall show: Identification marks of members, dimensions, size, arrangement, and weights of members, bridging, requirements, such as punched or drilled holes, for attachment of other materials or parts of construction; type, size, and location of shop and field connections; type, size, and extent of welds; joint welding procedures, welding sequences, type, and dry thickness of paint. (Use welding symbols adopted by American Welding Society).
- C. Prepare complete design calculations, properly coordinated with joist placement plans, for each specific type of steel joist indicated on the drawings. Calculations shall be signed and sealed by a professional engineer registered in the Commonwealth of Massachusetts. Submit to the Architect for review. Submittal shall include the following:
 1. Non-SJI standard bridging details (e.g. for cantilevered condition, net uplift)
 2. Connection details for:
 - a. Non-SJI standard connections (e.g. flush framed or framed connections)
 - b. Field splices
 - c. Joist headers
- D. Review of shop drawings will be for type, size, and arrangement of principal and auxiliary components and strength of connections. Dimensional errors on shop drawings are the responsibility of the Construction Manager.
- E. A notarized affidavit from an officer of the joist fabricator shall be required, listing each material that is used, its required applicable specification, and a statement that the materials comply with the applicable specifications.

1.4 LEED SUBMITTALS

- A. This subcontractor shall provide all documentation indicating applicability of products of this Section to potential LEED credits to the Project LEED Administrator for submission to LEED-Online: <https://leedonline.usgbc.org>. Refer to 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS for all requirements; and Section 01 81 13.40 – SPEC MATERIALS TRACKING MATRIX.

1.5 QUALITY ASSURANCE

- A. General: Provide joists fabricated in compliance with the Steel Joist Institute (SJI) "Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders".
- B. The open web steel joists shall be furnished by a manufacturer who shall have a Steel Joist Institute design and production approval for all the specific joists designations employed on the project's structural drawings. All joists shall be manufactured and installed in accordance with these approvals and with the Standard Specifications adopted by the Steel Joist Institute as amended to date.
- C. Qualification of field welding: Qualify welding process and welding operators in accordance with the American Welding Society (AWS) "Structural Welding Code - Steel" AWS D1.1.
- D. Inspection: Inspect joists and girders in accordance with SJI "Specifications".

1.6 TESTING AND INSPECTION

- A. Inspection, Testing, and Quality Control: A program of Inspection and Testing of steel joist work will be established by the Structural Engineer of Record (SER), who will direct the implementation of tests as carried out by an independent testing agency. All costs for initial inspection and testing shall be borne by the Owner. This subcontractor shall be responsible for costs associated with re-inspection or retesting of defective work.
- B. The materials and workmanship to be furnished under this Section shall be subject to inspection in the shop and field by the SER and/or testing agency. Such inspection shall not relieve the Construction Manager of his requirements to furnish materials and workmanship in accordance with requirements of the Contract Documents.
- C. Access shall be provided for inspection of all facilities by the testing agency and/or SER. The fabricator shall, when requested, aid the inspectors in carrying out their duties.

1.7 GUARANTEE

- A. The Construction Manager shall furnish to the Owner a written guarantee covering all defects in materials and workmanship of the work of this Section that occur within a period of one year from the date of final completion of the building. Should any defects in materials or workmanship develop within this time, all necessary repairs and replacements shall be made at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All steel is to consist of a minimum of 95% recycled steel with over 80% post-consumer and 15% pre-consumer recycled content as defined in the USGBC LEED for Schools V4 credit descriptions.
- B. Steel for joist members shall be newly fabricated and shall comply with the Standard Specifications of the Steel Joists Institute, latest issue, and the Standard for Steel Construction current edition published by AISC. Material for bridging shall conform to ASTM A-36.
 - 1. Selection of steel type shall conform to the standard specifications for steel joists of the type (K), (KCS), (LH), and (DLH) being used of the American Institute of Steel Construction and the Steel Joist Institute.
- C. Filler metal for Welding: Arc-Welding electrodes shall conform to "Mild Steel Covered Arc Welding Electrodes" ASTM Specification A-233, E60 or E70 Series.
- D. Paint: Paint for shop coats on all steel joists shall be one prime coat of Tnemec #1009 Gray by Tnemec Co., Kansas City, Missouri or approved equal.

2.2 DESIGN AND FABRICATION

- A. All open web steel joists shall be designed and fabricated in accordance with the Standard Specifications for Open Web Steel Joists and adopted by the Steel Joist Institute (SJI) and the AISC and as specified herein.
- B. Joist shall be fabricated by a member of the Steel Joist Institute.
- C. Top and bottom chord members shall be limited in shape to angles or structural tees for all joists.
- D. All joists, bridging, and anchorage shall be designed for the following uplift criteria:
 - 1. Provide bridging at first panel points in addition to standard or required bridging.
 - 2. Joists, anchorage, and bridging to be designed for a net uplift of:
 - 3. 30 pounds per square foot (PSF) minimum.
 - 4. 70 pounds per square foot (PSF) minimum at roof edges located within a distance of 15 ft. from all edges.
 - 5. 110 pounds per square foot (PSF) minimum at corners located within a distance of two-tenths the least width of the structure or two times forty percent (40%) of the height of the building.
 - 6. All of the above are minimum requirements. Any additional loads required by local codes shall apply.
- E. Substitutions of sections or modifications of details or both shall be made only with the prior written review of the Architect and/or the SER.
- F. The Construction Manager shall furnish the following:
 - 1. A certified mill test report covering chemical and physical properties of steel used in joists
 - 2. A certificate stating that the joists conform to or exceed the requirements of the Steel Joist Institute.

2.3 ACCESSORIES

- A. Bridging for joists shall be in conformance with recommended practices of the SJI Specifications.
- B. All bridging rows shall be spaced no further than is standard with SJI Specifications. Provide anchors for all ends of bridging lines terminating at walls or beams. Positive anchorage shall be provided at the ends of each bridging list at both top and bottom of chords. Where joists are too close to parallel walls for bridging, provide sidewall anchors.
- C. Ceiling extensions shall be either an extended bottom chord or a separate unit as standard with the manufacturer. Provide ceiling extensions where hung ceilings are indicated on the drawings and where so indicated on the structural drawings. Provide hangers for the ceiling extension to limit the deflection of the free end.
- D. Headers, trimmers, and bearing plates shall be manufacturer's standard items.
- E. Provide extended ends for top and/or bottom chords of steel joists where indicated on the drawings.

2.4 PAINTING

- A. Joists, bridging, anchors, and other accessories shall be cleaned of all rust, scale, weld slag and weld splatter, oil and grease deposits, and given one shop coat of primer paint as specified herein.
- B. Joists receiving spray fireproofing shall not be painted and shall be SSPC - SP3.

2.5 HANDLING, SHIPPING AND STORAGE

- A. Care shall be exercised at all times to avoid damage through careless handling. Materials shall be unloaded and placed on skids; dumping onto the ground will not be permitted.
- B. All materials shall be stored off the ground in a well-drained location and protected from the weather. No damaged or bent joists may be used or installed.

PART 3 - EXECUTION

3.1 ERECTION

- A. All steel joists shall be erected in accordance with the procedures and details shown on the reviewed shop drawings, as shown on the contract drawings, and in strict conformance with the Standard Specifications for open web steel joists.
- B. Unless otherwise shown, joists shall bear a minimum of 3 in. on structural steel. The end of bearing shall extend 1 in. beyond the centerline of the beam or column, except where joists abut each other. Each joist shall be anchored to the steel supports with a minimum 1/8 in. fillet weld 2 in. long, each side.
- C. The joists shall be permanently fastened to supports and all bridging and anchors completely installed before any construction loads (other than workmen) are placed on the joists.
- D. All bridging shall be installed within 3 in. of panel points.

- E. Field welding shall be executed in accordance with the "Code of Arc and Gas Welding in Building Construction", of the AWS, and only by welding operators who have been previously qualified to perform the type of work involved.
- F. No burn holes will be permitted in the chords of the joists. Any joist whose chords have burn holes which damage 20 percent or more of the chord section shall be reinforced or replaced where exposed.
- G. Concentrated loads over 150 pounds hung from the top or bottom chord shall be located at a panel point or a panel point shall be provided by adding a diagonal web member. No concentrated load shall be hung from the joists without authorization from the SER.
- H. As erection progresses, the work shall be securely bolted or welded to take all dead loads, wind, and erection loads. No permanent welding shall be performed until the structure has been properly aligned.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install the following items required to complete the work of this Section as shown on the drawings and specified herein:
 - 1. Roof and floor deck.
 - 2. Closure plates, bent angle plates, sump pans, hanger tabs, and accessories for fastening the deck to the steel frame, perimeter closure angles, and closure angles around interior openings.
- B. Sustainable Design Intent: comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System of the US Green Building Council. Refer to Division 01 Section "SUSTAINABLE DESIGN REQUIREMENTS" for certification level and certification requirements.
- C. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to the Owner's LEED v4 BD+C certificate goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- D. Section 01 81 13.40 – SPEC MATERIALS TRACKING MATRIX.

1.2 RELATED REQUIREMENTS

- A. The Conditions of the Contract and General Requirements of the Project Manual, including the Construction Manager's Scoping documents apply to this subcontractor, material suppliers, and all other persons furnishing labor and materials under this Section. General Conditions, Supplementary Conditions, Construction Manager's Scoping documents, and applicable parts of Division 01 are included as part of this Section.
- B. Work being performed by others, but related to this Section, and with which this contractor must coordinate with and/or accommodate the Work of, or which contain requirements that affect the Work of this Section include the following:
 - 1. Section 01 45 23 - TESTING AND INSPECTING SERVICES.
 - 2. Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
 - 3. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
 - 4. Section 05 12 00 - STRUCTURAL STEEL FRAMING.
 - 5. Section 05 15 00 - STUD SHEAR CONNECTORS.
 - 6. Section 07 54 00 – THERMOPLASTIC MEMBRANE ROOFING.
 - 7. Section 07 81 00 – APPLIED FIREPROOFING; surface preparation of steel scheduled to receive fireproofing.
 - 8. Section 23 00 10 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC); coordination and requirements of steel-framed floor and roof openings for HVAC ducts and equipment.

1.3 PRE-INSTALLATION CONFERENCE

- A. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 07 54 00 – THERMOPLASTIC MEMBRANE ROOFING.

1.4 QUALITY ASSURANCE

- A. Any material or operation specified by reference to the published specifications or a manufacturer, the American Society for Testing and Materials (ASTM), the American Welding Society (AWS), the American Iron and Steel Institute (AISI), the Steel Deck Institute (SDI), or other published standard, shall comply with the requirements of the current specifications or standard listed. In case of a conflict between the referenced specification and the project specification, the project specification shall govern.
- B. The Construction Manager shall furnish a notarized affidavit from an officer of the deck manufacturer listing each material that is used, its required applicable specification, and a statement that the materials comply with the applicable specifications. However, such certification shall not relieve the Construction Manager from the responsibility of complying with any added requirements specified herein.
- C. Deck and erection methods shall conform to the Handbook of Industrial Loss Prevention, Chapter 75, "Wind Forces and Roof Anchorage Design", published by Factory Mutual Engineering and Research of Norwood, Massachusetts.

1.5 SUBMITTALS

- A. Notarized affidavit from an officer of the deck manufacturer listing each material that is used, its required applicable specification, and a statement that the materials comply with the applicable specifications.
- B. Shop drawings for steel deck shall include the name of the manufacturer and all physical properties.
- C. Metal deck layout shop drawing shall be drawn no smaller than 1/8 in. = 1 ft. – 0 in. and sections showing all edge conditions and conditions around openings, changes in deck direction, etc., shall be clearly detailed drawn to a scale no smaller than 3 in. = 1 ft. – 0 in. Welds and crimps as specified herein shall also be detailed on the shop drawings. Shop drawings shall state type of steel and minimum yield point. Shop drawings will not be reviewed without all the above information clearly indicated.
- D. No fabrication shall take place until the shop drawings have been reviewed.
- E. All welds shall be indicated by AWS "Welding Symbols".
- F. The Construction Manager shall check the shop drawings and shall indicate in colored pencil his corrections, holes, etc., modifications for the other trades, and necessary field dimensions before forwarding them to the Architect for correction and review.
- G. Complete calculations verifying the ability of the deck to support all design loads.

1.6 LEED SUBMITTALS

- A. This subcontractor shall provide all documentation indicating applicability of products of this Section to potential LEED credits to the Project LEED Administrator for submission to LEED-Online: <https://leedonline.usgbc.org>. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS for all requirements; and Section 01 81 13.40 – SPEC MATERIALS TRACKING MATRIX.

1.7 TESTING AND INSPECTION

- A. Inspection, Testing, and Quality Control:
 - 1. A program of Inspection and Testing of steel decking work will be established by the Structural Engineer of Record (SER) who will direct the implementation of tests as carried out by an independent testing agency. All costs for initial inspection and testing shall be borne by the Owner. This subcontractor shall be responsible for all costs related to re-inspection or retesting of work identified or proven to be defective.
- B. The materials and workmanship to be furnished under this Section shall be subject to inspection in the shop and field by the SER and/or the testing agency. Such inspection shall not relieve the Construction Manager of his requirements to furnish materials and workmanship in accordance with requirements of the Contract Documents.
- C. Access shall be provided for inspection of all facilities by the SER and/or the testing agency and the fabricator shall, when requested, aid the inspectors in carrying out their duties.

1.8 GUARANTEE

- A. The Construction Manager shall furnish to the Owner a written guarantee covering all defects in materials and workmanship of the work of this Section that occur within a period of one year from the date of final completion of the building. Should any defects in materials or workmanship develop within this time, all necessary repairs and replacements shall be made at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All steel is to consist of a minimum of 95 percent recycled steel with over 80 percent post-consumer and 15 percent pre-consumer recycled products as defined in the USGBC LEED for Schools v4 credit descriptions.
- B. Metal roof deck shall be one of the following with gage as shown on the drawings.
 - 1. Type B, wide rib, one and one half in. deep, 36 in. wide galvanized sheet carbon steel conforming to ASTM A653, Grade 40 with a minimum yield point of 40,000 PSI
 - 2. Type NS, wide ribbed, three-in. deep, 24-in. wide galvanized sheet carbon steel conforming to ASTM A653, Grade 40 with a minimum yield point of 40,000 PSI
 - 3. Type NSA, wide ribbed, three-in. deep, 24-in. wide, galvanized sheet carbon steel conforming to ASTM A653, Grade 40 with a minimum yield point of 40,000 PSI Webs shall be perforated and filled with acoustic batts that fit into ribs. Minimum noise reduction coefficient shall be 0.70.

4. Type NCAS, wide ribbed, three-in. deep, 24-in. wide, galvanized sheet carbon steel conforming to ASTM A653, Grade 40 with a minimum yield point of 40,000 PSI. Top panel shall be Type N and the bottom panel shall be flat and perforated. Acoustic batts shall be factory installed within the cells. Minimum noise reduction coefficient shall be 0.90.
 5. Roof form deck shall be one inch (1") deep; UF1X type sheet galvanized corrugated steel with a minimum yield point of 80,000 PSI
- C. Floor deck shall be one of the following with gage as shown on the drawings:
1. Floor deck shall be composite wide rib 2-inch deep sheet carbon, galvanized conforming to ASTM A1008 or A653 with a minimum yield point of 40,000 PSI. Deck shall be formed with deformations to provide a mechanical lock between concrete and steel.
- D. Roof deck shall be hot dipped galvanized to ASTM A653 coating, Class G90 with floor deck conforming to ASTM A653 coating, Class G60.

2.2 MATERIAL FABRICATION

- A. Decks shall be fabricated to fit about all roof openings. Special 18 gauge edge overlapping pieces with one rib or 18 gauge channel shall be used at all edges, parallel to the span where the deck is continuous, wherever the centerline of a regular rib does not occur within 2 in. of the edge. On the sides of all openings, parallel to deck, provide a similar channel or single ribbed piece. Flat bearing must be provided at all edges of the roof and around all openings, so nailers or metal curbs will have solid bearing.
- B. All deck shall be shop fabricated to proper lengths and delivered to the job with durable identification corresponding to the shop drawings.
- C. Deck shall be fabricated in three span lengths or longer.
- D. The Construction Manager shall submit complete calculations to the Engineer. Calculations shall verify ability of the deck to support all design loads.

2.3 ACCESSORIES

- A. Sixteen Gauge minimum sheet steel closures and cover plates as required to close panel end conditions where panels end, change direction, or abut.
- B. Sheet steel closures for column to close openings between panels and structural steel columns.

2.4 HANDLING AND STORAGE

- A. Handle and stack materials carefully in order to prevent deformation or damage during unloading and hoisting, extra care shall be taken to prevent damage to ends and sides of individual panels. If panels are to be stored prior to installation, they shall not be placed in direct contact with ground and shall be protected from elements and dry. If mud, dirt, or other foreign matter is accumulated on panels, such accumulation shall be completely removed prior to erection. All deformed or damaged panels shall be removed from the site and replaced at no additional expense to the Owner.

PART 3 - EXECUTION

3.1 ERECTION

- A. Metal decking panels and accessories shall be erected and welded in accordance with the manufacturer's specification, for diaphragm action as reviewed on shop drawings, and as specified.
 - 1. NOTE: Penetration through metal decking panels for hangers or hanger attachment devices is prohibited. Do not hang from bare metal roof deck.
- B. Metal decking panels shall be shipped to the field cut to the proper length. All notching at column bevel cuts or other similar fabrication shall be performed by metal decking erector.
- C. No ducts, conduits, pipes or any other mechanical, electrical, fire protection or plumbing equipment shall be supported from the metal deck.
- D. Holes and openings, which are located and dimensioned on the structural drawings, shall be cut by the metal decking erector. Holes required for work by other trades will be located and cut by the respective trades. All openings cut in the metal deck panels shall be reinforced as required by the metal deck supplier. No opening shall be cut in metal decking panels unless shown on the structural drawings.
- E. All cutting of metal decking panels shall be performed in a workmanlike fashion by power shears, gas-torch cold chisel, or other means reviewed by the Architect.
- F. Metal decking panels shall be placed on support steel and accurately aligned to final position before being permanently fastened. All metal roof deck panels shall have a minimum bearing of 2 in. on the supporting steel.
- G. If the supporting steel framework is not in proper alignment, or at the proper level, the metal decking erector shall notify the Construction Manager for corrective action. The metal decking panels shall not be installed until the necessary corrections have been made.
- H. Metal decking panels shall rest tightly on the flange of beams or girders of any other support surfaces.
- I. Steel Decking shall be fastened to all supporting steel members as follows and as shown on the structural drawings:
 - 1. 1 1/2 in. Deep Deck:
 - a. Field: 5/8 in. diameter round spot welds to steel supports at each rib, 6 in. on center;
 - b. Perimeter: 5/8 in. diameter round spot welds to steel supports at 6 in. on center;
 - c. Openings: 5/8 in. diameter round spot welds to steel supports at 6 in. on center;
 - d. Corners: one 3/4 in. diameter round spot weld to steel supports;
 - e. Sidelaps: No. 10 TEK screws at 1 ft. – 0 in. on center at sidelaps between supports.
 - 2. 3 in. Deep Deck:
 - a. Field: 5/8 in. diameter round spot welds to steel supports at each rib, 8 in. on center
 - b. Perimeter: 3/4 in. diameter round spot welds to steel supports at 8 in. on center
 - c. Openings: 3/4 in. diameter round spot welds to steel supports at 8 in. on center
 - d. Corners: two each 3/4 in. diameter round spot welds to steel supports
 - e. Sidelaps: No. 10 TEK screws at 1 ft. – 0 in. on center at sidelaps between supports.

3. 2 in. and 3 in. Deep Composite Deck:
 - a. Field: 5/8 in. diameter round spot welds to steel supports at each rib, 12 in. on center
 - b. Perimeter: 5/8 in. diameter round spot welds to steel supports at 12 in. on center
 - c. Openings: 5/8 in. diameter round spot welds to steel supports at 12 in. on center
 - d. Corners: one each 5/8 in. diameter round spot welds to steel supports;
 - e. Sidelaps: No. 10 TEK screws at 2 ft. – 0 in. on center or closer to support wet concrete and construction loads at sidelaps between supports.
 4. Spot welds shall be fully joined all around to the deck. After welding, all roof deck welds shall be painted with ZRC Cold Galvanizing Compound.
- J. After welding all roof deck, welds shall be painted with ZRC cold galvanizing compound.

END OF SECTION

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Exterior non-load-bearing wall framing.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for masonry shelf angles and connections.
 - 2. Section 061600 - SHEATHING for exterior sheathing applied to cold-formed metal framing.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
 - 4. Section 092120 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As required by Code.
 - 2. Deflection Limits: Design framing systems to withstand design loads within deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing:

- 1) Horizontal deflection of $l/240$ of the wall height for metal panel systems.
 - 2) Horizontal deflection of $1/600$ of the wall height for masonry systems.
 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load, plus superimposed dead load, deflection of primary building structure.
- C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
1. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- 1.4 SUBMITTALS
- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. LEED Submittal:
1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For cold-formed metal framing, submit EPDs.
 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Recycled Content: For cold-formed metal framing, submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 3. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.

- a. For interior field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 1. Shop drawings shall be signed and sealed by a professional engineer currently licensed in the Commonwealth of Massachusetts.
- D. Delegated-Design Submittal: For framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Welding certificates.
- F. Qualification Data: For professional engineer.
- G. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional structural engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.
- D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

- E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
 - 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
 - 1. California Expanded Metals Co. (CEMCO).
 - 2. ClarkDietrich Building Systems.
 - 3. EB Metal U.S.
 - 4. Marino\WARE.

2.2 MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90.
- C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90 (Z275).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch (18 gauge).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ClarkDietrich Building Systems.
 - b. MarinoWARE, a division of Ware Industries.
 - c. The Steel Network, Inc.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, threaded carbon-steel bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - 1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10

times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - 1. Basis of Design: Sika; SikaGrout 212.
 - 2. VOC Content: 0 g/L.
- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- D. Sill Sealer Gaskets: Closed-cell foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install sill sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
- D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 055000

METAL FABRICATIONS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.
 - 1. Loose steel bearing and leveling plates, including bearing plates for steel joists, galvanized at exterior locations and in exterior walls.
 - 2. Restraining steel angles for concrete masonry walls and partitions. Galvanized steel lintels with shop-applied primer at exterior locations.
 - 3. Steel lintels with shop-applied zinc-rich primer at interior locations.
 - 4. Galvanized shelf angles with shop applied primer at exterior locations.
 - 5. Shelf angles with zinc-rich shop-applied primer at interior locations.
 - 6. Steel elevator machine beams.
 - 7. Steel support angles for elevator door sills.
 - 8. Cants in elevator hoistways made from sheet steel.
 - 9. Miscellaneous steel framing and supports:
 - a. Steel framing and supports with shop applied primer for operable partitions.
 - b. Galvanized steel framing and supports for overhead doors.
 - c. Galvanized steel framing and supports for mechanical and electrical equipment.
 - d. Steel framing and supports for applications where framing and supports are not specified in other Sections; galvanized at exterior locations and in exterior walls.
 - e. Prefinished slotted steel channel support framing.
 - f. Steel framing and supports with shop-applied primer for countertops.
 - g. Steel framing and supports with shop-applied primer for miscellaneous classrooms and spaces including but not limited to OT/PT, Theater, Lab, Shop. And other indicated spaces requiring supplemental framing and supports for equipment and furnishings.
 - 10. Ladders:
 - a. Aluminum ladders to all roof levels.
 - b. Aluminum ladders at interior locations.
 - c. Aluminum ladder safety cages.

- d. Aluminum elevator pit ladders.
 - e. Aluminum ships' ladders.
 - f. Ladder vertical lifeline fall arrest system.
 - 11. Galvanized steel bollards with shop-applied primer.
 - B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
 - C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Lintels, sleeves, anchors, inserts, plates and similar items.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Lintels, miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
 - D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING for structural steel items.
 - 2. Section 055100 - METAL STAIRS AND RAILINGS for steel stairs, handrails, and guardrails.
 - 3. Section 055300 - METAL GRATINGS for metal bar gratings
 - 4. Section 099000 - PAINTING AND COATING for field painting work of this section.
 - 5. Section 102210 - WIRE MESH PARTITIONS for interior wire mesh partitions.
 - 6. Section 118129 - FACILITY FALL PROTECTION for metal anchors at rooftop.
- 1.3 PERFORMANCE REQUIREMENTS
- A. Delegated Design: Design ladders and miscellaneous framing and supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - B. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
 - 1. For ladders exceeding 24 feet, include loads imposed by fall arrest system.
 - C. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each product.
- B. LEED Submittals:
 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For aluminum extrusions, cold-rolled sheet, and hot-rolled sheet, submit industry-wide EPDs.
 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For interior field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Shop Drawings: Show fabrication and installation details for metal fabrications.
 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 2. Provide templates for anchors and bolts specified for installation under other Sections.
 3. Where fabrications are to receive sprayed-on fireproofing, include statement that primer is compatible with fireproofing proposed for use.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Welding certificates.
- F. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated for this Project in material, design, and extent.
- C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. AWS D1.6, "Structural Welding Code--Stainless Steel."
4. AWS D1.2, "Structural Welding Code--Aluminum."

- D. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 at interior, Type 316L at exterior.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 at interior, Type 316L at exterior.

- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- H. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.
 - 1. Basis of Design: Unistrut Corp.
- I. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.2 NONFERROUS METALS

- A. Environmental Product Declarations (EPD): Industry-wide EPDs for aluminum extrusions, cold-rolled sheet, and hot-rolled sheet are available from the Aluminum Association.
- B. Aluminum Plate and Sheet: ASTM B 209/B 209M, Alloy 6061-T6.
- C. Aluminum Extrusions: ASTM B 221/221M, Alloy 6063-T6.
- D. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- E. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- C. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- D. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488,

conducted by a qualified independent testing agency. Anchors shall have an ICC-ES report with approval for use in cracked concrete.

1. Acceptable Manufacturers: Kwik-Bolt TZ by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head, Power-Stud+ by Powers Fasteners, or Strong Bolt by Simpson.

- E. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

- C. Zinc-Rich Primer: Urethane zinc-rich primer compatible with topcoat Specified in Section 099000 - PAINTS AND COATINGS.

1. Available Products: Tnemec; Series 394 PerimePrime, or approved equal.
2. VOC Content: 250 g/L or less.

- D. Galvanizing Repair Paint: High-zinc-dust-content (95% by weight) paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Duncan Galvanizing; ZiRP.
 - b. ZRC Worldwide; Galvilite Galvanizing Repair, low VOC type.
2. VOC Content: 250 g/L or less.

- E. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dayton Superior; 1107 Advantage Grout.
 - b. Sika; SikaGrout 212.
2. VOC Content: 0 g/L.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.7 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

2.8 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

2.10 METAL LADDERS, SHIPS LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, unless otherwise indicated.
 - 2. For elevator pit ladders, comply with ASME A17.1.
 - 3. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.
 - 4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
- B. Manufacturers:
 - 1. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:

- a. (Basis of Design) O'Keeffe's, Inc.; San Francisco, CA.
 - b. ALACO Ladder Co., Chino, CA.
 - c. Precision Ladders, LLC, Morristown, TN.
 - d. Or equal.
 2. Basis of Design:
 - a. Ladders: Model 504 by O'Keeffe's
 - 1) At floor access doors and areaways provide modified rail with Safety Post.
 - b. Ships Ladders: Model 520 by O'Keefe's
 - 1) At floor access doors provide modified rail.
- C. Finishes:
1. Factory Painted:
 - a. Exterior locations: Powder coated in custom color to be selected by Architect.
 - b. Interior locations: Polyurethane over chemically pretreated substrate. Color to be selected from manufactures full range of standard colors.
- D. Materials:
1. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
 2. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.
- E. Fabrication
1. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18-3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
 - a. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.
 2. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.
 3. Landing Platform: 1-1/2 inches (38 mm) or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.
 4. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.
 5. Mounting Accessories: as recommended by ladder manufacturer and suitable for abutting substrates.
 6. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
 7. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
 8. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners, unless otherwise indicated.
 9. Provide Ladder Safety Posts as indicated on drawings.

- F. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers, pipe and tube railings, and bar grating treads, unless otherwise indicated. Provide brackets and fittings for installation.

2.11 LADDER FALL ARREST DEVICES

- A. General: Provide personal fall arrest system for fixed ladders exceeding 24-feet in height.
- B. Manufactured system to consist of pre-swaged stainless-steel cable and galvanized steel channels or pipe, designed to be secured to ladder. Include mounting brackets, rung clamps, cable tensioner, automatic pass-through traveling devices and energy absorbing lanyard for complete installed system.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, include but are not limited to, the following:
 - a. FixFastUSA; KattClimb Ladder Fall Arrest.
 - b. Honeywell Industrial Safety; Miller Vi-Go.
 - c. MSA; Latchways Vertical Ladder Kit.
 - 2. Cable: 3/16-inch (5 mm) diameter, 1-by-7 wire cable made from stainless steel wire Type 316.
 - 3. Carriers: Automatic locking with anti-inversion feature, with no more than 20-inch (500 mm) movement in a fall event.
 - 4. Arrest Capacity: Single person use; 1400 lbs. (635 kg) rated.
 - 5. Performance Standards: Units to meet or exceed OSHA 1910.28, ANSI A14.3 and ANSI Z359.16.
- C. Mount personal fall arrest system to ladder rungs in accordance with manufacturer's instructions, and approved submittals.

2.12 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all 4 corners for 3/4-inch anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

2.13 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.14 STEEL PRIMERS AND FINISHES

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Urethane Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush Off Blast Cleaning."
 3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.
 4. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 5. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages."
- B. Zinc-Rich Primer: Urethane zinc-rich primer compatible with topcoat Specified in Section 099000 - PAINTS AND COATINGS.
1. Available Products: Tnemec; Series 394 PerimePrime, or approved equal.
 2. VOC Content: 340 g/L or less.

2.15 HOT-DIP GALVANIZING

- A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.
1. Basis-of-Design: Duragalv by Duncan Galvanizing.
 2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
 3. Provide thickness of galvanizing specified in referenced standards.
 4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
 5. Fill vent holes after galvanizing, if applicable, and grind smooth.

2.16 HOT-DIP GALVANIZING AND FACTORY-APPLIED PRIMER

- A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.
1. Basis-of-Design: Duragalv by Duncan Galvanizing.
 2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
 3. Provide thickness of galvanizing specified in referenced standards.
 4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
 5. Fill vent holes after galvanizing, if applicable, and grind smooth.
- B. Factory-Applied Primer over Galvanized Steel: Provide factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and local requirements. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer coat shall exhibit a rugosity (smoothness) not greater than 4 rug

(16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year re-coat window for application of finish coat. Coatings must meet or exceed the following performance criteria as stipulated by the coatings manufacturer:

1. Basis-of-Design: Primergalv by Duncan Galvanizing.
2. Abrasion Resistance: ASTM D 4060 (CS17 Wheel, 1,000 grams load).1kg load, 200 mg loss.
3. Adhesion: ASTM D4541, 1050 psi.
4. Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours; rating 10 per ASTM D714 for blistering and rating 7 per ASTM D610 for rusting.
5. Direct Impact Resistance: ASTM D2794, 160 in. lbs.
6. Flexibility: Method: ASTM D522, 180 degree bend, 1 inch mandrel, passes.
7. Pencil Hardness: ASTM D3363, 3B.
8. Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours; passes, no cracking or delamination.
9. Dry Heat Resistance: Method: ASTM D2485, 250 degrees F.
10. Warranty: Provide galvanizer's warranty that materials will be free from 10 percent or more visible rust for a period of 20 years.

2.17 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.18 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges

and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of steel that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of isolation coating.

3.2 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.4 INSTALLING PIPE BOLLARDS

- A. Anchor bollards to existing construction with anchor bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
 - 1. Embed anchor bolts at least 4 inches in concrete.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touch-Up and Repair for Galvanized Surfaces: For damaged and field-welded metal coated surfaces, clean welds, bolted connections and abraded areas.
 - 1. For galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780, modified to 95 percent zinc in dry film. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or A 153 as applicable. Touch-up of galvanized surfaces with silver paint, brite paint, or aluminum paints is not acceptable.
 - 2. For factory-applied finish coatings, field-touch-up shall be performed by factory approved personnel. Touch-up shall be such that repair is not visible from a distance of 6 feet.
 - 3. A touch-up repair kit or touchup instructions shall be provided to the Owner for each type of factory-applied finish.

END OF SECTION

SECTION 055100

METAL STAIRS AND RAILINGS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Preassembled steel stairs with concrete filled treads.
 - 2. Industrial-type stairs with steel grating treads.
 - 3. Steel railings, handrails and guardrails, interior and exterior.
 - 4. Steel mesh infill panels.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Sleeves, anchors, inserts, plates and similar items.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for metal treads and nosings not installed in metal stairs.
 - 2. Section 057300 - DECORATIVE METAL RAILINGS for decorative railings.
 - 3. Section 061000 - ROUGH CARPENTRY for wood blocking for anchoring railings.

4. Section 092110 - GYPSUM BOARD ASSEMBLIES for metal backing for anchoring railings.
5. Section 099000 - PAINTING AND COATING for field painting work of this section.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design stairs and railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Uniform Load and Concentrated Loads: As required by Code.
 2. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 3. Limit deflection of treads, platforms, and framing members to $L/360$ or $1/4$ inch, whichever is less.
- C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and Code required loads and stresses within limits and under conditions indicated.
- D. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to Code.

1.4 SUBMITTALS

- A. Product Data: For each product.
 1. Manufacturer's product lines of railings assembled from standard components.
 2. Grout, anchoring cement, and paint products.
- B. LEED Submittals:
 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For interior field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 1. Provide templates for anchors and bolts specified for installation under other Sections.
 2. Shop drawings shall be signed and sealed by a professional engineer currently licensed in the Commonwealth of Massachusetts.
- D. Delegated-Design Submittal: For stairs and railings indicated to comply with performance requirements and design criteria, including structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- E. Welding certificates.
- F. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal stairs and railings that are similar to those indicated for this Project in material, design, and extent.
- C. Installer Qualifications: Fabricator of products.
- D. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Preassembled Stairs: Commercial class.
 - 2. Industrial Type Stairs: Industrial class.
 - 3. Ornamental Stairs: Architectural class.
- E. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 3. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- C. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- D. Wire Rod for Grating Crossbars: ASTM A 510.
- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.
- G. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.
- H. Woven-Wire Mesh, Carbon Steel: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 099000 - PAINTING AND COATING.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.
- E. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 1. Available Products: Sika; SikaGrout 212, or approved equal.
 2. VOC Content: 0 g/L.
- G. Concrete Materials and Properties: Comply with requirements in Section 033000 - CAST-IN-PLACE CONCRETE for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 1. Join components by welding, unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
 4. Weld exposed corners and seams continuously, unless otherwise indicated.
 5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- H. Comply with "Guideline 1: Joint Finishes", by National Ornamental & Miscellaneous Metals Association (NOMMA), as follows:
1. Typical Railing: Type 2 or better, unless otherwise indicated.
 2. Service Stair Railing: Type 3 or better, unless otherwise indicated.
 3. Ornamental Railing: Type 1.
- I. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Alfab, Inc.
 2. American Stair, Inc.
 3. Worthington Metal Fabricators, formerly Sharon Companies Ltd. (The).
- B. Stair Framing:
1. Fabricate stringers of steel plates or channels. Provide closures for exposed ends of stringers.
 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
 3. Weld stringers to headers; weld framing members to stringers and headers.
 4. Where stairs are enclosed by gypsum board or shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.
1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
 2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 3. Shape metal pans to include nosing integral with riser.

4. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.
- D. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
 1. Fabricate treads and platforms from welded steel grating with openings in gratings no more than 1/2 inch in least dimension.
 2. Surface: Serrated.
 3. Finish: Galvanized.
 4. Fabricate grating treads with rolled-steel floor plate nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
 5. Fabricate grating platforms with nosing matching that on grating treads. Provide toeplates at open-sided edges of grating platforms. Weld grating to platform framing.

2.7 STEEL RAILINGS

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
- C. Form changes in direction of railings as detailed on the Drawings.
- D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 1. Connect posts to stair framing by direct welding, unless otherwise indicated.
 2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
- H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to

suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.

2.9 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
 - 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 - 4. Handrails: Galvanizing shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of the railings.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
 - 1. Exterior Stairs (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Place and finish concrete fill for treads and platforms to comply with Section 033000 - CAST-IN-PLACE CONCRETE.
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.2 INSTALLING STEEL RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding directly to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 3. For hollow masonry anchorage, use toggle bolts.
 - 4. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 5. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 055300

METAL GRATINGS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON, Trade Bid Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Metal bar gratings.
 - 2. Metal frames and supports for gratings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Sleeves, anchors, inserts, plates and similar items.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING for structural-steel framing system components.
 - 2. Section 055100 - METAL STAIRS AND RAILINGS for stairs fabricated with metal bar grating treads and platforms

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design gratings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Floors: Uniform load of 250 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.
 - 2. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. or concentrated load of 8000 lbf, whichever produces the greater stress.
 - 3. Limit deflection to L/360 or 1/4 inch, whichever is less.
- C. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 SUBMITTALS

- A. Product Data: For each product.
 - 1. Including clips and anchorage devices for gratings.
 - 2. Paint products.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For interior field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Shop Drawings: Include plans, sections, details, and attachments to other work.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Qualification Data: For qualified professional engineer.
- F. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- G. Welding certificates.
- H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual" and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."

- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- D. Wire Rod for Bar Grating Crossbars: ASTM A 510.
- E. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30.
- F. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating.
- G. Expanded-Metal Carbon Steel: ASTM F 1267, Class 1.
- H. Expanded-Metal Galvanized Steel: ASTM F 1267, Class 2, Grade A.

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Plain Washers: Round, ASME B18.22.1.
- E. Lock Washers: Helical, spring type, ASME B18.21.1.
- F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.
- B. Shop Primers: Provide primers that comply with Section 099000 - PAINTING AND COATING.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in steel, complying with SSPC-Paint 20.
 - 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less.
- E. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
 - 2. Fabricate toeplates for attaching in the field.
 - 3. Toeplate Height: 4 inches unless otherwise indicated.

2.5 METAL BAR GRATINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alabama Metal Industries Corporation; a Gibraltar Industries company.
 - 2. Fisher & Ludlow; Division of Harris Steel Limited.
 - 3. IKG Industries; a division of Harsco Corporation.
 - 4. Ohio Gratings, Inc.
- B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
- C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
 - 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

- D. Do not notch bearing bars at supports to maintain elevation.
- E. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.
- F. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish gratings, frames, and supports after assembly.
- G. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 055813

ARCHITECTURAL METAL COLUMN COVERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Column covers.
- B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for non-ornamental metal fabrications.
 - 2. Section 076100 - SHEET METAL ROOFING for items made of formed metal for roofing and for items made of formed metal for parapets and copings
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM for items made of formed metal for flashings.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Loads: Capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved, including anchors and connections, and without exhibiting permanent deformation in any components:
 - 1. Wind Loads on Exterior Items: As indicated on Drawings.
- B. Thermal Movements: Provide exterior ornamental formed-metal assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- C. Corrosion Control: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including finishes.
- B. Shop Drawings: Show fabrication and installation details for formed metal fabrications.
 - 1. Include plans, elevations, sections, and details of formed metal fabrications and their connections. Show anchorage and accessory items.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.
 - 3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the jurisdiction where Project is located responsible for their preparation.
 - 4. Where fabrications are to receive sprayed-on fireproofing, include statement that primer is compatible with fireproofing proposed for use.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, including mechanical finishes, and patterns available for each type of ornamental formed-metal product indicated.
- D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square samples of metal of same thickness and material indicated for the Work.
- E. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing ornamental formed metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
 - 1. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Anodic Finisher Qualifications: A firm experienced in successfully applying anodic finishes of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- C. Source Limitations: Obtain each ornamental formed-metal item through one source from a single manufacturer.
- D. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code - Aluminum."
 - 2. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ornamental formed-metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

- B. Store products on elevated platforms in a dry location.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with ornamental formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate installation of anchorages for ornamental formed-metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of ornamental formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.

PART 2 - PRODUCTS

2.1 COLUMN COVERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Forms + Surfaces.
 - 2. Gordon. Inc.
 - 3. Industrial Louvers, Inc.
 - 4. MM Systems Corporation.
 - 5. Pittcon Industries.
- B. Basis of Design: Gordon - CeramicSteel Column Covers or approved equal.

2.2 MATERIALS

- A. Column covers shall be roll-formed from aluminum sheet in .090" (2.3mm) thickness and fabricated in two vertical divided sections attached with demountable interlock assembly.
 - 1. Thickness: 0.090" (2.3mm)
- B. All fasteners are to be concealed.
- C. All support structures to be supplied by column cover manufacturer.
- D. Column cover sections shall be supplied free of scratches and surface blemishes.

2.3 FABRICATION

- A. Column covers shall be manufactured to specific dimensions and tolerances, and accurately formed to radii shown on drawings.
- B. Column covers shall be fabricated in two vertical divided sections attached with a demountable interlock joint. Columns shall have no exposed fasteners unless specified.
- C. Column covers shall be self-aligning with attachment clips at 18" o.c. to assure solid attachment to post structures.
- D. Provide column covers in sections a maximum 12' 0" tall per section. Provide stacking joint for additional sections to achieve finished heights above.
- E. Provide additional bracing components as necessary to stiffen substructure and insure solid mid- span bracings and connections.

2.4 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for steel sheet finishes.
- C. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
- D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- E. Apply organic and anodic finishes to formed metal after fabrication, unless otherwise indicated.
- F. Finish items after assembly.
- G. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70

percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

- C. Color and Gloss: Provide custom colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of ornamental formed metal.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate and place ornamental formed-metal items level and plumb and in alignment with adjacent construction.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior ornamental formed-metal items weatherproof.
- E. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses, to make interior ornamental formed-metal items soundproof or lightproof as applicable to the type of fabrication indicated.
- F. Corrosion Protection: Apply nonmelting/nonmigrating-type bituminous coating or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING

- A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

- A. Protect finishes of ornamental formed-metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 057300

DECORATIVE METAL RAILINGS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Decorative metal (ornamental) railings.
 - 2. Glass railings.
 - 3. Cable railings handrail ifill.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Sleeves, anchors, inserts, plates and similar items.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055100 - METAL STAIRS AND RAILINGS for other steel stairs, handrails, and guardrails.
 - 2. Section 061000 - ROUGH CARPENTRY for wood blocking for anchoring railings.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for metal backing for anchoring railings.

1.3 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Stainless Steel: 60 percent of minimum yield strength.
 - 2. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."
- C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and Code required loads and stresses within limits and under conditions indicated.
 - 1. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.
- D. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

- A. Product Data: For each product.
 - 1. Manufacturer's product lines of railings assembled from standard components.
 - 2. Grout, anchoring cement, and paint products.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For interior field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.

- b. For wet-applied products, submit volume used.
 - C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of metal railings; fabrication; and fastening and anchorage details, including mechanical fasteners. Include plans, elevations, sections, details, and attachments to other work.
 - D. Delegated-Design Submittal: For railing products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - E. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Each type of glass required.
 - 3. Fittings and brackets.
 - 4. Welded connections.
 - 5. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
 - F. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
 - G. Welding certificates.
 - H. Qualification Data: For professional engineer.
- 1.6 QUALITY ASSURANCE
- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
 - B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal railings that are similar to those indicated for this Project in material, design, and extent.
 - C. Installer Qualifications: Fabricator of products.
 - D. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
 - E. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.6, "Structural Welding Code--Stainless Steel."
 - F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Stainless-Steel Ornamental Railings:
 - a. Blum, Julius & Co., Inc.
 - b. Blumcraft, A Division of C.R. Laurence Co., Inc.
 - c. HDI Railing Systems.
 - d. Livers Bronze Co.
 - e. Wagner, R & B, Inc.; a division of the Wagner Companies.
 2. Glass Railings:
 - a. Blum, Julius & Co., Inc.
 - b. Blumcraft, A Division of C.R. Laurence Co., Inc.
 - c. HDI Railing Systems.
 - d. Livers Bronze Co.
 3. Stainless-Steel and Cable Ornamental Railings:
 - a. Cable Connection (The).

- b. Carl Stahl DecorCable, Inc.
- c. Feeney Wire Rope & Rigging.
- d. Hayn Enterprises, LLC.
- e. Johnson Marine Architectural Fittings.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails, unless otherwise indicated.
 - 1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.
 - 3. Provide extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

2.3 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 304 at interior locations and 316L at exterior locations.
- B. Pipe: ASTM A 312, Grade TP 304 at interior locations and 316L at exterior locations.
- C. Castings: ASTM A 743, Grade CF 8 or CF 20.
- D. Plate and Sheet: ASTM A 666, Type 304 at interior locations and 316L at exterior locations.
- E. Wire Rope: 1 x 19 wire rope made from wire complying with ASTM A 492, Type 316.
- F. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.4 GLASS AND GLAZING MATERIALS

- A. Glass: Provide as specified in Section 088000 - GLAZING; with polished and eased edges where exposed.

2.5 CABLE RAILINGS

- A. Basis of Design: Carl Stahl, or approved equal. Not for vehicular guard rails.
 - 1. Stainless Steel Alloys: 316 exterior, 304 interior.
 - 2. Cables: 3.2 mm diameter, 1 x 19, mill finish stainless steel.
 - 3. Cable Fittings: Swageless. The Cable Connection "Ultra Tec Invisiware Fittings", NAAMM #4 satin finish.
 - 4. Cable Tension: As shown or, if not shown, then ≥ 225 pounds.
 - 5. Cable Spacings: As shown and as required to meet Code requirements

6. Cable Grommets: Black, ultraviolet light resistant "Delrin".

B. Fabrication:

1. Barrier Free Accessibility: Comply with 28 CFR Part 36 ADA Standards for Accessible Design.
2. Deflection Limit: $H/60$ [rail height divided by 60].
3. Shop Fabrication: Fully shop fabricate railing assemblies. As needed for shipping and handling, disassemble shop fabricated railings and provide "match marks" for field reassembly.
4. Railing To Railing Joints: As shown or, if not shown, then welded, except for necessary expansion and control joints.
5. Hollow Members: Cap visible ends with matching material.

2.6 FASTENERS

A. General: Provide the following:

1. Stainless-Steel Components: Type 316 stainless-steel fasteners.
2. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
3. Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
4. Dissimilar Metals: Type 316 stainless-steel fasteners.

- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work, unless exposed fasteners are the standard fastening method for railings indicated.

- D. Anchors: Provide anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.7 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Isolation Coating (Bituminous Paint): ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

1. Available Products: Sika; SikaGrout 212; or approved equal.
2. VOC Content: 0 g/L.

2.8 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Form changes in direction as detailed on the Drawings and as standard with system selected.
- H. Comply with "Guideline 1: Joint Finishes", by National Ornamental & Miscellaneous Metals Association (NOMMA), as follows:
 1. Ornamental Railing: Type 1.
- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.9 GLAZING PANEL FABRICATION

- A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.

- B. Structural Glass Balusters: Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications, unless field glazing is standard with manufacturer.

2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform finish indicated, free of cross scratches.
 - 1. Run grain of directionally textured finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, attached to post with set screws.
- D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.
- E. Anchor steel posts to steel with flanges, angle or floor type as required by conditions, welded to posts and bolted to metal supporting members.
- F. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 1. For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.
 2. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
- G. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.4 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete and masonry as indicated on the drawings and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces.

3.5 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.6 INSTALLING GLASS PANELS

- A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.
 - 1. Attach base channel to building structure, then insert and connect factory-fabricated and -assembled glass panels.
 - a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.
 - 2. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
 - 3. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.
- B. Post-Supported Glass Railings: Install assembly to comply with railing manufacturer's written instructions and with requirements in other Part 3 articles. Erect posts and other metal railing components, then set factory-cut glass panels. Do not cut, drill, or alter glass panels in field. Protect edges from damage.

3.7 CLEANING

- A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.
- B. Clean and polish glass.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 061000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wood blocking, cants, and nailers.
 - 2. Plywood backing panels.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for wood nailers and blocking built into masonry.
 - 2. Section 061600 - SHEATHING for plywood and gypsum sheathing.
 - 3. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for interior woodwork not specified in this Section.
 - 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for sheet metal backing.

1.3 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
 - 1. Indicate component materials and dimensions and include construction and application details.
 - 2. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - 3. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. LEED Submittals:

1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For wood products, submit industry-wide EPDs.
2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Wood Products: Wood products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For wood composite materials, submit test results, including TVOC emissions.
 - b. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
 - c. For wet-applied products, submit volume used.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Environmental Product Declarations (EPD): Industry-wide EPDs for wood products are available from the American Wood Council and Canadian Wood Council.
- B. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Salvaged wood products are exempt from FSC requirements for LEED certifications.
- C. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
 - 4. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
- D. Plywood Panels:
 - 1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
 - 2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
 - 3. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - a. Use Borate or Copper Azole treatments. Product shall not contain creosote, arsenic or pentachlorophenol.
 - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 18 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

- C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete in exterior walls.
- E. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hoover Treated Wood Products; PyroGuard.
 - 2. Koppers Performance Chemicals; LifeWood MicroPro Treatment.
 - 3. Sustainable Northwest Wood; Pressure Treated Wood with Copper Azule.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: For fire-rated exterior walls, all interior use materials, and where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
 - 5. Product shall not contain creosote, arsenic or pentachlorophenol.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

- E. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. Technologies Boralife Inc.; Boraflame.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide FRTW lumber for support or attachment of other construction, including, but not limited to, the following: Rooftop equipment bases and support curbs, blocking, cants, nailers, furring and grounds.
- B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent moisture content.

2.5 PANEL PRODUCTS

- A. Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch.
- B. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5; except provide stainless steel complying with ASTM F 593 and

ASTM F 594, Alloy Group 1 or 2, where in contact with pressure-preservative treated wood or when exposed to exterior conditions.

2.7 MISCELLANEOUS MATERIALS

- A. Adhesive, Including Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Henkel Corp.; Loctite PL Premium Polyurethane Construction Adhesive.
 - b. Henkel Corp.; OSI SF450 Heavy Duty Subfloor Construction Adhesive.
 - 2. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. VOC Content: 70 g/L or less.
 - 4. Do not use adhesives that contain urea formaldehyde.
 - 5. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Apply field treatment complying with AWP A M4 to cut surfaces of preservative-treated lumber and plywood.
- D. Securely attach carpentry work as indicated and according to applicable codes and the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- E. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.

- F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install as required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION

SECTION 061600

SHEATHING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Gypsum sheathing attached to cold-formed metal framing members at exterior wall.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for masonry-veneer anchors and insulation in cavity wall construction.
 - 2. Section 054000 - COLD-FORMED METAL FRAMING for metal framing at exterior wall.
 - 3. Section 061000 - ROUGH CARPENTRY for plywood backing panels.
 - 4. Section 072700 - AIR BARRIERS for modified bituminous sheet membrane over gypsum sheathing and membrane flashing.
 - 5. Section 076200 - SHEET METAL FLASHING AND TRIM for flashing applied to gypsum sheathing.

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology Standard: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum sheathing board construction not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. Product Data: For each product specified.
- B. LEED Submittals:

1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):

- a. Option 1: For glass-mat gypsum sheathing, submit product-specific Type III EPD.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each gypsum sheathing product through one source from a single manufacturer.
- B. Fire-Resistance-Rated Assemblies: Where gypsum sheathing boards are part of fire-resistance-rated assemblies, provide assemblies as follows:
 1. Assemblies comply with requirements of fire-response-tested assemblies indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual"; or by design designations in UL's "Fire Resistance Directory" or in certification listings of another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Fire-resistance ratings were determined by fire-response testing assemblies according to ASTM E 119.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles, each bearing brand name and identification of manufacturer.
- B. Store materials protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Neatly stack gypsum sheathing board flat on leveled supports off the ground, under cover, and fully protected from weather.

1.7 SEQUENCING AND SCHEDULING

- A. Sequence installing sheathing with installing exterior cladding to comply with requirements indicated below:
 1. Do not leave glass-mat gypsum sheathing board exposed to weather for more than 180 days.

PART 2 - PRODUCTS

2.1 SHEATHING BOARD

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; GlasRoc.
 - b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond, e²XP.
 - d. USG Corporation; Securock.

2. Type and Thickness: 5/8 inch, Type X.
3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.

2.2 FASTENERS

- A. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 1. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.
- B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.
- C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
- D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
- F. Vertical Installation: Install 48-inch- wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud:
 1. Perimeter: 6 inches on center.
 2. Field: 8 inches on center.

END OF SECTION

SECTION 064020

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Custom interior architectural woodwork as indicated on Drawings.
 - 2. Display cases.
 - 3. Counters.
 - 4. Wood Benches.
 - 5. Fixed and adjustable Wood Shelving.
 - 6. Running Wood Trims, Edging and Bases.
 - 7. Miscellaneous finish hardware for work of this Section.
 - 8. Glass and glazing required for work of this Section.
 - 9. Exposed blocking and blocking concealed by the work of this Section required for the installation of architectural woodwork.
 - 10. Shop finishing of interior woodwork.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
 - 2. Division 03 - CONCRETE.
 - 3. Division 04 - MASONRY for T.O. walls.
 - 4. Division 05 - METAL FABRICATIONS (supports).
 - 5. Division 22 PLUMBING.
 - 6. Division 26 - ELECTRICAL (light box receptacles and display case lighting)

1.3 SUBMITTALS

- A. Product Data: For each type of product specified, including casework hardware and accessories, and finishing materials and processes.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content
 - a. Include statement indicating costs for each product having recycled content.
 - 2. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - a. Include statement indicating costs for each certified wood product.
 - 3. Product Data for Credit IEQ 4.1: For installation adhesives, including printed statement of VOC content.
 - 4. Product Data for Credit IEQ 4.4:
 - a. For each composite-wood product used, documentation indicating that the bonding agent contains no added urea formaldehyde.
 - b. For each adhesive used, documentation indicating that the adhesive contains no added urea formaldehyde.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - a. Provide schedule of blocking required to support the Work of this Section.
 - 2. Show locations and sizes of cutouts and holes for plumbing fixtures, electrical components and other items installed in architectural woodwork.
 - 3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
- D. Samples for Verification:
 - 1. Lumber with or for transparent finish, not less than 6 inches wide by 12 inches long for each species and cut, finished on 1 side and 1 edge.
 - 2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.

- a. Submit step-type range sample sets of factory finished plywood and factory finished solid wood in size illustrating wood grain and specified finish, including edge banding detail and any veneer or solid edge glue joints.
 - b. Submit one leaf for every 1000 gross square foot of veneer required.
 - c. Provide additional reference samples for matching with manufactured casework and flush wood doors.
- 3. Plastic laminates, 8 by 10 inches for each type, color, pattern, and surface finish, with 1 sample applied to core material, and specified edge material applied to 1 edge.
- 4. Solid-surfacing materials, 6 inches square.
- E. Woodwork Quality Standard Compliance Certificates: Submit registration number for AWI Quality Certification Program.
- F. Qualification Data: For Installer and fabricator.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Certified participant in AWI's Quality Certification Program, with a minimum of 5 years experience with similar work in scope and size as this project.
- C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with blueprint-matched wood veneers and components.
- D. Quality Standard: Unless otherwise indicated, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards," latest edition, including errata, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 - 1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified. Upon notice of award, register the work under this section with the AWI Quality Certification Program.
- E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Provide mockups of the following, as directed by the Architect: Display cases, counters, running wood trims, and solid surfacing stools.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
 1. The HVAC systems as specified elsewhere may not provide for humidity controls. The expected ranges of relative humidity are expected to be as high as 55% to a low of uncontrolled during the heating system. Comply with AWS Section 2, Care and Storage.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MILLWORKERS

- A. Wright Architectural Millwork, Northampton, MA.
- B. CWC Architectural Woodworking, Bristol, CT.
- C. Eastern Millwork Inc., Jersey City, NJ.

- D. Nova Wood Products, Lunenburg, NS.

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of AWI/AWMAC/WI's "Architectural Woodwork Standards" for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- C. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- D. Wood Veneers and Lumber: Provide AWI Premium Grade materials and workmanship, unless otherwise indicated. For species not listed in the AWS comply with the following:
1. Provide AWI Lumber Grade 1 and AWI Grade AA Veneer, book-matched, minimum 6 inch face veneer width. Kiln dry to 6-8 percent moisture content. Components shall be free of defects and sapwood. Match adjacent pieces for color and grain pattern.
 2. Single-Source Requirement for Wood Veneers and Solids: Intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and solids from the same distributor, and from the same flitches and solids sources to the greatest extent possible.
- E. Wood Species and Cut for Transparent Finish: Maple, Plain Sawn.
1. Architect's control samples for transparent finish, veneer grain and figure characteristics are available for review at the office of the Architect.
 2. Veneer Matching Requirements:
 - a. Matching Between Adjacent Veneer Leaves: Book match and architectural end match.
 - b. Matching Within Individual Panel Faces: Balance and Center Match.
 - c. Method of Matching Panels: Blueprint-matched panels and components.
- F. Wood Species for Opaque Finish: Any closed-grain hardwood.
- G. Wood Products: Comply with the following:
1. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with recycled content.
 2. Hardboard: AHA A135.4.
 3. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade MD, made with binder containing no added urea formaldehyde.
 4. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 5. Softwood Plywood: DOC PS 1, Medium Density Overlay (MDO).
 6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no added urea formaldehyde.

- a. Resin impregnated paper backs are not permitted. Backs shall be of compatible hardwood species and cut. Contact adhesive is not permitted.
- H. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
 - a. Formica Corporation.
 - b. Nevamar Company; a division of Panolam Industries.
 - c. Wilsonart International; Div. of Premark International, Inc.
 - d. Pionite Company; a division of Panolam Industries.
 - e. Arborite; Division of ITW Canada, Inc.
- I. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS-1 and ISSFA-2.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Staron by Lotte Advanced Material, Inc.
 - b. Avonite, Inc.
 - c. Corian by DuPont.
 - d. Formica Corporation.
 - e. LG Chemical, Ltd.
 - f. Nevamar Company, LLC; Decorative Products Div.
 - g. Wilsonart International; Div. of Premark International, Inc.
- J. Solid-Surfacing Material, Quartz-Agglomerate Type: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin complying with ANSI SS-1 and ISSFA-2.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Radianz by Lotte Advanced Material, Inc.
 - b. Corian Quartz by DuPont.
 - c. CaesarStone.
 - d. Cosentino USA; Silestone.
 - e. Dal-Tile; ONE Quartz Surfaces.
- K. Tempered Float Glass for Casework Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.
- L. Tempered Float Glass for Casework Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.

- M. Resin Panel Material: Provide polyethylene terephthalate glycol-modified (PETG) resin materials.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. 3form
 - 1) Basis of Design: Varia
 - b. Lumicor
 - c. Pane Specialists
 2. Fire-Resistance: Panels shall comply with the following:
 - a. Smoke Density Rating: 3 to 33% per ASTM D 2843.
 - b. Combustion Rating: CC-1 rating per ASTM D 635.
 - c. Self-Ignition Temperature: 850°F per ASTM D 1929.
 3. Fasteners: Provide fasteners as recommended by panel manufacturer.
 4. Adhesives: Silicone as recommended by manufacturer.
 5. Color: Fray Baltic. (Preliminary color selection upon approval during construction.)
 6. Thickness: 1/2"

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.
1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:
1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
 2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 3. Kiln-dry materials before and after treatment to levels required for untreated materials.

- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
 - 1. Fire-Retardant Fiberboard and Particleboard: Provide five ply construction with crossbands to prevent any ammonia fuming from the core to the face veneers.

2.4 CASEWORK HARDWARE AND ACCESSORIES

- A. General: Provide casework hardware and accessory materials associated with architectural casework, except for items specified in Section 087100 - DOOR HARDWARE.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Catches: Push-in magnetic catches, BHMA A156.9, B03131.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 or BHMA A156.9, B04102; with shelf brackets, B04112.
- F. Drawer Slides: BHMA A156.9, B05091; side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated-steel with steel ball-bearings; of the following grades:
 - 1. Box Drawer Slides: Grade 1.
 - 2. File Drawer Slides: Grade 1HD-100.
 - 3. Pencil Drawer Slides: Grade 2.
 - 4. Keyboard Slides: Grade 1.
 - 5. Trash Bin Slides: Grade 1HD-100.
- G. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
 - 2. Satin Aluminum, Clear Anodized: BHMA 628.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: 30 g/L.
 - 2. Contact Adhesives: Not permitted on the Project without Architect's prior approval.

2.6 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- B. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Casework and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.
- F. Install glass to comply with applicable requirements in Section 088000 - GLAZING and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.7 INTERIOR STANDING AND RUNNING TRIM, BASES AND MOLDINGS FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Wood Species and Cut: Maple, plain sawn.
 - 1. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
- C. For trim items wider than available lumber, use veneered construction. Do not glue for width.
- D. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.
- E. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- F. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.8 CUSTOM MILLWORK, GENERAL DESCRIPTIONS

- A. Custom Display Case
 - 1. 3/8" full tempered glass, chamfered edges, pre-drilled for hardware installation.
 - a. Double working hinge: 2-1/2" wide stainless steel, full radius corners, assembled with hinge pivot pin, equal to "StructureLite SL-ADWH250" by Stand-Offs Systems, for right or left side pivot, outside corner application.
 - 2. Composition Cork: 1/4" thick premium grade fine grain tan composition cork mounted on hardboard, equal to "Tan Nucork" by Claridge Products.
 - 3. Trim: Maple, plain sawn, stained with clear finish.
 - 4. Shelf Standards: Provide extruded aluminum shelf standards by Rakks or approved equal.

2.9 WOOD CASEWORK FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. AWI Type of Casework Construction: Flush overlay.
- C. Wood Species and Cut for Exposed Surfaces: As specified hereinabove.
 - 1. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
 - 2. Matching of Veneer Leaves: Book match.
 - 3. Vertical Matching of Veneer Leaves: End match.
 - 4. Veneer Matching within Panel Face: Running match.
 - 5. Veneer Matching within Room: Provide casework veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

D. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Compatible species to that indicated for exposed surfaces, stained to match.
2. Drawer Sides and Backs: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
3. Drawer Bottoms: Hardwood plywood.

2.10 PLASTIC-LAMINATE CASEWORK

A. Grade: Custom.

B. AWI Type of Casework Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: Grade HGS.

D. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range.

2.11 WOOD COUNTERTOPS

A. Grade: Premium.

B. Type of Top: Solid wood for transparent finish, edge glued, with crown direction reversed in adjacent boards, to produce widths indicated. Select boards for similarity of color and grain and arrange boards for optimum match between adjacent boards. Species and cut as follows:

1. Wood Species and Cut: As specified hereinabove.

C. Type of Top: Panel product for transparent finish (wood veneer laminated over core) as follows:

1. Wood Species and Cut: As specified hereinabove
2. Matching of Adjacent Veneer Leaves: Book match.
3. Matching of Adjacent Veneer Leaves: End match.
4. Veneer Matching within Panel Face: Running match.
5. Edge Treatment: Solid wood matching face for species and cut.
6. Core Material: Exterior-grade plywood.

2.12 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Custom.
- B. High-Pressure Decorative Laminate Grade: HGS.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. As selected by Architect from manufacturer's full range.
- D. Edge Treatment: As indicated.
- E. Core Material: Exterior-grade plywood.
- F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.13 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. Grade: Custom.
- B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
 1. As selected by Architect from manufacturer's full range, and as indicated on drawings.
- C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 1. Fabricate tops with shop-applied edges of materials and configuration indicated.
 2. Fabricate tops with loose backsplashes for field application.
- D. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.14 SHELVING

- A. Grade: Custom.
- B. Shelf Material: 1-inch plastic laminate-faced panel product with solid-lumber edge.
- C. Cleats: 3/4-inch solid lumber.

- D. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.
- E. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.
- F. Clothes Rods: 1-5/16-inch-diameter, chrome-plated-steel tubes.
 - 1. Rod Flanges: Chrome-plated steel.

2.15 SHOP FINISHING

- A. General: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" for factory finishing.
 - 1. Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.
- C. Shop Priming: Shop apply the prime coat including backpriming, if any, for opaque-finished items specified to be field finished. Refer to Section 099000 - PAINTING AND COATING for material and application requirements.
- D. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen with sheen measured on 60-degree gloss meter per ASTM D 523:
 - 1. Grade: Same as item to be finished.
 - 2. AWS Finish System 5: Water white conversion varnish.
 - 3. Staining: Match approved sample for color.
 - 4. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 - 6. Sheen: Satin, 30-50 gloss units.
 - 7. Effect: Partially filled pore.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 - 1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
 - 2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
 - 3. Shop fabricate when possible.
- H. Casework: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install casework with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of casework with transparent finish.
- I. Countertops: Anchor securely by screwing through corner blocks of base casework or other supports into underside of countertop.
 - 1. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

- 3. Secure backsplashes to tops with concealed metal brackets at 16 inches and to walls with adhesive.
 - 4. Calk space between backsplash and wall with sealant specified in Section 079200 - JOINT SEALANTS.
- J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.
- D. Protection: Protect all woodwork from marring, defacement of other damage until final completion and acceptance of the project by the Owner.

END OF SECTION

SECTION 066400

FRP PANELING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood furring for installing plastic paneling.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- 1. Flame-Spread Index: 25 or less.
- 2. Smoke-Developed Index: 450 or less.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Crane Composites.
 - 2. Marlite.
 - 3. Nudo Products, Inc.

2.2 PLASTIC SHEET PANELING

- A. General: Gelcoat-finished, glass-fiber reinforced plastic (FRP) panels complying with ASTM D 5319.
 - 1. Nominal Thickness: Not less than 0.075 inch.
 - 2. Surface Finish: Smooth texture.
 - 3. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Adhesive: As recommended by plastic paneling manufacturer for substrate indicated.

1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 2. VOC Content: 50 g/L or less.
 3. Do not use adhesives that contain urea formaldehyde.
 4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
- E. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 - JOINT SEALANTS.
1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 2. VOC Content, Architectural Sealants: 250 g/L or less.
 3. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels and so that trimmed panels at corners are not less than 12 inches wide.
 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
 2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive.
- D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 070001

WATERPROOFING, DAMPPROOFING AND CAULKING

(TRADE BID REQUIRED)

Trade Contractors on this CM-at-Risk project are required by law to provide payment and performance bonds for the full value of their trade contracts, and trade contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Bids will only be accepted from trade contractors pre-qualified by the awarding authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

- B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 070001 - WATERPROOFING, DAMPPROOFING
AND CAULKING.

2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 8 of Chapter 149A of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority.
3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

- C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings: ((always insert accurate list of sheet numbers of applicable Drawings)).

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 071100 - BITUMINOUS DAMPPROOFING
2. All Work of Section 071300 - SHEET WATERPROOFING
3. All Work of Section 071610 - CRYSTALLINE WATERPROOFING
4. All Work of Section 072700 - AIR BARRIERS
5. All Work of Section 079200 - JOINT SEALANTS

END OF SECTION

SECTION 070002

ROOFING AND FLASHING

(TRADE BID REQUIRED)

Trade Contractors on this CM-at-Risk project are required by law to provide payment and performance bonds for the full value of their trade contracts, and trade contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Bids will only be accepted from trade contractors pre-qualified by the awarding authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 070002 - ROOFING AND FLASHING

2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 8 of Chapter 149A of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority.
3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
To be inserted with final documents.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 075400 - THERMOPLASTIC MEMBRANE ROOFING
2. All Work of Section 076100 - SHEET METAL SIDING
3. All Work of Section 076200 - SHEET METAL FLASHING AND TRIM
4. All Work of Section 077100 - ROOF SPECIALTIES

END OF SECTION

SECTION 070800

THERMAL AND MOISTURE PROTECTION SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 RELATED SECTIONS

- A. Division 01 – General Requirements
- B. Section 019113 – General Commissioning Requirements
- C. Division 07 – Thermal and Moisture Protection

1.3 REQUIRMENTS

- A. The Commissioning process requires the participation of Division 07, Thermal and Moisture Protection Contractor, to ensure that all systems fulfill the requirements set forth in these construction documents. The general commissioning requirements and coordination are detailed in Section 019113. Division 07, Thermal and Moisture Protection, shall fulfill commissioning responsibilities assigned to division 07 in accordance with Section 019113.

PART 2 - PRODUCTS **(NOT USED)**

PART 3 - EXECUTION

3.1 PRE-FUNCTIONAL CHECKLISTS

- A. Inspection reports/checklists assist in the process to document that the equipment and systems are installed properly.
- B. The contractor shall provide any associated checklist and inspection documentation associated with the respective section as indicated by the contract documents.

3.2 FUNCTIONAL PERFORMANCE TESTING

- A. Intent of functional performance testing is to prove thru functional test procedures proper system operation.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: The contractor associated with this division will engage a qualified testing agency to perform tests and inspections.
 - B. Acceptance testing of new roofing systems shall include field uplift testing in accordance with ASTM E907 as applicable.
 - 1. ASTM E907, "Standard Test Method for Field Testing Uplift Resistance of Adhered Membrane Roofing Systems," provides a procedure for field testing roof assemblies' resistance to uplift pressures. The test apparatus creates a localized negative pressure (vacuum) region over the surface of a roof assembly to simulate wind-uplift load. The negative pressure is raised incrementally and the resulting roof assembly deflection is monitored until the agreed upon pressure is reached or roof assembly failure occurs.
 - C. Testing shall be performed under the construction contract and witnessed and evaluated by the commissioning consultant.
 - D. Roof sections shall be considered defective if they do not pass tests and inspections.
 - E. Retesting will be necessary for areas found to be defective.
 - F. Prepare test and inspection reports. Issue reports to Construction manager and Commissioning Agent for review, record and distribution
- 3.4 INSPECTION CHECKLISTS AND FUNCTIONAL PREFORMANCE TESTING
- A. Inspection Checklists and testing procedures will be performed on the following system types. These inspection and testing requirements are in addition to and do not replace any testing required elsewhere in Division 08 or by applicable codes.)
 - 1. Windows and Walls

END OF SECTION

SAMPLE ONLY

Installation Checklist and Functional Testing

ROOFING

1. Participants

Discipline	Name	Company
CxA		Consulting Engineering Services
Mechanical		
Controls		
TAB		
Plumbing		
Electrical		
Roofing		
Date Returned to CxA		

2. Prerequisite Checklist

Check	Description
☐	Roof installation is complete and all equipment has been set on the roof fully installed.
☐	Roof pull test has been performed by necessary contractor.
☐	Schedules and setpoints implemented - This checklist does not take the place of the manufacturer's recommended checkout and startup procedures. - Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others). - Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.

3. Installation Checks

Check		COMMENT
General Roof Conditions		
Roof free of debris	☐	
Drainage observed to be working properly and free of debris	☐	
No physical damage to roofing observed	☐	
No structural deformations observed	☐	
Flat/Membrane Roof		
Membrane coating in good condition – no color fade or chalking observed	☐	
Granular loss not observed	☐	
No punctures observed	☐	
No blistering apparent	☐	
No ponding observed	☐	
All heat welded seams are in good condition	☐	
All pipes and protrusions have been clamped and caulked with approved caulking	☐	
All corner areas have prefabricated flex inside/outside corner or secondary membrane patch installed.	☐	
Roof Features		
Fascia in good condition	☐	
Soffit in good condition	☐	
Flashing in good condition	☐	
Gutters/drains are clear	☐	
Skylights in good condition, no leaking apparent	☐	
Chimneys/Vents	☐	
Fall Arrest Anchors	☐	
Zone control access	☐	
Exterior Wall Surfaces		
Deformed finish not observed	☐	
No surface deterioration observed	☐	
No staining observed	☐	
Interior Wall Surfaces		
No cracks observed	☐	
No water staining observed	☐	
No water leaks observed	☐	
No deformed finishes observed	☐	
Ceiling Conditions		
No cracks observed	☐	
No water staining observed	☐	

Check		COMMENT
No water leaks observed	☐	

4. Testing performed by 3rd Party Testing Agency

Standard: ASTM E907 – 04 – Standard Test Method for Field Testing Uplift of Adhered Membrane Roofing Systems

Scope: ASTM E907 covers the determination of the resistance of adhered membrane roofing systems to uplift pressure.

Applicable Products: Roofing systems with or without rigid board insulation or base ply, which are either adhered or mechanically fastened, and fully adhered membranes.

Test Procedure: A controlled negative pressure is created on top of the roof surface by means of a chamber fitted with a pressure sensing device and vacuum equipment. Loose surfacing such as gravel, slag or granules are removed via sweeping a wide path around the perimeter of the test area. A heavy pouring of hot asphalt is applied over the swept area and allowed to cool. This provides a smooth surface and allows the edges of the chamber to be in complete contact with the roof surface so that a negative pressure is developed inside the chamber. Other methods are not to be used to prepare the test area unless the method used will produce a tight seal and is compatible so as not to damage the roof membrane. Additional approved methods for sealing the chamber are the use of wet sand, duct tape, water or polythene film.

End Result: Upon the completion of a successful test, the roofing system meets the performance criteria for water penetration resistance or does not meet criteria and further remediation may be required to pass.

☐Respective Testing Agency has provided passing testing reports for review and record.

SECTION 071100

BITUMINOUS DAMPPROOFING

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Cold-applied, emulsified-asphalt dampproofing applied to the following surfaces:
 - a. Exterior, below-grade surfaces of concrete and masonry foundation walls without occupied space at interior, and not indicated to receive waterproofing.
 - b. Back side of concrete and masonry retaining walls, below grade.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 071300 - SHEET WATERPROOFING for other waterproofing.
 - 2. Section 071610 - CRYSTALLINE WATERPROOFING for other waterproofing.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer recommendations for method of application, primer, number of coats, coverage or thickness, and protection course. Indicate special procedures and perimeter conditions requiring special attention.
- B. Material Certificates: For each product, signed by manufacturers.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Euclid Chemical Company.
 - 2. Henry Company.
 - 3. Karnak Corporation.
 - 4. Meadows, W. R., Inc.
 - 5. Sonneborn, Degussa Building Products.
 - 6. Tremco Inc.

2.2 BITUMINOUS DAMPPROOFING

- A. Cold-Applied, Emulsified-Asphalt Dampproofing, Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.3 MISCELLANEOUS MATERIALS

- A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.
- B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- C. Mastics and related materials as recommended by manufacturer.
- D. Patching Compound: Manufacturer's fibered mastic of type recommended by dampproofing manufacturer.
- E. Protection Course: Multi-ply semi-rigid core composed of a mineral-fortified asphalt core formed between two outside layers of asphalt impregnated reinforced mats, manufactured in accordance with ASTM D 6506, 1/8 inch thick biodegradable hardboard.
- F. Drainage Board: Two-part prefabricated composite drain consisting of formed polystyrene or PVC dimpled core covered on one side with a polypropylene filter fabric, 1/4 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
 - 1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
 - 2. Verify substrate surfaces are durable and free of matter detrimental to adhesion or application of dampproofing system.

3.2 PREPARATION

- A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.
- C. Apply manufacturer approved patching compound for filling and patching tie holes, honeycombs, reveals, and other imperfections.

3.3 APPLICATION

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
 - 1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.
 - 2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.
 - 3. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.
 - 4. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 5. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat required for embedding fabric is in addition to other coats required.
- B. On Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft.. for second coat.
- C. On Backs of Concrete and Masonry Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft.

3.4 INSTALLATION OF PROTECTION COURSE

- A. Install protection course over completed-and-cured dampproofing. Butt joints of adjacent panels and adhere with mastic. Comply with dampproofing material manufacturer's written

recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated. Place drainage panel directly over dampproofing, butt joints, place to encourage drainage downwards.

- B. Scribe and cut boards around projections, penetrations, and interruptions.

3.5 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION

SECTION 071300

SHEET WATERPROOFING

(Part of Work of Section 070001 - Waterproofing, Dampproofing and Caulking,
Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Post-applied, sheet waterproofing.
 - 2. Pre-applied, sheet waterproofing.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 072100 - THERMAL INSULATION for insulation at foundations and under slabs.
 - 2. Section 079200 - JOINT SEALANTS for joint-sealant materials and installation.
 - 3. Section 079500 - EXPANSION CONTROL for expansion-joint systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing that prevents the passage of water.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For the following products:
 - 1. 12-by-12-inch square of waterproofing and flashing sheet.
 - 2. 4-by-4-inch square of drainage panel.
- D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- E. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is acceptable to waterproofing manufacturer to install manufacturer's products.
- B. Source Limitations: Obtain waterproofing materials, protection course, and molded-sheet drainage panels through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.

- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.
 - 1. Warranty does not include failure of waterproofing due to failure of substrate not prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
 - 2. Warranty Period: Five years after date of Substantial Completion.
 - 3. Warranty includes removing and reinstalling protection board, drainage panels, insulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Post-Applied Sheet Waterproofing:
 - a. Rubberized-Asphalt Sheet Waterproofing:
 - 1) American Hydrotech, Inc.; VM 60.
 - 2) Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; MiraDRI 860/861.
 - 3) Cetco; Envirosheet.
 - 4) GCP Applied Technologies (formerly W.R. Grace); Bituthene 3000.
 - 5) Henry Company; WP 200
 - b. Composite HDPE/Bentonite Sheet Waterproofing:
 - 1) Tremco Inc.; Peraseal Membrane for vertical surfaces.
 - 2. Pre-Applied Sheet Waterproofing:
 - a. HDPE Sheet Waterproofing:
 - 1) GCP Applied Technologies (formerly W.R. Grace); Preprufe 160R Plus for vertical surfaces and Preprufe 300R Plus for horizontal surfaces.
 - 2) MiraPLY-H for horizontal and MiraPLY-V for vertical by Carlisle Coatings and Waterproofing.
 - b. Polypropylene Sheet Waterproofing:
 - 1) Henry Company; Blueskin PreSeal 320/435.
 - c. Composite HDPE/Bentonite Sheet Waterproofing:

- 1) Tremco Inc.; Peraseal LG Membrane for blindside conditions on retained earth or below slab and Peraseal GM for blindside conditions with hydrostatic water.

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

- A. Rubberized-Asphalt Sheet: 60-mil-thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil-thick, polyethylene film with release liner on adhesive side.
 1. Physical Properties: As follows, measured per standard test methods referenced:
 - a. Tensile Strength: 325 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (movement; ASTM C 836.
 - e. Puncture Resistance: 50 lbf minimum; ASTM E 154.
 - f. Hydrostatic-Head Resistance: 200 feet (minimum; ASTM D 5385.
 - g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 COMPOSITE HDPE/BENTONITE SHEET WATERPROOFING

- A. HDPE/Bentonite Sheet for Vertical Applications: Dual-waterproofing, resealable, composite sheet membrane system composed of high-density polyethylene with a sodium-bentonite face
- B. Physical Properties: As follows, measured per standard test methods referenced:
 1. Puncture Resistance: 169 lbs.; ASTM E154.
 2. Tensile Strength: 4,000 psi; ASTM D412.
 3. Water Vapor Permeance: 0.03 perms; ASTM E96
 4. Percent Elongation: 700 percent; ASTM D638, Type 4 Dumbbell.
 5. Resistance to Hydrostatic Head: 150 feet: ASTM D751
 6. Warranted Crack-Bridging Capability: 1/8 inch.

2.4 HDPE SHEET WATERPROOFING

- A. HDPE Sheet for Vertical Applications: 32-mil-thick, uniform, flexible sheets consisting of 16-mil-thick, HDPE sheet coated with a pressure-sensitive rubber adhesive, a protective adhesive coating; release sheet not required.
- B. HDPE Sheet for Horizontal Applications: 46-mil-thick, uniform, flexible sheets consisting of 30-mil-thick, HDPE sheet coated with a pressure-sensitive rubber adhesive, a protective adhesive coating, a detackifying surface treatment, an uncoated self-adhering side lap strip, and a release liner.
- C. Physical Properties: As follows, measured per standard test methods referenced:
 1. Tensile Strength, Film: 4000 psi minimum; ASTM D 412.
 2. Lateral Water Migration Resistance: Pass at 231 ft. of hydrostatic head pressure; ASTM D 5385, modified.

3. Low-Temperature Flexibility: Pass at minus 10 deg F; ASTM D 1970.
4. Peel Adhesion to Concrete: 5 lbf/in.; ASTM D 903, modified.
5. Lap Adhesion: 2.5 lbf/in.; ASTM D 1876, modified.
6. Hydrostatic-Head Resistance: 231 feet; ASTM D 5385, modified.
7. Vapor Permeance: 0.01 perms; ASTM E 96, Water Method.

2.5 POLYPROPYLENE SHEET WATERPROOFING

- A. Pre-applied fully bonded polypropylene sheet waterproofing membrane comprised of polypropylene film with a heat bonded dimple surfaced geotextile, used to form a mechanical and chemical bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete; having the following typical properties:
 1. Resistance to Hydrostatic Head (ASTM D5385): 231 ft. (70.4m)
 2. Puncture Resistance (ASTM E154): [110 lbs (490 N)] [225 lbs (1000 N)]
 3. Lateral Migration Resistance (ASTM D5385 Modified): 231 ft. (70.4m)
 4. Lap Peel Adhesion (ASTM D1876): 6.9lbs/in (1200 N/m)
 5. Permeance (ASTM E96): <0.1 Perms
 6. Peel Adhesion to Concrete (ASTM D903): 5 lbs/in (875 N/m)

2.6 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.
- E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
 1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

- I. Protection Course: Fan-folded, extruded-polystyrene board insulation, unfaced, nominal thickness 3/8 inch.

2.7 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to 1 side with a polymeric film bonded to the other side of a 3-dimensional (studded), nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).
 1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Hydrotech, Inc.; Hydrodrain 420.
 - b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRAIN 6200 series.
 - c. GCP Applied Technologies (formerly W.R. Grace); Hydroduct 220 vertical, 660 horizontal.
 - d. Henry Company; DB 220 vertical, DB 650 horizontal.
 - e. Sika Sarnafil Inc.; Drainage Panel 900 series.
 - f. Tremco Inc. TREMDrain 1000 or TREMDrain 2000.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
 2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 3. Verify that compacted subgrade and substrates are dry, smooth, and sound; ready to receive HDPE sheet.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
 - b. At plaza deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 RUBBERIZED-ASPHALT SHEET APPLICATION

- A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F .
- D. Horizontal Application: Apply sheets from low point to high point of decks to ensure that side laps shed water.
- E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- F. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.

- G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing as applicable.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.
- I. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 HDPE SHEET APPLICATION

- A. Install HDPE sheets according to waterproofing manufacturer's written instructions.
- B. Vertical Applications: Install sheet membrane with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch-minimum lap widths and end laps. Overlap and seal seams and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.
 - 1. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detailing tape.
- C. Horizontal Applications: Install sheet membrane with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch-minimum lap widths and end laps. Overlap and seal seams. Overlap, stagger, and seal end laps with detail tape to ensure watertight installation.
- D. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.
- E. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.
- F. Install sheet waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.
- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet membrane and firmly secure with detail tape.
- H. Correct deficiencies in or remove waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.5 POLYPROPYLENE SHEET INSTALLATION

- A. Verify substrate is ready to receive the waterproofing in accordance with the Waterproofing Manufacturer's TDS and guide specification.
- B. Air and substrate temperature limitations:
 - 1. Do not perform Work when ambient (air) and substrate temperatures are below 32 °F (0 °C).

C. Detailing/Flashing:

1. Install detailing and flashings per Waterproofing Manufacturer's details.

D. Waterproofing Assembly Installation:

1. Vertical substrates:
 - a. Install waterproofing membrane with polypropylene film side facing existing substrate, dimpled surface geotextile side facing the installer.
 - b. Where vertical securement is required, select from the following methods:
 - 1) Tape:
 - a) Secure membrane with double sided tape.
 - 2) Mechanical attachment:
 - a) Secure membrane at selvedge with small, low profile, non-rusting, substrate appropriate fasteners to create a smooth and flat membrane seam.
 - c. Verify waterproofing is clean, dry and free from contaminants prior to subsequent membrane installations; wipe with damp cloth if necessary.
 - d. Overlap membrane seams two (2) inches.
 - e. Remove plastic release liner at selvedge and firmly press overlapping membrane into place to adhere membrane seams.
 - f. Seal membrane seams in accordance with Waterproofing Manufacturer details.
2. Horizontal substrates:
 - a. Install waterproofing membrane with polypropylene film side facing existing substrate, dimpled surface geotextile side facing the installer.
 - b. Extend pre-applied waterproofing twenty-four (24) inches beyond base slab to create a trafficable space and minimize membrane soiling or damage.
 - c. Verify waterproofing is clean, dry and free from contaminants prior to subsequent membrane installations; wipe with damp cloth if necessary.
 - d. Stagger end laps to avoid layer build up.
 - e. Overlap membrane seams two (2) inches.
 - f. Remove plastic release liner at selvedge and firmly press overlapping membrane into place to adhere membrane seams.
 - g. Seal membrane seams in accordance with Waterproofing Manufacturer details.

3.6 COMPOSITE HDPE/BENTONITE INSTALLATION

- A. Install composite HDPE/bentonite sheets according to waterproofing manufacturer's written instructions.
- B. Below Slab Installation:
 1. Bentonite-Side Up:
 - a. Install membrane sheets bentonite-side up with edges overlapped 3" minimum over stable, smoothed and compacted subgrade or mud slab; position membrane to stagger end laps 12"; securely fasten seams with staples every 8" on center.
 - b. Extend membrane upward 6" minimum within the formwork at bottom edges of mat slabs and wrapped footings to provide for proper tie-in to vertical membrane; install membrane in double layer continuous along bottom edges of slabs and wrapped footings extending 6" from edge in both directions.

- c. Install membrane to wrap footings where shown on Drawings; carry membrane across top surfaces of unwrapped footings or mud slab to interior vertical faces of walls and columns and terminate as manufacturer recommends.
 - d. Waterproof penetrations in accord with manufacturers recommendations.
 - e. Verify membrane is protected from damage caused by rebar and support chairs.
 - f. Protect exposed bentonite from moisture with temporary plastic sheets; remove plastic sheets before final covering.
- 2. Bentonite-Side Down:
 - a. Install polyethylene base sheets with edges lapped 5" over stable, smoothed and compacted subgrade or mud slab; trim base sheet away from penetrations and terminations.
 - b. Install membrane bentonite-side down over polyethylene base sheets with edges lapped 3" minimum; position membrane sheets to stagger end laps 12"; tape seams with reinforced seam tape closely following membrane placement and immediately secure by roll-pressing with hand-held metal seam roller.
 - c. Extend membrane upward 6" minimum within the formwork at bottom edges of mat slabs and wrapped footings; install a second layer of membrane, with the bentonite-side up, under the field membrane and extending upward within the formwork at bottom edges of mat slabs and wrapped footings to provide for proper tie-in to vertical membrane; membrane double layer continuous along bottom edges of slabs and wrapped footings shall extend 6" from edge in both directions.
 - d. Install membrane to wrap footings where shown on Drawings; carry membrane across top surfaces of unwrapped footings or mud slab to interior vertical faces of walls and columns and terminate as manufacturer recommends.
 - e. Waterproof penetrations in accord with manufacturer's recommendations.
 - f. Verify membrane is protected from damage caused by rebar and support chairs.
- 3. Backfilled Wall Installation:
 - a. Install membrane sheets in vertical or horizontal lifts with HDPE-side facing applicator to prepared surfaces conforming to manufacturer's requirements.
 - 1) Vertical installation: Securely fasten membrane 12" on center along top edge with sheet extending out onto footing surfaces 6" minimum, overlapping below-slab membrane 6"; install subsequent membrane sheets to overlap previous sheets 1-1/2" minimum; securely fasten membrane 24" on center through both sheets at overlaps; securely fasten 18" on center to tops of footing surfaces and horizontal shelves; apply seam tape to seam overlaps.
 - 2) Horizontal installation: Start membrane at lowest portion of wall; securely fasten membrane 24" on center along top edge with sheet extending out onto footing surfaces 6" minimum, overlapping under slab membrane 6"; install subsequent membrane sheets to overlap previous sheets minimum 1-1/2" in shingle fashion with staggered end laps; securely fasten membrane 24" on center through both sheets at overlaps; securely fasten 18" on center to tops of footing surfaces and horizontal shelves; apply seam tape to seam overlaps.
 - b. Waterproof penetrations in accord with manufacturer's recommendations.

4. Blindsided Wall Installation:

- a. Ensure that vertical surfaces to receive waterproofing system conform to manufacturer's requirements as applicable to the earth retaining system employed prior to commencing installation; contact manufacturer for requirements of project conditions not provided for in installation manuals.
- b. Install waterproofing membrane starter-strip to vertical surfaces of earth retaining system with bentonite-side facing applicator prior to placement of concrete footings or foundation mat slab.
- c. Prepare all vertical inside corners that occur along the earth retaining system by fastening a minimum 12" wide strip of membrane pressed tight into corner with bentonite-side facing applicator; securely fasten along vertical edges 24" on center.
- d. Install membrane sheets oriented vertically with bentonite-side facing applicator; overlap membrane sheets 3" minimum for poured-in-place walls and 4" minimum for shotcrete/gunite walls; securely fasten membrane through both sheets at overlap areas with nails every 24" on center and staples every 3" on center.
- e. Verify which penetrations must be accessed after concrete placement for completion of waterproofing detail treatment and ensure that sufficient access to membrane is provided within a formed boxout; verify which penetrations will not be accessed after concrete placement for completion of waterproofing detail treatment and ensure that final detailing procedures are completed prior to erection of concrete formwork or shotcreting/guniting; waterproof penetrations in accord with manufacturer's current procedures; contact manufacturer for procedures at project conditions not provided for in installation manuals.
- f. Protect membrane system from excessive rain.
- g. Inspect and repair damages to membrane system immediately prior to erection of concrete formwork or shotcreting/guniting; ensure that concrete directly contacts membrane.
- h. Complete waterproofing details and terminations at gradeline coordinating with other trades.

5. Deck Installation:

- a. Install membrane with bentonite-side down against deck surfaces with edges overlapped minimum 1-1/2" in shingle fashion with staggered end laps; start installation at lowest point; tape seams with reinforced waterproofing seam tape closely following membrane placement and immediately secure by roll-pressing with hand-held metal seam roller.
- b. Waterproof penetrations, horizontal-to-vertical junctures and vertical terminations with liquid-applied elastomeric flashing carried out onto deck surfaces 12"; overlap cured elastomeric flashing 6" with membrane sheet and seal leading edge with reinforced waterproofing seam tape.
- c. Conduct flood-test of membrane installed to elevated horizontal surfaces by damming perimeter, stopping drains and covering with 2" of water for 24 hours; if leakage occurs, make repairs and repeat flood-test; when area is proven watertight, drain water and remove dams; obtain written authorization by manufacturer's representative prior to conducting flood-test.
- d. Ensure membrane is protected from damage caused by construction trades.

3.7 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install board insulation before installing drainage panels.

3.8 FIELD QUALITY CONTROL

- A. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
 - 2. Flood each area for 24 hours.
 - 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.
 - 4. Engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

3.9 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed insulation from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 071610

CRYSTALLINE WATERPROOFING

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Crystalline waterproofing for the following applications.
 - a. Elevator pits.
 - b. Sump pits.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete substrate and finishing concrete walls and slabs to receive waterproofing.
 - 2. Section 042000 - UNIT MASONRY for preparing concrete unit masonry walls to receive waterproofing.
 - 3. Section 079200 - JOINT SEALANTS for elastomeric and preformed sealants in concrete and masonry walls and floors.

1.3 SUBMITTALS

- A. Product Data: Include manufacturer's installation instructions and general recommendations for waterproofing applications, substrate preparation, project specific construction details, and material descriptions and installation instructions for crystalline waterproofing.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions and warranty requirements.
- B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete and masonry substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of crystalline waterproofing that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to maintain watertight conditions within specified warranty period.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Crystalline Waterproofing:
 - a. Anti-Hydro International, Inc.; Hydro Cap.
 - b. Conproco Corp.; Super Seal.
 - c. Tamms Industries, Inc.; Hey'Di K-11.
 - d. ThoRoc, Div. of ChemRex; Tegraproof.
 - e. Vandex International Ltd.; Vandex Super.
 - f. Xypex Chemical Corporation; Xypex. (Basis-of-Design)

2.2 MATERIALS

- A. Crystalline Waterproofing: A prepackaged, proprietary blend of Portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates by capillary action into concrete or masonry and reacts chemically with free lime in the presence of

water to develop crystalline growth within concrete or masonry capillaries to produce an impervious, dense, waterproof concrete or masonry with properties meeting or exceeding the following criteria:

1. Permeability: 0 for water at 33 feet when tested according to CE CRD-C 48.
 2. Compressive Strength: Minimum 3000 psi when tested according to ASTM C 109/C 109M.
- B. Patching Compound: Cementitious waterproofing and repair mortar for filling and patching tie holes, honeycombs, reveals, and other imperfections; with properties meeting or exceeding the following criteria:
1. Compressive Strength: 7600 psi at 28 days when tested according to ASTM C 109/C 109M.
 2. Flexural Strength: 710 psi at 28 days when tested according to ASTM C 348.
 3. Shrinkage: Minus 0.093 percent at 28 days and plus 0.073 percent at 90 days when tested according to ASTM C 596.
- C. Plugging Compound: Cementitious compound with hydrophobic properties; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead and horizontal surfaces not exposed to vehicular traffic); with properties meeting or exceeding the following criteria:
1. Permeability: 30 feet when tested according to CE CRD-C 48.
 2. Compressive Strength: 6000 psi at 28 days when tested according to ASTM C 109/C 109M.
 3. Flexural Strength: 1000 psi at 28 days when tested according to ASTM C 348.
 4. Bond Strength: 300 psi at 14 days when tested according to ASTM C 321.
- D. Water: Potable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Conditions: Examine substrates, with Applicator present, where waterproofing is to be applied.
1. Proceed with application only after unsatisfactory conditions have been corrected.
 2. Notify Architect in writing of active leaks or structural defects that would affect system performance.

3.2 PREPARATION

- A. Protect other work from damage from cleaning, preparation, and application of crystalline waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.
- B. Stop active water leaks according to waterproofing manufacturer's written instructions.

- C. Repair damaged or unsatisfactory concrete or masonry according to manufacturer's written instructions.
- D. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, curing compounds, and form-release agents to ensure that waterproofing bonds to concrete or masonry surfaces.
 - 1. Clean masonry surfaces according to ASTM D 4261.
 - a. Lightweight Concrete Masonry: Etch with 10 percent muriatic (hydrochloric) acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
 - b. Medium- and Normal-Weight Concrete Masonry: Sandblast or bushhammer to a depth of 1/16 inch.
 - 2. Clean concrete surfaces according to ASTM D 4258.
 - a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
 - b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
 - 3. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.
 - 4. Cracks: Clean and fill cracks according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

- A. General: Comply with waterproofing manufacturer's written instructions for application.
 - 1. Dampen surface with water and maintain damp condition until applying waterproofing.
 - 2. Apply waterproofing to negative-side surfaces.
 - 3. Number of Coats: Two coats.
 - 4. Dampen surface between coats.
- B. Final Coat Finish: Smooth
- C. Moist-cure waterproofing for three days immediately after application has set, followed by two days of air drying as recommended in writing by manufacturer.
- D. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:
 - 1. Onto columns integral with treated walls.
 - 2. Onto every substrate in areas indicated for treatment, including pipe trenches, pits, and sumps.

3.4 CLEANING AND PROTECTION

- A. Protect applied crystalline waterproofing from rapid drying, severe weather exposure, and water accumulation. Maintain completed Work in moist condition for not less than three days by procedures recommended in writing by waterproofing manufacturer. Protect waterproofing from temperatures below 36 deg F.
- B. Cleaning: Clean spillage and soiling from adjacent surfaces using appropriate cleaning agents and procedures.
- C. Protection: Take measures to protect completed crystalline waterproofing coating from damage after application.

3.5 FIELD QUALITY CONTROL

- A. Inspection: Engage manufacturer's representative to inspect completed application and to provide a written report that application complies with manufacturer's written instructions.

END OF SECTION

SECTION 072100

THERMAL INSULATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Rigid insulation under slabs-on-grade and at perimeter foundation walls.
 - 2. Rigid insulation at cavity walls.
 - 3. Glass-fiber blanket insulation.
 - 4. Mineral-wool blanket and board insulation.
 - 5. Spray polyurethane foam insulation.
 - 6. Vapor retarders.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for underslab vapor barrier.
 - 2. Section 072700 - AIR BARRIERS for air and vapor barrier membrane.
 - 3. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roofing insulation.
 - 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for acoustic insulation in gypsum board assemblies.
 - 5. Division 22 - PLUMBING for plumbing insulation.
 - 6. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for mechanical insulation.

1.3 SUBMITTALS

- A. Product Data: Manufacturer product data, installation instructions, performance criteria, and product limitations for each type of product indicated.
- B. LEED Submittals:

1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For insulation, submit industry-wide EPDs.
 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 1: For insulation, submit corporate sustainability reports (CSR).
 - c. Option 2, Leadership Extraction Practices:
 - 1) Recycled Content: For insulation, submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For mineral wool blanket insulation, submit Declare product labels.
 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For insulation, submit GreenGuard Gold certification.
 - b. For adhesives, submit test results, including TVOC emissions and VOC content.
 - c. For wet-applied products, submit volume used.
 - C. Cavity Wall Insulation Certification: Submit manufacturer's certification that cavity wall insulation, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.
 - D. Qualification Data: For Installer of spray-applied products and Testing Agency.
- 1.4 QUALITY ASSURANCE
- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
 - B. Installer Qualifications: A qualified installer who has been trained by and is acceptable to spray polyurethane foam insulation manufacturer to install manufacturer's products.
 - C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- D. Fire Test Performance for Insulation in Cavity Wall: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- E. Testing Agency Qualifications: An independent agency qualified as a "Certified Infrared Thermographer" per ASNT SNT-TC-1A guidelines, Level I certification minimum.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store in a dry and secure location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic and spray polyurethane foam insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver materials to Project site before installation time.
 - 3. Complete installation and concealment of materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 FOUNDATION WALL AND UNDER SLAB INSULATION

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. DuPont (formerly Dow Chemical); Reduced GWP Styrofoam series (gray color).
 - 2. Sika Corporation; Sarnatherm XPS
 - 3. Owens Corning; Foamular NGX (Next Generation Extruded) series.
- B. Extruded-Polystyrene (XPS) Board Insulation: ASTM C 578, square edged of type, density, and compressive strength indicated below:
 - 1. For vertical applications, Type IV, 1.6-lb/cu. ft. minimum density and 25-psi minimum compressive strength.
 - 2. For horizontal applications, pedestrian traffic, Type VII, 2.2-lb/cu. ft. minimum density and 60-psi minimum compressive strength.
 - 3. For horizontal applications, vehicular traffic, Type V, 3-lb/cu. ft. minimum density and 100-psi minimum compressive strength.
 - 4. Thermal Resistivity (R-value): 5.0 per inch.
 - 5. Blowing Agent: Honeywell; Solstice Liquid Blowing Agent, low global warming potential (GWP) hydrofluoro-olefin (HFO), or approved equal.
 - a. Other insulation manufacturers may be considered, if they have adopted the HFO blowing agents by start of construction.
 - 6. Recycled Content: 20 percent min.

- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.2 CAVITY WALL INSULATION (NOT FOR USE BEHIND METAL WALL PANEL)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. DuPont (formerly Dow Chemical); Reduced GWP Styrofoam series (gray color).
 - 2. Kingspan; Greenguard XPS LG series.
 - 3. Owens Corning; Foamular NGX (Next Generation Extruded) series.
- B. Extruded-Polystyrene (XPS) Board Insulation: ASTM C 578, Type X, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, and ASTM D 1621 compressive strength of 15 pounds per square inch minimum.
 - 1. Thermal Resistivity (R-value): 5.0 per inch.
 - 2. Blowing Agent: Honeywell; Solstice Liquid Blowing Agent, low global warming potential (GWP) hydrofluoro-olefin (HFO), or approved equal.
 - a. Other insulation manufacturers may be considered, if they have adopted the HFO blowing agents by start of construction.
 - 3. Recycled Content: 20 percent min.
- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.3 CAVITY WALL INSULATION, POLYISOCYANURATE BOARD

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Atlas Roofing Corp.
 - 2. Dow Chemical Company.
 - 3. Rmax Inc.
- B. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 or 2, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; 25-psi minimum compressive strength.
 - 1. Fire Resistance: NFPA 286, for interior walls.
 - 2. Thermal Resistance: ASTM C 518, R-Value 6.5 per inch.
 - 3. Blowing Agent: Free from CFCs, HCFCs, or HFCs.
- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- D. Joint Tape: Provide manufacturer's recommended foil tape, as approved by the Architect.

2.4 CAVITY WALL INSULATION, MINERAL-WOOL BOARD

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Isolatek International.
 - 2. Owens Corning; Thermafiber.
 - 3. Rockwool (formerly Roxul).
- B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612, Type IVB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Nominal density of 4 lb/cu. ft. Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F minimum.
 - 2. Fiber Color: Natural, except darkened where visible through joints in cladding.
 - 3. NFPA 285 Assembly Fire Propagation Characteristics Testing Results: Passing.
 - 4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Industry-wide EPD.
- C. Attachment to Substrate, Masonry Veneers: Manufacturer's recommended mechanical attachment clip or disk.
- D. Attachment to Substrate, Panel Veneers: Manufacturer's recommended adhesively attached, spindle-type insulation anchors.

2.5 BLANKET INSULATION, GLASS FIBER BLANKET

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. CertainTeed Corporation.
 - 2. Johns Manville.
 - 3. Knauf Insulation.
 - 4. Owens Corning.
- B. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. GreenGuard certified as formaldehyde free and low chemical emissions.
- C. Glass-Fiber Blanket, Polypropylene-Scrim-Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier). GreenGuard certified as formaldehyde free and low chemical emissions.
- D. Glass-Fiber Blanket, Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier). GreenGuard certified as formaldehyde free and low chemical emissions.
- E. Glass-Fiber Blanket, Foil Faced: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor

barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene. GreenGuard certified as formaldehyde free and low chemical emissions.

2.6 BLANKET INSULATION, MINERAL-WOOL BLANKET

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Owens Corning; Thermafiber UltraBatt FF.
 2. Isolatek International.
 3. Rockwool (formerly Roxul).
- B. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Recycled Content: 70 percent min.
 2. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 3. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification, formaldehyde-free.
- C. Mineral-Wool Blanket, Reinforced-Foil Faced: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene. GreenGuard certified as formaldehyde free and low chemical emissions.

2.7 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Accella Polyurethane Systems; Ecobay CC/CC Polar.
 2. BASF Corporation; WALLTITE.
 3. Corbond Corporation, a division of Johns Manville; Corbond III.
 4. Demilec (USA) LLC; Heatlok.
 5. DuPont; STYROFOAM Spray Polyurethane Foam (CM Series).
 6. Henry Company; PERMAX.
 7. NCFI, a Division of Barnhardt Mfg. Co.; InsulStar.
- B. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type I and II.
1. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
 2. Fire Resistance: ASTM E 84, Flame Spread 75 max., and Smoke Developed 450 max.
 3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Industry-wide EPD.
 4. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.

2.8 SPRAYED-FOAM INSULATION, AT GAPS AND VOIDS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Dow Chemical; GreatStuff Pro.
 - 2. ICP Adhesives and Sealants (formerly Fomo Products): Handi-Foam products.
 - 3. Approved equal.
- B. Sprayed-Foam Insulation: Water-cure closed cell polyurethane containing no urea-formaldehyde and no CFCs.
 - 1. Minimum density of 0.4 lb/cu. ft., thermal resistivity of 4.0 deg F x h x sq. ft./Btu x in. at 75 deg F.
 - 2. Fire Resistance: UL 723, Flame Spread 25 max., and Smoke Developed 50 max.
 - 3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Industry-wide EPD.
 - 4. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.

2.9 THERMAL AND IGNITION BARRIERS

- A. Thermal Barrier for Foam Plastic Insulation at Occupied Spaces: Provide thermal barrier recommended by foam plastic manufacturer and tested with the specific product. Product shall have an active building code evaluation report that lists report number and effective dates of product acceptance.
- B. Ignition Barrier for Foam Plastic Insulation at Attic and Crawl Spaces, including Areas not Separated from Occupied Spaces by a Thermal Barrier: Provide ignition barrier recommended by foam plastic manufacturer and tested with the specific product. Product shall have an active building code evaluation report that lists report number and effective dates of product acceptance.

2.10 VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.06 perm.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.11 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
 - 1. Low-Emitting Materials: Provide interior adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 2. Do not use adhesives that contain urea formaldehyde.
 - 3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

B. Masonry and Concrete Fasteners:

1. Hardened nails, pneumatically-driven fasteners or other anchors recommended by insulation manufacturer, sufficient to penetrate substrate and permanently retain insulation.
2. Self-adhering insulation stick pins: Galvanized steel plate welded to projecting steel spindle; capable of holding insulation thicknesses indicated securely in position indicated with self-locking galvanized steel washer in place. Backseal fastener penetrations.

C. Tape: Adhesive tape recommended by insulation manufacturer, to tape joints and tears in faced insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Spray Polyurethane Foam: Comply with recommendations of the American Chemistry Council, "Health and Safety Product Stewardship Workbook for High-Pressure Application of Spray Polyurethane Foam (SPF)."
1. Spray Polyurethane Foam: Spray insulation no greater than 1-1/2 inch thickness per layer. Allow each layer to fully cure before spraying additional thickness.
 2. Contain and fully ventilate the area being sprayed with negative air machines, venting directly to the exterior. Do not operate permanent building HVAC system during installation. Continue ventilation during curing process.
 3. Install spray polyurethane foam insulation with uniform full thickness and with density which will not displace adjacent materials.

4. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

- E. Miscellaneous Voids: Install spray polyurethane foam insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

1. Cure insulation with continuous natural or mechanical ventilation.
2. Remove and dispose of over-spray.

3.4 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set rigid insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line.

- B. On horizontal surfaces, loosely lay rigid insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties (if applicable) and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated. Fill gaps with compatible insulating material.

- B. Install mineral wool board cavity insulation per manufacturer's instructions. Fit insulation with edges butted tightly in both directions. Do not compress insulation. Maintain cavity width of dimension indicated between insulation and cladding material.

1. Masonry Veneers: Secure with clips installed over masonry anchors. Provide at least 6 clips per mineral wool board.
2. Panel Veneers: Secure with adhesively attached, spindle-type insulation anchors. Space anchors according to insulation manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

- B. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.7 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
 - 1. Attach vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints.
 - 2. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports.
- B. Infrared Camera Survey: Perform an infrared camera scan of walls, floors, and ceilings to determine where insulation and air barrier are not continuous, after insulation has been installed, but prior to plaster patching or new gypsum board installation.
 - 1. Provide complete digital report with images of test results with recommendations for repairs.
- C. Repair or replace work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation

is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 072600

UNDERSLAB VAPOR RETARDERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Vapor retarders under slabs-on-grade.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 VAPOR RETARDER

- A. Basis-of-Design: Stego Wrap Vapor Retarder by Stego Industries LLC, or Perminator by W.R. Meadows, or Viper VaporCheck II 15 mil by ISI Building Products. Vapor retarder shall have the following qualities:
 - 1. Permeance of less than 0.01 perms per ASTM F 1249 or ASTM E 96.

2. ASTM E 1745 Class A, with the permeance requirement modified to not exceed 0.01 perms both before and after conditioning.
3. Thickness: 15 mils.

B. Accessories:

1. Seam Tape: Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96.
2. Vapor Proofing Mastic: Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96.
3. Pipe Boots: Construct pipe boots from vapor retarder material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.3 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.

3.4 PROTECTION

- A. Protect installed vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION

SECTION 072700

AIR BARRIERS

(Part of Work of Section 070001 - Waterproofing, Dampproofing and Caulking,
Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Self-adhering, vapor-retarding, modified bituminous sheet air barrier.
 - 2. Self-adhering, vapor-permeable, modified bituminous sheet air barrier.
 - 3. Fluid-applied, vapor-retarding membrane air barrier.
 - 4. Fluid-applied, vapor-permeable membrane air barrier
 - 5. Transition strips to adjacent and penetrating materials.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for substrate for air and vapor barrier system.
 - 2. Section 061600 - SHEATHING for sheathing substrate for air and vapor barrier system.
 - 3. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roof air and vapor barrier.
 - 4. Section 079200 - JOINT SEALANTS for joint sealant requirements.

1.3 DEFINITIONS

- A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall or soffit, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air Barrier Assembly Air Leakage: Not to exceed 0.03 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., ASTM E 2357.
- C. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.5 PRECONSTRUCTION TESTING

- A. Mockup Testing: Air barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
 - 1. The Owner may engage a qualified testing agency.
 - 2. Quantitative Air Leakage Testing: Testing of the mockup for air leakage will be conducted not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage when tested according to ASTM E 783.
 - 3. Notify Architect and the Owner a minimum of seven days in advance of the dates and times when mockup testing will take place.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For air barriers, submit Declare product labels.
- C. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 1. Include details of interfaces with other materials that form part of air barrier.
 - 2. Include details of mockups.

- D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with air barrier; signed by product manufacturer.
- E. Air Barrier Certification: Submit manufacturer's certification that air barrier, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.
- F. Qualification Data: For Applicator.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.7 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly 150 sq. ft., incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
 - 1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
 - 2. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - 3. If the Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Include installers of other construction connecting to air barrier, such as roofing, waterproofing, architectural precast concrete, masonry, joint sealants, windows, glazed curtain walls, and door frames.
 - 2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
- B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- C. Store rolls according to manufacturer's written instructions.

- D. Protect stored materials from direct sunlight.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SELF-ADHERING SHEET MEMBRANE AIR BARRIERS, FIRE-RATED TYPES

- A. Self-Adhering, Vapor-Retarding Aluminum-Faced Sheet: Rubberized asphalt laminated to cross-laminated polyethylene film with aluminum facing on one side, with release liner on adhesive side, and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing; CCW 705FR-A.
 - b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier Aluminum Wall Membranes.
 - c. Henry Co.; Metal Clad Membrane.
 - 2. Thickness: 40 mils minimum.
 - 3. Physical and Performance Properties:
 - a. Vapor Permeance: Not more than 0.1 perm, ASTM E 96, Water Method.
 - b. Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - c. Fastener Sealability: No water leaking through fastener penetration after 24 hours; ASTM D 1970.
 - d. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
 - 4. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.
- B. Self-Adhering, Vapor-Permeable Sheet:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Fire Resist 705 VP.
 - b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier VPS.
 - c. Henry Co.; Blueskin VP 160.
 - 2. Thickness: 40 mils minimum.

3. Physical and Performance Properties:

- a. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

4. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.

2.2 FLUID-APPLIED MEMBRANE AIR BARRIERS, FIRE-RATED TYPES

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous, or synthetic polymer membrane.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. Carlisle Coatings & Waterproofing; Fire Resist Barritech NP.
- b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier NPL 10.
- c. Henry Co.; Air Bloc 16MR or 17MR.
- d. Tremco; ExoAir 130.
- e. W.R. Meadows; Air-Shield LSR.

2. Physical and Performance Properties:

- a. Vapor Permeance: Not more than 0.1 perm, ASTM E 96, Water Method.
- b. Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
- c. Fastener Sealability: No water leaking through fastener penetration after 24 hours; ASTM D 1970.
- d. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

3. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.

B. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous, or synthetic polymer membrane.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. Carlisle Coatings & Waterproofing; Barritech VP.
- b. GCP Applied Technologies (formerly W.R. Grace); Perm-A-Barrier VPL.
- c. Henry Co.; Air Bloc 17MR.
- d. Tremco; ExoAir 230.
- e. W.R. Meadows; Air-Shield LMP.

2. Physical and Performance Properties:

- a. Membrane Air Permeance: Not to exceed 0.004 cfm/ sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.

- b. Membrane Vapor Permeance: Not less than 10 perms; ASTM E 96.
- c. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of air barrier material.
- C. Counterflashing Strip: Modified bituminous 40-mil-thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil-thick, crosslaminated polyethylene film with release liner backing.
- D. Butyl Strip at Termination with EPDM or TPO Roofing Membrane: Vapor-retarding, 30- to 40-mil-thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.
- E. Modified Bituminous Strip To Cover Cracks and Joints and Terminate Air Barrier to Compatible Roofing Membrane: Vapor-retarding, 40-mil-thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- polyethylene film with release liner backing.
- F. Termination Mastic: Cold fluid-applied elastomeric liquid; trowel grade.
- G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- H. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- I. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.
- J. Sprayed Polyurethane Foam Sealant to Fill Gaps at Penetrations and Openings: one- or two-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- K. Modified Bituminous Transition Strip to Seal Air Barrier Terminations with Glazing Systems: Vapor-retarding, 40-mil-thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene or aluminum film with release liner backing.
- L. Preformed Silicone-Sealant Extrusion to Seal Air Barrier Terminations with Glazing Systems: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 123 Silicone Seal.
 - b. Elbex Corp: Transition Silicone Sheeting.
 - c. GE Silicone; UltraSpan US1100.
 - d. Tremco; approved equal.
- M. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 - JOINT SEALANTS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 4. Verify that masonry joints are flush and completely filled with mortar.
 5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

- G. Bridge and cover isolation joints expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping modified bituminous strips.
- H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT IN PREPARATION FOR INSTALLATION OF FLUID-APPLIED MEMBRANE

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - 1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.
- B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

- A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install butyl or modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

- E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
 - 2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
 - 3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, modified bituminous strip.
- J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 INSTALLATION OF SELF-ADHERING SHEET MEMBRANE

- A. Install modified bituminous sheets according to air barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air barrier sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.
- C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.

- D. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- E. Apply and firmly adhere modified bituminous sheets horizontally or vertically over area to receive air barrier sheets. Accurately align sheets and maintain a uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure airtight installation.
 - 1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
 - 2. Roll sheets firmly to enhance adhesion to substrate.
 - 3. Apply termination mastic on any horizontal, field-cut or non-factory edges.
- F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.
- G. Seal top of non-metallic through-wall flashings to air barrier sheet with an additional 6-inch- wide strip.
- H. Seal exposed edges of metallic sheets at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- I. Install air barrier sheets and auxiliary materials to form a seal with adjacent construction and to maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install compatible strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.
- J. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings using accessory materials.
- K. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply membrane specified below so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
 - 1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
 - 2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
 - 3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.

- L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- M. At end or each working day, seal top edge of membrane to substrate with termination mastic.
- N. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air barrier sheet extending 6 inches beyond repaired areas in all directions.
- P. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.6 INSTALLATION OF FLUID-APPLIED MEMBRANE AIR BARRIER

- A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- C. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- D. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Retarding Membrane Air Barrier: 60-mil dry film thickness.
 - 2. Vapor-Permeable Membrane Air Barrier: 120-mil wet film thickness.
- E. Apply strip and transition strip a minimum of 1 inch onto cured air membrane or strip and transition strip over cured air membrane overlapping 3 inches onto each surface according to air barrier manufacturer's written instructions.
- F. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air barrier system has been provided.
 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed.
 7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
 8. Termination mastic has been applied on cut edges.
 9. Air barrier has been firmly adhered to substrate.
 10. Compatible materials have been used.
 11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation, and priming of surfaces, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.
- C. Tests:
1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186.
 2. Quantitative Air Leakage Testing: Testing not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage according to ASTM E 783.
- D. Remove and replace deficient air barrier components and retest as specified above.

3.8 CLEANING AND PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed to these conditions for more than 30 days.
 2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.
- B. Clean spills, stains, and soiling from adjacent construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 074200

METAL WALL PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Factory-formed and -assembled, foamed-insulation-core metal wall panels.
 - 2. Exposed-fastener, lap-seam metal wall panels.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 054000 - COLD-FORMED METAL FRAMING for secondary support framing supporting metal wall panels.
 - 2. Section 072100 - THERMAL INSULATION for insulation behind metal wall panels.
 - 3. Section 077700 - WALL CLADDING SUPPORT SYSTEM.
 - 4. Section 076200 - SHEET METAL FLASHING AND TRIM for copings, flashings, and other sheet metal work not part of metal wall panel assemblies.
 - 5. Section 079200 - JOINT SEALANTS for field-applied sealants not otherwise specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

- C. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 and ASTM E 330 as applicable.
 - 1. Wind Loads: As required by Code.
 - 2. Deflection Limits: Engineer metal wall panel assemblies to withstand test pressures with deflection no greater than 1/180 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span, at code required loading.
- D. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- E. Thermal Movements for Metal Wall Panels: Provide wall panel assemblies that allow for noiseless thermal movements resulting from the following range in ambient temperatures and that prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects:
 - 1. Ambient Temperature Range: Minus 20 to plus 180 deg F.
- F. Seismic Performance: Metal wall panels shall withstand the effects of earthquake motions determined according to Code.
 - 1. Component Importance Factor: 1.0 [1.5].

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. LEED Submittal:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For composite metal panel, submit industry-wide (generic) EPDs or product specific Type III EPDs.
 - 2. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
- C. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the Commonwealth of Massachusetts responsible for their preparation. All costs for professional engineering shall be included in the bid price for the Work of this Section.
- D. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Exterior Wall Certification: Submit manufacturer's certification that exterior wall panels, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.
- F. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal wall panel accessories. Include 4-way joint for panels.
 2. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of metal wall panels adjacent to joint sealants.
- G. Qualifications: Qualifications of professional engineer and qualifications of installer as specified.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of panels that are similar to those indicated for this Project in material, design, and extent.
- C. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.
- D. Fabricator Qualifications: Certified by metal wall panel manufacturer to fabricate and install manufacturer's wall panel system.
- E. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.
- F. Fire Test Performance for Exterior Wall: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

- G. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - 1. Meet with The Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
 - 7. Review temporary protection requirements for metal wall panel assembly during and after installation.
 - 8. Review wall panel observation and repair procedures after metal wall panel installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
- I. Mockups: Provide mock-ups as specified in Section 014330 - MOCK-UPS, coordinate with other trades as required.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with

other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.

- E. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal wall panels without field measurements, or allow for field trimming of panels. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed-in-place during fabrication with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 1. Panel Performance:
 - a. Flatwise Tensile Strength: 30 psi when tested according to ASTM C 297.
 - b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F and 100 percent relative humidity according to ASTM D 2126.
 - c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F according to ASTM D 2126.
 - d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F according to ASTM D 2126.
 - e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. positive and negative wind load and with deflection of L/180 for 2 million cycles.
 - f. Autoclave: No delamination when exposed to 2-psi pressure at a temperature of 212 deg F for 2-1/2 hours.
 - g. Fire-Test-Response Characteristics: Class A according to ASTM E 108.
 2. Isocyanurate Insulation-Core Performance:
 - a. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
 - b. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
 - c. Shear Strength: 26 psi when tested according to ASTM C 273.
- B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aluma Shield Industries, Inc., a Member of Metecno Group.
 - b. CENTRIA Architectural Systems.
 - 1) Basis of Design:
 - a) Flat Panels: Centria Formawall Dimension Series DS58 Panel.
 - b) Corrugated Panels: Centria Formawall Dimension Series DS60 Panel
 - c. Metl-Span.

2. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - a. Material: Zinc-coated (galvanized) G90 steel sheet, 22 gauge thick at exterior panel and 26 gauge at interior panel.
 - b. Exterior Finish, Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605. Color and gloss: Provide custom colors as selected by Architect.
 - c. Interior Facing Finish: Manufacturer's standard 0.2 mil primer with 0.6 mil acrylic.
 - d. Exterior Surface: Smooth, flat.
3. Panel Thickness: 2.0 inches; 13/16 in. thick at reveals.
4. Panel Module: 24 in.

2.2 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ATAS International, Inc.
 2. CENTRIA Architectural Systems.
 - a. Basis of Design: Centria Concept Series wall panels - CS-260.
 3. Englert, Inc.
 4. Fabral.
 5. MBCI Metal Roof and Wall Systems, Division of NCI Group.
 6. McElroy Metal, Inc.
 7. Morin, a Kingspan Company
- B. General: Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- C. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 1. Thickness: 0.040 inch.
 2. Surface: Smooth, flat finish.
 3. Exposed Coil-Coated Finish:
 - a. Exterior Finish, Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605. Color and gloss: Provide custom colors as selected by Architect.

4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

- D. Corrugated-Profile, Exposed-Fastener Metal Wall Panels: Formed with alternating curved ribs spaced at 2.67 inches o.c. across width of panel.

1. Rib Spacing: As indicated on the Drawings.

2.3 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
- B. Trim: Formed from 0.0179-inch-thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.4 METAL FRAMING

- A. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G60, hot-dip galvanized zinc coating.
- B. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch and depth required to fit insulation thickness indicated.
- C. Rainscreen System: Provide system that has been tested in accordance with AAMA 508 (Pressure Equalized Rain Screen Wall Cladding Test) – Standard Test Method for Water Penetration of Exterior Vented Rainscreen Panel System. The test requires a minimum airflow of 1 CFM / SF of weather wall area through the vented rainscreen system to replicate severe storm and imperfection in air/vapor barrier system. While maintaining 1 CFM/SF airflow, the system must be able to pressure equalize and sustain zero pressure difference between the interior and exterior wall cavity without any water penetration.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Universe Systems, Division of Universe Corporation.
 - b. LYMO Architectural Panel Systems Inc.
 - c. POHL Inc. of America.
 - d. Centria Architectural Systems.
 - e. Metal Sales & Service, Inc.

2. Rout and return wall panel system with dry joints for rainscreen assembly; as approved by the Architect.

- D. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.5 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
2. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.

- B. Sheet Metal Accessories: Fabricate trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.

- a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in

the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

- D. High-Performance Organic Finish (2-Coat Fluoropolymer Mica Finish System): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing mica and not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.2 mil). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Metallic Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
1. Examine primary and secondary wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION, GENERAL

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall

panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal wall panels by torch is not permitted.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
5. Install screw fasteners in predrilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install flashing and trim as metal wall panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners, Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

3.4 WALL PANEL INSTALLATION

A. General: Install attachment system required to support wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
2. Do not begin installation until weather barrier and flashings that will be concealed by metal panels are installed.

B. Track-Support Installation: Provide manufacturer's standard horizontal and vertical tracks that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach panels to wall by interlocking tracks with perimeter extrusions attached to wall panels. Fully engage integral gaskets and leave horizontal and vertical joints with open reveal.

1. Attach routed-and-turned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.

3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 075400

THERMOPLASTIC MEMBRANE ROOFING

(Part of Work of Section 070002 - Roofing and Flashing, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Adhered membrane-roofing system.
 2. Cover board over insulation.
 3. Roof insulation.
 4. Substrate Board (thermal barrier).
 5. Vapor retarder.
 6. Membrane clad metal flashing.
 7. Flashing for equipment mounted on roofing and roofing penetrations.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Installed Only: Install the following items as furnished by the designated Sections:
1. Section 220001 - PLUMBING:
 - a. Roof drains.
 2. Section 230001 - HEATING, VENTILATING, AND AIR CONDITIONING:
 - a. Roof curbs for HVAC equipment.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
 2. Section 076200 - SHEET METAL FLASHING AND TRIM for metal roof penetration flashings, flashings, and counterflashings.
 3. Section 079200 - JOINT SEALANTS for sealants.

THERMOPLASTIC MEMBRANE ROOFING

4. Division 22 - PLUMBING for roof drains.
5. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for roof curbs for HVAC equipment.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Roofing system shall be designed to withstand loads indicated on Drawings, but not less than loads required by Code.
- D. Flashings: Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations in FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings; FMG 1-29 Loss Prevention Data Sheet for Above Deck Roof Components; NRCA Roofing and Waterproofing Manual (Fourth Edition) for Construction Details and SMACNA Architectural Sheet Metal Manual (Fifth Edition) for Construction Details, as applicable.
- E. Energy Performance: Provide roofing system with Solar Reflectance Index (SRI) not less than the following when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency:
 1. Low-sloped roof (less than or equal 2:12) - 82 minimum (initial); 64 (3-year aged).
 2. Steep-sloped roof (greater than 2:12) - 39 minimum (initial); 32 (3-year aged).
- F. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- G. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):

- a. Option 1: For PVC membrane roofing, submit product-specific Type III EPDs.
 - C. Shop Drawings: For each roofing system and level. Include plans, elevations, sections, details, and attachments to other Work. Include manufacturer's reviewed and approved details that are project-specific and include dimensions, scaled layouts, assembly profiles, and similar items. Manufacturer generic details will not be accepted. At a minimum, include the following:
 - 1. Base flashings and membrane terminations.
 - 2. Transitions to air barrier membrane.
 - 3. Tapered insulation, including slopes.
 - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations and note zone dimensions on shop drawing plans.
 - 5. Requirements for meeting specified uplift requirements.
 - 6. Tapered insulation layout, including amount and direction of slopes and drain sumps.
 - 7. Walkway pad plan and detail, as required.
 - 8. Proposed temporary, watertight, tie-off details for each substrate type.
 - D. Qualification Data: From Installer and manufacturer stating that the roof installer is acceptable to the manufacturer to install the specified system.
 - E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - F. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
 - G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.
 - H. Maintenance Data: For roofing system to include in maintenance manuals.
 - I. Sample Warranties: For manufacturer's special warranties.
 - J. Closeout Submittals: Following completion of Work, submit roofing system manufacturer's inspection report of completed roofing installation and completed warranty; submit Installer's completed warranty.
- 1.6 QUALITY ASSURANCE
- A. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.
 - B. Manufacturer Qualifications: A qualified manufacturer shall have minimum of ten years of experience in manufacturing of specified membrane.
 - C. Installer Qualifications: A qualified firm with at least five years project experience and at least three projects with size and complexity similar to the Project, that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

- D. Roofing Inspector: Owner may engage a full-time roofing inspector during installation of the deck, insulation assembly, membrane, flashing and other appurtenances, and when a survey of the roof and roof drains is conducted. Cooperate with Owner's roofing inspector and allow unlimited access to roofing during construction.
- E. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:
 - 1. Meet with the Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Roofing Contractor's Warranty: The roofing subcontractor shall supply Owner with a minimum two-year workmanship warranty for each roof. In the event any work related to the roofing, flashing, or metalwork is found to be defective within two years of substantial completion, the roofing contractor shall remove and replace such at no additional cost to the Owner. The roofing subcontractor's warranty obligation shall run directly to the Owner, and a copy the roofing signed warranty shall be sent to the roofing system's manufacturer.
 - 1. The duration of the Roofing Contractor's two-year warranty shall run concurrent with the roofing system's manufacturer's 20-year warranty.
- B. Roofing Systems Manufacturer's Warranty: The roofing manufacturer shall guarantee roof areas to be in a watertight condition, for a period of 20 years, from the date of final acceptance of the roofing system. The warranty shall be a 20-year no dollar limit (NDL), non-prorated total system labor and material warranty, for wind speed as required by Code or as indicated on the Drawings. Total system warranty shall include all roofing materials, related components and accessories including, but not limited to the substrate board, vapor retarder, insulation board, cover board, roofing membrane, membrane flashings, fasteners, adhesives, metal roof copings, metal roof edges and termination metals and roof drain assemblies. The manufacturer shall repair defects in materials and workmanship as promptly after observation as weather and site conditions permit.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

- A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet conforming to ASTM D 6878 and formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:
 - 1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products Company.
 - 1) Basis of Design: Elevate InvisiWeld.
 - c. GAF Materials Corporation.
 - d. GenFlex Roofing Systems.
 - e. Johns Manville.
 - f. Versico Inc.

2. Thickness: 60 mils (1.5 mm) nominal.
3. Exposed Face Color: White.
4. Physical Properties:
 - a. Breaking Strength: 225 lbf; ASTM D 751, grab method.
 - b. Elongation at Break: 15 percent; ASTM D 751.
 - c. Tearing Strength: 55 lbf minimum; ASTM D 751, Procedure B.
 - d. Water Absorption: Less than 4 percent mass change after 166 hours' immersion at 158 deg F; ASTM D 471.

2.2 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
 3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.
- C. TPO-Clad Metal Roof Flashing: Heat-weldable flashing designed to serve as gravel stop and fascia at perimeter of thermoplastic membrane roofing.
 1. Composition: 24 gauge steel with G90 galvanized coating, with 0.035 in. TPO membrane laminated to the outside face. Provide unsupported width of membrane along edge to be welded to roofing membrane.
 2. Profile: As shown on Drawings.
 3. Product: Sure-Weld TPO Coated Metal by Carlisle
 4. Exposed Face Color: Match membrane.
- D. Bonding Adhesive: Manufacturer's recommended bonding adhesive.

- E. Metal Termination Bars: Manufacturer's standard predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.3 VAPOR RETARDER

- A. Self-Adhering Sheet Vapor Retarder: ASTM D 1970, minimum 40-mil- thick film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 0.1 perm; cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.4 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.
 - 1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Atlas Roofing Corporation.
 - b. Carlisle SynTec Incorporated.
 - c. Firestone Building Products Company.
 - d. GAF Materials Corp.
 - e. GenFlex Roofing Systems.
 - f. Johns Manville International Inc.
 - 2. Compressive Strength at Terraces: In accordance with ASCE 7-05, "Minimum Design Load for Building and other Structures", pedestrian terraces are required to support a minimum live load of 100 psf. Use 40 psi insulation for when pavers are on pedestals and exclusive of planters and other heavy concentrated loads such as heavy wheel traffic.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.
 - 1. Cover Board Adhesive: Manufacturer's cold fluid-applied adhesive formulated to adhere cover board to insulation substrate.
- D. Cover Board: Provide the following, as required by roofing manufacturer to comply with performance requirements and provide specified warranty.
 - 1. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 or 5/8 inch thick, factory primed.
- E. Substrate Board (Thermal Barrier): ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch (16 mm) thick, factory primed.

2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured vinyl walkway pads or rolls approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Section 053100 - STEEL DECKING.
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 - 7. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD INSTALLATION

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions and as required to comply with performance requirements.

3.4 VAPOR-RETARDER INSTALLATION

- A. Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side, and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.
- B. Completely seal vapor retarder at side laps, end laps, terminations, obstructions, and penetrations to prevent air movement into roofing system.
- C. Tie vapor retarder to wall air barrier. Coordinate construction sequence to ensure air barrier continuity at roof to wall interfaces.

3.5 INSULATION AND COVERBOARD INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - 2. For insulation applied in multiple layers, loose-lay first layer and mechanically fasten top layer.
- H. Mechanically Fastened Cover Boards: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and mechanically fasten to roof deck.
 - 1. Mechanically fasten cover boards, unless otherwise indicated.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- I. Adhered Cover Boards: Install cover boards over mechanically-fastened insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Adhere cover boards to mechanically-fastened insulation in ribbons of bead-applied adhesive or full-spread adhesive, as required to comply with performance and warranty requirements.
 - 1. Locations for Adhered Cover Board Installation: Provide under green roof areas and elsewhere, where indicated.
 - 2. Adhere cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.6 ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply solvent-based bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
- E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

- F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
- H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement (except for heat-welded application), and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings.

3.8 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. Manufacturer's Technical Representative: Engage a qualified manufacturer's technical representative to perform roof tests and inspections and to prepare test reports.
- C. Final Roof Inspection: Engage roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect and the Owner 48 hours in advance of date and time of inspection.

- D. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Protect membrane-roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and the Owner.
- B. Correct deficiencies in or remove membrane-roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane-roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 076100

SHEET METAL SIDING

(Part of Work of Section 070002 - ROOFING AND FLASHING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Factory-formed and field assembled, titanium zinc flat-lock tiles.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council
 - 1. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
 - 2. Refer to Section 018111, SUSTAINABLE DESIGN REFERENCE DOCUMENTS.
- C. Related Sections include the following:
 - 1. Section 051200 – STRUCTURAL STEEL FRAMING, for structural steel supports for metal wall panels.
 - 2. Section 054000 – COLD-FORMED METAL FRAMING for secondary support framing supporting metal wall panels.
 - 3. Section 055000 – METAL FABRICATIONS for attached ladders.
 - 4. Section 061000 – ROUGH CARPENTRY for shims, and blocking.
 - 5. Section 072100 – THERMAL INSULATION for mineral wool insulation.
 - 6. Section 076200 – SHEET METAL FLASHING AND TRIM for fasciae, copings, flashings and other sheet metal work not part of metal wall panel assemblies.
 - 7. Section 072500 –AIR BARRIERS, for air vapor barrier materials that require tie-into wall panel systems.
 - 8. Section 079200 – JOINT SEALANTS for field-applied sealants not otherwise specified in

this Section.

9. Division 8 – OPENINGS for windows and curtain wall.

1.3 DEFINITION

- A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight system.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.
- B. Air Infiltration for insulated metal panel: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 psf (76 Pa).
- C. Water Penetration: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lb/sq. ft. (300 Pa) and not more than 12 lb/sq. ft. (575 Pa).
- D. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
1. General: The intent of these specifications is to meet or exceed the requirements of the local State Building Code.
 2. Wind Loads: Determine loads based on the following minimum design wind pressures:
Uniform pressure as indicated on Drawings.
 3. Deflection Limits: Engineer metal wall panel assemblies to withstand test pressures with deflection no greater than 1/180 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span.
 - a. Test Pressures: 150 percent of inward and outward wind-load design pressures.
- E. Seismic Performance: Provide metal wall panel assemblies capable of withstanding the effects of earthquake motions determined according to the New Hampshire State Building Code.
- F. Thermal Movements: Provide metal wall panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.
- B. LEED Submittal: For each product specified, complete the PRODUCT DATA REPORTING FORM for LEED v4 PRODUCTS – See Section 018110 – SUSTAINABLE DESIGN REQUIREMENTS. All columns of information must be completed, and back-up documentation provided for all attributes being claimed as pertaining to the following credits:
 - 1. MR Credit: Building Product Disclosure and Optimization (BPDO) – Environmental Product Declarations (EPD); See Section 018110 - 2.3B.
 - 2. MR Credit: Building Product Disclosure and Optimization (BPDO) – Sourcing of Raw Materials; See Section 018110 - 2.3C.
 - 3. MR Credit: Building Product Disclosure and Optimization (BPDO) – Material Ingredients; See Section 018110 - 2.3D.
- C. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories, expansion and control joints, and special details. Distinguish between factory- and field-assembled work.
 - 1. Accessories: Include details of the following items, at a scale of not less than 6 inches per 12 inches:
 - a. Flashing and trim.
- D. Calculations: For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:
 - 1. Wall panels and attachments.
 - 2. Stud framing.
 - 3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
- F. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
 - 2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.
- G. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Wall Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
 - 2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 - 3. Corner Treatment: 12 inches (300 mm) long each side of corner, by 12 inches (300 mm)

- high, showing panels, inside and outside corner trim and related accessories.
- 4. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
- 5. Exposed Gaskets: 12 inches (300 mm) long.
- 6. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of metal wall panels adjacent to joint sealants.
- H. Qualification Data: For Installer, professional engineer and testing agency.
- I. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:
 - 1. Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- J. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
 - 1. Metal Wall Panels: Include reports for air infiltration, water penetration, and structural performance.
- K. Maintenance Data: For metal wall panels to include in maintenance manuals.
- L. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional structural engineering services, certified in the state of New Hampshire, needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of data for each metal wall panels system type, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Testing Agency Qualifications: Required tests shall be performed by agencies qualified according to ASTM E 329 for testing indicated.
- C. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

- E. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. Perform tests under environmental conditions replicating those that will exist during installation.
 2. Submit no fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
- F. Mockups: Provide materials for and build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
1. Build mockup of typical wall panel 4'-0" x 8'-0", or as shown on Drawings; full thickness, including insulation, supports, attachments, and accessories.
 2. Do not apply wall panel materials to the mock-up until the Pre-Installation Conference, described in this section, has commenced.
 3. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
 4. Air Barrier Quality Control: Before the metal siding has been installed, this mockup may also be used to comply with requirements for air barrier quality control, as specified in Section 072500 – AIR BARRIERS
 5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
 2. Schedule conference after wall panel product data & shop drawing submittals have been approved and before wall panel materials have been applied to the required mockup(s).
 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
 5. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 6. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
 8. Review temporary protection requirements for metal wall panel assembly during and after installation.

9. Review wall panel observation and repair procedures after metal wall panel installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal wall panels without field measurements, or allow for field trimming of panels. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 TITANIUM ZINC METAL WALL TILES

- A. General: Provide factory-formed metal wall tile assembly designed to be installed with flat-

lock seams.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - 1. (Basis of Design) RHEINZINK Canada Ltd.
 - 2. UnitedZinc, by IMETCO.
 - 3. VM Zinc.
- C. Zinc Alloy Sheet/Coils:
 - 1. Titanium Zinc Alloy whose base is electrolytic high grade fine zinc (DIN EN1179) with a 99.995 % Zn degree of purity and alloying additives of + 0.1% copper and + 0.1% titanium in accordance with DIN EN 988.
 - a. Pre-Weathered: pickling process (no phosphating)
 - 1) Color: As selected by Architect from manufacturer's full range.
 - 2. Minimum Panel Thickness: 1.0 mm.
 - 3. Minimum Flashing Thickness: 0.7 mm (24 ga.)
- D. Ventilation Mat at Titanium Zinc: Provide manufacturer's approved ventilation mat equal to Enkamat 7010 or Enkamat 7008; by Colbond.
 - 1. Ventilation mat adequately functions as slipsheet. Do not use red rosin paper as underlayment to zinc as this causes corrosion.

2.2 MISCELLANEOUS METAL FRAMING FOR METAL TILES

- A. Provide metal framing and attachment systems for metal wall panels as recommended by manufacturer to meet indicated design loads.
- B. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G60, hot-dip galvanized zinc coating.
- C. Subgirts: C- or Z-shaped sections fabricated from 0.0598-inch (1.5-mm) bare steel thickness, shop-painted, cold-formed, galvanized steel sheet.
- D. Z-Shaped Furring and Hat Channels: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), galvanized steel with minimum bare metal thickness of 0.0598-inch (1.5-mm), and depth required to fit insulation thickness indicated.
- E. J-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), galvanized steel with minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
- F. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.3 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.
 - 1. Fasteners for Wall Panels: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 - 4. Clips: Manufacturer's standard clips as required for installation of panels.
- B. Panel Sealants:
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.
- C. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- D. Provide mineral wool insulation in accordance with Section 072100 – THERMAL INSULATION.

2.4 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
 - 1. Closures: Provide head closure piece and closures at eaves and rakes, fabricated of same metal and thickness as metal wall panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- B. Insect Mesh: Fused, entangled polymer filaments heat-bonded to each other to form a rigid mat comprising an open, three-dimensional geomatrix.
Product:
 - 1. Colbond Industries, *Enkamat*, or equal by approved manufacturer.
- C. Custom Closure, Flashing and Trim: Formed from same gauge as panels, Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations

include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.5 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 - 2. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Exposed Mitered/Welded Corners shall be fabricated from same gauge as panels. These corners shall be furnished in the same profile and width as the panels. Leg length of each corner shall be 13".
- E. Where indicated, fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
- F. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 - 5. Exterior only: Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
 - 1. Examine primary and secondary wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Install flashings and other sheet metal to comply with requirements specified in Section 076200 – SHEET METAL FLASHING AND TRIM.
- C. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations.
- D. Coordinate work with the installation of air vapor barrier specified in Section 072500 – Air Barriers, and mineral wool insulation specified in Section 072100 – Thermal Insulation.

3.3 METAL TILE PANEL INSTALLATION, GENERAL

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal

and structural movement.

1. Field cutting of metal wall panels by torch is not permitted.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
5. Install concealed screw fasteners in predrilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install flashing and trim as metal wall panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Concealed Fasteners:

1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

E. Provide support framing where not indicated to be provided by others.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar

items.

- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in water-proof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner will engage a qualified independent testing and inspecting agency to perform the following field tests and inspections and prepare test reports. The Contractor shall notify the Owner when the installation is ready for testing, and shall cooperate with the Owner's testing agency as needed to test siding in a timely manner.
1. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal wall panel installation, including accessories. Report results in writing.
- C. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.
- D. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On

- completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
 - C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

(Part of Work of Section 070002 - ROOFING AND FLASHING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Sheet metal flashing and trim for the following applications:
 - a. Through-wall flashing.
 - b. Formed wall flashing and trim.
 - c. Formed low-slope roof flashing and trim.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 042000 - UNIT MASONRY:
 - a. Through-wall flashings.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
 - 2. Section 072700 - AIR BARRIERS for perimeter terminations at air and vapor barrier assembly.
 - 3. Section 074200 - METAL WALL PANELS for factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
 - 4. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for installing sheet metal flashing and trim integral with roofing membrane.
 - 5. Section 079200 - JOINT SEALANTS for field-applied sheet metal flashing and trim sealants.

6. Section 079500 - EXPANSION CONTROL for manufactured sheet metal expansion-joint covers.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing and copings capable of resisting Wind Zone forces required by Code according to recommendations in FMG Loss Prevention Data Sheet 1-49.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.
- E. Interface with Other Systems:
 1. Do not proceed with installation of flashing and sheet metal until completion of curb and substrate construction, cants, blocking, reglets and other construction required to receive flashing.
 2. Coordinate flashing with other Work for correct sequencing of items comprising entire membrane or system of roofing or waterproofing and rain drainage.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. LEED Submittals:
 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
- C. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
 1. Identify material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
 1. Meet with the Owner, Architect and Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 2. Review methods and procedures related to sheet metal flashing and trim.
 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005. Thickness as specified in this Section. Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
 - 1. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - a. Available Products: Sherwin-Williams Coil Coatings; Valspar Fluropon Pure; approved equal.
 - 1) Building Product Disclosure and Optimization, Material Ingredients: Declare product label.
 - b. Color and Gloss: As selected by Architect from manufacturer's full range.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, with No. 2D dull, cold-rolled finish. Thickness as specified in this Section.
- C. Zinc Sheet: Zinc, 99 percent pure, alloyed with 0.08 to 1.00 percent copper, 0.06 to 0.20 percent titanium, and up to 0.015 percent aluminum; with manufacturer's standard factory-applied, flexible, protective back coating.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Contrarian Metal Resources; Alloy 710 Zinc.
 - b. IMETCO; United Zinc.
 - c. Jarden Zinc Products; Solid Zinc Strip.
 - d. Rheinzink America Inc.; RHEINZINK.
 - e. Umicore Building Products USA, Inc.; VM ZINC series.
 - 2. Finish: Preweathered gray.

2.2 UNDERLAYMENT MATERIALS

- A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - 1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Solder for Zinc: ASTM B 32, 40 percent tin and 60 percent lead with low antimony, as recommended by zinc manufacturer.
- E. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- F. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength. Provide 2 in. min. end dams at terminations (riveted and sealed watertight).
 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 3. Soldered Seams in Stainless Steel: Prefabricated inside and outside corners and 2 in. min. end dams at terminations (riveted and soldered watertight).
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Furnish with 6-inch-wide joint cover plates.
1. Joint Style: Butt, with 12-inch-wide concealed backup plate.
 2. Fabricate from the following material:
 - a. Aluminum: 0.050 inch (1.27 mm) thick.
 - b. Zinc: 0.059 inch (1.50 mm) thick.
- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
1. Joint Style: Butt, with 12-inch-wide concealed backup plate.
 2. Fabricate copings from the following material:
 - a. Aluminum: 0.050 inch (1.27 mm) thick.
 - b. Zinc: 0.059 inch (1.50 mm) thick.
- C. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:
1. Aluminum: 0.050 inch (1.27 mm) thick.
 2. Zinc: 0.039 inch (1.00 mm) thick.

- D. Base Flashing: Fabricate from the following material:
 - 1. Aluminum: 0.040 inch (1.02 mm) thick.
 - 2. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - 3. Zinc: 0.039 inch (1.00 mm) thick.
- E. Counterflashing: Fabricate from the following material:
 - 1. Aluminum: 0.032 inch (0.81 mm) thick.
 - 2. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - 3. Zinc: 0.039 inch (1.00 mm) thick.
- F. Roof-Penetration Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- G. Roof-Drain Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.016 inch (0.40 mm) thick.
- H. Splash Pans: Fabricate from the following material:
 - 1. Stainless Steel: 0.025 inch thick.

2.6 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing, Typical: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high end dams. Fabricate from the following material:
 - 1. Stainless Steel: 0.016 inch (0.40 mm) thick.
 - 2. Zinc: 0.039 inch (1.00 mm) thick.
- B. Through-Wall Flashing, In Masonry: Through-wall flashing in masonry is specified in Section 042000 – UNIT MASONRY.
- C. Wall Expansion-Joint Cover: Fabricate from the following material:
 - 1. Aluminum: 0.040 inch (1.02 mm) thick.
 - 2. Zinc: 0.039 inch (1.00 mm) thick.

2.7 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system. Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer installation instructions, and SMACNA "Architectural Sheet Metal Manual". Anchor units work of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams that will be permanently watertight and weatherproof.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of stainless-steel sheet metal flashing and trim with isolation coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip-sheet or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - 1. Aluminum: Use aluminum or stainless steel fasteners.
 - 2. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with elastomeric sealant as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 - JOINT SEALANTS.
- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
 - 1. Do not solder aluminum sheet.
 - 2. Stainless-Steel Soldering: Prein edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
 - 3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
- J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.
 - 1. Secure in a waterproof manner by means of snap-in installation and sealant.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - 1. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for flashing on vent piping.

3.4 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing In Masonry: Installation of through-wall flashing in masonry is specified in Section 042000 - UNIT MASONRY.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 077100

ROOF SPECIALTIES

(Part of Work of Section 070002 - ROOFING AND FLASHING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roof-edge drainage systems.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
 - 2. Section 079200 - JOINT SEALANTS for sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 - 1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 3. Details of termination points and assemblies, including fixed points.
 - 4. Details of special conditions.
- C. Samples for Verification: For roof-edge drainage systems made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge, including gutter and downspout approximately 10 feet long, including supporting construction, seams, attachments, and accessories.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
 - 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005. Thickness as specified in this Section. Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
 - 1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil; complying with AAMA 2605.
 - 1) Color: As selected by Architect from manufacturer's full range.

2.2 CONCEALED METALS

- A. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated Copper Sheet: Series 300 stainless steel.
- C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- D. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

2.4 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ATAS International, Inc.
 - 2. Berger Building Products, Inc.

3. Cheney Flashing Company.
4. Hickman Company, W. P.
5. Merchant & Evans, Inc.
6. Metal-Era, Inc.
7. Metal-Fab Manufacturing, LLC.
8. MM Systems Corporation.

- B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Fabricate from the following exposed metal:
 - a. Aluminum: 0.050 inch (1.27 mm) thick.
2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
3. Corners: Factory mitered and soldered.
4. Gutter Supports: As indicated with finish matching the gutters.
5. Gutter Accessories: Bronze wire ball downspout strainer,

- C. Downspouts: Plain round complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Aluminum: 0.040 inch (1.02 mm) thick.

- D. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout.

1. Fabricate from the following exposed metal:
 - a. Aluminum: 0.040 inch (1.02 mm) thick.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow

solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and solder to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
 - 1. Provide elbows at base of downspout to direct water away from building.
- D. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below gutter discharge.

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 077200

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roof hatches and safety rails.
 - 2. Elevator vents.
 - 3. Free-standing non-penetrating rooftop railing system.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for metal vertical ladders, ships' ladders, and stairs for access to roof hatches, and from roof to roof.
 - 2. Section 061000 - ROUGH CARPENTRY for wood cants and wood nailers
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
 - 4. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for roof-mounted ventilators.
 - 5. Division 26 - ELECTRICAL for power supply and final connections for automatically operated heat and smoke vents.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 ROOF HATCHES

- A. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Babcock-Davis; ThermalMAX roof hatch.
 - 2. Bilco; Thermally Broken Roof Hatch.
- B. Roof Hatches, Thermally Broken Types: Fabricate roof hatches with insulated double-wall lids and insulated double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
 - 1. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loads.
 - 2. Type and Size: Lid type and size as indicated on Drawings.
 - 3. Curb and Lid Material: Galvanized steel or aluminum sheet, 0.079 inch thick.
 - 4. Insulation: Manufacturer's standard board insulation, R-18 min.
 - 5. Curb: Fabricate units to minimum height of 12 inches.
 - 6. Thermal Break: Fabricate with thermal break between interior and exterior surfaces.
 - 7. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
 - 8. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.

- C. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
1. Height: 42 inches above finished roof deck.
 2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
 3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
 4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
 5. Chain Passage Barrier: Galvanized proof coil chain with quick link on fixed end.
 6. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
 7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
 8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
 9. Fabricate joints exposed to weather to be watertight.
 10. Fasteners: Manufacturer's standard, finished to match railing system.
 11. Finish: Manufacturer's standard.

2.2 FREE-STANDING ROOFTOP RAILING SYSTEM

- A. Free-Standing Rooftop Fall Protection Systems: KeeGuard Roof Edge Protection System as manufactured by Kee Safety Inc., or approved equal.
1. Description: Permanent, modular, free-standing, roof edge railing system that does not penetrate the roofing system; including but not limited to
 2. Provide components including but not limited to pipe railings, uprights, bases, counterweights, fittings and accessories as indicated or required to match design indicated on Drawings and to provide complete installation.
 3. Compliance: OSHA Standard 29 CFR 1910.23. 42 inch (1067 mm) minimum height to provide a pedestrian egress barrier on the roof to withstand a minimum load of 200 lb (90719 g). OSHA Standard 29 CFR 1926.501. OSHA Standard 29 CFR 1926.502.
 4. System Design: Designed for applications with flat or low slope roof up to 10 degrees. Counterbalances: PVC, with one fixing collar per counterbalance
 5. System Configuration: As indicated on Drawings.
 6. Top and Intermediate Rails: 1.9 inches outside diameter with 0.109 inch wall thickness.
 7. Fittings: Galvanized malleable cast iron, ASTM A 47 with ASTM A 153 galvanizing.
 8. Fasteners: Type 304 or 305 stainless steel.
 9. Components: In-fill panels and toeboards as required.
 10. Finish: Powder coat or baked-enamel in colors as selected by Architect.

2.3 ELEVATOR VENTS

- A. Elevator Hoistway Penthouse Vent: Provide louvered penthouse assemblies with automatic dampers, complying with the following:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Airolite Corp.
 - b. Industrial Louvers Inc.
 - c. McDermott Metal Works Corp.
2. Basis of Design: Industrial Louvers Inc. 480XP Penthouse Louver.
3. Finish: Manufacturer's standard mill finish.

2.4 MISCELLANEOUS MATERIALS

- A. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWWA C2; not less than 1-1/2 inches thick.
- B. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
- D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- E. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 2. Verify dimensions of roof openings for roof accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory

installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

- B. Install roof accessories to fit substrates and to result in watertight performance.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof accessories with isolation coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip-sheet, or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
- E. Roof Hatch Installation:
 - 1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
 - 2. Attach safety railing system to roof hatch curb.
 - 3. Attach ladder safety post according to manufacturer's written instructions.
- F. Elevator Vent Installation: Locate, install, and test heat and smoke vents according to NFPA 204.
 - 1. Check vent for proper operation. Adjust operating mechanism as required.
- G. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.3 TOUCH UP

- A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 099000 - PAINTING AND COATING.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 077700

WALL CLADDING SUPPORT SYSTEM

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Non-combustible thermally-broken continuous insulation and cladding support system at exterior.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 054000 – COLD-FORMED METAL FRAMING for exterior wall framing.
 - 2. Section 072000 - THERMAL INSULATION for insulation.
 - 3. Section 074200 – METAL WALL PANELS for exterior cladding.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design support system and framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Provide support system and framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As required by code and not less than indicated on the Structural Drawings.

1.4 SUBMITTALS

- A. Product Data: For each product.

- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types; and fastening and anchorage details, including mechanical fasteners. Show opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of framing that are similar to those indicated for this Project in material, design, and extent.
- C. Mock-Up: Provide labor and materials for mock-ups specified in Section 014000 – QUALITY REQUIREMENTS.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

PART 2 - PRODUCTS

2.1 COMPOSITE FRAMING SUPPORT

- A. Non-Combustible, Thermally Broken Continuous Insulation and Cladding Support System: Coordinated with exterior insulation, engineered to support exterior cladding dead loads and project specific wind loads, and without thru-insulation thermal bridging other than brackets and/or fasteners. Acceptable systems are limited to the following:
 - 1. Stand-Off PV Bracket by ExoTec Mfg.
 - 2. KnightWall MFI-System.
 - 3. Alpha VCI or HCI Sub-Framing System by ECO Cladding.

2.2 ACCESSORIES

- A. Fasteners: Corrosion-resistant, self-tapping and self-drilling screws, bolts, nuts, and other fasteners as recommended by panel support system manufacturer for project application.
- B. Sealants: Provide sealants as recommended by exterior wall panel manufacturer for openings within wall panels and perimeter conditions.
 - 1. Refer to Section 079200 – JOINT SEALANTS for requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas of this work, and project conditions with installer present for compliance with requirements for installation tolerances, substrates, wall panel support conditions, and other conditions affecting performance of this Work.
- B. Examine structural wall framing to ensure that angles, channels, studs, and other structural support members have been installed within alignment tolerances required by continuous insulation wall panel support system manufacturer.
- C. Verify that water resistive barrier has been installed over exterior sheathing to control air infiltration or water penetration as indicated for project.
- D. Examine rough-in for components and systems penetrating wall panel support system to coordinate actual locations of penetrations relative to exterior wall panel joint locations prior to installation.
- E. Proceed with installation only after exterior walls have been properly prepared and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION, GENERAL

- A. Install wall panel support system in accordance with manufacturer's installation instructions, approved submittals, and in proper relationship to adjacent construction.
- B. Install wall panel support system in compliance with exterior wall panel orientation, sizes, and locations as indicated on Drawings.

3.4 TOLERANCES

- A. Shim and align wall panel units with installed tolerances of 1/4 inch in 20 feet, non-cumulative, on level, plumb, and location lines as indicated.

3.5 PROTECTION

- A. Protect installed products from damage until date of Substantial Completion.

END OF SECTION

SECTION 078100

APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Standard Durability sprayed fire-resistive materials for concealed spaces not exposed to view or weather, non-high-rise construction.
 - 2. Medium Durability sprayed fire-resistive materials for interior spaces exposed to view and abrasion (in final construction) but not to weather.
 - 3. High Durability sprayed fire-resistive materials for exposed spaces, including at loading docks, at parking garages, and where exposed to weather.
 - 4. Exposed thin-film mastic and intumescent fire-resistive coatings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete protecting structural steel.
 - 2. Section 042000 - UNIT MASONRY for masonry protecting structural steel.
 - 3. Section 051200 - STRUCTURAL STEEL FRAMING for surface conditions required for structural steel receiving sprayed fire-resistive materials.
 - 4. Section 078410 - PENETRATION FIRESTOPPING for firestopping and firesafing insulation.
 - 5. Section 092110 - GYPSUM BOARD ASSEMBLIES for fire-resistance-rated assemblies.
 - 6. Section 092120 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES for fire-resistance-rated assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:

1. For paints and coatings, documentation including printed statement of VOC content.
 2. Laboratory Test Reports for Credit EQ 4: For paints and coatings used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: Structural framing plans indicating the following:
1. Locations and types of surface preparations required before applying sprayed fire-resistive material.
 2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:
 - a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
 3. Treatment of sprayed fire-resistive material after application.
- D. Samples for Verification: For each type of colored, exposed sprayed fire-resistive material, two Samples, each 4 inches square, of each color, texture, and material formulation to be applied. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
- E. Qualification Data: For Installer, manufacturer, and testing agency.
- F. Compatibility and Adhesion Test Reports: From sprayed fire-resistive material manufacturer indicating the following:
1. Materials have been tested for bond with substrates.
 2. Materials have been verified by sprayed fire-resistive material manufacturer to be compatible with substrate primers and coatings.
 3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed sprayed fire-resistive materials.
1. Engineering Evaluation: Provide engineering evaluation of modification of submitted fire-resistance design, if required to comply with required fire-test-response characteristics, specified under Quality Assurance Article herein.
- 1.4 QUALITY ASSURANCE
- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its sprayed fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

- B. Testing Agency Qualifications: An independent approved testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented in accordance with local State Building Code.
- C. Source Limitations: Obtain sprayed fire-resistive materials through one source from a single manufacturer for each type of material.
- D. Sprayed Fire-Resistive Materials Testing: By an approved testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.
 - 1. Sprayed fire-resistive materials are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Testing is performed on specimens of sprayed fire-resistive materials that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
 - 3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.
- E. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.
 - 1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 - 2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with sprayed fire-resistive material.
- F. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing sprayed fire-resistive materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction, for sprayed fire-resistive material serving as direct-applied protection tested per ASTM E 119.
 - a. Steel members shall be considered restrained unless specifically noted otherwise. Structural design capacity for framing members shall be assumed as "fully-loaded". Non-load restricted fire-resistance designs shall be utilized for steel beams and joists requiring more than a 1 hour rating. Fire-resistance designs that indicate a load restriction factor are not permitted for steel beams and joists requiring more than a 1 hour rating.
 - b. As required by Code, the individual beam and joist must match the assembly rating ratings.

2. Surface-Burning Characteristics: ASTM E 84, limits in accordance with applicable local Building Code.
 - G. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."
 - H. Code-Required Inspections: Notify Architect and Owner's independent testing agency a minimum of 72 hours prior to commencing work of this Section, for Code-required special inspections.
 - I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to sprayed fire-resistive materials including, but not limited to, the following:
 1. Review and finalize construction schedule and verify sequencing and coordination requirements.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
 - B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
 - C. Store materials inside, under cover, aboveground, and kept dry until ready for use. Remove from Project site and discard wet or deteriorated materials.
- 1.6 PROJECT CONDITIONS
- A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat is provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
 - B. Ventilation: Ventilate building spaces during and after application of sprayed fire-resistive material. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly. Comply with manufacturer's recommended ventilation procedures.
- 1.7 COORDINATION
- A. Sequence and coordinate application of sprayed fire-resistive materials with other related work specified in other Sections to comply with the following requirements:
 1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
 2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.

3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
6. Except for thin-film intumescent fireproofing, do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace sprayed fire-resistive materials that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 1. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of sprayed fire-resistive materials from substrates.
 2. Not covered under the warranty are failures due to damage by occupants and the Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.
- B. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
- B. Low-Emitting Materials: Fireproofing used within the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 STANDARD DURABILITY SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: For standard density sprayed fire-resistive materials for concealed spaces not exposed to view or weather, non-high-rise construction, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carbolite Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 5GP.
 - b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type MK-6/HY.
 - c. Isolatak International, Cafco Products; Cafco 300.
- B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 - 1. Dry Density: 15 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWC Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 - 2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
 - a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
 - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft.
 - 3. Bond Strength: 150 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:
 - a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance

with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."

- c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.
4. Compressive Strength: Minimum 1200 psf as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb/cu. ft.
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.3 MEDIUM-DURABILITY CEMENTITIOUS SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: For medium-density sprayed fire-resistive materials for interior spaces exposed to view and abrasion (in final construction) but not to weather provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carbolite Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 7GP.
 - b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type Z-106/HY.
 - c. Isolake International Corp., Cafco Products.; Cafco 300 or Cafco 400.
- B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 1. Dry Density: 22 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWC Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:

- a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
 - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 22 lb/cu. ft.
3. Bond Strength: 430 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:
 - a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."
 - c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.
4. Compressive Strength: 100 psi as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 22 lb/cu. ft.
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.4 HIGH-DURABILITY CEMENTITIOUS SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: For high-density sprayed fire-resistive materials for exposed spaces, including at loading docks, at parking garages, and where exposed to weather, provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carbolite Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 7HD.
 - b. GCP Applied Technologies (formerly W.R. Grace); Monokote Type Z146.
 - c. Isolite International Corp., Cafco Products.; Fendolite MII.

- B. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 - 1. Dry Density: 40 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605.
 - 2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
 - a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
 - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 40 lb/cu. ft.
 - 3. Bond Strength: 10,000 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:
 - a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests in accordance with ASTM E736 while using criteria of acceptance in UL's "Fire Resistance Directory."
 - c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.
 - 4. Compressive Strength: Minimum 500 psi as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 40 lb/cu. ft.
 - 5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
 - 6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
 - 7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
 - 8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
 - 9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.5 EXPOSED THIN-FILM MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS (MIFRC)

- A. Conditioned Interior Space Conditions: Coatings limited to interior climate controlled spaces having no exposure to condensation, and where the relative humidity and temperature are controlled according to the manufacturers recommendations or to not more than 75 percent, which ever is less, during the application and curing of the coating, the construction and the occupancy of the building.
 - 1. Isolatek International Corp., Cafco Products; Cafco SprayFilm WB 4 with topcoat.
 - 2. Carboline.; Thermo-Sorb VOC without topcoat.
 - 3. Sherwin Williams; Firetex FX5120 without topcoat.
- B. Interior General Use Conditions: Coatings limited to interior service where protection of the coating during application and curing, the construction and the occupancy of the building are as recommended by the product manufacturer for the specific application.
 - 1. Carboline; Firefilm III.
 - 2. Carboline; Thermo-Sorb VOC.
 - 3. Isolatek Internaional Corp., Cafco Products; Cafco SprayFilm WB-5.
- C. Exterior Use Conditions: Coatings for exterior use or interior use where exterior environmental conditions exist.
 - 1. Isolatek International Corp., Cafco Products; Cafco SprayFilm-WB 4 with Topseal.
 - 2. International Paint, LLC; Interchar 212 with topcoat.
 - 3. Carboline.; Thermo-Lag E100 with topcoat.
- D. Thin-Film Mastic and Intumescent Fire-Resistive Coating: Factory-mixed formulation.
 - 1. Approved by manufacturer and authorities having jurisdiction for interior or exterior use.
 - 2. Multicomponent system consisting of primer, intumescent base coat and topcoat.
 - 3. Systems shall comply with applicable VOC requirements and meet OTC emission regulations.
- E. Color and Gloss: As indicated by manufacturer's designations.

2.6 AUXILIARY FIRE-RESISTIVE MATERIALS

- A. General: Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:
 - 1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory," for coating materials based on a series of bond tests per ASTM E 736.
 - 2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of sprayed fire-resistive material per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

- C. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of sprayed fire-resistive material.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.
- E. Reinforcing Fabric for Use with Intumescent Coatings: Glass-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated, approved by manufacturer of thin-film mastic and intumescent coating fire-resistive material.
- F. Topcoats: Provide fireproofing manufacturer recommended topcoats for exposed fireproofing.
 - 1. Color and Gloss: Provide custom colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:
 - 1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
 - 2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
 - 3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.
- B. Verify that concrete work on steel deck has been completed.
- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are completed.
- D. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.

- B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.
- C. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of sprayed fire-resistive material. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL

- A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- B. Apply sprayed fire-resistive material that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.
- C. Install metal lath and reinforcing fabric, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath and fabric to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer. Attach accessories where indicated or required for secure attachment of lath and fabric to substrate.
- D. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by sprayed fire-resistive material manufacturer for material and application indicated.
- E. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by sprayed fire-resistive material manufacturer, install body of fire-resistive covering in a single course.
- F. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.
- G. Where sealers are used, apply products that are tinted to differentiate them from sprayed fire-resistive material over which they are applied.

3.4 APPLICATION, CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

- A. Apply concealed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.
- B. Cure concealed sprayed fire-resistive material according to product manufacturer's written recommendations.

3.5 APPLICATION, EXPOSED SPRAYED FIRE-RESISTIVE MATERIALS

- A. Apply exposed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.
- B. Provide a uniform finish complying with description indicated for each type of material and matching Architect's sample or, if none, finish approved for field-erected mockup.
- C. Apply exposed cementitious sprayed fire-resistive materials to produce the following finish:
 - 1. Even, spray-textured finish, produced by rolling flat surfaces of fire-protected members with a damp paint roller to remove drippings and excessive roughness.
- D. Cure exposed sprayed fire-resistive material according to product manufacturer's written recommendations.

3.6 APPLICATION, EXPOSED MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. Apply exposed thin-film mastic and intumescent fire-resistive coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.
- B. Apply mastic and intumescent fire-resistive coating as follows:
 - 1. Install reinforcing fabric as required to obtain designated fire-resistance rating and where indicated.
 - 2. Finish: Even, spray-textured finish produced by lightly rolling flat surfaces of fire-protected members before fire-resistive material dries, to smooth out surface irregularities and to seal in surface fibers.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports, as required by 2015 IBC 1705.15.
 - 1. Cooperate with testing agency, provide access.
- B. Remove and replace applications of sprayed fire-resistive material that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.
- C. Apply additional sprayed fire-resistive material, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.
- D. Field inspect intumescent materials in accordance with AWCI Tech Manual 12B.

3.8 CLEANING, PROTECTING, AND REPAIR

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect sprayed fire-resistive material, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.
- C. Coordinate application of sprayed fire-resistive material with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect sprayed fire-resistive material and patch any damaged or removed areas.
- D. Repair or replace work that has not successfully protected steel.

END OF SECTION

SECTION 078410

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joint sealers.
 - 2. Section 079200 - JOINT SEALANTS for standard joint sealers.
 - 3. Section 142100 - MACHINE-ROOM-LESS TRACTION ELEVATORS for cutting penetrations for traction elevator piping, cabling and conduit penetrations and providing firestopping complying with requirements in this Section.
 - 4. Section 142400 - HYDRAULIC ELEVATORS for cutting penetrations for elevator piping, cabling and conduit penetrations and providing firestopping complying with requirements in this Section.
 - 5. Division 21 - FIRE SUPPRESSION for cutting penetrations for fire-suppression piping and providing firestopping complying with requirements in this Section.
 - 6. Division 22 - PLUMBING for cutting penetrations for plumbing piping and providing firestopping complying with requirements in this Section.
 - 7. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for cutting penetrations for ductwork and HVAC piping and providing firestopping complying with requirements in this Section.
 - 8. Division 25 - INTEGRATED AUTOMATION for cutting penetrations for cable and conduit and providing firestopping complying with requirements in this Section.
 - 9. Division 26 - ELECTRICAL for cutting penetrations for cable and conduit and providing firestopping complying with requirements in this Section.
 - 10. Division 27 - COMMUNICATIONS for cutting penetrations for cable and conduit and providing firestopping complying with requirements in this Section.

PENETRATION FIRESTOPPING

11. Division 28 - ELECTRONIC SAFETY AND SECURITY for cutting penetrations for cable and conduit and providing firestopping complying with requirements in this Section.

1.3 COORDINATION

- A. Jobsite conditions of each through-penetration firestop system must meet all details of the UL-Classified System selected. If jobsite conditions do not match any UL-classified systems, contact firestop manufacturer for alternative systems or Engineer Judgment Drawings.
- B. Coordinate work with other trades to assure that penetration-opening sizes are appropriate for penetrant locations.
- C. Verify that the schedule is current at the time of construction, and that each referenced system is suitable for the intended application.

1.4 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 1. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping:

1. Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
 2. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems demonstrating no evidence of water leakage when tested according to UL 1479.
 - b. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
- F. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For firestopping products, submit Health Product Declarations (HPD) or Declare product labels.
 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For firestopping, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
1. Types of penetrating items.
 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

- E. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Either a firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors" or a firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction of a minimum of five projects with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.
- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed in the UL "Fire Resistance Directory."
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to the following:
 - 1. Hilti, Inc.
 - 2. BioFireshield; RectorSeal Corporation.
 - 3. Specified Technologies, Inc. (STI).
 - 4. 3M; Fire Protection Products Division.

2.2 FIRESTOPPING MATERIALS

- A. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content:
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.
- C. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-

penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

- D. Materials: Provide through-penetration firestop systems containing primary materials and fill materials which are part of the tested assemblies indicated in the approved Through-Penetration Firestop System Schedule submittal. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

1. Available Products:

- a. BioFireshield; RectorSeal Smoke and Acoustic Sealant.
- b. Hilti; CP 606 Flexible Firestop Sealant.
- c. Hilti; CP 653 BA Firestop Speed Sleeve.
- d. Hilti; FS-ONE Intumescent Firestop Sealant.

- E. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

- F. Endothermic Mats: 3M Interam Endothermic Mats by 3M Fire Protection Products; located in rated walls behind cabinet unit heaters, fire extinguisher cabinets and electrical panels where there are space limitations to maintain the wall rating.

2.3 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports, as required by 2015 IBC 1705.17 and 1705.17.1. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 078440

FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to fire-resistive joint systems for the following:
 - 1. Floor-to-floor joints.
 - 2. Floor-to-wall joints.
 - 3. Head-of-wall joints.
 - 4. Wall-to-wall joints.
 - 5. Perimeter fire-resistive joint systems consisting of floor-to-wall joints between perimeter edge of fire-resistance-rated floor assemblies and exterior curtain walls.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 078410 - PENETRATION FIRESTOPPING for firestopping.
 - 2. Division 21 - FIRE SUPPRESSION for fire-protection piping penetrations.
 - 3. Division 22 - PLUMBING for piping penetrations.
 - 4. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for duct and piping penetrations.
 - 5. Division 26 - ELECTRICAL for cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
- B. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For fire-resistive joint system sealants, submit Health Product Declarations (HPD) or Declare product labels.
 - 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For fire-resistive joint system sealants, submit test results, including TVOC emissions and VOC content.
 - b. For fire-resistive joint system sealants, submit GreenGuard Gold certifications.
 - c. For wet-applied products, submit volume used.
- C. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
- D. Fire-Resistive Joint Systems Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
 - 1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- E. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.
- F. Qualification Data: For Installer.
- G. Field quality-control test reports.
- H. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration fire stop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted

in construction of a minimum of five projects with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Evidence of FMG 4991 approval is acceptable for installer qualifications, but not mandatory.

- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
 - a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
 - b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, fire-resistive joint systems that may be incorporated into the Work include, but are not limited to the following:
 - 1. Hilti, Inc.
 - 2. BioFireshield; RectorSeal Corporation.
 - 3. Specified Technologies, Inc. (STI).
 - 4. 3M; Fire Protection Products Division.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

- A. Low-Emitting Materials: Fire-resistive joint system sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. VOC Content: Provide fire-resistive joint system sealants that comply with the following limits for VOC content:
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.
- C. General: Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- D. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079.
- E. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa) or ASTM E 2307.
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

- F. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
 - 1. L-Rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.
- G. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- H. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports, as required by 2015 IBC 1705.17 and 1705.17.2. Independent inspecting agency shall comply with ASTM E 2393 requirements including those related to qualifications, conducting inspections, and preparing test reports.
- B. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.
 - 1. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
- C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
- D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If

damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION

SECTION 079200

JOINT SEALANTS

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING,
Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Joint sealants and fillers.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for masonry control and expansion joint fillers and gaskets.
 - 2. Section 088000 - GLAZING for glazing sealants.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
 - 4. Section 093000 - TILING for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 5. Section 095100 - ACOUSTICAL CEILINGS for sealing edge moldings at perimeters of acoustical ceilings.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each product indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For sealants, submit Health Product Declarations (HPD) or Declare product labels.
 - 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For sealants, submit test results, including TVOC emissions and VOC content.
 - b. For sealants, submit GreenGuard Gold certifications.
 - c. For wet-applied products, submit volume used.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- E. Qualification Data: For Installer and qualified testing agency.
- F. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- G. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- H. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- I. Field Test Report Log: For each elastomeric sealant application.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- D. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - b. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with joint sealant backing and glazing and gasket materials.
 - 2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 4. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of nonelastomeric sealant and joint substrate indicated.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

4. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Low-Emitting Materials: Interior sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. VOC Content: Provide interior sealants and sealant primers that comply with the following limits for VOC content:
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.
- D. Colors of Exposed Joint Sealants: Provide colors as selected by the Architect from manufacturer's full range of standard and custom colors; maximum of five colors, three standard colors and two custom colors.

2.2 JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Elastomeric sealants shall be nonstaining to porous substrates. Provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600 or ANSI/NSF Standard 51.
- D. Exterior Silicone Sealant, Single-Component Neutral-Curing Type:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Silicones; SilPruf LM SCS2700.
 - c. Pecora Corporation; 864.
 - d. Tremco Inc.; Spectrem 1.
 - 2. Extent of Use: Exterior joints in vertical and soffit surfaces.

- E. Exterior Urethane Sealant, Multicomponent Pourable (Self-Leveling) Type for Pedestrian Traffic: ASTM C 920, Type M, Grade P, Class 25, Use T, M, & O.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Meadows, W. R., Inc.; POURTHANE.
 - b. Pecora Corporation; Urexpan NR-200.
 - c. Sika; Sikaflex-2c SL.
 - d. Tremco Inc.; THC-901.
 - 2. Extent of Use: Exterior joints in horizontal surfaces.
- F. Interior Sanitary Silicone Sealant, Single-Component Mildew-Resistant, Acid-Curing (Acetoxo) Type: ASTM C 920, Type S, Grade NS, Class 25, Use NT, G, A, and O.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik; Pure Silicone.
 - b. Dow Corning Corporation; 786 Mildew Resistant.
 - c. GE Silicones; Sanitary SCS1700.
 - d. Pecora; 898NST.
 - e. Sika; Sikasil GP.
 - f. Tremco; Tremsil 200.
 - 2. Extent of Use: Interior sanitary joints at toilet rooms, kitchens, and other wet areas.
- G. Interior Acrylic Latex Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Henkel Corp.; Loctite Polyseamseal Acrylic Caulk with Silicone.
 - b. Pecora Corporation; AC-20+.
 - c. Tremco Inc.; Tremflex 834.
 - 2. Extent of Use: Interior non-moving joints.

2.3 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin) or other type, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Availavle Products: Armacell Canada Inc.; ITP Standard Backer Rod; or approved equal.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include concrete, masonry, unglazed surfaces of ceramic tile, and exterior insulation and finish systems.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

Nonporous joint substrates include the following metal, glass, porcelain enamel, and glazed surfaces of ceramic tile.

- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage

or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 079500
EXPANSION CONTROL

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Architectural expansion joint systems for interior and exterior joints as scheduled on the Drawings and specified in this Section.
- B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 033000 - CAST-IN-PLACE CONCRETE for block-outs for architectural joint systems in concrete floors, decks, and walls.
 2. Section 042000 - UNIT MASONRY for masonry wall expansion joint cover.
 3. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roof level expansion joint.
 4. Section 078446 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joints not associated with expansion control assemblies.
 5. Section 079200 - JOINT SEALANTS for elastomeric sealants and preformed compressed-foam sealants without metal frames.
 6. Section 092110 - GYPSUM BOARD ASSEMBLIES for framing joint in gypsum board assemblies.

1.3 DEFINITIONS

- A. Architectural Joint System: Any filler or cover used to span, fill, cover, or seal a joint, except expanding foam seals and poured or foamed in-place sealants.
- B. Cyclic Movement: Periodic change between widest and narrowest joint widths in an automatically mechanically controlled system.
- C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint.
- D. Maximum Joint Width: Widest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.

- E. Minimum Joint Width: Narrowest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.
- F. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage of nominal value of joint width.
- G. Nominal Joint Width: Width of linear gap indicated as representing the conditions existing when architectural joint systems will be installed or, if no nominal joint width is indicated, a width equal to the sum of maximum and minimum joint widths divided by two.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide factory-fabricated architectural joint systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E 1399.
 - 1. Vehicular Traffic Joints: Support vehicular traffic across joint, including construction equipment and full-loaded fire apparatus.
 - 2. Pedestrian Traffic Joints: Support pedestrian traffic across joint.
 - 3. Exterior Joints: Maintain continuity of weather enclosure.
 - 4. Joints in Fire-Resistance-Rated Assemblies: Maintain fire-resistance ratings of assemblies.
 - 5. Joints in Smoke Barriers: Maintain integrity of smoke barrier.
 - 6. Joints in Acoustically Rated Assemblies: Inhibit passage of airborne noise.
 - 7. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.
 - 8. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
 - b. Component Importance Factor is 1.5.
 - 9. Joints in Surfaces with Architectural Finishes: Serve as finished architectural joint closures.

1.5 SUBMITTALS

- A. Product Data: Include manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.
- B. Shop Drawings: For each joint system specified, provide the following:
 - 1. Placement Drawings: Include line diagrams showing entire route of each joint system, plans, elevations, sections, details, joints, splices, locations of joints and splices, and attachments to other Work. Where joint systems change planes, provide Isometric Drawings depicting how components interconnect to achieve continuity of joint covers and fillers.

- C. Samples for Verification: Full-size units 6 inches long of each type of joint system indicated; in sets for each finish, color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
- D. Product Test Reports: From a qualified testing agency indicating architectural joint systems comply with requirements, based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain architectural joint systems through one source from a single manufacturer. Coordinate compatibility with adjoining joint systems specified in other Sections.
- B. Fire-Test-Response Characteristics: Where indicated, provide joint systems incorporating fire barriers that are identical to those of assemblies tested for fire resistance per UL 2079 or ASTM E 1966, including hose-stream test of vertical wall assemblies and wall-to-ceiling assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Balco, Inc.
 - 2. Construction Specialties, Inc.
 - 3. JointMaster/InPro Corporation.
 - 4. Michael Rizza Company, LLC.
 - 5. MM Systems Corporation.
 - 6. Nystrom, Inc.
 - 7. Sika / Emseal.
 - 8. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.

2.2 MATERIALS

- A. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions; ASTM B 209, alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Stainless Steel: ASTM A 666, Type 304 with No. 2B finish, unless otherwise indicated, for plates, sheet, and strips.
- C. Preformed Seals: Single or multicellular extruded elastomeric seals designed with or without continuous, longitudinal, internal baffles. Formed to be installed in frames or with anchored

flanges, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

- D. Strip Seals: Elastomeric membrane or tubular extrusions with a continuous longitudinal internal baffle system throughout complying with ASTM E 1783; used with compatible frames, flanges, and molded-rubber anchor blocks.
- E. Compression Seals: Preformed, elastomeric extrusions having internal baffle system complying with ASTM E 1612 in sizes and profiles indicated or as recommended by manufacturer.
- F. Preformed Cellular Foams: Nonextruded, low-density, crosslinked, nitrogen-blown ethylene-vinyl-acetate copolymer extruded, compressible foam.
- G. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint.
- H. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 ARCHITECTURAL JOINT SYSTEMS

- A. General: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.
 - 1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.
 - 2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.
 - 3. Frames for Strip Seals: Designed with semiclosed cavity that provides a mechanical lock for seals of type indicated.
 - 4. Public Area Seals: Non-slip seals designed for installation on treads and risers and to lie flat with adjacent surfaces, and complying with ADA guidelines for public areas.

2.4 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.5 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

2.6 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Polish: No. 4 finish.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to architectural joint system manufacturer's written instructions.
- B. Coordinate and furnish anchorages, Placement Drawings, and instructions for installing joint systems to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.
- C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.
- D. Provide the services of a surveyor licensed in the **state the project is located** prior to and after paving substrate to confirm alignment of joint.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for handling and installing architectural joint assemblies and materials, unless more stringent requirements are indicated.
- B. Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.
- C. Terminate exposed ends of exterior architectural joint assemblies with factory-fabricated termination devices to maintain waterproof system.
- D. Install factory-fabricated transitions between building expansion-joint cover assemblies and roof expansion-joint assemblies to provide continuous, uninterrupted, watertight construction.
- E. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.
 - 1. Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

2. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
 3. Set covers in horizontal surfaces at elevations that place exposed surfaces flush with adjoining finishes.
 4. Locate covers in continuous contact with adjacent surfaces.
 5. Securely attach in place with required accessories.
 6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- F. Continuity: Maintain continuity of joint systems with a minimum number of end joints and align metal members. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- G. Extruded Preformed Seals: Install seals to comply with manufacturer's written instructions and with minimum number of end joints.
1. For straight sections, provide preformed seals in continuous lengths.
 2. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer.
 3. Apply adhesive, epoxy, or lubricant adhesive approved by manufacturer to both frame interfaces before installing preformed seals.
 4. Seal transitions according to manufacturer's written instructions.
 5. Install foam seals with adhesive recommended by manufacturer and heat seal all splices.
- H. Joint Systems with Seals: Seal end joints within continuous runs and joints at transitions according to manufacturer's written instructions to provide a watertight installation.
- I. Seismic Seals: Install interior seals in continuous lengths. Install exterior seal in standard lengths and vulcanize or heat-weld field splice joints to provide watertight joints using manufacturer's recommended procedures. Seal transitions and end joints according to manufacturer's written instructions.
- J. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and end joints.

3.3 CLEANING AND PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

END OF SECTION

SECTION 080001

METAL WINDOWS

(TRADE BID REQUIRED)

Trade Contractors on this CM-at-Risk project are required by law to provide payment and performance bonds for the full value of their trade contracts, and trade contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Bids will only be accepted from trade contractors pre-qualified by the awarding authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 080001- METAL WINDOWS

2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 8 of Chapter 149A of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority.
3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings: ((always insert accurate list of sheet numbers of applicable Drawings)).

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 085110 - ALUMINUM WINDOWS.

END OF SECTION

SECTION 080002

GLASS AND GLAZING

(TRADE BID REQUIRED)

Trade Contractors on this CM-at-Risk project are required by law to provide payment and performance bonds for the full value of their trade contracts, and trade contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Bids will only be accepted from trade contractors pre-qualified by the awarding authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 080002- GLASS AND GLAZING

2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 8 of Chapter 149A of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority.
3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings: ((always insert accurate list of sheet numbers of applicable Drawings)).

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 088000 - GLAZING.

END OF SECTION

SECTION 080800

OPENINGS SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 RELATED SECTIONS

- A. Division 01 – General Requirements
- B. Section 019113 – General Commissioning Requirements
- C. Division 08 – Openings
- D. Section 084410 Glaze Aluminum Curtain Walls
- E. Section 084412 Glazed Wood and Aluminum Curtain Walls
- F. Section 085110 Aluminum Windows

1.3 REQUIRMENTS

- A. The Commissioning process requires the participation of Division 08, Openings Contractor, to ensure that all systems fulfill the requirements set forth in these construction documents. The general commissioning requirements and coordination are detailed in Section 019113. Division 08, Openings, shall fulfill commissioning responsibilities assigned to division 08 in accordance with Section 019113.

PART 2 - PRODUCTS **(NOT USED)**

PART 3 - EXECUTION

3.1 PRE-FUNCTIONAL CHECKLISTS

- A. Inspection reports/checklists assist in the process to document that the equipment and systems are installed properly.
- B. The contractor shall provide any associated checklist and inspection documentation associated with the respective section as indicated by the contract documents.

3.2 FUNCTIONAL PERFORMANCE TESTING

- A. Intent of functional performance testing is to prove thru functional test procedures proper system operation.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: A qualified testing agency shall be engaged to perform tests and inspections.
- B. Acceptance testing of newly installed window and door systems shall include water penetration testing in accordance with ASTM E1105
 - 1. ASTM E1105 - This test method covers the determination of the resistance of installed exterior windows, curtain walls, skylights, and doors to water penetration when water is applied to the outdoor face and exposed edges simultaneously with a static air pressure at the outdoor face higher than the pressure at the indoor face
- C. Testing shall be performed by others (a 3rd party testing agency) but selectively witnessed and evaluated by the commissioning consultant.
- D. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements as indicated above.
 - 1. Air Infiltration: As indicated in 084410 associated with field quality control in testing utilizing standards ASTM E283,
 - 2. Water Infiltration: As indicated in 084410 associated with field quality control in testing utilizing standards ASTM E1105 and AAMA 501.2 and 084412 for AAMA 501.3 associated with Curtainwalls and 085110 for AAMA 502 and AAMA/NWWDA101/I.S.2 for Aluminum Windows
- E. Glazed aluminum curtain walls and windows will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports. Issue reports to Construction manager and Commissioning Agent for review, record and distribution

3.4 INSPECTION CHECKLISTS AND FUNCTIONAL PREFORMANCE TESTING

- A. Inspection Checklists and testing procedures will be performed on the following system types. These inspection and testing requirements are in addition to and do not replace any testing required elsewhere in Division 08 or by applicable codes.)
 - 1. Walls/Window/Door Systems

END OF SECTION

SAMPLE ONLY

Installation Checklist and Functional Testing

Windows and Walls

1. Participants

Discipline	Name	Company
CxA		Consulting Engineering Services
Window		
Wall Systems		
Date Returned to CxA		

2. Prerequisite Checklist

Check	Description
☐	Fenestration installation is complete and ready for inspection and testing
☐	Air and Water Infiltration tests have been performed by 3 rd Party Testing Agency
☐	Schedules and setpoints implemented - This checklist does not take the place of the manufacturer's recommended checkout and startup procedures. - Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others). - Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.

3. Installation Checks

Check		COMMENT
General Conditions		
No physical damage observed	☐	
No structural issues observed	☐	
Exterior Wall Surfaces		
Deformed finish not observed	☐	
No surface deterioration observed	☐	
No staining observed	☐	
Interior Wall Surfaces		
No cracks observed	☐	
No water staining observed	☐	
No water leaks observed	☐	
No deformed finishes observed	☐	
Window Conditions		
No water leaking observed	☐	
No air leaking observed	☐	
Window units are plumb, level and true to line, without warp or rack of frames or sash	☐	
Masonry surfaces are dry and free of excess mortar, sand or other debris	☐	
Metal surfaces are dry and clean	☐	
Sill members and other members have been set in a bed of sealant or with joint fillers or gaskets to provide weather tight construction	☐	
Weeps are installed per construction documents	☐	
Weep holes are open and free of debris/blockages	☐	
Joint Sealants		
Backing material has been installed in accordance with sealant mfg requirements	☐	
Surfaces are clean and dry prior to sealant application	☐	
Joints are completely filled	☐	
Sealant has cured according to mfg recommendations and is ready for testing	☐	

4. Testing performed by 3rd Party Testing Agency

Window and Curtainwall Testing

Air Infiltration

Water Infiltration

☐ Respective Testing Agency has provided passing testing reports for review and record.

SECTION 081110

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Standard hollow-metal steel doors and frames.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for building anchors into masonry construction.
 - 2. Section 087100 - DOOR HARDWARE for door hardware for steel doors.
 - 3. Section 088000 - GLAZING for glazed lites.
 - 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for insulation.
 - 5. Section 099000 - PAINTING AND COATING for field painting steel doors and frames.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, temperature-rise ratings, and finishes for each type of steel door and frame specified.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For doors and frames, submit product-specific Type III EPDs.
 - 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:

- a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 - 3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For doors and frames, submit Health Product Declarations (HPD) or Declare product labels.
 - 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For doors and insulation, submit GreenGuard Gold certification.
 - C. Shop Drawings:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
 - D. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
 - E. Qualification Data: For Installer.
 - F. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.
- 1.4 QUALITY ASSURANCE
- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.
 - C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-

protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
 2. Temperature-Rise Limit: Fire door assemblies in interior exit stairways and ramps and exit passageways shall have a maximum transmitted temperature rise of not more than 450 degrees F (250 degrees C) above ambient at the end of 30 minutes of standard fire test exposure. Exception: The maximum transmitted temperature rise is not required in buildings equipped throughout with an automatic sprinkler system installed in accordance with IBC Section 903.3.1.1 or 903.3.1.2.
- D. Fire-Rated, Borrowed-Light Assemblies (Including Sidelights and Transoms): Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ceco Door Products; an ASSA ABLOY Group Company.
 2. CURRIES Company; an ASSA ABLOY Group Company.
 3. de LaFontaine
 4. Philipp Manufacturing Company.
 5. Steelcraft; an Allegion (formerly Ingersoll-Rand) company.

2.2 MATERIALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated, (Galvanized/Galvannealed) Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60/A60 metallic coating.
- E. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- H. Insulation: Comply with requirements in Section 092110 - GYPSUM BOARD ASSEMBLIES.
- I. Glazing: Comply with requirements in Section 088000 - GLAZING.
- J. Environmental Product Declarations (EPD): Product-specific Type III EPDs for hollow metal doors and frames are available from manufacturers listed herein.
- K. Low-Emitting Materials: Provide building products in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 STANDARD STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - b. Thermal-Rated (Insulated) Exterior Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 2.5 when tested according to ASTM C 1363.
 - 3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick end closures or channels of same material as face sheets.
 - 4. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated (galvanized/galvannealed) steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated (galvanized/galvannealed) steel sheet.
 - 1. Fabricate frames with full profile welded joints.
 - 2. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.

- C. Interior Frames: Fabricated from cold-rolled steel sheet.
 - 1. Fabricate frames with full profile welded joints.
 - 2. Frames for Level 2 Steel Doors: 0.053-inch-thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.8 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Glazed Lites: Factory cut openings in doors.
 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 1. Full Profile Welded Frames: Weld joints continuously; grind, fill, dress, and make smooth, flush, and not visible.
 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as doorframe. Fasten members at crossings and to jambs by butt welding.
 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.

- 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - c. Compression Type: Not less than two anchors in each jamb.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 - DOOR HARDWARE.
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 - ELECTRICAL.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings, so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow metal work.

5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard epoxy primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 2. Refer to Section 099000 – PAINTING AND COATING for field-applied coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack insulation behind frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for filling space between frames and masonry with insulation.
 - 5. Concrete Walls: Solidly fill space between frames and concrete with insulation.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 - 9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

- c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
 - C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.
 - D. Glazing: Comply with hollow metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.
- 3.4 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
 - B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
 - C. Metallic-Coated (Galvanized/Galvannealed) Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 081119

STAINLESS-STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Stainless-steel, hollow-metal doors.
 - 2. Stainless-steel, hollow-metal frames.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 042000 - UNIT MASONRY for building anchors into and grouting steel frames in masonry construction.
 - 2. Section 081113 - HOLLOW METAL DOORS AND FRAMES.
 - 3. Section 087100 - DOOR HARDWARE for door hardware for steel doors.
 - 4. Section 088000 - GLAZING for glazed lites.

1.4 DEFINITIONS

- A. Stainless-Steel Sheet Thicknesses: Indicated as the specified thicknesses for which over- and under-thickness tolerances apply, according to ASTM A 480/A 480M.

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, temperature-rise ratings, and finishes for each type of steel door and frame specified.
- B. Shop Drawings:

1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of each different wall opening condition.
 6. Details of anchorages, joints, field splices, and connections.
 7. Details of accessories.
 8. Details of moldings, removable stops, and glazing.
 9. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of stainless steel door and frame work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
- D. Qualification Data: For Installer.
- E. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain stainless steel doors and frames through one source from a single manufacturer.
- C. Fire-Rated Door, Sidelight and Transom Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.
1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high, wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

- A. Coordinate installation of anchorages for stainless-steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in [concrete] [or] [masonry]. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ceco Door Products; an ASSA ABLOY Group Company.
 - 2. Security Metal Products.
 - 3. Steelcraft; an Ingersoll-Rand Company.

2.2 MATERIALS

- A. Stainless-Steel Sheet: ASTM A167, Type 304.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
- E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.
- G. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching stainless-steel door frames of type indicated.
- H. Grout: Comply with ASTM C 476, with a slump of 4 inches for stainless-steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.

- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.

- J. Glazing: Comply with requirements in Section 088000 - GLAZING.

2.3 STAINLESS-STEEL DOORS

- A. General: Provide flush-design doors, not less than 1-3/4 inches thick, of seamless hollow construction, unless otherwise indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces.
 - 1. Visible joints or seams around glazed lite inserts are permitted.
 - 2. For single-acting swing doors, bevel both vertical edges 1/8 inch in 2 inches.
 - 3. For double-acting swing doors, round vertical edges with 2-1/8-inch radius.
- B. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty). Minimum 16 gage (0.053-inch - 1.3-mm) thick steel, Model 2 (Fully welded, seamless face and edges).
- C. Face Sheets: Fabricated from minimum 0.042-inch-thick, stainless-steel sheet, Type as follows:
 - 1. Doors for Aesthetic Applications: Type 304.
 - 2. Doors for Moderately Corrosive Applications: Type 304.
 - 3. Doors for Highly Corrosive Applications: Type 316.
- D. Core Construction: Fabricate doors with core indicated.
 - 1. Laminated Steel-Stiffened Core: 0.026-inch-thick, steel vertical stiffeners extending full-door height, with vertical webs spaced not more than 6 inches apart, fastened to face sheets with waterproof adhesive. Spaces filled between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire-Rated Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
- E. Top and Bottom Channels: Minimum 0.053-inch-thick, steel channel spot welded, not more than 6 inches o.c., to face sheets.
 - 1. Tops and bottoms of doors reinforced with inverted horizontal channels, continuous across full width of door, of same material as face sheets so flanges of channels are even with bottom and top edges of face sheets.
 - 2. Top and bottom edges closed with closing channels of same material and thickness as face sheets; welded so webs of channels are flush with door edges.
- F. Hardware Reinforcement: Fabricate reinforcement plates from stainless steel according to ANSI A250.6.

2.4 STAINLESS-STEEL FRAMES

- A. General: Fabricate frames of construction indicated, with faces of corners mitered and contact edges closed tight.

1. Frames: Welded.
2. Door Frames for Openings 48 Inches Wide or Less: Fabricated from 0.053-inch-thick, stainless-steel sheet.
3. Door Frames for Openings More Than 48 Inches Wide: Fabricated from 0.067-inch-thick, stainless-steel sheet.
4. Sidelight Frames: Fabricated from same material as adjacent door frame.
5. Borrowed-Light Frames: Fabricate from 0.053-inch-thick, stainless-steel sheet.

B. Material: Fabricate frames from stainless-steel sheet, Type as follows:

1. Frames for Aesthetic Applications: Type 304.
2. Frames for Moderately Corrosive Applications: Type 304.
3. Frames for Highly Corrosive Applications: Type 316.

C. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.053 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.156 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

D. Floor Anchors: Formed from material indicated in Part 2 "Fabrication" Article, not less than 0.067 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.5 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with stainless-steel frames, minimum 5/8-inch high, unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.
- D. Terminated Stops (Hospital Stops): On interior door frames, terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

2.6 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.7 FABRICATION

- A. General: Fabricate stainless-steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Stainless-Steel Doors: Comply with ANSI A250.4, Level A.
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 2. Glazed Lites: Factory cut openings in doors.
 - 3. Edges: Door face sheets joined at vertical edges by continuous weld extending full height of door; with edges ground and polished, providing smooth, flush surfaces with no visible seams.
 - 4. Doors for Aesthetic Applications: Fabricate doors with door faces of Type 304 stainless-steel sheet and internal components, including stiffeners and hardware reinforcements, from cold-rolled, hot-rolled, or metallic-coated steel sheet.
 - 5. Doors for Moderately Corrosive Applications: Fabricate doors with door faces and internal components, including stiffeners and hardware reinforcements, from Type 304 stainless-steel sheet.
 - 6. Doors for Highly Corrosive Applications: Fabricate doors with door faces and internal components, including stiffeners and hardware reinforcements, from Type 316 stainless-steel sheet.
- C. Stainless-Steel Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
 - 1. Frames for Aesthetic Applications: Fabricate frames with internal components, including anchors, plaster guards, and hardware reinforcements, from cold-rolled, hot-rolled, or metallic-coated steel sheet.
 - 2. Frames for Moderately Corrosive Applications: Fabricate frames with internal components, including anchors, plaster guards, and hardware reinforcements, from Type 304 stainless-steel sheet.
 - 3. Frames for Highly Corrosive Applications: Fabricate frames with internal components, including anchors, plaster guards, and hardware reinforcements, from Type 316 stainless-steel sheet.
 - 4. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints. Fasten members at crossings and to jambs by butt welding according to joint designs in HMMA 820.

5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
6. Grout Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.
7. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
8. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - c. Compression Type: Not less than two anchors in each jamb.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
9. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 - DOOR HARDWARE.
 1. Locate hardware as indicated, or if not indicated, according to ANSI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Section 260000 - ELECTRICAL WORK.

- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.8 STAINLESS-STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Remove tool and die marks and stretch lines or blend into finish.
 - 1. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches.
 - a. Grain for Doors: Vertical (long dimension of door).
 - b. Grain for Frame Jambs: Vertical (long dimension of jamb).
 - c. Grain for Frame Heads: Horizontal (long dimension of head).
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish stainless-steel doors and frames after assembly.
- D. Directional Satin Finish: No. 4 finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.

- B. Prior to installation and with installation spreaders in place, adjust and securely brace stainless-steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install stainless-steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Stainless-Steel Frames: Install stainless-steel frames of size and profile indicated.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors, if so indicated and approved on Shop Drawings.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 04 Section "Unit Masonry."
 - 4. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

6. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
 8. Installation Tolerances: Adjust stainless-steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Stainless-Steel Doors: Fit stainless steel doors accurately in frames, within clearances specified below. Shim as necessary
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch .
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.
- 3.4 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
 - B. Remove grout and other bonding material from hollow metal work immediately after installation.
 - C. Stainless-Steel Touchup: Immediately after erection, smooth any abraded areas of stainless steel and polish to match undamaged finish.

END OF SECTION

SECTION 081400

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Solid-core flush wood doors for transparent and opaque finishes.
 - 2. Factory finishing for wood doors with transparent finish.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
 - 4. Louvers and glass lites for flush wood doors.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for wood door frames.
 - 2. Section 087100 - DOOR HARDWARE for hardware for wood doors.
 - 3. Section 088000 - GLAZING for glass and glazing requirements.
 - 4. Section 099000 - PAINTING AND COATING for field finishing of opaque wood doors.

1.3 SUBMITTALS

- A. Product Data: For each type of product, including the following:
 - 1. Door core and edge construction, face type, louvers, and trim for openings.
 - 2. Factory-finishing specifications.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For wood doors, submit product-specific Type III EPDs.

2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 2, Leadership Extraction Practices:
 - 1) Wood Products: Wood products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For wood doors, submit Health Product Declarations (HPD) or Declare product labels.
4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For wood doors, submit GreenGuard Gold or SCS Indoor Advantage Gold certification.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
 1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 3. Details of frame for each frame type, including dimensions and profile.
 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 5. Dimensions and locations of blocking for hardware attachment.
 6. Dimensions and locations of mortises and holes for hardware.
 7. Clearances and undercuts.
 8. Requirements for veneer matching.
 9. Doors to be factory primed or finished and application requirements.
- D. Samples for Verification:
 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of finish color, sheen, and grain to be expected in finished work.
 2. Frames for light openings, 6 inches long, for each material, type, and finish required.

- E. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
 - 1. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- C. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
- D. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
- E. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
- F. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and

maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall include hardware installation and replacement of glass and glazing.
 - 3. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SUSTAINABLE DESIGN PERFORMANCE REQUIREMENTS

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Salvaged and reclaimed wood is excluded from certified wood requirements.
- B. Low-Emitting Materials: Provide wood doors in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Lambton Doors; EnviroDesign Series.
 - 2. Masonite Architectural; Aspiro and Graham Series (formerly Algoma and Marshfield). Cendura Series is not acceptable.
 - 3. Oregon Doors; Architectural Series.
 - 4. VT Industries Inc.; Eggers and Heritage collections.

2.3 DOOR CONSTRUCTION, GENERAL

- A. Doors for Transparent Finish:
 - 1. Grade: AWI Premium, with AWI Grade AA faces, 4 inch veneer width.
 - 2. Species and Cut: Select White Maple, plain sawn/sliced.

3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces: Center-balance.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Transom Match: Continuous match.
7. Stiles: Same species as face.
8. Cross-Banding: 1/8 in. high density fiberboard, no added formaldehyde (NAF).
9. Adhesives: WDMA T.M.-6, Type I.

B. Doors for Opaque Finish:

1. Grade: Premium.
2. Faces for Interior Doors: Either medium-density overlay (MDO) or high-density fiberboard (HDF).
3. Stiles: Match face.
4. Cross-Banding: 1/8 in. high density fiberboard, no added formaldehyde (NAF).
5. Adhesives: WDMA T.M.-6, Type I.
6. Factory Primer: Manufacturer's standard water-based low VOC primer.

2.4 SOLID-CORE DOORS

A. Cores: Comply with the following requirements:

1. Composite Wood, General: CARB II compliant or made with binder containing no added formaldehyde (NAF).
2. Particle Core: ANSI A 208.1, Grade 1-LD-2.
3. Agrifiber Core: ANSI A 208.1, Grade 1-LD-2.
4. Structural Composite Lumber Core: WDMA I.S.10, Timberstrand LSL.
5. Provide doors with structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated or where light or louver cutouts exceed 40% of the door area.

B. Interior Veneer-Faced Doors:

1. Construction: Five plies, hot-pressed, with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
 - a. Fire Retardant Mineral Core, with no added formaldehyde cross-banding.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.

2.5 LOUVERS AND LIGHT FRAMES

- A. Wood Louvers: Door manufacturer's standard solid-wood louvers, unless otherwise indicated.
1. Wood Species: Same species as door faces.
 2. Profile: Flat.
- B. Fire Door Louvers (not required on 20 min. doors): Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire rating of one and one-half hours and less.
1. Metal and Finish: Galvanized steel, 0.0396 inch thick, hot-dip zinc coated and factory primed for paint finish.
- C. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
1. Wood Species: Same species as door faces.
 2. Profile: Manufacturer's standard shape.
 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- D. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

2.6 GLAZING SYSTEMS

- A. Glazing: Provide factory installed glass products in accordance with requirements in Section 088000 - GLAZING.

2.7 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA/DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining. Drill pilot holes for screws for butt hinges and lock fronts at the factory.
 2. Metal Astragals: Factory prime and premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors to receive concealed vertical rod exit devices.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
1. Fabricate door and transom panels with full-width, solid-lumber meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal doorframes.
- D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Louvers: Factory install louvers in prepared openings.
 3. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 - GLAZING.

2.8 FACTORY FINISHING

- A. Doors for Opaque Finish: Factory prime faces and edges of doors, including cutouts, with one coat of wood primer specified in Section 099000 - PAINTING AND COATING.
- B. Doors for Transparent Finish: Factory finish doors that are indicated to receive transparent finish. Finish faces and edges of doors, including cutouts.
- C. Transparent Finish:
1. Grade: Premium.
 2. Finish: WDMA TR-8, UV cured acrylated polyester or urethane.
 3. Staining: Provide water-based stain, custom color as selected by Architect.
 4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 - DOOR HARDWARE.
- B. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Protection: Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

- C. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083110

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Access doors and frames for walls and ceilings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for blocking out openings for access doors and frames in concrete.
 - 2. Section 042000 - UNIT MASONRY for anchoring and grouting access door frames set in masonry construction.
 - 3. Section 087100 - DOOR HARDWARE for rim cylinder locks and master keying.

1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door and frame through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 for vertical access doors and frames.
 - 2. ASTM E 119 for horizontal access doors and frames.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Steel Sheet: Electrolytic zinc-coated, ASTM A 879/A 879M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

- D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 STAINLESS-STEEL MATERIALS

- A. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.
 - 1. Finish: Directional Satin Finish, No. 4.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Acudor Products, Inc.
 - 2. Babcock-Davis.
 - 3. Dur-Red Products.
 - 4. JL Industries (a division of Activar Construction Products Group).
 - 5. Karp Associates, Inc.
 - 6. Larsen's Manufacturing Company.
 - 7. Milcor Inc.
 - 8. Nystrom, Inc.
- B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal, set flush with surrounding finish surfaces.
 - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead flange.
 - 4. Hinges: Continuous piano.
 - 5. Lock: Cylinder.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE.
- C. Recessed Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal in the form of a pan recessed 5/8 inch for gypsum board infill.
 - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead for gypsum board surfaces.
 - 4. Hinges: Concealed pivoting rod hinge.
 - 5. Lock: Cylinder.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE.

- D. Fire Rated, Uninsulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel at typical areas and from stainless-steel sheet at toilets and wet areas.
 - 1. Locations: Wall surfaces.
 - 2. Fire-Resistance Rating: Not less than that of adjacent construction.
 - 3. Door: Minimum 0.060-inch-thick sheet metal, flush construction.
 - 4. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch-wide, surface-mounted trim.
 - 5. Hinges: Continuous piano.
 - 6. Automatic Closer: Spring type.
 - 7. Lock: Self-latching device with cylinder lock.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 - 1. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
 - 2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
 - 3. Provide mounting holes in frames for attachment of units to metal or wood framing.
 - 4. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
 - 1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For cylinder lock, furnish two keys per lock and key all locks alike.
 - 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 083310

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Manual or electric-motor-operated overhead coiling doors of the following types:
 - a. Insulated service doors.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for miscellaneous steel supports.
 - 2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 3. Division 26 - ELECTRICAL for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Wind Load: Uniform pressure (velocity pressure) required by Code but not less than 20 lbf/sq. ft. acting inward and outward.
- B. Maximum Air Leakage Rate: Installed products shall comply with the following in accordance with the 2018 International Energy Conservation Code (IECC) Table C402.5.2:
 - 1. Rolling Doors: 1.00 cfm/sq.ft. per ANSI/DASMA 105, NFRC 400, or ASTM E283 at 1.57 psf.

- C. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 10 cycles per day.

1.4 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
 - 1. Summary of forces and loads on walls and jambs.
 - 2. Fire-Rated Doors: Include description of fire-release system including testing and resetting instructions.
- B. Shop Drawings: Shop drawings to show the air seal at the sill, jambs, and head from the door to the adjacent construction. Also include any special components and installations not dimensioned or detailed in manufacturer's product data.

- C. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from overhead coiling door manufacturer.
- C. Fire-Test-Response Characteristics: Provide assemblies complying with NFPA 80 that are identical to door and frame assemblies tested for fire-test-response characteristics per UL 10b and NFPA 252, and that are listed and labeled for fire ratings indicated by UL, FMG, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with all standard construction requirements of tested and labeled fire-rated door assemblies except for size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. CornellCookson Inc.
 - 2. McKEON Door Company.
 - 3. Overhead Door Corp.
 - 4. Raynor Garage Door Co.
 - 5. Wayne-Dalton Corp.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.
 - a. Minimum Base-Metal (Uncoated) Thickness: 0.0209 inch.
 - b. Flat profile slats.
 - 2. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
 - 3. Inside Curtain Slat Face: To match material of outside metal curtain slat.
- B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- D. Bottom Bar for Service Doors: Consisting of 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; galvanized, stainless-steel, or aluminum extrusions to suit type of curtain slats.
- E. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, either stainless steel or aluminum extrusions to suit type of curtain slats.
- F. Curtain Jamb Guides for Service Doors: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch-thick galvanized steel sections complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Slot boltholes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.
- G. Curtain Jamb Guides for Counter Doors: Fabricate curtain jamb guides of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

2.3 HOODS AND ACCESSORIES

- A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide

fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.

1. Fabricate hoods for steel doors of minimum 0.028-inch-thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.
 2. Include automatic drop baffle to guard against passage of smoke or flame.
- B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch-thick, replaceable, continuous sheet secured to inside of hood.
1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
 2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene at doorjamb for a weathertight installation.
- C. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks. Lock cylinder is specified in Section 087100 - DOOR HARDWARE.
- D. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.
- E. Automatic-Closing Device for Fire-Rated Doors: Provide automatic-closing device that is inoperative during normal door operations, with governor unit complying with requirements of NFPA 80 and with an easily tested and reset release mechanism, and designed to be activated by building fire alarm and detection system and door-holder-release devices.

2.4 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

2.5 ELECTRIC DOOR OPERATORS

- A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- B. Comply with NFPA 70.
- C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
- E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.
- F. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, drive, and chain and sprocket secondary drive.
- G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.
 - 1. Type: Polyphase, medium-induction type.
 - 2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
- H. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
 - 1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
- J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- K. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.
- L. Radio Control: Provide radio control system consisting of the following:

1. Three-channel universal coaxial receiver to open, close, and stop door, one per operator.
2. Multifunction remote control.
3. Remote antenna mounting kit.

2.6 FINISHES

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Powder-Coat Finish: Manufacturer's standard powder-coat finish consisting of primer and topcoat according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.
 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.
 1. Install fire-rated doors to comply with NFPA 80.

3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 1. Complete installation and startup checks according to manufacturer's written instructions.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 083470

INTERIOR SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wood and steel sound-control door types.
 - 2. Steel frames and sound-control seals.
- B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 081100 - HOLLOW METAL DOORS AND FRAMES for standard steel doors.
 - 2. Section 081400 - FLUSH WOOD DOORS for standard flush wood doors.
 - 3. Section 087100 - DOOR HARDWARE for hardware for wood doors.
 - 4. Section 088000 - GLAZING for glazed lites.
 - 5. Section 099000 - PAINTING AND COATING for field finishing doors and frames.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include sound ratings, construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
 - 2. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire ratings for fire doors.
 - 6. Details of sound-control seals, door bottoms, and thresholds.
- C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
 2. Frames for light openings, 6 inches long, for each material, type, and finish required.
- D. Schedule: Provide a schedule of sound-control door assemblies prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.
- E. Product Certificates: For each type of sound-control door assembly, from manufacturer.
- F. Field Test Report.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain sound-control door assemblies, including doors, frames, sound-control seals, hinges (when integral for sound control), thresholds, and other items essential for sound control, from single source from single manufacturer.
- B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- C. Forest Certification: Provide doors made from wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."
- D. Fire-Rated Wood Doors and Frames: Doors and frames complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- E. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.
- F. Sound Rating: Provide sound-control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:
1. STC Rating: As indicated in the Door Schedule, as determined by ASTM E 413 when tested in an operable condition according to ASTM E 90 and ASTM E 1408.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.

- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install wood sound-control wood doors until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-control door assemblies that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
 - a. Failure to meet sound rating requirements.
 - b. Faulty operation of sound seals.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.
 - d. Wood doors that are warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
- 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Interior Solid-Core Wood Doors: Life of installation.
 - b. Steel Doors: Five years.

PART 2 - PRODUCTS

2.1 SOUND-CONTROL DOORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AMBICO Limited.
 - 2. Industrial Acoustics.
 - 3. Krieger Specialty Products Company.
 - 4. Overly Door Company.
- B. Description: Provide flush-design sound-control doors, 1-3/4 inches thick; with manufacturer's standard sound-retardant core as required to provide STC and fire rating indicated on Door Schedule.
- C. Materials: Comply with for fabrication, and other requirements unless otherwise indicated.
 - 1. Steel Doors: Comply with Section 081100 - HOLLOW METAL DOORS AND FRAMES.

2. Wood Doors: Comply with Section 081400 - FLUSH WOOD DOORS.
3. Glazing: As required by sound-control door assembly manufacturer to comply with sound-control and fire-rated-door labeling requirements.

2.2 SOUND-CONTROL FRAMES

- A. Description: Fabricate sound-control door frames with corners mitered, reinforced, and continuously welded full depth and width of frame. Fabricate according to ANSI/NAAMM-HMMA 865.
1. Weld frames according to NAAMM-HMMA 820.
 2. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075-inch nominal thickness, or thicker as required to provide STC rating indicated.
 3. Sound-Control Panel Stops: Formed integral with frames, a minimum of 5/8 inch high, unless otherwise indicated.
 4. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 865 of same material as face sheets.
 5. Head Reinforcement: Reinforce frames with metallic-coated steel channel or angle stiffener, 0.108-inch nominal thickness, welded to head.
 6. Jamb Anchors:
 - a. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.064-inch nominal thickness metallic-coated steel with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.156 inch thick.
 - b. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.048-inch nominal thickness uncoated steel unless otherwise indicated.
 - c. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter, metallic-coated steel bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
 7. Floor Anchors: Not less than 0.079-inch nominal thickness metallic-coated steel, and as follows:
 - a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - b. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.
 8. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- wide uncoated steel unless otherwise indicated.
 9. Plaster Guards: Metallic-coated steel sheet, not less than 0.026 inch thick.
- B. Materials:
1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 2. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

3. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with G60 zinc (galvanized) or A40 zinc-iron-alloy (galvannealed) coating designation.
4. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
5. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M or ASTM F 2329.
6. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching sound-control door frames of type indicated.
7. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

2.3 SOUND-CONTROL HARDWARE

- A. Description: Provide manufacturer's standard sound-control system, including head and jamb seals, door bottoms, cam-lift hinges, and thresholds, as required by testing to achieve STC and fire rating indicated.
1. Compression Seals: One-piece units; consisting of closed-cell sponge neoprene seal held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
 2. Magnetic Seals: One-piece units; consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
 3. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
 4. Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.
 5. Cam-Lift Hinges: Full-mortise template type that raises door 1/2 inch when door is fully open; with hardened pin; fabricated from stainless steel.
 6. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer. Material and finish as required by Door Hardware Schedule.
- B. Other Door Hardware: Comply with requirements in Section 087100 - DOOR HARDWARE.

2.4 SOUND-CONTROL ACCESSORIES

- A. Glazing: Comply with requirements in Section 088000 - GLAZING.
- B. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches as measured according to ASTM C 143/C 143M.
- C. Isolation (Corrosion-Resistant) Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Sound-Control Steel Door Fabrication: Sound-control doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
1. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
 2. Glazed Lites: Factory install glazed lites according to requirements of tested assembly to achieve STC rating indicated. Provide fixed stops and moldings welded on secure side of door.
 3. Hardware Preparation: Factory prepare sound-control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified.
 - a. Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
 - b. Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
 4. Tolerances: Fabricate doors to tolerances indicated in ANSI/NAAMM-HMMA 865.
- B. Sound-Control Wood Door Fabrication: Factory fit doors to suit frame-opening sizes indicated, with uniform clearances and bevels according to referenced quality standard, unless otherwise indicated. Comply with final door hardware schedules and hardware templates.
1. Comply with clearance requirements in NFPA 80 for fire-rated doors.
 2. Locate door hardware as indicated, or if not indicated, according to DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - a. Coordinate measurements of hardware mortises in steel frames to verify dimensions and alignment before factory machining.
- C. Sound-Control Frame Fabrication: Fabricate sound-control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:

- a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches in height.
 - 2) Three anchors per jamb from 60 to 90 inches in height.
 - 3) Four anchors per jamb from 90 to 96 inches in height.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches in height.
 - 2) Four anchors per jamb from 60 to 90 inches in height.
 - 3) Five anchors per jamb from 90 to 96 inches in height.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
 - 5) Two anchors per head for frames more than 42 inches wide and mounted in metal stud partitions.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
- 5. Head Reinforcement: For frames more than 48 inches wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.
 - 6. Hardware Preparation: Factory prepare sound-control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified.
 - a. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
 - b. Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
 - 7. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound-control seal preparations to close off interior of openings in frames to be grouted.
 - 8. Tolerances: Fabricate frames to tolerances indicated in ANSI/NAAMM-HMMA 865.

2.6 FINISHES

- A. Steel Doors and Frames, Painted Finish: Match Section 081100 - HOLLOW METAL DOORS AND FRAMES.
 - 1. Refer to Section 099000 – PAINTING AND COATING for field-applied coating.
- B. Wood Doors, Transparent Finish: Match Section 081400 - FLUSH WOOD DOORS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of sound-control door assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace sound-control door frames to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install sound-control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.
- B. Frames: Install sound-control door frames in sizes and profiles indicated.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. At openings requiring smoke and draft control, install frames according to NFPA 105.
 - c. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
 - d. Install sound-control frames with removable glazing stops located on secure side of opening.

- e. Remove temporary braces only after frames or bucks have been properly set and secured.
 - f. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Apply corrosion-resistant coatings coating to backs of frames to be filled with mortar, grout, and plaster containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors, if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
 - 9. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - 10. Installation Tolerances: Adjust sound-control door frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Doors: Fit sound-control doors accurately in frames, within clearances indicated below. Shim as necessary. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
- 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.

- D. Door Hardware, General: For installation, see Section 087100 - DOOR HARDWARE.
- E. Sound-Control Seals: Where seals have been prefitted and preinstalled in the factory and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.
- F. Cam-Lift Hinges: Install hinges according to manufacturer's written instructions.
- G. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 079200 - JOINT SEALANTS.
- H. Glazing: Comply with installation requirements in Section 088000 - GLAZING and with sound-control door assembly manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Acoustical testing and inspecting agency shall select three sound-control door(s) at random from sound-control door assemblies that are completely installed and perform testing for verification that assembly complies with STC rating requirements.
 - 1. Field tests shall be conducted according to ASTM E 336, with results calculated according to ASTM E 413. Acceptable field STC values shall be within 5 dB of laboratory STC values.
 - 2. Inspection Report: Acoustical testing agency shall submit report in writing to Design Professional and Construction Manager within 24 hours after testing.
 - 3. If tested door fails, replace or rework all sound-control door assemblies to bring them into compliance at Contractor's expense.
 - a. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Prepare test and inspection reports.

3.5 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and adjust seals, door bottoms, and other sound-control hardware items right before final inspection. Leave work in complete and proper operating condition.
- B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.
 - 1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

- D. Metallic-Coated Surfaces: Clean abraded areas of doors and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Finished Wood Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083510

HORIZONTAL-SLIDING ACCORDION FIRE DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Horizontal-sliding, accordion-type fire doors.
- B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for miscellaneous steel framing and supports.
 - 2. Division 26 - ELECTRICAL for electrical service and connections for powered operators and accessories and tie-in to fire alarm system.

1.3 SUBMITTALS

- A. Product Data: For each type and size of fire door and accessory. Include the following:
 - 1. Summary of forces and loads on walls and jambs.
 - 2. Include description of fire-release system including testing and resetting instructions.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.
- C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum five years experience in producing horizontal-sliding accordion-type fire door systems of the type specified. Manufacturer shall maintain a quality control program in accordance with ICBO-ES Acceptance Criteria AC 77.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

- C. Source Limitations: Obtain horizontal-sliding accordion fire doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from door manufacturer.
- D. Fire-Test-Response Characteristics: Provide assemblies complying with NFPA 80 that are identical to door and frame assemblies tested for fire-test-response characteristics per UL 10b and NFPA 252, and that are listed and labeled for fire ratings indicated by UL, FMG, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- F. Testing Laboratory Label:
 - 1. UL Listing.
 - 2. OSHPD Anchorage Pre-Approval No. R-0318.
- G. Pre-Installation Meeting:
 - 1. Schedule and convene a pre-installation meeting prior to commencement of field operations with representatives of the following in attendance: Owner, Design Professional, Construction Manager, fire door system sub-contractor, and electrical sub-contractor.
 - 2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
 - 3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications and installation instructions.

1.5 TESTS

- A. Fire-Resistance: Where fire-resistance ratings are indicated or required by authorities having jurisdiction, provide curtains which are identical to curtains whose fire-resistance rating has been tested in compliance with ASTM E152 by independent agencies acceptable to the Design Professional and authorities having jurisdiction.
- B. ASTM A240 - Standard Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
- C. ICBO Evaluation Services: AC77 - Acceptance Criteria for Smoke-Containment Systems Used With Fire-Resistive Elevator Hoistway Doors and Frames.
- D. NFPA Codes and Standards:
 - 1. 70 - National Electrical Code.
 - 2. 105 - Recommended Practice for the Installation of Smoke-Control Door Assemblies.
 - 3. 72 - National Fire Alarm Code
- E. SBCCI Public Safety and Evaluation Services, Inc., Report No 9710 - Smoke Guard.
- F. UL Standards:

1. 268 - Smoke Detectors for Fire Protective Signaling Systems.
2. 508 - Industrial Control Equipment.
3. 864 - Control Units for Fire Protective Signaling Systems.
4. 1784 - Air Leakage Tests for Door Assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cornell Iron Works.
 2. McKeon SafeScape AC8000 Series.
 3. Modernfold, a DORMA company.
 4. Won-Door Corp.
- B. Basis-of-Design: Won-Door - FG90.

2.2 IDENTIFICATION

- A. Label each smoke containment system with following information:
1. Manufacturer's name.
 2. Maximum leakage rating at specified pressure and temperature conditions.
 3. Label of quality control agency.

2.3 MATERIALS

- A. Construction: shall consist of two parallel, accordion-type walls of panels independently suspended with no floor tracks, pantographs, or interconnections except at the lead-post.
- B. Panels shall be formed of 24-gauge enamel coated steel V-grooved for strength and resilience. Panels shall be connected by full height 24-gauge enamel coated steel hinges. Panels shall be modular in design and capable of in-place repair-ability.
- C. Suspension System: shall consist of two 14-gauge cold rolled steel (or 0.125 aluminum) tracks on 8 inch centers attached to the overhead structural support. Each lead post shall be suspended by an 8-wheel ball bearing trolley. Each panel shall be suspended by a steel hanger pin and a ball bearing roller.
- D. Lead-Posts: shall be of 24-gauge cold rolled steel and shall be connected by specially formed steel panels. An internally mounted stabilizer bar shall keep lead-posts plumb and in proper alignment during operation and insure a tight fitting closure.
- E. Perimeter Seals: shall consist of continuous extruded vinyl sweeps attached to the top and bottom of the fire door to form a smoke and draft seal.
- F. Hanging Weight: 5.5 pounds per square foot.

G. Automatic Closing System shall consist of the following:

1. Microprocessor based Electronic Control box with these features:
 - a. Ability to monitor dual power sources continually for peak performance including:
 - 1) Detect a missing battery, bad battery, or low battery condition.
 - 2) Detect if the charging circuit is bad.
 - 3) Detect fuse failures.
 - 4) Detect high or low AC conditions.
 - b. Ability to monitor the health of the drive train including:
 - 1) Direction errors, obstruction errors, hindrance errors, and position errors.
 - 2) Active daily path checks, by actually closing and opening to assure a clear path and proper operation.
 - 3) Ability to monitor a passive input such as an infrared light beam to assure the closing path is clear.
 - c. Ability to monitor inputs including:
 - 1) Sticky door block, exit hardware, patron hardware, and key switches.
 - 2) Key switch mis-wires where key open and key close are both on simultaneously.
 - d. Ability to self-monitor the health of:
 - 1) Internal volatile and non-volatile memory.
 - 2) Proper operation of firmware.
 - e. Ability to run a “watch dog” monitoring circuit which will force a software restart in the event the software hangs, including the ability to track the number of resets that occur for diagnostic purposes.
 - f. Ability to record the number of times the door has closed, opened, lost communication with external microprocessors, and the number of times the controller has been reset manually.
 - g. Ability to monitor ambient temperature and lockout the operating devices once the environment at the door becomes untenable.
 - h. Ability to enter a security mode to help control access through the door including:
 - 1) The ability to automatically re-close and secure itself after a legitimate patron access has occurred.
 - 2) The ability to unlock and revert to a fire door in a fire alarm condition, including the ability to re-lock automatically after the fire alarm condition has cleared.
 - i. Ability to withstand voltages up to 120 volts AC on the fire alarm input circuit without damage including the ability to indicate that the alarm circuit has not been wired as a dry contact, “no voltage” circuit when errant voltages are applied to the circuit.

- j. Ability to communicate with other microprocessors on the system via an internal bus system, including but not limited to microprocessors on the motor drive, in the leading edge of the door, and on a wall mounted display panel adjacent to the door.
- k. Ability to indicate alarm, trouble and door status both locally and at a remote location.
 - 1) Local conditions shall be audibly and or visually indicated at the door where each condition shall have distinct audible pattern as explained in the owners manual.
 - 2) Remote indications shall be via isolated dry contact form C relays. One each to indicate if the door has received the fire alarm signal from the building system/smoke detector; if the door is in a trouble condition; and if the door is closed or not.
- 2. Motor Operator Assembly including: A DC gear-motor, drive sprocket, clutch, and position sensors. The motor shall drive the fire door by means of a chain attached to a stabilizer bar trolley each time the door operates including the initial closing cycle.
- 3. A door control momentary rocker switch shall be mounted on one side of the door near the lead post and shall have the following functions: Pressing the upper portion of the switch shall close the door and/or clear fault conditions. Pressing the lower portion of the switch shall open the door and/or temporarily mute the local horn. For doors using wall mounted key switches, option L, a color coordinated cover plate shall be provided to fill the hole left when the rocker switch is removed.
- 4. The control box shall be equipped with a service switch that performs the following functions:
 - a. When the switch is off with AC power present, the controller shall emit an audible coded sound indicating the system is out of service. In this mode all normal functions shall cease including motor and communications.
 - b. When the switch is off and AC power is not present, the controller shall enter a sleep mode during which the system shall use the battery to monitor the AC line for power but do nothing else.
 - c. When the switch is moved from the off position to the on position, the controller shall enter a calibrate mode where it emits a coded audible alert indicating that the door needs to be closed to complete the calibration sequence. As soon as the door is closed, the controller shall automatically stop the audible alert, and resume all normal functions and monitoring.

H. Leading Edge Obstruction Detector:

- 1. Shall be pressure sensitive such that each contact with an obstruction shall cause the door to stop, reverse enough to remove pressure on the leading edge, pause, and then re-close when in an alarm condition. The leading edge obstruction detector shall be fully functional at all times, including during the initial closing cycle.
- 2. Constant pressure to the leading edge in the direction of opening shall, while the door is opening under motor power, continue to open under motor power until the leading edge is released. This is termed motor assisted opening.
- 3. Constant pressure to the leading edge while not under motor power shall prevent motor operation and allow the door to be opened manually.

- I. I. Exit Hardware shall be located on both sides of each fire door.
 - 1. In emergency mode, a slight pressure on the hardware will cause the door to open a minimum of 32 inches, pause for 3 seconds, and then automatically close.
 - 2. The open distance shall be field programmable, up to the entire opening width, if the local authority requires an opening larger than 32 inches.
 - 3. The pause before re-close shall be field programmable, up to 30 seconds, if the local authority requires a longer pause time.
 - 4. The exit hardware shall have the ability when not in the emergency (fire) mode or the security (lock) mode to be used to open the door and move it back into the storage pocket.
 - 5. The exit hardware shall be field programmable to provide access control. When programmed, the exit hardware shall not respond when pressed until activated by signal from smoke detector or fire alarm.

2.4 ACCESSORIES

- A. Provide automatic-closing device that is inoperative during normal door operations, with governor unit complying with requirements of NFPA 80 and with an easily tested and reset release mechanism, and designed to be activated by building fire alarm and detection system and door-holder-release devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install fire doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.
 - 1. Install fire doors to comply with NFPA 80.

3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 083610

SECTIONAL DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Electrically-motor-operated, aluminum and glass sectional overhead doors.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for miscellaneous steel supports.
 - 2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 3. Division 26 - ELECTRICAL for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure (velocity pressure) as required by Code but not less than 18 lbf/sq. ft. acting inward and outward.
- B. Operation-Cycle Requirements: Provide sectional overhead door components and operators capable of operating for not less than 50,000 cycles.

1.4 SUBMITTALS

- A. Product Data: For each type and size of sectional overhead door and accessory. Include the following:
 - 1. Summary of forces and loads on walls and jambs.
 - 2. Motors: Show nameplate data and ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.
- C. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain sectional overhead doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from sectional overhead door manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cornell Iron Works.
 - 2. Overhead Door Corp.
 - a. Basis of Design: Model 521 with Glass.
 - 3. Raynor Garage Door Co.
 - 4. Wayne-Dalton Corp.

2.2 ALUMINUM DOOR SECTIONS

- A. Sections: Construct door sections with stiles and rails formed from extruded-aluminum shapes, complying with ASTM B 22, alloy and temper recommended by manufacturer for type of use and finish indicated, with wall thickness not less than 0.065 inch for door section 1-3/4 inches deep. Fabricate sections with stile and rail dimensions and profiles shown on Drawings. Join stiles and rails by welding or with concealed, 1/4-inch-minimum diameter, aluminum or nonmagnetic stainless-steel through bolts, full height of door section. Form meeting rails to provide a weathertight-seal joint.

1. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
2. Provide reinforcement for hardware attachment.

- B. Full-Vision Sections: Manufacturer's standard, tubular, aluminum-framed section fully glazed with tempered insulating glass units equal to SolarBan 70XL with R-Value 4.09 and set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops.

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653/A 653M for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced at 2 inches apart for door-drop safety device. Slope tracks at proper angle from vertical or design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.
- B. Track Reinforcement and Supports: Galvanized steel track reinforcement and support members, complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
1. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.
 - a. Repair galvanized coating on tracks according to ASTM A 780.
- C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of overhead door.
1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
 2. Provide continuous flexible seals at door jambs for a weathertight installation.

2.4 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty galvanized steel hinges of not less than 0.0747-inch-thick, uncoated steel at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double

hinges are required. Provide 3-inch-diameter roller tires for 3-inch-wide track and 2-inch-diameter roller tires for 2-inch-wide track.

- D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.
- E. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
- F. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks. Lock cylinder is specified in Section 087100 - DOOR HARDWARE.
- G. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.5 COUNTERBALANCE MECHANISM

- A. Extension Spring: Counterbalance mechanism with aircraft-type steel cable over ball-bearing sheaves. Provide oil-tempered wired springs with internal safety rods. Combine operation with a spring bumper in each horizontal track to cushion door at end of opening operation.
- B. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from oil-tempered-steel wire complying with ASTM A 229/A 229M, Class II, mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for a minimum of 10,000 cycles.
- C. Cable Drums: Cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.
- D. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level shaft and prevent sag.
- E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.6 ELECTRIC DOOR OPERATORS

- A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- B. Comply with NFPA 70.
- C. Disconnect Device: Hand-operated disconnect device or mechanism for automatically engaging chain-and-sprocket operator and releasing brake for emergency manual operation while

disconnecting motor without affecting timing of limit switch. Mount disconnect device and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

- D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
- E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70, Class 2 control circuit, maximum 24-V, ac or dc.
- F. Electric Motors: High-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.
 - 1. Type: Polyphase, medium-induction type.
 - 2. Service Factor: Comply with NEMA MG 1, unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
- G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
- H. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
- I. Limit Switches: Adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.
- B. Fasten vertical track assembly to framing, spaced not less than 24 inches apart. Hang horizontal track from structural overhead framing with angle or channel hangers fastened to framing by welding or bolting or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Protect doors and tracks against damage from construction operations and placement of equipment and fixtures during the remainder of construction period.

3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and with weathertight fit around entire perimeter.
- B. Adjust belt-driven motors as follows:
 - 1. Use adjustable motor-mounting bases for belt-driven motors.
 - 2. Align pulleys and install belts.
 - 3. Tension belt according to manufacturer's written instructions.
- C. Touch-up Painting: Immediately after welding galvanized track to track supports, clean field welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain sectional overhead doors.

END OF SECTION

SECTION 084110

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Exterior and interior aluminum-framed storefronts.
 - 2. Exterior and interior manual-swing aluminum doors.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
 - 2. Section 084410 - GLAZED ALUMINUM CURTAIN WALLS for curtain-wall systems that mechanically retain glazing on four sides.
 - 3. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 4. Section 088000 - GLAZING for glazing requirements to the extent not specified in this Section.
 - 5. Section 089000 - LOUVERS AND VENTS for units installed with aluminum-framed systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design entrance and storefront system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural loads.
 - 2. Thermal movements.

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

3. Dimensional tolerances of building frame and other adjacent construction.
4. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
 - g. Failure of operating units to function properly.
- C. Structural Loads: Wind and seismic loads as indicated on the Structural Drawings, but not less than that required by Code.
- D. Deflection of Framing Members:
 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller, amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch and clearance between members and operable units directly below to less than 1/16 inch.
- E. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- F. Air Infiltration: Provide doors and storefront which comply with the following. Test unit in accordance with ASTM E 283.
 1. Swinging Entrance Doors, ASHRAE Requirement: 1.0 cfm/sf maximum air leakage at a pressure differential of 1.57 psf.
 2. Storefront, ASHRAE Requirement: 0.06 cfm/sf maximum air leakage at a pressure differential of 1.57 psf or higher.
- G. Water Leakage Test: Test fixed framing system in accordance with ASTM E 331.
 1. Test Pressure: 8 psf.
 2. Performance: No leakage as defined in test method at specified test pressure. No uncontrolled water penetrating system or appearing on normally exposed interior surfaces.

- H. Solar Heat-Gain Coefficient: Provide units with a whole-unit SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.
- I. Thermal Transmittance: Provide window units that have a U-value as required by Code rated in BTU/hour/sq. ft./degrees F at 15-mph exterior wind velocity, when tested in accordance with AAMA 1503.1. Test unit to be 4 ft. x 6 ft. Submit proof of compliance with submittals as specified.
- J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 65 for fixed storefront units and not less than 55 for doors when tested according to AAMA 1503.

1.4 SUBMITTALS

- A. Product Data: Include installation instructions, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated. Indicate special procedures and perimeter conditions requiring special attention.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
- C. Shop Drawings: Prepared under the supervision of a qualified professional engineer detailing fabrication and assembly of aluminum-framed systems. For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Include structural analysis of story drift and deflection from anticipated live loads, and determination whether head receptors are required.
 - 3. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
 - 4. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
 - 5. Wiring diagrams for power, signal, and control wiring.
 - 6. Activation and safety devices.
 - 7. Include full-size isometric details of each vertical-to-horizontal intersection of storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions
 - d. Glazing
 - e. Flashing and drainage.

8. Include details showing interface with perimeter conditions to depict interface with adjacent thermal, weather, air and vapor barriers, and adjacent flashings.
 9. Shop drawings must be signed and stamped by a professional engineer.
- D. Delegated-Design Submittal: For entrance and storefront systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Show structural testing for attachment of the storefront to the existing structure. Contractor should survey slab edge locations and conditions of the embeds to develop the attachment details.
- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- F. Qualification Data: For Installer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.
- H. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that units as glazed for this Project meet or exceed Code requirements for the following:
1. U-value.
 2. Solar heat-gain coefficient.
- I. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- J. Warranties: Special warranties specified in this Section.
- 1.5 QUALITY ASSURANCE
- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of entrance and storefront systems that are similar to those indicated for this Project in material, design, and extent.
- C. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
- D. Accessible Entrances: Comply with authorities having jurisdiction, local state building code and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
- E. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to storefront system, including, but not limited to, the following:
1. Review structural load limitations.

2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review required testing, inspection, and certifying procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Faulty operation of operators, controls, and hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Exterior Storefront, Thermal Break, 2 inch by 4-1/2 inch profile:
 - a. (Basis of Design) EFCO Corporation, 403X.
 - b. Kawneer North America, 451UT.
 - c. Oldcastle BuildingEnvelope, 3000XT.
 - d. Tubelite Inc., TU24000.
 - e. YKK AP America Inc., YES 45 XT.

2. Interior Storefront, 1-3/4 inch by 4-1/2 inch profile:

- a. (Basis of Design) EFCO Corporation, 403.
- b. Kawneer North America, Trifab 400.
- c. Oldcastle BuildingEnvelope, FG-1000.
- d. Tubelite Inc., INT45.
- e. YKK AP America Inc., YES 40 FS.

3. Interior Doors, Wide Stile:

- a. EFCO, a Pella Company, D-500.
- b. Kawneer North America, 500.
- c. Oldcastle BuildingEnvelope, WS-500.
- d. Tubelite Inc., Wide.
- e. YKK AP America Inc., 50D.

4. Exterior Doors, Wide Stile, Thermally-Broken:

- a. EFCO, a Pella Company, D-502.
- b. Kawneer North America, Insulpour 500T.
- c. Oldcastle BuildingEnvelope, WS-500TC.
- d. Tubelite Inc., Wide Thermal Block.
- e. YKK AP America Inc., 50XT.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

- 1. Sheet and Plate: ASTM B 209.
- 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
- 3. Extruded Structural Pipe and Tubes: ASTM B 429.
- 4. Structural Profiles: ASTM B 308/B 308M.
- 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

- 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
- 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
- 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

- 1. Construction: Dual thermal-break.

- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.
- F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 - GLAZING.
- B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.5 DOORS

- A. Doors: Manufacturer's standard glazed doors, for manual swing operation.
 - 1. Door Construction: Mechanical clip fastening, SIGMA deep penetration plus welds and 1-1/8 inch long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type and EPDM glazing gaskets reinforced with non-stretchable cord.

2.6 DOOR HARDWARE

- A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.
 - 1. Opening-Force Requirements:
 - a. Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf.

- B. Hardware Sets: Provide as specified in Section 087100 - DOOR HARDWARE.

2.7 ACCESSORY MATERIALS

- A. Insulating Materials: As specified in Section 072100 - THERMAL INSULATION.
- B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 - JOINT SEALANTS.
- C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

- A. Form aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).
- E. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
 - 1. At exterior doors, provide compression weather stripping at fixed stops.
 - 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- F. Doors: Reinforce doors as required for installing hardware.
 - 1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- G. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Provide custom colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 6. Seal joints watertight, unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 - JOINT SEALANTS and to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, without warp or rack.
- F. Install glazing as specified in Section 088000 - GLAZING.
 - 1. Structural-Sealant Glazing:
 - a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - b. Install weatherseal sealant according to Section 079200 - JOINT SEALANTS and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- G. Entrances: Install to produce smooth operation and tight fit at contact points.
 - 1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
 - 2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- H. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
 - 3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - 1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under Part 1 "Performance Requirements" Article, but not more than

- 0.09 cfm/sq. ft. of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.
2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under Part 1 "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft., and shall not evidence water penetration.
 3. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 3.4 ADJUSTING
- A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.
1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

END OF SECTION

SECTION 084410

GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Glazed aluminum-framed curtain wall systems.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for perimeter fire-containment systems (safing insulation) field installed with glazed aluminum curtain wall systems.
 - 2. Section 079200 - JOINT SEALANTS for installation of joint sealants installed with glazed aluminum curtain wall systems and for sealants to the extent not specified in this Section.
 - 3. Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS for entrance and storefront systems.
 - 4. Section 085110 - ALUMINUM WINDOWS for windows installed with glazed aluminum curtain wall systems.
 - 5. Section 088000 - GLAZING for glass and glazing of aluminum curtain wall systems.
 - 6. Section 089000 - LOUVERS AND VENTS for units installed with glazed aluminum curtain wall systems.
 - 7. Section 107113 - EXTERIOR SUN CONTROL DEVICES for sunshades attached to curtain wall framing.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design glazed curtain wall, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: Provide glazed aluminum curtain wall systems, including anchorage, capable of withstanding, without failure, the effects of the following:

GLAZED ALUMINUM CURTAIN WALLS

1. Structural loads.
 2. Thermal movements.
 3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 4. Dimensional tolerances of building frame and other adjacent construction.
 5. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
- C. Structural Loads: Wind and seismic loads as indicated on the Structural Drawings, but not less than that required by Code.
- D. Structural-Test Performance: Provide glazed aluminum curtain wall systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Duration: As required by design wind velocity but not less than 10 seconds.
- E. Deflection of Framing Members:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches, and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller, amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
- F. Story Drift: Provide glazed aluminum curtain wall systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
 2. Test Performance: No glass breakage, anchor failures, or structural damage when tested according to AAMA 501.4.
- G. Thermal Movements: Provide glazed aluminum curtain wall systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 - H. Air Infiltration: Provide glazed aluminum curtain wall systems with maximum air leakage of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
 - I. Water Penetration Under Static Pressure: Provide aluminum glazed curtain wall systems that do not evidence water penetration when tested according to ASTM E 331 at a minimum differential static pressure of 20 percent of positive design wind load, but not less than 12 lbf/sq. ft.
 1. Maximum Water Leakage: No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.
 - J. Condensation Resistance: Provide glazed aluminum curtain wall systems with condensation-resistance factor (CRF) of not less than 75 when tested according to AAMA 1503.
 - K. Solar Heat-Gain Coefficient: Provide units with a whole-unit SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.
 - L. Thermal Transmittance: Provide window units that have a U-value as required by Code rated in BTU/hour/sq. ft./degrees F at 15-mph exterior wind velocity, when tested in accordance with AAMA 1503.1. Test unit to be 4 ft. x 6 ft. Submit proof of compliance with submittals as specified.
- 1.4 SUBMITTALS
- A. Product Data: For each type of product indicated.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - B. LEED Submittals:
 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
 - C. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of glazed aluminum curtain wall systems.
 1. Include structural analysis of story drift and deflection from anticipated live loads, and determination whether head receptors are required.
 2. Include weatherproofing, drainage and anchorage provisions.
 3. Include details, materials, adjacent and adjacent construction. Include isometric views of complex intersections.

- D. Delegated-Design Submittal: For glazed curtain wall system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
 - F. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
 - G. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that units as glazed for this Project meet or exceed Code requirements for the following:
 - 1. U-value.
 - 2. Solar heat-gain coefficient.
 - H. Compatibility Test Reports: Test reports by glazing and/or sealant manufacturers that show chemical compatibility and adhesion (if required) between all non-aluminum components including, but not limited, to:
 - 1. Gaskets
 - 2. Insulated glass edge seals
 - 3. Setting blocks
 - 4. Anti-walk blocks
 - 5. End dams
 - 6. Sealants
 - 7. Silicone sheet membrane flashing
 - I. Welding certificates.
 - J. Qualification data for Installer.
 - K. Field quality-control test reports.
 - L. Warranties: Special warranties specified in this Section.
- 1.5 QUALITY ASSURANCE
- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
 - B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of

glazed curtain wall system that are similar to those indicated for this Project in material, design, and extent.

- C. Installer Qualifications: Capable of assuming engineering responsibility and performing Work of this Section and who is acceptable to manufacturer.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field-testing, and in-service performance.
- E. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."
- F. Installation Sequence Conference: Conduct conference at Project site to review sequence of installation of curtain wall systems, including installation of joint sealants, flashing, and glass. Conference shall be attended by all installers of applicable components.
- G. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as indicated on Drawings.
 - 2. Build mockup in sequence recommended by manufacturer including installation of joint sealants, flashing and glass.
 - 3. The construction of the mockup shall be observed by all tradesmen constructing the curtain wall system.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to glazed aluminum curtain wall systems including, but not limited to, the following:
 - 1. Review structural load limitations.
 - 2. Review installation sequence, including installation of sealants, flashing, and glass.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review required testing, inspecting, and certifying procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain wall systems by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating glazed aluminum curtain wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain wall systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water leakage.
 - e. Failure of operating components to function normally.
 - 2. Warranty Period: Three years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Curtain Wall - Pressure Plate System:
 - a. (Basis of Design) EFCO Corporation, System 5600X.
 - b. Kawneer North America, 1600UT System 1.
 - c. Oldcastle BuildingEnvelope, Reliance-TC.
 - d. Wausau, Superwall.
 - e. YKK AP America Inc., YCW-750 XTP.

2.2 FRAMING SYSTEMS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209
 - 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
- B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 2. Cold-Rolled Sheet and Strip: ASTM A 611.
 3. Hot-Rolled Sheet and Strip: ASTM A 570/A 570M.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 2. Reinforce members as required to receive fastener threads.
 3. Where acceptable, use exposed fasteners with countersunk Phillips screw heads.
 4. Finish exposed portions to match framing system.
 5. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.
- E. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- F. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- G. Joint Sealants: Provide manufacturer recommended sealants for seams and joints within aluminum framing system.

2.3 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 - GLAZING.
- B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.4 INSULATED SPANDREL PANELS

- A. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
1. Overall Panel Thickness: 1 inch.
 2. Exterior and Interior Skin: Aluminum.
 - a. Thickness: Manufacturer's standard for finish and texture indicated.
 - b. Finish: Matching framing system.
 - c. Texture: Smooth.

- d. Backing Sheet: Manufacturer's standard.
- e. Thermal Insulation Core: Manufacturer's standard.

2.5 ACCESSORY MATERIALS

- A. Perimeter Fire-Containment Systems (Safing Insulation): Specified in Section 078440 - FIRE-RESISTANT JOINT SYSTEMS.
- B. Insulating Materials: Specified in Section 072100 - THERMAL INSULATION.
- C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
- D. Silicone Membrane: Pre-cured silicone sheet that is physically and chemically compatible with the approved silicone sealant for the curtain wall system.
- E. Foam Tape: Foam glazing tape with adhesive on one side. Select the thickness and width to provide an adequate air and water seal and to provide adequate clamping pressure to silicone flashing.

2.6 FABRICATION

- A. Form aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 - 1. Sharp profiles, straight and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to prevent glazing-to-glazing contact and to maintain required glazing edge clearances.
- C. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating:

manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: Provide custom colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal joints watertight, unless otherwise indicated.

- B. Connecting and Sealing to Adjacent Enclosure Systems:

1. At locations where the curtain wall will be installed adjacent to back vented and drained rain screen wall systems, connect the curtain wall to the water-resistive barrier of the adjacent wall system with silicone membrane flashing.
2. Seal and clamp the silicone membrane into the curtain wall glazing pocket.
 - a. Use a sealant that is compatible with the silicone membrane and the silicone in the joints of the curtain wall system.
 - b. Use an L-shaped pressure bar with applied foam tape to clamp the silicone membrane to the curtain wall mullion.
3. Notch the stem on vertical mullions as needed to install flashing at the tops and bottoms of the curtain wall. Flashing shall be continuously sealed and clamped into the curtain wall glazing pocket and sealed to adjacent air barrier or enclosure system as indicated on the Drawings. Install similar flashing at the jambs of the curtain wall to provide continuous perimeter flashing.
4. At locations where the curtain wall will be installed adjacent to roofing systems connect the curtain wall to the roofing vapor barrier and the roof membrane. The roofing vapor barrier may be adhered directly to the inboard side of the curtain wall. Provide a metal

backpan if needed to allow for this connection. Connect the roofing membrane to the curtain wall by transitioning the roof membrane to a silicone sheet membrane.

- a. Provide stainless steel sheet or foil-faced membrane as needed to transition between the roofing membrane and the silicone sheet.
- b. Seal and clamp the silicone sheet into the curtain wall as described above.

C. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

E. Install components plumb and true in alignment with established lines and grades.

F. Coordinate with glazing and installation of glazing which is specified in Section 088000 - GLAZING.

G. Coordinate with sealants and installation of perimeter sealants which is specified in Section 079200 - JOINT SEALANTS.

H. Coordinate with insulation and installation of insulation which is specified in Section 072100 - THERMAL INSULATION.

I. Coordinate with materials and installation for perimeter fire-containment systems (safing insulation) which is specified in Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS.

J. Erection Tolerances: Install glazed aluminum curtain wall systems to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet ; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet ; 1/4 inch in 40 feet.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or greater, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed system with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - 1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified under Part 1 "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
 - 2. Water Penetration: Areas shall be tested according to ASTM E 1105 at minimum cyclic static-air-pressure difference of 0.67 times the pressure specified under Part 1 "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. and shall not evidence water penetration.
 - 3. Water Spray Test: After the installation of minimum area of 75-feet-by-2-story glazed aluminum curtain wall system has been completed but before installation of interior finishes has begun, a 2-bay area of system designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION

SECTION 084523

FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Aluminum-framed assemblies glazed with fiberglass sandwich panels (translucent) window wall and skylight assemblies, insulated with aerogel.
 - 2. Operable vents within assemblies, including insulating glass, hardware, and screens.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for sealants installed at perimeters of assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide fiberglass sandwich panel assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural loads.
 - 2. Thermal movements.
 - 3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 4. Dimensional tolerances of building frame and other adjacent construction.
 - 5. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - d. Noise or vibration created by wind and thermal and structural movements.

FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

- e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
 - B. Structural-Test Performance: Provide glazed aluminum curtain-wall systems tested according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Duration: As required by design wind velocity but not less than 10 seconds.
 - C. Deflection of Framing Members:
 - 1. Deflection Normal to Wall Plane: Limited to 1/60 of clear span.
 - D. Thermal Movements: Provide glazed aluminum curtain-wall systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- 1.4 SUBMITTALS
- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for assemblies.
 - B. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - C. Samples for Initial Selection: For each type of exposed finish required, in manufacturer's standard sizes.
 - D. Samples for Verification: Submit 12 by 12 inch sample panel assemblies, for each color selected.
 - E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.
 - F. Maintenance Data: For assemblies to include in maintenance manuals.
 - G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing Work of this Section and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Preparation of data for structured panel assemblies including shop drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- C. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."
- D. NFRC Certification: Provide fiberglass sandwich panels that are certified for U-factors indicated according to NFRC 100 and listed in its "National Fenestration Council Incorporated - Certified Products Directory."
- E. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to glazed aluminum curtain-wall systems including, but not limited to, the following:
 - 1. Review structural load limitations.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review required testing, inspecting, and certifying procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain-wall systems by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating glazed aluminum curtain-wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Fiberglass-Sandwich-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship.
 - 1. Defects include, but are not limited to, the following:
 - a. Delamination of coating, if any, from exterior face sheet.
 - b. Discoloration of exterior face sheet of more than 8.0 units Delta E when measured according ASTM D 2244.
 - c. Delamination of panel face sheets from panel cores.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Kalwall Corporation.
 - 2. Major Industries, Inc.
 - 3. Approved equal.

2.2 ALUMINUM FRAME SYSTEMS

- A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
- B. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
- C. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch thick.
- D. Frame-System Gaskets: Manufacturer's standard.
- E. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.
1. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
 2. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- F. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- G. Anchor Bolts: ASTM A 307, Grade A, hot-dip zinc coating, ASTM A 153/A 153M, Class C or mechanically deposited zinc coating, ASTM B 695, Class 50.
- H. Frame System Fabrication:
1. Fabricate components before finishing.
 2. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within the assembly to exterior.
 3. Fabricate sill closures with weep holes and for installation as continuous component.
 4. Reinforce components as required to receive fastener threads.
 5. Weld components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

2.3 FIBERGLASS SANDWICH PANELS

- A. Panel Construction: Assembly of uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core and complying with requirements applicable to panel materials in ICBO ES AC04, "Sandwich Panels."

1. Face-Sheet, Self-Ignition Temperature: 650 deg F or more per ASTM D 1929.
 2. Face-Sheet Burning Extent: 1 inch or less per ASTM D 635.
 3. Face-Sheet, Smoke-Developed Index: 450 or less per ASTM E 84.
 4. Interior Face-Sheet, Flame-Spread Index: Not more than 25 per ASTM E 84.
 5. U-Value: Based on color selections.
 6. Light Transmission: Based on color selections.
- B. Panel Thickness: 2-3/4 inches.
- C. Grid Core: Mechanically interlocked extruded-aluminum I-beams, with a minimum flange width of 7/16 inch.
1. Extruded Aluminum: ASTM B 221, in alloy and temper recommended in writing by manufacturer.
 2. Grid Pattern: As indicated on Drawings.
- D. Face Sheets:
1. Exterior Color: As selected by Architect.
 2. Interior Color: As selected by Architect.
- E. Insulation: Manufacturer's standard translucent aerogel material.
- F. Fiberglass-Sandwich-Panel Adhesive: ASTM D 2559.
- G. Panel Fabrication: Factory assemble and seal panels.
- 2.4 ACCESSORY MATERIALS
- A. Isolation Coating (Bituminous Paint): ASTM D 1187, VOC compliant, cold-applied asphalt-mastic paint, containing no asbestos, formulated for 30-milthickness per coat.
- 2.5 ALUMINUM FINISHES
- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
1. Color and Gloss: Provide custom colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Weld aluminum components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - 7. Seal joints watertight, unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
- D. Install components to drain water passing joints, condensation occurring within aluminum members and panels, and moisture migrating within assembly to exterior.
- E. Install components plumb and true in alignment with established lines and elevations.
- F. Coordinate with sealants and installation of perimeter sealants which is specified in Section 079200 - JOINT SEALANTS.
- G. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
 - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION

SECTION 085110

ALUMINUM WINDOWS

(Part of Work of Section 080001 - METAL WINDOWS, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fixed and operable aluminum-framed windows with factory-installed glass and glazing.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
 - 2. Section 084410 - GLAZED ALUMINUM CURTAIN WALLS for curtain wall assemblies.
 - 3. Section 088000 - GLAZING for requirements for glass and glazing.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:
 - 1. Minimum size required by AAMA/NWWDA 101/I.S.2.
- B. AAMA/NWWDA Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.
 - 1. Performance Class: Architectural Grade AW.
 - 2. Performance Grade: Minimum for performance class indicated.
 - 3. Exception to AAMA/NWWDA 101/I.S.2: In addition to requirements for performance class and performance grade, design glass framing system to limit lateral deflections of glass

edges to less than 1/175 of glass-edge length or 3/4 inch whichever is less, at design pressure based on the following:

- C. Structural Performance: Provide aluminum windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated and as required by Code:
 - 1. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on structural computations.
 - 2. Wind and Seismic Loads: As indicated on the Structural Drawings, but not less than that required by Code.
 - 3. Movements of supporting structure including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads as required by Code. Deflection may require special considerations including but not limited to head receptors.
- D. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.
 - 1. Maximum Rate: As required by Code.
- E. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.
 - 1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. or more than 12 lbf/sq. ft.
- F. Condensation-Resistance Factor: Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 52 where windows are indicated to be "thermally improved."
- G. Thermal Transmittance: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.
 - 1. U-Value: As required by Code. Submit proof of compliance with submittals as specified.
- H. Solar Heat-Gain Coefficient: Provide aluminum windows with a whole-window SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.
- I. Thermal Movements: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
- C. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:
 - 1. Mullion details, including reinforcement and stiffeners.
 - 2. Joinery details.
 - 3. Expansion provisions.
 - 4. Flashing and drainage details.
 - 5. Weather-stripping details.
 - 6. Thermal-break details.
 - 7. Glazing details.
 - 8. Window cleaning provisions.
 - 9. Window System Operators: Show locations, mounting, and details for installing operator components and controls.
 - 10. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:
 - a. Structural test pressures and design pressures from basic wind speeds indicated.
 - b. Deflection limitations of glass framing systems.
- D. Samples for Verification: Full-size operable window of each type of window.
- E. Qualification Data: For Installer, professional engineer and testing agency.
- F. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.
- H. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that windows as glazed for this Project meet or exceed Code requirements for the following:
 - 1. U-value.
 - 2. Solar heat-gain coefficient.

- I. Maintenance Data: For operable window sash, operating hardware, weather stripping, and finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
- B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of windows that are similar to those indicated for this Project in material, design, and extent.
- D. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.
- E. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- F. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Provide AAMA certified aluminum windows with an attached label.
- G. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.
- H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup for types of windows indicated, in locations shown on Drawings.
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to aluminum windows including, but not limited to, the following:
 - 1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review required testing and inspecting procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Failure to meet performance requirements.
 - 2. Structural failures including excessive deflection.
 - 3. Water leakage, air infiltration, or condensation.
 - 4. Faulty operation of movable sash and hardware.
 - 5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 6. Insulating glass failure.
- B. Warranty Period: Ten years from date of Substantial Completion.
- C. Warranty Period for Metal Finishes: Ten years from date of Substantial Completion.
- D. Warranty Period for Glass: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. EFCO, a Pella Company.
 - 2. Graham Architectural Products Corp.
 - 3. Kawneer North America.
 - 4. Peerless Products, Inc.
 - 5. Wausau Window and Wall Systems.

2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.

- B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
 - 1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
 - 2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- E. Compression-Type Weather Stripping, typical: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
- F. Sliding-Type Weather Stripping for Double-Hung and Horizontal-Sliding Windows: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
 - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- G. Replaceable Weather Seals: Comply with AAMA 701/702.
- H. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 GLAZING

- A. Insulating-Glass Units for Vertical Glazing: Provide insulating glass units in accordance with requirements of Section 088000.
- B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

2.4 HARDWARE

- A. Hardware Requirements: Provide hardware that complies with AAMA/NWWDA 101/I.S.2.
 - 1. Hardware Finishes: To be selected by Architect from manufacturer's full range.

2.5 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Provide for each operable exterior sash or ventilator.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 - 1. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
 - 2. Finish: Match aluminum window members.
- C. Stainless-Steel Wire Fabric: 18-by-16 mesh of 0.009-inch-diameter, nonmagnetic stainless-steel wire, Type 304 or 316, complying with FS RR-W-365, Type VI.
- D. Wickets: Not permitted.

2.6 ACCESSORIES

- A. Window Cleaner Anchor Bolts: Provide window cleaner anchor bolts of standard design, complying with requirements of authorities having jurisdiction. Fabricate bolts of nonmagnetic stainless steel.
 - 1. Reinforce window units or mullions to receive bolts and provide additional anchorage of units at bolt locations.

2.7 FABRICATION

- A. General: Fabricate aluminum windows, in sizes indicated, that comply with AAMA/NWWDA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.
- B. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
- C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
- D. Weep Holes: Provide concealed weep holes and internal passages to conduct infiltrating water to exterior.
- E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

- F. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with AAMA/NWWDA 101/I.S.2.

2.8 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Coatings shall be fluorosurfactant free Kynar 500 by Arkema or fluorosurfactant-compliant Hylar 5000 by Solvay; or equal. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Provide custom colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances; and other conditions affecting performance of work.
 - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- E. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
 - 1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
 - 2. Air-Infiltration Testing:
 - a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Resistance Testing:
 - a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
 - 5. Test Reports: Prepared according to AAMA 502.
- C. Remove and replace windows where test results indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING

- A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.5 PROTECTION AND CLEANING

- A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior

concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

- B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 085610

PASS WINDOWS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Sliding aluminum pass windows, interior security and acoustic rated types.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 088000 – GLAZING for requirements for glass and glazing, to the extent not specified in this Section.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, and operational clearances.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain windows through one source from a single manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

- C. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify window openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PASS WINDOWS

- A. Basis of Design: C.R. Laurence Co.; Daisy Model No. D1041 A, horizontal sliding pass-through assembly with full bottom track, D6 overhead track and jambs.
 - 1. Sizes: As indicated on Drawings.
 - 2. Locking: Provide manufacturer's standard key lock.
 - 3. Glazing: Provide security glass in accordance with requirements of Section 088000 - GLASS AND GLAZING for requirements.

2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.
- B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
 - 1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
 - 2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

2.3 FABRICATION

- A. Fabricate pass windows to be truly straight, plumb, level and square, within tolerances permitted by reference standards.
- B. Fabricate work to sizes, shapes, and profiles indicated on Contract Documents and approved shop drawings.
- C. Fabricate work with uniform, tight hairline joints, free from sharp edges.

2.4 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall surface and other adjacent construction.

3.3 PROTECTION AND CLEANING

- A. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 086200

PLASTIC UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Prefabricated, plastic unit skylights at roof.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Division 07 for roofing and joint sealants.
 - 2. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roof flashing.
 - 3. Section 079200 - JOINT SEALANTS for perimeter joint sealants.

1.3 SUBMITTALS

- A. Product Data: Submit complete manufacturer's product data to Architect for approval, consisting of complete product description and specifications, complete test data and technical characteristics, installation instructions, complete maintenance instructions, and other pertinent technical data required for complete product and product use information.
- B. Shop Drawings: Submit complete shop drawings of all work of this Section to Architect for approval, showing large scale details of construction and methods of installation and anchorage, including types, sizes, thicknesses, shapes, and finishes of all materials; anchorage; closures; flashings; sealing; and relationship to surrounding work by other trades. Sufficient typical and special conditions shall be shown to fully establish the design, quality, character, and weathertight integrity of the proposed installation.

1.4 QUALITY ASSURANCE

- A. The manufacturer shall be responsible for the configuration, fabrication, and performance of the unit skylights, in general conformance with the Contract Documents.

- B. The manufacturer shall be able to identify at least five projects in the regional area where unit skylights of similar type and size have been installed and have performed satisfactorily since their installation, for a period of at least the last ten consecutive years.

1.5 TESTS AND PERFORMANCE REQUIREMENTS

- A. Manufacturer's Standard Tests: Provide manufacturer's standard test data showing compliance with code requirements. Provide specified tests if manufacturer's standard skylight units have been modified, or when custom skylights are used.
- B. Skylight system shall be designed for design loads for snow, wind, etc., established by the governing laws and the applicable building code, with a maximum deflection of $L/175$ of the unsupported span of any member, and without cracking or breakage of glazing material, permanent deformation of any member, exceeding of the ultimate tensile strength of any member, or failure of any fastening or anchor.
 - 1. Plastic unit skylights shall not transmit any horizontal loads to structure.

1.6 COORDINATION

- A. Coordinate work of this Section with work of other trades affecting, or affected by, this work to assure the steady progress of all the work of the Contract.
- B. Before proceeding with installation work inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section, and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Package and deliver all materials, and store and handle in such manner, as to assure complete protection of all materials from damage.
- B. Store skylights several inches above the ground, blocked and under cover to prevent warping. Clean all aluminum and panels before installation, and maintain all joint surfaces thoroughly clean until sealants are applied.

1.8 WARRANTY

- A. Include written warranty, signed by manufacturer, installer and Contractor, covering defects of materials and workmanship for a period of ten years from the date of Substantial Completion of Project.
- B. Include manufacturer's standard written warranty covering defects of insulating skylight for a period of ten years against breakage, delamination, or seal failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Bristolite Skylights, Coollite ALT-SF-2.
 2. Wasco, EcoSky3.
 3. Approved equal.

2.2 SKYLIGHTS

- A. Factory-Fabricated Skylights:
1. Sizes: As indicated on the Drawings.
 2. Aluminum members shall be extruded 6063 aluminum conforming to ASTM B 221, with a minimum thickness of 0.094 in.
 3. Cap fasteners shall be 1/4 in. diameter stainless steel with stainless steel and neo-prene sealing washers, spaced a maximum of 12 in. o.c.
 4. Internal fasteners shall be stainless steel.
 5. Glazing seal shall be butyl sealant tape to allow for thermal movement of acrylic glaz-ing.
 6. Acrylic shall be double glazed type, clear and translucent as selected by Architect. Outside acrylic panel shall be high impact type to withstand 200 lb. load as required by OSHA.
 7. Glazing Performance Requirements: Comply with minimum requirements of ASHRAE 90.1-2004, and as follows:
 - a. U-value: 0.45 minimum.
 - b. Solar Heat Gain Coefficient (SHGC): 0.34 maximum.
 - c. Visible Light Transmission (VLT): 43%, minimum.
 - d. VLT/SHGC: 1.25 or better.
 8. Curb: Self-flashing curb, 12 in. high.
 9. Finish: Finish shall be selected by Architect from manufacturer's standard finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Plastic unit skylights shall be installed in strict accordance with the approved shop drawings and the manufacturer's printed installation instructions by the skylight manufacturer utilizing his own fully experienced, adequately supervised, erection crews. Installation shall be complete in all

respects, including all framing and all related aluminum closures, flashings, fillers, fastenings, anchors, sealing, required for a complete weathertight installation, including sealing between the skylight system components and the surrounding construction.

- B. Provide positive and adequate fastening and anchorage of all components, including fastening into existing construction. Work shall not void the warranty provisions of existing roof construction.
- C. Contact surfaces between aluminum and dissimilar materials shall be protected with coating of bituminous mastic or application of nonabsorptive, dielectric tape for prevention of electrolytic action and corrosion. Do not use bituminous mastic where it might contaminate a joint or surface to receive sealant.

3.3 SEALING

- A. Do all metal-to-metal sealing required to assure thoroughly weathertight installations throughout, as recommended by sealant manufacturer and conforming to the general procedures specified under Section 079200 - JOINT SEALANTS.

3.4 PROTECTION AND CLEANING OF ALUMINUM

- A. Protect finished metal surfaces from damage during fabrication, shipping, storage, and erection, and from then until acceptance by Owner.
- B. Clean all metal and glazing surfaces promptly after installation. Remove excess sealant, dirt, and other substances.

3.5 PROTECTION AND CLEANING OF GLAZING

- A. Replace all glazing which is broken, cracked, or chipped prior to time of final acceptance of Project by Owner.
- B. Clean glazing surfaces promptly after installation, exercising care to avoid damage to same.

END OF SECTION

SECTION 087100

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes:
 - 1. Mechanical and electrified door hardware for:
 - a. Swinging doors.
 - b. Sliding doors.
 - c. Gates.
 - 2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:
 - 1. Windows
 - 2. Cabinets (casework), including locks in cabinets
 - 3. Signage
 - 4. Toilet accessories
 - 5. Overhead doors
- C. Related Sections:
 - 1. Division 01 Section "Alternates" for alternates affecting this section.
 - 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
 - 3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.
 - 4. Division 13 Section "Radiation Protection" for requirements for lead-lining for door hardware at openings indicated to receive radiation protection.
 - 5. Division 26 sections for connections to electrical power system and for low-voltage wiring.
 - 6. Division 28 sections for coordination with other components of electronic access control system.

1.03 REFERENCES

- A. UL - Underwriters Laboratories
 - 1. UL 10B - Fire Test of Door Assemblies
 - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies

3. UL 1784 - Air Leakage Tests of Door Assemblies
 4. UL 305 - Panic Hardware
- B. DHI - Door and Hardware Institute
1. Sequence and Format for the Hardware Schedule
 2. Recommended Locations for Builders Hardware
 3. Key Systems and Nomenclature
- C. ANSI - American National Standards Institute
1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

- a. Door Index; include door number, heading number, and Architects hardware set number.
- b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
- c. Type, style, function, size, and finish of each hardware item.
- d. Name and manufacturer of each item.
- e. Fastenings and other pertinent information.
- f. Location of each hardware set cross-referenced to indications on Drawings.
- g. Explanation of all abbreviations, symbols, and codes contained in schedule.
- h. Mounting locations for hardware.
- i. Door and frame sizes and materials.
- j. Name and phone number for local manufacturer's representative for each product.
- k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
 - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

- a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
- b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
- c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
- f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product Certificates for electrified door hardware, signed by manufacturer:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

3. Certificates of Compliance:

- a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
 - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
 - c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
5. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
- a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - e. Final approved hardware schedule, edited to reflect conditions as-installed.
 - f. Final keying schedule
 - g. Copies of floor plans with keying nomenclature
 - h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
 - i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
 - a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.
 2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural

Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 2. Can provide installation and technical data to Architect and other related subcontractors.
 3. Can inspect and verify components are in working order upon completion of installation.
 4. Capable of producing wiring diagrams.
 5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
 2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

- I. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- J. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
 - 2. Maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
 - 4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.
- K. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
 - 1. Attendees: Owner, Contractor, Architect, Installer, and Supplier's Architectural Hardware Consultant.
 - 2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
- L. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Inspect and discuss preparatory work performed by other trades.
 - 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 - 4. Review sequence of operation for each type of electrified door hardware.
 - 5. Review required testing, inspecting, and certifying procedures.
- M. Coordination Conferences:
 - 1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
 - a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Architect and Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
 1. Promptly replace products damaged during shipping.
 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- F. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.07 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Direct shipments not permitted, unless approved by Contractor.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - 1) Mechanical: 10 years.
 - b. Automatic Operators: 2 years.
 - c. Exit Devices:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
 - d. Locksets:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
 - e. Continuous Hinges: Lifetime warranty
 - 2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

- A. Maintenance Tools:
 - 1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

- 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 - 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
 - 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
- 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Ives 5BB series
- 2. Acceptable Manufacturers and Products: Hager BB series, Stanley FBB Series

B. Requirements:

- 1. Provide five-knuckle, ball bearing hinges conforming to ANSI/BHMA A156.1.
- 2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
- 3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 4. 2 inches or thicker doors:

- a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
 - 6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
 - 7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
 - 8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
 - 9. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.

2.04 CONTINUOUS HINGES

A. Aluminum Geared

- 1. Manufacturers:
 - a. Scheduled Manufacturer: Ives.
 - b. Acceptable Manufacturers: Select, Stanley.
- 2. Requirements:
 - a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
 - b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with 0.25-inch (6 mm) diameter Teflon coated stainless steel hinge pin.
 - c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
 - d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
 - e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
 - f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
 - g. Install hinges with fasteners supplied by manufacturer.
 - h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

- A. Manufacturers:
 - a. Scheduled Manufacturer: Von Duprin EPT-10
 - b. Acceptable Manufacturers: ABH PT1000, Securitron CEPT-10
- B. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.
- C. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLUSH BOLTS

- A. Manufacturers:
 - 1. Scheduled Manufacturer: Ives
 - 2. Acceptable Manufacturers: Burns, Rockwood
- B. Requirements:
 - 1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 SURFACE BOLTS

- A. Manufacturers:
 - 1. Scheduled Manufacturer: Ives
 - 2. Acceptable Manufacturers: Burns, Rockwood
- B. Requirements:
 - 1. Surface bolts to have 1" throw for maximum security with concealed mounting that prevents vandalism. Units to be constructed of heavy duty steel and cUL listed up to three (3) hours when used on the inactive door of a pair up to 8' in height.

2.08 COORDINATORS

- A. Manufacturers:
 - 1. Scheduled Manufacturer: Ives
 - 2. Acceptable Manufacturers: Burns, Rockwood
- B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices if required.

2.09 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series
2. Acceptable Manufacturers and Products: Sargent 8200 Series, Best 45H series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Indicators: Where specified, provide indicator window measuring a minimum 2 inch x 1/2 inch with 180 degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
 - a. Inside Security Indicator: Provide indicator above cylinder for visibility during lockdown that identifies the trim as locked/unlocked status of the door. Indicator in unlocked state has a white background with black text and icon. Indicator in the locked state has a red background with white text and icon.
 - b. Occupied Indicator: Provide indicator above cylinder for visibility while operating the lock that identifies the trim as occupied/unoccupied status of the door. Indicator in unoccupied state has a white background with black text and icon. Indicator in the occupied state has a red background with white text and icon.
3. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
4. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
5. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide a request to exit (RX) switch that is actuated with rotation of inside lever.
6. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: Schlage 06A.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.10 AUXILIARY LOCKS

A. Deadlocks:

1. Manufacturers and Products:

- a. Scheduled Manufacturer and Product: Schlage L400 series
 - b. Acceptable Manufacturers and Products: Sargent, Best
2. Requirements:
- a. Provide mortise deadlock series conforming to ANSI/BHMA A156 and function as specified. Cylinders: Refer to "KEYING" article, herein.
 - b. Provide deadlocks with standard 2-3/4 inches (70 mm) backset. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
 - c. Provide manufacturer's standard strike.

2.11 EXIT DEVICES

A. Manufacturer and Product:

- 1. Scheduled Manufacturer: Von Duprin 98/35 series.
- 2. Acceptable Manufacturers and Products: Sargent 80-series, Precision Apex series

B. Requirements:

- 1. Provide exit devices tested to ANSI/BHMA A156.3-2014 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
- 2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
- 3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.
- 4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.
- 5. Provide rim devices with a dual cylinder or inside thumb turn cylinder option with a visual security indicator that identifies the trims locked/unlocked status of the door from the inside of the room. Indicator in unlocked state presents a 1/2 inch x 1/2 inch white metal flag with black icon at top of device head. Indicator in locked state has no flag present. Provide rim devices without the dual cylinder or inside thumb turn cylinder option capable of being retrofitted with the visual security indicator.
- 6. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.
- 7. Provide exit devices with manufacturer's approved strikes.
- 8. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
- 9. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
- 10. Provide cylinder dogging at non-fire-rated exit devices, unless specified less dogging.
- 11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.
- 12. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

- a. Lever Style: Match lever style of locksets.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
- 13. Provide UL labeled fire exit hardware for fire rated openings.
 - 14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
 - 15. Provide electrified options as scheduled in the hardware sets.

2.12 POWER SUPPLIES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Schlage or Von Duprin PS900 series
- 2. Acceptable Manufacturers and Products: Sargent, Precision.

B. Requirements:

- 1. Provide power supplies, recommended and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
- 2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
- 3. Provide regulated and filtered 24 VDC power supply , and UL class 2 listed.
- 4. Options:
 - a. Provide power supply, where specified, with internal capability of charging sealed backup batteries 24 VDC, in addition to operating DC load.
 - b. Provide sealed batteries for battery back-up at each power supply where specified.
 - c. Provide keyed power supply cabinet.
- 5. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
- 6. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.

2.13 CYLINDERS

A. Manufacturers:

- 1. Scheduled Manufacturer: Schlage
- 2. Acceptable Manufacturers: Sargent, Best.

B. Requirements:

- 1. Provide cylinders/cores from the same manufacturer of locksets compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Full-size interchangeable core with primus restricted keyway
3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent-protected.
4. Nickel silver bottom pins.
5. Replaceable Construction Cores.
 - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - 1) 3 construction control keys
 - 2) 12 construction change (day) keys.
 - b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.14 KEYING

- A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Requirements:
 1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - a. Master Keying system as directed by the Owner.
 2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 3. Provide keys with the following features:
 - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 4. Identification:
 - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
 - b. Identification stamping provisions must be approved by the Architect and Owner.
 - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
 - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
 5. Quantity: Furnish in the following quantities.
 - a. Change (Day) Keys: 3 per cylinder/core.

- b. Permanent Control Keys: 3.
- c. Master Keys: 6.

2.15 KEY CONTROL SYSTEM

A. Manufacturers:

- 1. Scheduled Manufacturer: Telkee
- 2. Acceptable Manufacturers: HPC, Lund

B. Requirements:

- 1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.16 KEY MANAGEMENT SOFTWARE

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Schlage SITEMASTER 200
- 2. Acceptable Manufacturers and Products: Best Keystone 600N, Sargent KeyWizard,

B. Requirements:

- 1. Software: Provide tracking, issuing, collecting and transferring information regarding keys. Provide customized query, reporting, searching capability, comprehensive location hardware listings, display key holder photos and signature for verification, and provide automatic reminders for maintenance, back-ups and overdue keys.
- 2. Provide training for Owner's personnel on proper operation and application of key management software.

2.17 DOOR CLOSERS

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: LCN 4010/4110/4020 series
- 2. Acceptable Manufacturers and Products: Sargent 281/281P10/281TJ series factory assembled (without PRV)

B. Requirements:

- 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Stamp units with date of manufacture code.
- 2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
- 3. Cylinder Body: 1-1/2 inch (38 mm) diameter, with 5/8 inch (16 mm) diameter double heat-treated pinion journal.

4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.18 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4600 series
2. Acceptable Manufacturers and Products: Norton 6000 series, Besam Power Swing

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve to control door.
6. Provide drop plates, brackets, or adapters for arms as required for details.
7. Provide hard-wired actuator switches for operation as specified.
8. Provide weather-resistant actuators at exterior applications.
9. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
10. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
11. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.19 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
5. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
6. Provide wire pulls of solid bar stock, diameter and length as scheduled.
7. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.20 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.21 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: Rixson, Sargent

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.22 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.23 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: National Guard, Reese

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.24 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives

2. Acceptable Manufacturers: Burns, Rockwood
- B. Requirements:
1. Provide "push-in" type silencers for hollow metal or wood frames.
 2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
 3. Omit where gasketing is specified.

2.25 MAGNETIC HOLDERS

- A. Manufacturers:
1. Scheduled Manufacturer: LCN
 2. Acceptable Manufacturers: Rixson, Sargent
- B. Requirements:
1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.26 LATCH PROTECTORS

- A. Manufacturers:
1. Scheduled Manufacturer: Ives
 2. Acceptable Manufacturers: Burns, Rockwood
- B. Provide stainless steel latch protectors of type required to function with specified lock.

2.27 FINISHES

- A. Finish: BHMA 626/652 (US26D); except:
1. Hinges at Exterior Doors: BHMA 630 (US32D)
 2. Continuous Hinges: BHMA 628 (US28)
 3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
 4. Protection Plates: BHMA 630 (US32D)
 5. Overhead Stops and Holders: BHMA 630 (US32D)
 6. Door Closers: Powder Coat to Match
 7. Wall Stops: BHMA 630 (US32D)
 8. Latch Protectors: BHMA 630 (US32D)
 9. Weatherstripping: Clear Anodized Aluminum
 10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Where on-site modification of doors and frames is required:
 - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 - 2. Field modify and prepare existing door and frame for new hardware being installed.
 - 3. When modifications are exposed to view, use concealed fasteners, when possible.
 - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Furnish permanent cores to owner for installation.
- I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Testing and labeling wires with Architect's opening number.
- J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- L. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
 - 1. Configuration: Provide with electrified door hardware.
- N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- R. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.05 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.06 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.07 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.08 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Hardware Sets:

HARDWARE SET: 001 - (ALUMINUM ENTRY PAIR WITH CARD ACCESS)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-35A-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-35A-NL-OP-388	626	VON
1	EA	MORTISE CYLINDER	MORTISE CYLINDER AS REQUIRED	626	SCH
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 10"	630	IVE
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	THRESHOLD	655A-V3	A	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	POWER SUPPLY	PS902 900-2RS	LGR	VON
1			CARD READER BY OTHERS		
1			SEALS BY DOOR SUPPLIER		

TEMPLATE OVERHEAD STOPS FOR 90 DEGREES.

OPERATIONAL DESCRIPTION

DOORS NORMALLY CLOSED AND LOCKED. VALID CARD FROM OUTSIDE TO RETRACT LATCHES, ALLOWING ENTRY. MECHANICAL ENTRY BY KEY IN ACTIVE LEAF. FREE EGRESS THROUGH EITHER LEAF BY INSIDE PUSH BARS. LATCHES MAY ALSO BE HELD RETRACTED INDEFINITELY BY SIGNAL FROM THE ACCESS SYSTEM TO PROVIDE PUSH/PULL OPERATION AS REQUIRED.

HARDWARE SET: 002 - (ALUMINUM ENTRY PAIR WITH CARD ACCESS AND AUTO OPERATOR)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-35A-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-35A-NL-OP-388	626	VON
1	EA	MORTISE CYLINDER	MORTISE CYLINDER AS REQUIRED	626	SCH
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 10"	630	IVE
2	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS	689	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-856	630	LCN

1	EA	THRESHOLD	655A-V3	A	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	POWER SUPPLY	PS902 900-2RS	LGR	VON
1			CARD READER BY OTHERS		
1			SEALS BY DOOR SUPPLIER		

TEMPLATE OVERHEAD STOPS FOR 90 DEGREES.

OPERATIONAL DESCRIPTION

DOORS NORMALLY CLOSED AND LOCKED. VALID CARD FROM OUTSIDE TO RETRACT LATCHES, ALLOWING ENTRY. MECHANICAL ENTRY BY KEY IN ACTIVE LEAF. FREE EGRESS THROUGH EITHER LEAF BY INSIDE PUSH BARS. LATCHES MAY ALSO BE HELD RETRACTED INDEFINITELY BY SIGNAL FROM THE ACCESS SYSTEM TO PROVIDE PUSH/PULL OPERATION AS REQUIRED.

AUTOMATIC OPERATION OF ACTIVE LEAF BY ACTUATORS. COORINDATE WIRING OF EXTERIOR ACTUATOR SO IT IS ONLY ENABLED WHEN DOOR IS UNLOCKED. INSIDE ACTUATOR TO RETRACT LATCH AND OPEN DOOR AT ALL TIMES.

HARDWARE SET: 003 - (ALUMINUM VESTIBULE PAIR WITH CARD ACCESS)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	ELEC PANIC	RX-QEL+-35A-EO	626	VON
		HARDWARE			
1	EA	ELEC PANIC	RX-QEL+-35A-NL-OP-388	626	VON
		HARDWARE			
1	EA	MORTISE CYLINDER	MORTISE CYLINDER AS REQUIRED	626	SCH
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 10"	630	IVE
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	POWER SUPPLY	PS902 900-2RS	LGR	VON
1			CARD READER BY OTHERS		
1			SEALS BY DOOR SUPPLIER		

TEMPLATE OVERHEAD STOPS FOR 90 DEGREES.

OPERATIONAL DESCRIPTION

DOORS NORMALLY CLOSED AND LOCKED. VALID CARD FROM OUTSIDE TO RETRACT LATCHES, ALLOWING ENTRY. MECHANICAL ENTRY BY KEY IN ACTIVE LEAF. FREE EGRESS THROUGH EITHER LEAF BY INSIDE PUSH BARS. LATCHES MAY ALSO BE HELD RETRACTED INDEFINITELY BY SIGNAL FROM THE ACCESS SYSTEM TO PROVIDE PUSH/PULL OPERATION AS REQUIRED.

HARDWARE SET: 004 - (ALUMINUM VESTIBULE PAIR WITH CARD ACCESS AND AUTO OPERATOR)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-35A-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-35A-NL-OP-388	626	VON
1	EA	MORTISE CYLINDER	MORTISE CYLINDER AS REQUIRED	626	SCH
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 10"	630	IVE
2	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS	689	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-856	630	LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	POWER SUPPLY	PS902 900-2RS	LGR	VON
1		CARD READER BY OTHERS			
1		SEALS BY DOOR SUPPLIER			

TEMPLATE OVERHEAD STOPS FOR 90 DEGREES.

OPERATIONAL DESCRIPTION

DOORS NORMALLY CLOSED AND LOCKED. VALID CARD FROM OUTSIDE TO RETRACT LATCHES, ALLOWING ENTRY. MECHANICAL ENTRY BY KEY IN ACTIVE LEAF. FREE EGRESS THROUGH EITHER LEAF BY INSIDE PUSH BARS. LATCHES MAY ALSO BE HELD RETRACTED INDEFINITELY BY SIGNAL FROM THE ACCESS SYSTEM TO PROVIDE PUSH/PULL OPERATION AS REQUIRED.

AUTOMATIC OPERATION OF ACTIVE LEAF BY ACTUATORS. COORINDATE WIRING OF EXTERIOR ACTUATOR SO IT IS ONLY ENABLED WHEN DOOR IS UNLOCKED. INSIDE ACTUATOR TO RETRACT LATCH AND OPEN DOOR AT ALL TIMES.

HARDWARE SET: 005 - (ALUMINUM VESTIBULE PAIR)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	628	IVE
2	EA	PUSH/PULL BAR	9190HD-10"	630	IVE
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
1		SEALS BY DOOR SUPPLIER			

TEMPLATE OVERHEAD STOPS FOR 90 DEGREES.

HARDWARE SET: 006 - (ALUMINUM ENTRY PAIR WITH KEYED HARDWARE)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	628	IVE
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	PANIC HARDWARE	CD-35A-EO	626	VON
1	EA	PANIC HARDWARE	CD-35A-NL-OP-388	626	VON
3	EA	MORTISE CYLINDER	MORTISE CYLINDER AS REQUIRED	626	SCH
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 10"	630	IVE
2	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	THRESHOLD	655A-V3	A	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1			SEALS BY DOOR SUPPLIER		

TEMPLATE OVERHEAD STOPS FOR 90 DEGREES.

HARDWARE SET: 007 - (MAIN OFFICE, WORKROOM, NURSE)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY LOCK	L9071 06A L283-711	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP/HOLDER	FS41	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

OMIT SILENCERS AT ALUMINUM FRAMES.

HARDWARE SET: 008 - (OFFICE)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	COAT AND HAT HOOK	571	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 009 - (ELECTRICAL)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	STOREROOM LOCK	L9080 806A 06A	626	SCH
1	EA	FLOOR STOP	FS438	626	IVE
1	EA	GASKETING	485AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-V3	A	ZER

HARDWARE SET: 010 - (LOCKER ROOM WITH CARD ACCESS)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL	626	VON
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	POWER SUPPLY	PS902 900-2RS	LGR	VON
1			CARD READER BY OTHERS		

OPERATIONAL DESCRIPTION

DOOR NORMALLY CLOSED AND LOCKED. VALID CARD TO RETRACT LATCH, ALLOWING ENTRY.
MECHANICAL ENTRY BY KEY. FREE EGRESS BY INSIDE PUSH BAR.

HARDWARE SET: 011 - (SINGLE-FIXTURE TOILET ROOM)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE W/SIM RETRACT	L9056 06A L583-363 L283-722	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 012 - (NETWORK, MECHANICAL, STORAGE)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080 06A	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 013 - (MULTI-FIXTURE TOILET ROOM)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM DEAD LOCK	L463	626	SCH
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 014 - (STORAGE CLOSET PAIR)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080 06A	626	SCH
2	EA	WALL STOP	WS406/407CVX	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 015 - (STAFF TOILET)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FAC RESTRM W/IND	L9486 06A L583-363 L583-375	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE

1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 016- (CLASSROOM COMMUNICATING DOOR)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	DBL CYL STORE W/DB	L9466 06A	626	SCH
1	EA	FLOOR STOP	FS438	626	IVE

HINGES AND GASKETING FURNISHED WITH ACOUSTIC DOOR ASSEMBLY.

HARDWARE SET: 017 - (CLASSROOM)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM SECURITY LOCK	L9071 06A L283-711	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE SET: 018 - (MAIN ELECTRIC)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-NL-F-06-KN	626	VON
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1	EA	GASKETING	488SBK PSA	BK	ZER

TEMPLATE CLOSER FOR 90 DEGREE STOP.

HARDWARE SET: 019 - (EXIT STAIR PAIR)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	FIRE EXIT HARDWARE	9827-L-BE-F-LBR-06-499F-SNB	626	VON

2	EA	SURFACE CLOSER	4011	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
2	EA	FIRE/LIFE FLOOR MAG	SEM7820	689	LCN
1	EA	GASKETING	488SBK PSA	BK	ZER

MAGNETIC HOLD-OPENS MUST RELEASE ON FIRE ALARM.

HARDWARE SET: 020 - (EMERGENCY ELECTRIC, ELEVATOR MACHINE)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080 806A 06A	626	SCH
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1	EA	GASKETING	488SBK PSA	BK	ZER

TEMPLATE CLOSER FOR 90 DEGREE STOP.

HARDWARE SET: 021 - (GYM, AUDITORIUM)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9827-DT-LBR	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9827-NL-LBR	626	VON
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
1	EA	POWER SUPPLY	PS906 900-4RL		VON

TEMPLATE CLOSERS FOR 90 DEGREE STOP.

SPECIFIED POWER SUPPLY CAN CONTROL UP TO 4 DOOR LEAVES. COORDINATE QUANTITY AND PLACEMENT WITH ELECTRICAL.

OPERATIONAL DESCRIPTION

DOORS CONTROLLED BY VELOCITY ACCESS SYSTEM. A SINGLE CARD READER OUTSIDE EACH SPACE (GYM AND AUDITORIUM) WILL SERVE TO LOCK AND UNLOCK ALL PERIMETER DOORS. WHEN LOCKED, MECHANICAL ENTRY BY KEY. FREE EGRESS THROUGH EITHER LEAF BY INSIDE PUSH BARS AT ALL TIMES. EMERGENCY PUSH BUTTONS IN EACH SPACE (BY SECURITY) WILL IMMEDIATELY LOCK ALL PERIMETER DOORS IN THE EVENT OF A LOCK-DOWN REQUIREMENT.

HARDWARE SET: 022 - (STORAGE)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080 06A	626	SCH
2	EA	SURFACE CLOSER	4011	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
2	EA	FLOOR STOP	FS438	626	IVE
2	EA	SILENCER	SR64	GRY	IVE

FURNISH DOOR CLOSER FOR ACTIVE LEAF ONLY.

HARDWARE SET: 023 - (CUSTODIAN)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080 06A	626	SCH
1	EA	SURFACE CLOSER	4111 HCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

TEMPLATE CLOSER FOR 90 DEGREE STOP/HOLD.

HARDWARE SET: 024 - (CROSS-CORRIDOR PAIR)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	CD-9827-DT-LBR	626	VON
1	EA	PANIC HARDWARE	CD-9827-NL-LBR	626	VON
2	EA	MORTISE CYLINDER	MORTISE CYLINDER AS REQUIRED	626	SCH
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
2	EA	FLOOR STOP/HOLDER	FS41	626	IVE
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 025 - (CLASSROOM PAIR)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM W/DEADBOLT	L9480 06A	626	SCH
2	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	MEETING STILE	383AA	AA	ZER
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE SET: 026 - (AUDITORIUM VESTIBULE)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	PUSH PLATE	8200 4" X 16"	630	IVE
2	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
2	EA	SURFACE CLOSER	4111 SHCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

TEMPLATE CLOSERS FOR 90 DEGREE STOP.

HARDWARE SET: 027 - (LOCKER ROOM)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	CD-98-NL	626	VON
1	EA	MORTISE CYLINDER	MORTISE CYLINDER AS REQUIRED	626	SCH
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 028 - (RECEIVING)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
2	EA	SURFACE BOLT	SB1600M1 T	689	IVE
1	EA	EU MORTISE LOCK	L9092EU 06A RX	626	SCH
1	EA	LOCK GUARD	LG7	630	IVE
1	EA	OH STOP & HOLDER	90H	652	GLY
1	EA	SURFACE CLOSER	4111 SHCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
1	EA	GASKETING	429A	A	ZER
1	EA	ASTRAGAL	8193AA	AA	ZER
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	655A-V3	A	ZER
1	EA	RAIN DRIP	142A	A	ZER
1		CARD READER BY OTHERS			

FURNISH DOOR CLOSER FOR ACTIVE LEAF ONLY. FURNISH OVERHEAD STOP FOR INACTIVE LEAF. TEMPLATE CLOSER AND STOP FOR 90 DEGREES.

INSTALL 429 GASKETING BEFORE DOOR CLOSER.

OPERATIONAL DESCRIPTION

DOORS NORMALLY CLOSED AND LOCKED. VALID CARD TO UNLOCK LEVER, ALLOWING ENTRY. MECHANICAL ENTRY BY KEY. FREE EGRESS BY INSIDE LEVER.

HARDWARE SET: 029 - (SCIENCE PREP)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080 06A	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 030 - (STAIR DISCHARGE PAIR)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	9827-EO-F-LBR-499F	626	VON
1	EA	FIRE EXIT HARDWARE	9827-L-F-LBR-06-499F-SNB	626	VON
1	EA	RIM CYLINDER	RIM CYLINDER AS REQUIRED	626	SCH
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7850	689	LCN
1	EA	GASKETING	488SBK PSA	BK	ZER

MAGNETIC HOLD-OPENS MUST RELEASE ON FIRE-ALARM.

HARDWARE SET: 031 - (ROOF ACCESS)

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080 06A	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	GASKETING	429A	A	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	561A-V3	A	ZER
1	EA	RAIN DRIP	142A	A	ZER

INSTALL 429 GASKETING BEFORE DOOR CLOSER. TEMPLATE CLOSER FOR 90 DEGREE STOP.

INSTALL LOCK WITH KEY CYLINDER ON STAIR-SIDE. KEY REQUIRED TO ACCESS ROOF AT ALL TIMES. ROOF-SIDE LEVER TO ALLOW FREE EGRESS BACK TO STAIR.

END OF SECTION

SECTION 088000

GLAZING

(Part of Work of Section 080002 - GLASS AND GLAZING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Glass and glazing for the following products and applications:
 - a. Steel doors, frames and sidelights specified in Section 081110 - HOLLOW METAL DOORS AND FRAMES.
 - b. Glazed entrances and storefronts specified in Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
 - c. Glazed curtain walls specified in Section 084410 - GLAZED ALUMINUM CURTAIN WALLS.
 - d. Interior lites.
 - e. Unframed mirrors.
 - f. Glazing film.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 081400 - FLUSH WOOD DOORS for factory glazing.
 - 2. Section 085110 - ALUMINUM WINDOWS for factory glazing.

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
- F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: As required by Code.
 - b. Specified Design Snow Loads for Sloped Glazing: As required by Code.
 - c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 60 seconds or less.
 - d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
 - 1) Load Duration: 30 days.

- e. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
 - 1) For monolithic-glass lites heat-treated to resist wind loads.
 - 2) For insulating glass.
 - 3) For laminated-glass lites.
 - f. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
- 1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 - 2. For laminated-glass lites, properties are based on products of construction indicated.
 - 3. For insulating-glass units, properties are based on units with lites 6.0 mm thick and a nominal 1/2-inch-wide interspace.
 - 4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 6.3 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For flat glass and processed glass, submit product-specific Type III EPDs.
 - 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content, or GreenGuard Gold certifications.
 - b. For wet-applied products, submit volume used.

- C. Samples: 12-inch- square Samples for each type of glass and glass assembly, glazing sealants.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
 - 1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- F. Qualification Data: For installers.
- G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- H. Product Test Reports: For each type of glazing products:
- I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance..
- B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, laminated glass and insulating glass.
- C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 - 1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- F. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
- G. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.
1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test, unless required by authorities having jurisdiction.
- H. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency] acceptable to authorities having jurisdiction.
 2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
- I. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
1. Insulating Glass Certification Council.
- K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup for types of windows indicated, in locations shown on Drawings.

- L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 1. Warranty Period: Ten years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to the Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 1. Warranty Period: Five years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to the Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INSULATING-GLASS UNITS

A. Schedule:

Type GX1 - Most exterior glass on the project	Composition: 1) Exterior Glass Ply: 1/4" Blue-Green, heat strengthened. 2) Coating: Low-E on #2 Surface. 3) Airspace: 1/2" airspace, mill finish, argon filled. 4) Silicone: black. 5) Interior Glass Ply: 1/4" clear, heat strengthened.	Viracon-VE6-2M:Transmittance: 1) Visible Light Transmittance: 60% 2) Solar energy: 25% 3) U-V: 6% c. Reflectance: 1) Exterior (Vis-Out) Reflectance: 10% 2) Visible light - Interior: 11% 3) Solar energy: 12% d. NFRC U-Values: 1) Winter U-Value: .25 2) Summer U-Value: .21 e. Shading Coefficient: .35 f. Solar Heat Gain Coefficient: .3 g. Light to Solar Gain Ratio: 1.94
Type GX2 - Spandrell glass	Composition: 1) Exterior Glass Ply: 1/4" Blue-Green, heat strengthened. 2) Coating: Low-E on #2 Surface. 3) Airspace: 1/2" airspace, mill finish, argon filled. 4) Silicone: black. 5) Interior Glass Ply: 1/4" clear, heat strengthened spandrel glass with Viraspan silk screening: V933	Viracon-VE6-2M:Transmittance: 1) Visible Light Transmittance: 39% 2) Solar energy: 18% 3) U-V: 4% c. Reflectance: 1) Exterior (Vis-Out) Reflectance: 24% 2) Visible light - Interior: 30% 3) Solar energy: 26% d. NFRC U-Values: 1) Winter U-Value: .25 2) Summer U-Value: .21 e. Shading Coefficient: .26 f. Solar Heat Gain Coefficient: .23 g. Light to Solar Gain Ratio: 1.7

Type GX3 - Trans-lucent Glass	Composition: 1) Exterior Glass Ply: 1/4" Blue-Green, heat strengthened. 2) Coating: Low-E on #2 Surface. 3) Airspace: 1/2" airspace, mill finish, argon filled. 4) Silicone: black. 5) Interior Glass Ply: 1/4" clear, 0.030 inch Viraspan "Arctic Snow" PVC laminated and heat strengthened.	Viracon-VE6-2M:Transmittance: 1) Visible Light Transmittance: 60% c. Reflectance: 1) Exterior (Vis-Out) Reflectance: 10% d. NFRC U-Values: 1) Winter U-Value: .25 2) Summer U-Value: .21 e. Shading Coefficient: .36 f. Solar Heat Gain Coefficient: .31 g. Light to Solar Gain Ratio: 1.93
Type GX4 - Fritted Glass	Composition: 1" thick or deeper as determined by the manufacture, "VE6-2M" Insulating Coated Glass as manufactured by Viracon. 1) Exterior Glass Ply: 1/4" Blue-Green, heat strengthened. 2) Coating: Low-E on #2 Surface. 3) Airspace: 1/2" airspace, mill finish, argon filled. 4) Silicone: black. 5) Interior Glass Ply: 1/4" clear, tempered 6) Silk Screen 1/8" dot, 40% coverage on # 3 surface. Final pattern to be selected by Architect from manufacturer's full range of standard patterns.	Viracon-VE6-2M:Transmittance: 1) Visible Light Transmittance: 42% c. Reflectance: 1) Exterior (Vis-Out) Reflectance: 16% d. NFRC U-Values: 1) Winter U-Value: .25 2) Summer U-Value: .21 e. Shading Coefficient: .28 f. Solar Heat Gain Coefficient: .24 g. Light to Solar Gain Ratio: 1.75
Type GX5 - Security Glass School Guard Glass	Composition: 1) Nominal thickness: 1" with the following make up: 2) Exterior lite: 1/4" tempered glass with low-E coating on #2 surface. 3) Air space 3/8" argon gas filled with mill finish spacer. 4) SG4 security glass. b. Ratings: 1) 5-aa1 rated for 6 minutes. 2) BR Level 2 low spall. 3) F1233 Class 1 4) UL 972. c. Compliance: 1) ASTM 1048 – Standard Specification - Heat Strengthened & Fully Tempered Flat Glass 2) ASTM C1036 - Standard Specification - Flat Glass 3) ASTM C1172 - Standard Specifi-	1) Summer U-value: .20 2) Winter U-value: .24 3) Solar heat gain coefficient: .28 4) Reflective heat gain: 65 5) Visible light transmission: 59% 6) Shading coefficient: .32 7) Total solar transmittance: .22

cation for Laminated Architectural
Flat
Glass

4) ANSI Z97.1 Safety Materials
Used in Buildings

Performance Criteria: Test failure
occurs when a 4" object can pass
through the
glass materials.

1) Ballistic impact: Pass* (5 shots
with a .762 round) (*bullets pene-
trate but
glass stays in place).

2) Concentrated assault:

a) Brick: Pass.

b) Steel toed boots: Pass.

3) Forced entry:

a) Tools 2 min. test: Pass.

b) 3 lb. hammer & bat 3-1/2 min.
test: Pass.

4) Total time to failure: 6 min. 10
sec.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2. For uncoated glass, comply with requirements for Condition A.

3. For coated vision glass, comply with requirements for Condition C (other coated glass).

C. Coated Float Glass: Pyrolytic and vacuum deposited coatings on glass in conformance with ASTM C 1376.

D. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.

1. Tint Color: As selected by the Architect.

2. Visible Light Transmittance: As standard with manufacturer.

E. Tempered Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT; 1/4 inch thick unless indicated otherwise.

F. Patterned Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Form 3 (patterned); and of quality, finish, and pattern specified.

- G. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
1. Construction for Framed Units: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
 2. Construction for Units with Exposed Edges: Laminate glass with cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
 3. Interlayer Thickness: 0.030 inch (0.76 mm) thick for vertical glazing, 0.060 inch (1.52 mm) thick for sloped glazing.
 4. Interlayer Color: Clear unless otherwise indicated.
- H. Fire-Rated Monolithic Ceramic Glazing Material (Not for Doors or Locations Requiring Safety Glazing): Proprietary product in the form of clear flat sheets of 3/16-inch nominal (5.0 mm) thickness weighing 2.5 lb/sq. ft. and as follows:
1. Fire-Protection Rating: As indicated for the fire window in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Products: Subject to compliance with requirements, provide the following:
 - a. Technical Glass Products (TGP); FireLite Premium, polished both sides.
- I. Fire-Rated Laminated Ceramic Glazing Material (for Doors and Locations Requiring Safety Glazing): Category II safety glazing product in the form of 2 lites of clear ceramic glazing material laminated together to produce a laminated lite of 5/16-inch nominal (8.0 mm) thickness; polished on both surfaces; weighing 4 lb/sq. ft. and as follows:
1. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Polished on both surfaces, transparent.
 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Technical Glass Products (TGP); FireLite Plus.
 - b. Safti First; Pyran Platinum L, (for maximum 90 minute-rated openings).
 - c. Vetrotech Saint-Gobain; SGG Keralite FR-L.
- J. Laminated Glass with Intumescent Interlayers (Temperature-Rise-Rated Doors): Laminated glass made from multiple plies of uncoated, clear float glass; with intumescent interlayers; complying with testing requirements in 16 CFR 1201 for Category II materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. InterEdge, Inc., a subsidiary of AGC Glass; Pyrobel.
 - b. Pilkington Group Limited (distributed by Technical Glass Products); PyroStop.
 - c. Vetrotech Saint-Gobain; SGG Contraflam N2 or SGG Swissflam N2.

- K. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by an argon-filled interspace, and complying with ASTM E2190 and with requirements specified in this Section.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" paragraph.
 2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
 3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 4. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - a. Manufacturer's Standard Sealants. Butyl primary and silicone secondary sealants. Secondary sealant shall cover entire spacer bar at IGU perimeter.
 5. Spacer Specifications: Manufacturer's standard spacer material. Spacer corners shall be bent, soldered, or welded. Keyed spacer corners will not be accepted. Spacer may have a mid-span spacer key located at the midpoint of the insulating glass unit head. Where a mid-span spacer key is used, the key must be fully embedded (all sides) in butyl sealant.
- L. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.
1. Glass: Clear float.
 2. Ceramic Coating Color: Custom color as selected by the Architect.
- M. Ceramic-Coated Vision Glass: Float glass with ceramic enamel applied by silk-screened process and complying with ASTM C 1048, Condition C (other coated glass), Type I (transparent flat glass), Quality-Q3, Specification No. 95-1-31 in GANA Tempering Division's "Engineering Standards Manual," and other requirements specified.
1. Ceramic Frit Pattern: Custom pattern as selected by the Architect.
 2. Ceramic Coating Color: Custom color as selected by the Architect.
- N. Silicone-Coated Spandrel Glass: ASTM C 1048, Condition C, Type I, Quality-Q3, and complying with other requirements specified.
1. Products: Subject to compliance with requirements, provide ICD High Performance Coatings, Opaci-Coat 300; color as selected by Architect from manufacturer's full range.
- O. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
1. Mirror Edge Treatment: Flat polished edge.
- P. Glazing Film: Translucent, dimensionally stable, cast PVC film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

1. Manufacturers: Subject to compliance with requirements, available manufacturer's that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison, Graphics.
 - b. FDC Graphic Films, Inc.
 - c. Madico, Inc.
 - d. 3M Scotchcal.
2. Comply with requirements for safety glazing.
3. Use: Suitable for exterior and interior applications.
4. Patterns: As selected by Architect from manufacturer's full range.

2.3 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 1. Compatibility: Verify glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, interlayer of laminated glass, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
 4. VOC Emissions: Provide sealants in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. VOC Content:
 - a. Structural Glazing Adhesives: 100 g/L.
 - b. Architectural Sealants: 250 g/L.
 6. Methylene chloride and perchloroethylene may not be intentionally added to sealants.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants:
 - a. Dow Corning Corporation; 790.
 - b. GE Silicones; SilPruf LM SCS2700.
 - c. Tremco Inc.; Spectrem 1.
- C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.4 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for project conditions.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
 - 1. Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.5 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.
- G. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
 - 1. VOC Emissions: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 2. VOC Content: 250 g/L or less.
 - 3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
 - 4. Do not use adhesives that contain urea formaldehyde.

- H. Mirror Hardware, Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
- K. Glazing Film: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in single sheet completely overlaying the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.

- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION

SECTION 088050

FIRE-RATED GLAZED ASSEMBLIES

(Part of Work of Section 080002 - GLASS AND GLAZING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Interior glazed storefront framing assemblies, two-hour fire-rated.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 078410 - PENETRATION FIRESTOPPING for firestopping sealants at perimeter of fire rated framing systems.
 - 2. Section 081110 - HOLLOW METAL DOORS AND FRAMES for steel frames at other fire-rated locations.
 - 3. Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS for non-rated glazed storefront.
 - 4. Section 084226 - ALL-GLASS ENTRANCES for interior all-glass entrances and storefront systems.
 - 5. Section 088000 - GLAZING for fire-rated glazing at other locations.

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
- C. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 60 seconds or less.
 - b. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
 - 1) For monolithic-glass lites heat-treated to resist wind loads.
 - 2) For laminated-glass lites.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch-square Samples for glass.
 - 1. Each type of glass.

C. Shop Drawings:

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, method of field assembly, components, and location and size of each field connection.

D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

F. Qualification Data: For installers and professional engineer.

G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1. Include preconstruction field test reports.

H. Product Test Reports: For each of the following types of glazing products:

1. Fire-resistive glazing products.

I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance..

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, laminated glass and insulating glass.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

D. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

E. Glazing for Fire-Rated Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 and NFPA 257 for window assemblies.

F. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup for types of windows indicated, in locations shown on Drawings.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Ten years from date of Substantial Completion.

- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to the Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AGC Glass Co.; PyroSafe.
 2. (Basis of Design) SaftiFirst, a division of O'Keefe's; SaftiFire Framing GPX.
 3. Technical Glass Products (TGP); Fireframes Aluminum Series and Pilkington Pyrostop glazing.
 4. Vetrotech, Saint Gobain.

2.2 FIRE RATED GLASS AND FRAMING SYSTEM

- A. Performance Requirements:
1. Fire Rating: Two hours.
 2. Certification: System tested in accordance with ASTM E-119, NFPA 251, UBC 7-1, UL 263. Temperature on the non-fire side of the system at the conclusion of fire test shall be below 250 degree F (121 degree C) above ambient room temperature.
 3. Listing / Label: Fire Testing shall be conducted by an approved independent test laboratory similar to Intertek Testing Services (Warnock-Hersey) or Underwriters Laboratories, Inc. (UL).
- B. Aluminum Frame System:
1. Steel Frame: The steel framing members are made of two halves, nom. 1.9 in. wide with a nom. minimum depth of 1.3 in. with lengths cut according to glazing size.
 2. Aluminum Trim: Nom. 2 in. wide with a nom. depth of 1.5 in. with lengths cut according to glazing size.
 3. Stainless Steel Spacers: Nom 5/16 in. diameter with a nom. minimum depth of 1-1/8 in. with depth adjusted to match fire resistant glazing material.
 4. Framing Member Fasteners: Screws sized to accommodate the thickness of the fire resistant glazing material.
 5. Glazing Gasket: Nom. 3/4 in. by 3/16 in. black applied to the steel framing members to cushion and seal the glazing material when installed.
- C. Glass: Clear, low-iron, laminated with intumescent interlayer fire-rated glass with the following properties:
1. Basis of Design: Pilkington Pyrostop 120-106.
 2. Fire Rating: Two hours (120 min.).
 3. Glazing Type: Insulated glazing unit.
 4. Nominal Thickness: 2-1/4 in.
 5. Weight: 22.9 psf.
 6. Daylight Transmission: 75%
 7. Sound Transmission Coefficient: 46dB

2.3 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

- A. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air and vapor seal.
- B. Glazing Accessories: Line glazing pockets with intumescent tape supplied by frame manufacturer. Set Pyrostop glass using neoprene setting blocks.
- C. Setting Blocks: Hardwood or calcium silicate; glass width by 4 inches by 3/16 inch thick.
- D. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.
- E. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.4 ACCESSORY MATERIALS

- A. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 30-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Form aluminum shapes before finishing.
- B. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.
- C. Furnish frame assemblies pre-welded. When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings. Fit with suitable fasteners. Knock-down frames will not be accepted.
- D. Field glaze frame assemblies.
- E. Fabrication Dimensions: Fabricate fire rated assembly to approved dimensions. Guarantee dimensions where practicable within required tolerance.
- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.6 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.
- D. Aluminum Finish: Match work of Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 6. Seal joints to prevent the passage of fire.
- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with isolation coating.
- C. Install components plumb and true in alignment with established lines and grades, without warp or rack.
- D. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
 - 2. Alignment:

- a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
- b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.4 GLAZING INSTALLATION

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.5 CLEANING AND PROTECTION

- A. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

- B. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION

SECTION 089000

LOUVERS AND VENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fixed extruded-aluminum louvers and frames.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for louvers that are a part of mechanical equipment.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers. Loads as required by Code.

- B. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions as required by code.
- C. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F ambient; 180 deg F material surfaces.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For factory-applied metal finishes, submit Declare product labels.
- C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.
 - 1. For installed louvers indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Include sill, jambs, and head details showing the integration with adjacent air and water barriers.
 - 3. Include details of the continuous sill pan with upturned back and end dams. Note on drawings how continuity will be maintained at the sill pan corners.
- D. Samples for Verification: For each type of metal finish required.
- E. Qualification Data: For professional engineer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code--Aluminum."

- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Airolite Company, LLC.
 - 2. American Warming and Ventilating.
 - 3. Construction Specialties, Inc.
 - 4. Industrial Louvers, Inc.
- B. Horizontal Storm-Resistant Louvers:
 - 1. Louver Depth: As indicated on the Drawings.
 - 2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch.
 - 3. Performance Requirements: AMCA 550, required in Massachusetts through the 2015 IMC Code.
 - 4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 - 5. Free Area: Comply with requirements indicated on the Drawings.
- C. General: Provide screen at each exterior louver. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c. Fabricate frames with mitered corners to louver sizes indicated.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Bird screening, aluminum, 1/2-inch-square mesh, 0.063-inch wire
- D. Insulated, Blank-off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets.
 - 1. Thickness: 1 inch.
 - 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
 - 3. Insulating Core: Rigid insulation board.
 - 4. Seal perimeter joints between panel faces and louver frames with 1/8-by-1-inch PVC compression gaskets.

5. Panel Finish: Same finish applied to louvers.

2.2 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Coatings shall be fluorosurfactant free Kynar 500 by Arkema or fluorosurfactant-compliant Hylar 5000 by Solvay; or equal. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 1. Available Products: Sherwin-Williams Coil Coatings; Valspar Fluoropon Pure; or approved equal.
 2. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.
 3. Color and Gloss: Provide custom color as selected by Architect.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable only if they are within the range of approved Samples, or shall not exceed $DE^*a^*b^*$ of 2.0 from a single control sample. Noticeable variations in the same piece are not acceptable.'

2.3 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- D. Integral sills shall include a continuous sill pan with back and end dams. Water that runs off the louver shall be collected in the sill pan and drained away from the building.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Fully Recessed Mullions: Provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
- G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 - JOINT SEALANTS for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 090002

TILE

(TRADE BID REQUIRED)

Trade Contractors on this CM-at-Risk project are required by law to provide payment and performance bonds for the full value of their trade contracts, and trade contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Bids will only be accepted from trade contractors pre-qualified by the awarding authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 090002- TILE

2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 8 of Chapter 149A of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority.
3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. All Work of Section 093013 - CERAMIC TILE
 2. All Work of Section 093019 - PORCELAIN TILE

END OF SECTION

SECTION 090003

ACOUSTICAL TILE

(Trade Bid Required)

Trade Contractors on this CM-at-Risk project are required by law to provide payment and performance bonds for the full value of their trade contracts, and trade contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Bids will only be accepted from trade contractors pre-qualified by the awarding authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 090003- ACOUSTICAL TILE

2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 8 of Chapter 149A of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority.
3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 095100 - ACOUSTICAL CEILINGS

END OF SECTION

SECTION 090005

RESILIENT FLOORS

(Trade Bid Required)

Trade Contractors on this CM-at-Risk project are required by law to provide payment and performance bonds for the full value of their trade contracts, and trade contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Bids will only be accepted from trade contractors pre-qualified by the awarding authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade-Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 090005- RESILIENT FLOORS

2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 8 of Chapter 149A of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority.
3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 096510 RESILIENT FLOORING AND ACCESSORIES.
2. All Work of Section 096516 VINYL SHEET FLOORING.
3. All Work of Section 096523 RUBBER STAIR TREAD, RISER, TILE AND BASE.
4. All Work of Section 096530 RUBBER WALL BASE.
5. All Work of Section 096543 LINOLEUM SHEET FLOORING.
6. All Work of Section 096560 RESILIENT ATHLETIC FLOORING.
- 7.

END OF SECTION

SECTION 090006

TERRAZZO

(Trade Bid Required)

Trade Contractors on this CM-at-Risk project are required by law to provide payment and performance bonds for the full value of their trade contracts, and trade contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Bids will only be accepted from trade contractors pre-qualified by the awarding authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 090006- TERRAZZO

2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 8 of Chapter 149A of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority.
3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 096620 - TERRAZZO FLOORING

END OF SECTION

SECTION 090007

PAINTING

(Trade Bid Required)

Trade Contractors on this CM-at-Risk project are required by law to provide payment and performance bonds for the full value of their trade contracts, and trade contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Bids will only be accepted from trade contractors pre-qualified by the awarding authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 090007- PAINTING

2. Each trade bid submitted for work under this Section shall be on forms furnished by the Awarding Authority as required by Section 8 of Chapter 149A of the General Laws, as amended. Trade bid forms may be obtained at the office of the Awarding Authority
3. Trade bids filed with the Awarding Authority shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 099000 - PAINTING AND COATING

END OF SECTION

SECTION 092110

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Interior gypsum wallboard.
 - 2. Tile backing panels.
 - 3. Acoustic insulation (sound attenuation batts) in gypsum wallboard assemblies.
 - 4. Non-load-bearing steel framing, including angles in partial-height partitions.
 - 5. Installation of access panels.
 - 6. Marking and identification for fire- and smoke-partitions.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 054000 - COLD-FORMED METAL FRAMING for load-bearing steel framing.
 - 2. Section 061000 - ROUGH CARPENTRY for plywood backing panels.
 - 3. Section 061600 - SHEATHING for gypsum sheathing at exterior assemblies.
 - 4. Section 083110 - ACCESS DOORS AND FRAMES for furnishing access doors and frames in gypsum board assemblies.
 - 5. Section 092120 - GYPSUM BOARD SHAFT WALL ASSEMBLIES for framing, gypsum panels, other components of shaft wall assemblies, and finishing gypsum board shaft wall assemblies.
 - 6. Section 093000 - TILING for joint compound at cementitious tile backing panels.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.

2. Provide metal framing engineered to meet code requirements, project requirements, required heights, and the following deflection criteria. For gypsum board assemblies without applied rigid finishes L/240; for gypsum board assemblies with applied rigid finishes such as tile, stone, wood paneling L/360. Lateral load 5 psf except at shafts. Lateral load at shafts shall be required based on analysis of equipment and systems using shafts.
 3. Provide fire stop tracks capable of withstanding deflection within limits and under conditions indicated.
- B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
 2. Locate within 15 feet of end of each wall and repeat at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
 3. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in contrasting color, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.
 4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD).
 - a. Option 1: For gypsum board and metal framing, submit product-specific Type III EPDs.
 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 1: For gypsum board, submit corporate sustainability reports (CSR).
 - c. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: For gypsum board, submit evidence of reclamation and recycling programs.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 3. Building Product Disclosure and Optimization, Material Ingredients:

- a. Option 1, Material Ingredient Reporting: For gypsum boards and acoustical insulation, submit Health Product Declarations (HPD) or Declare product labels.
 - 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
 - b. For gypsum board, acoustic insulation, and joint compounds, submit GreenGuard Gold certification.
 - c. For wet-applied products, submit volume used.
 - C. Shop Drawings: If materials and systems other than those specified and those indicated on the Drawings are proposed for use, submit shop drawings signed and sealed by a structural engineer licensed in the jurisdiction of the project certifying proposed systems meet code and project requirements. and specified deflection criteria.
 - D. Samples: Full-size Sample in 12-inch-long length for each trim accessory indicated.
- 1.5 QUALITY ASSURANCE
- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
 - B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
 - C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 1.6 STORAGE AND HANDLING
- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.
 - 3. Recycled Content: Use minimum recycled content of 25%.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Postinstalled, expansion anchor.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges with depth as required for span and loading and indicated on Drawings.
- E. Furring Channels (Furring Members): 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.

- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.
 2. Performance Requirements: Ceiling support system shall support a live load of 6 psf minimum at L/240.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. California Expanded Metals Co. (CEMCO).
 2. EB Metal U.S.
 3. Marino\WARE.
 4. Studco Building Systems.
- B. Steel Studs and Runners: ASTM C 645.
1. Minimum Base-Steel (Uncoated) Thickness: 0.0296 inches (20 gage).
 2. Dimpled studs meeting performance values for equivalent standard studs are acceptable.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 3. Deflection Track / Deflection Clip: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Brady Innovations; Sliptrack Systems.
 - 2) California Expanded Metals Co. (CEMCO); CST Slotted Tracks.
 - 3) Clark Dietrich Building Systems; MaxTrak Slotted Deflection Track.
 - 4) Steel Network Inc. (The); VertiTrack VT Series.

- D. Fire Stop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness compatible with studs and in width to accommodate depth of studs.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. California Expanded Metals Co. (CEMCO); FAS-TRK 1000 Slotted Tracks.
 - b. Clark Dietrich Building Systems; BlazeFrame Fire Stop Deflection Track.
 - c. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
 - d. GCPAT; FlameSafe FlowTrack System.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.0312 inch (20 gauge).
- F. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0312 inch (20 gauge).
 - 2. Depth: 1-1/2 inches.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission. Strictly comply with manufacturer's installation instruction.
 - 1. Basis-of-Design: ClarkDietrich RC Deluxe, asymmetrical configuration.
- I. Resilient Sound Isolation Clips: Provide galvanized steel and resilient material sound-isolation clips, equal to the following:
 - 1. Kinetics Noise Control Co.; IsoMax.
 - 2. PAC International, Inc.; RSIC-1.
 - 3. Pliteq, Inc.; GenieClip.
 - 4. Studco Building Systems; Resilmount A237R.
- J. Spring Isolation Hangers: Provide galvanized and coated spring hanger system, equal to the following:
 - 1. Kinetics Noise Control Co.; ICW for wood framing, ICC for metal framing.
 - 2. PAC International, Inc.; RSIC--SI-CRC Pro Series.
- K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

- L. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- M. Isolation Strip at Exterior Walls: Adhesive-backed, closed-cell foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

2.4 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. CertainTeed Gypsum, Inc.
 - 2. Georgia-Pacific (G-P) Gypsum.
 - 3. National Gypsum Company.
 - 4. United States Gypsum Company (USG).
- B. Gypsum Wallboard: ASTM C 1396.
 - 1. Available Products: USG; SHEETROCK EcoSmart Panels.
 - 2. Thickness: 1/2 inch and 5/8 inch as indicated.
 - 3. Long Edges: Tapered.
 - 4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.
 - 5. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
- C. Gypsum Wallboard, Fire-Resistant Type X: ASTM C 1396.
 - 1. Available Products: USG; SHEETROCK EcoSmart Panels Firecode X.
 - 2. Thickness: 5/8 inch.
 - 3. Long Edges: Tapered.
 - 4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.
 - 5. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 - 6. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
- D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch, Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - 4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.
 - 5. Building Product Disclosure and Optimization, Material Ingredients: Declare product labels.
 - 6. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
- E. Abuse-Resistant Gypsum Panels: ASTM C 1629. Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board; 5/8 inch, Type X, long edges tapered.

- F. Impact-Resistant Gypsum Wallboard, Level 2: Sheetrock Brand Mold Tough VHI Firecode X by USG, ToughRock Fireguard X Mold-Guard Abuse-Resistant Gypsum Board by Georgia-Pacific, or Gold Bond Hi-Impact XP Gypsum Board by National Gypsum.

2.5 TILE BACKING PANELS

- A. Cementitious Tile Backing Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Wonderboard and Wonderboard Lite.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. National Gypsum Company; Permabase Cement Board.
 - d. USG Corporation; DUROCK Cement Board.
 - 2. Thickness: 5/8 inch.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc, with flanges for mechanical fastening, unless otherwise indicated.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint. For control joints in fire rated walls provide Cemco FAS 093X fire-rated control joint or equal.
 - e. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backing Units: Thinset, nonsag mortar, as recommended by backing unit manufacturer. Refer to Section 093000 - TILING.
 - 2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 2. VOC Content: 50 g/L or less.
 - 3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
 - 4. Do not use adhesives that contain urea formaldehyde.
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious tile backing units, use screws of type and size recommended by panel manufacturer.
 - 3. For fastening abuse-resistant gypsum panels, use Type S 'high-low' screws.
 - 4. For fastening impact-resistant gypsum panels, use Type S 'high-low' screws.

- D. Acoustic Insulation, Sound Attenuation (Batts) Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corporation; NoiseReducer.
 - b. Johns Manville; Unfaced Formaldehyde-Free Fiber Glass Insulation.
 - c. Knauf Insulation; EcoBatt.
 - d. Owens Corning; PINK Next Gen Fiberglass Sound Attenuation Batts (SAB).
 - e. Owens Corning; Thermafiber SAFB FF.
 - f. Rockwool (formerly Roxul); AFB evo.
 2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 3. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD).
 4. Recycled Content: Use minimum recycled content of 25%.
 5. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 6. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
- E. Acoustical Sealant: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, joint sealant, recommended for sealing interior concealed joints to reduce airborne sound transmission.
1. Available Products, for Concealed and Exposed Joints: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - c. USG; SHEETROCK Acoustical Sealant.
 2. Available Products, for Concealed Joints Only: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. OSI (a division of Henkel); Pro-Series SC-175.
 - b. Pecora Corp.; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical/Curtainwall Sealant.
 3. Low-Emitting Materials: Provide sealants in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. VOC Content, Architectural Sealants: 250 g/L or less.
 5. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

2.9 IDENTIFICATION LABELS FOR FIRE- AND SMOKE-PARTITIONS

- A. Identification Labels: Self-adhesive signs, to comply with applicable local Code.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Wall Signs, Inc.
 - b. Marking & Identification Tape (mnitape.com).
 - c. My Safety Sign.
 - d. Safety Supply Warehouse.
 - 2. Text: "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754. Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on doorframes; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

- b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.
- D. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Z-Furring Members:
 - 1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.7 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels to minimize end joints.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.8 APPLYING TILE BACKING PANELS

- A. Cementitious Tile Backing Units: ANSI A108.1, at locations indicated to receive tile, with joints treated to comply with ANSI A108.11.

- B. Water-Resistant Backing Board: Install at areas not subject to wetting and elsewhere as indicated with 1/4-inch gap where panels abut other construction or penetrations.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.9 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.10 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Comply with GA-214. Finish panels to levels indicated below:
 - 1. Level 1: Ceiling plenum areas and concealed areas not exposed to view.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Not Used.
 - 4. Level 4: Panel surfaces that will be exposed to view (typical panels).
 - 5. Level 5: Where indicated on Drawings; includes areas to receive dry erase coatings, wall graphics, and wallcoverings.
- E. Cementitious Tile Backing Units: Finish according to manufacturer's written instructions.

3.11 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.12 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 092120

GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Gypsum board shaft wall assemblies.
 - 2. Marking and identification for fire- and smoke-partitions.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 083110 - ACCESS DOORS AND FRAMES for installation in gypsum board assemblies.
 - 2. Section 092110 - GYPSUM BOARD ASSEMBLIES for non-shaft-wall gypsum board assemblies.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for applying and finishing panels in gypsum board assemblies.

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Provide gypsum board shaft wall assemblies capable of withstanding the full air-pressure loads indicated for maximum heights of partitions without failing and while maintaining an airtight and smoke-tight seal. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing track (runners) to bend or to shear and studs to become crippled.

2. Provide gypsum board shaft wall assemblies for horizontal duct enclosures capable of spanning distances indicated within deflection limits indicated.
- B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
 2. Locate within 15 feet of end of each wall and repeat at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
 3. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in contrasting color, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD).
 - a. Option 1: For gypsum board and metal framing, submit product-specific Type III EPDs.
 2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 1: For gypsum board, submit corporate sustainability reports (CSR).
 - c. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: For gypsum board, submit evidence of reclamation and recycling programs.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For gypsum boards and acoustical insulation, submit Health Product Declarations (HPD) or Declare product labels.
 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.

- a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
 - b. For gypsum board, acoustic insulation, and joint compounds, submit GreenGuard Gold certification.
 - c. For wet-applied products, submit volume used.
- C. Fire-Test-Response Reports: From a qualified independent testing and inspecting agency substantiating each gypsum board shaft wall assembly's required fire-resistance rating.
 - 1. Include data substantiating that elevator entrances and other items that penetrate each gypsum board shaft wall assembly do not negate fire-resistance rating.

1.6 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from FM's "Approval Guide, Building Products," UL's "Fire Resistance Directory," or ITS's "Directory of Listed Products."
- B. STC-Rated Assemblies: For gypsum board shaft wall assemblies indicated to have STC ratings, provide assembly materials and construction complying with requirements of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01. Review methods and procedures for installing work related to gypsum board shaft wall assemblies including, but not limited to, the following:
 - 1. Fasteners proposed for anchoring steel framing to building structure.
 - 2. Sprayed fire-resistive materials applied to structural framing.
 - 3. Elevator equipment, including hoistway doors, elevator call buttons, and elevator floor indicators.
 - 4. Wiring devices in shaft wall assemblies.
 - 5. Doors and other items penetrating shaft wall assemblies.
 - 6. Items supported by shaft wall-assembly framing.
 - 7. Mechanical work enclosed within shaft wall assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat on leveled supports off the ground to prevent sagging.

1.8 PROJECT CONDITIONS

- A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in Section 092110 - GYPSUM BOARD ASSEMBLIES.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. CertainTeed Gypsum, Inc.
 - 2. National Gypsum Company.
 - 3. United States Gypsum Company (USG).

2.2 ASSEMBLY MATERIALS

- A. General: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
 - 1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
 - 2. Provide auxiliary materials complying with gypsum board shaft wall assembly manufacturer's written recommendations.
- B. Steel Framing: ASTM C 645.
 - 1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized coating.
- C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness and with moisture-resistant paper faces.
- D. Gypsum Wallboard: ASTM C 1396, core type as required by fire-resistance-rated assembly indicated.
- E. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Section 092110 - GYPSUM BOARD ASSEMBLIES comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.
- F. Gypsum Wallboard Joint-Treatment Materials: ASTM C 475 and as specified in Section 092110 - GYPSUM BOARD ASSEMBLIES.
- G. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- H. Track (Runner) Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.
 2. Postinstalled Expansion Anchors: Where indicated, provide expansion anchors with capability to sustain, without failure, a load equal to 5 times that imposed by shaft wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 488.
-
- I. Laminating Adhesive: Comply with requirements of Section 092110 - GYPSUM BOARD ASSEMBLIES.
 - J. Acoustic Insulation, Sound Attenuation (Batts) Blankets: Comply with requirements of Section 092110 - GYPSUM BOARD ASSEMBLIES.
 - K. Acoustical Sealant: Comply with requirements of Section 092110 - GYPSUM BOARD ASSEMBLIES.
- 2.3 GYPSUM BOARD SHAFT WALL
- A. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing and inspecting agency.
 - B. Sustained Air-Pressure Loads: 5 lbf/sq. ft.
 - C. Deflection Limit: L/240.
 - D. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.
 1. Depth: As indicated.
 2. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.
 - E. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches in depth matching studs.
 1. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.
 - F. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs, and not less than 0.0341 inch thick.
 - G. Room-Side and Shaft-Side Finish: As indicated.
 - H. STC Rating: As indicated.
 - I. Cavity Insulation: Sound attenuation blankets.

2.4 IDENTIFICATION LABELS FOR FIRE- AND SMOKE-PARTITIONS

- A. Identification Labels: Self-adhesive signs, to comply with applicable local Code.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Wall Signs, Inc.
 - b. Marking & Identification Tape (mnitape.com).
 - c. My Safety Sign.
 - d. Safety Supply Warehouse.
 - 2. Text: "FIRE AND SMOKE BARRIER-PROTECT ALL OPENINGS"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway doorframes, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
 - 1. ASTM C 754 for installing steel framing and gypsum shaft wallboard.

- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. At elevator hoistway doorframes, provide jamb struts on each side of doorframe.
 - 2. Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.
- D. Integrate stair hanger rods with gypsum board shaft wall assemblies by locating cavity of assemblies where required to enclose rods.
- E. At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- F. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
- G. Install control joints to maintain fire-resistance rating of assemblies.
- H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.

3.4 FINISHING GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 - 1. Level 1: Ceiling plenum areas and concealed areas not exposed to view.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: Panel surfaces that will be exposed to view (typical panels).
 - 4. Level 5: Where indicated on Drawings.

3.5 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.6 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 093013

CERAMIC TILE

(Part of Work of Section 090002 - TILE, Trade-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Floor tile.
 - 2. Wall tile.
 - 3. Stone thresholds installed as part of tile installations.
 - 4. Waterproofing and crack-suppression membrane for thin-set tile installations.
 - 5. Elastomeric sealants for expansion, contraction, control, and isolation joints in tile surfaces.
 - 6. Surface preparation for tile and accessories.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for monolithic slab finishes specified for tile substrates.
 - 2. Section 079200 - JOINT SEALANTS for sealing of joints between dissimilar materials.
 - 3. Section 083110 - ACCESS DOORS AND FRAMES for installation in tile.
 - 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for cementitious backer units.
 - 5. Division 04 Section "Concrete Masonry Units": for concrete masonry unit substrate receiving wall tile finish.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A108.1A, 1999 - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.

2. ANSI A108.1B, 1999 - Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
3. ANSI A108.1C, 1999 - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
4. ANSI A108.4, 1999 - Specifications for Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
5. ANSI A108.5, 1999 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
6. ANSI A108.6, 1999 - Specifications for Ceramic Tile Installed with Chemical-Resistant, Water-Cleanable Tile-Setting and -Grouting Epoxy.
7. ANSI A108.8, 1999 - Specifications for Ceramic Tile Installed with Chemical-Resistant Furan Mortar and Grout.
8. ANSI A108.9, 1999 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
9. ANSI A108.10, 1999 - Specifications for Installation of Grout in Tilework.
10. ANSI A118.1, 1999 - Standard Specification for Dry-Set Portland Cement Mortar.
11. ANSI A118.3, 1999 - Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.
12. ANSI A118.4, 1999 - Latex-Portland Cement Mortar.
13. ANSI A118.5, 1999 - Chemical-Resistant Furan Mortar and Grout.
14. ANSI A118.6, 1999 - Standard Ceramic Tile Grouts.
15. ANSI A118.7, 1999 - Polymer Modified Cement Grouts
16. ANSI A118.8, 1999 - Modified Epoxy Emulsion Mortar/Grout.
17. ANSI A118.9, 1999 - Test Methods and Specifications for Cementitious Backer Units
18. ANSI A118.10, 1999 - Load bearing, Bonded, Waterproof Membranes for Thinset Ceramic Tile and Dimensional Stone.
19. ANSI A118.11, 1999 - Exterior Grade Plywood (EGP) Latex-Portland Cement Mortar.
20. ANSI A136.1, 1999 - Organic Adhesives for Installation of Ceramic Tile.
21. ANSI A137.1, 1988 - Specifications for Ceramic Tile.

B. ASTM International (ASTM):

1. ASTM C 150 - Standard Specification for Portland Cement.
2. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.
3. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
4. ASTM C 241 - Test Method For Abrasion Resistance of Stone Subjected to Foot Traffic.
5. ASTM C 503 - Specification for Marble Building Stone (Exterior).
6. ASTM C 615 - Specification for Granite Dimension Stone.
7. ASTM C 629 - Specification for Slate Dimension Stone.
8. ASTM C 847 - Standard Specification for Metal Lath.
9. ASTM C 1028 - Test method for Determining the Static Coefficient of Friction or Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull meter Method.
10. ASTM D 4397 - Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

C. Tile Council of North America (TCNA): TCA Handbook for Ceramic Tile Installation, 2007.

1.4 DEFINITIONS

- A. Module Size: Actual tile size plus joint width indicated.
- B. Face Size: Actual tile size, excluding spacer lugs.

1.5 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: Tile on walking surfaces shall be provided with the following values as determined by testing in conformance with ASTM C 1028.
 - 1. Level Surfaces: Minimum of 0.6 (Wet).
 - 2. Step Treads: Minimum of 0.6 (Wet).
 - 3. Ramp Surfaces: Minimum of 0.8 (Wet).

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Credit IEQ 4.1: Manufacturers' product data for adhesives and sealants, including printed statement of VOC content.
 - 2. Credit IEQ 4.3: Manufacturers' product data for tile floors, documentation from an independent testing agency indicating compliance with the FloorScore Standard.
 - 3. Credit IEQ 4.3: Manufacturers' product data for tile setting adhesives, including printed statement of VOC content.
 - 4. Laboratory Test Reports for Credit IEQ 4: For adhesives, sealants and tile flooring systems, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- D. Samples for Verification:
 - 1. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
 - 2. Full-size units of each type of trim and accessory for each color and finish required.
 - 3. Stone thresholds in 6-inch lengths.
 - 4. Metal edge strips in 6-inch lengths.
- E. Qualification Data: For Installer.
- F. Material Test Reports: For each tile-setting and -grouting product.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. Stone thresholds.
 - 2. Waterproofing.
 - 3. Joint sealants.
 - 4. Metal edge strips.
- D. Installer Qualifications: Installer shall have a minimum of five (5) years experiencing in the installation of similar products.
- E. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
- G. Mockups:
 - 1. Provide substrate preparation mockups in 10'x10' size for Architect's review and approval. (See drawings for size and location)
 - 2. The contractor shall not proceed with installation until the required mockup has been approved by Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquid additives in unopened containers and protected from freezing.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:

1. DalTile Corporation, Dallas, TX.
2. American Olean Tile Co., Dallas, TX.
3. Terra Green Ceramics, Richmond, IN.
4. Or equal.

- B. Basis of Design: DalTile, Dallas, TX.

- C. Tile Types:

1. Ceramic Floor Tile, 2" x 2":
 - a. Dal-Tile Corp: "Keystones" series. See Ceramic Tile Detail sheets for patterns.
2. Ceramic Wall Tile, 4 1/4" x 12 3/4":
 - a. Dal-Tile Corp: Linear Color Wheel, Semi-Gloss, Modern Dimensions, Festiva series. See Ceramic Tile Detail sheets for patterns.
3. Ceramic Wall Tile, 4 1/4" x 4 1/4":
 - a. Dal-Tile Corp: : Linear Color Wheel, Semi-Gloss, Modern Dimensions, Festiva series. See Ceramic Tile Detail sheets for patterns.
4. Ceramic Wall Tile, 1.5" Hexagon Mosaic:
 - a. Dal-Tile Corp: : Color Wheel Mosaic. See Ceramic Tile Detail sheets.

- D. Color Schedule: Preliminary color selection upon approval during construction.

1. Daltile Floor Tile:
 - a. CMT-1 = DESERT GRAY SPECKLE #D200
 - b. CMT-2 = MARBLE #D235
 - c. CMT-3 = SUEDE GRAY SPECKLE #D208
 - d. CMT-4 = NAUTICAL BLUE #D621
 - e. CMT-5 = NAVY SPECKLE #D209
 - f. CMT-6 = PEPPER WHITE #D037

- g. CMT-7 = AQUA GLOW #D197
 - h. CMT-8 = OCEAN BLUE #D159
- 2. Daltile Wall Tile 4 1/4" x 12 7/8":
 - a. CT-1 = BISCUIT K175
 - b. CT-2 = MATTE BISCUIT K775
 - c. CT-3 = ARCHITECTURAL GRAY 0109
 - d. CT-4 = DESERT GRAY X114
- 3. Daltile Wall Tile 4 1/4" x 4 1/4":
 - a. CT-5 = BISCUIT K175
 - b. CT-6 = MATTE BISCUIT K775
 - c. CT-7 = ARCHITECTURAL GRAY 0109
 - d. CT-8 = DESERT GRAY X114
 - e. CT-9 = NAVY K189
 - f. CT-10 = SEA BREEZE 1174
 - g. CT-11 = OCEAN BLUE 1049
 - h. CT-12 = ARCTIC WHITE 0190
- 4. Daltile Wall Tile 1.5" Hexagon Mosaic
 - a. CT-13 = BISCUIT K175

2.2 TRIM AND ACCESSORIES

- A. Pre-fabricated Trim and Profiles. Acceptable products are Schluter, Blanke Corporation, Ceramic Tool Company or equal.
 - 1. Schluter "RONDEC" – Continuous Trim:
 - a. Open edges of wall tile.
 - b. Expansion and control joints on wall.
 - c. Outside corners
 - d. Double-leg outside corners
 - 2. Schluter "JOLLY":
 - a. Open edges of wall tile.
 - b. Expansion and control joints on wall.
 - c. Outside corners
 - d. Double-leg outside corners
 - 3. Schluter DILEX-HKU
 - a. Open edges of wall tile.
 - b. Expansion and control joints on wall.
 - c. Outside corners.
 - d. Double-leg outside corners.

- B. Stone Thresholds: Provide stone thresholds uniform in color and finish and fabricated as follows:
 - 1. Material:
 - a. Marble complying with ASTM C 503.
 - 2. Color/Finish: selected by Architect from the manufacturer's standard range.
 - 3. Size:
 - a. Unless otherwise indicated on Drawings, fabricate threshold with width matching the door frame depth by full width of frame opening; 5/8 inch thick; with single or double Hollywood Handicap bevel on top side(s) as indicated on Drawings; without holes, cracks, or open seams.
 - 4. Provide to provide transition between tile surface and adjoining finishes and at the following locations:
 - a. At open edges of floor tile where adjacent finish is a different height.

2.3 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 - 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
 - 3. Large Format Tiles are defined as more than 12 inches in any nominal dimension.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
- E. Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes selected from manufacturer's standard shapes.
- F. Fabric-Reinforced, Fluid-Applied Waterproofing and Crack Suppression Membrane: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and fabric reinforcement.
 - 1. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane with fabric reinforcing.

2. LATICRETE International Inc.; Laticrete Hydroban Waterproof Membrane with fabric reinforcing.
 3. MAPEI Corporation; Aqua Defense with fabric reinforcing.
 4. Summitville Tiles, Inc.; S-9000 with fabric reinforcing.
- G. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- H. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik, Inc.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - e. Summitville Tiles, Inc.
 - f. TEC; a subsidiary of H. B. Fuller Company.
 2. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
- I. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Bostik, Inc.
 - c. Custom Building Products.
 - d. Laticrete International, Inc.
 - e. MAPEI Corporation.
 - f. Summitville Tiles, Inc.
 - g. TEC; a subsidiary of H. B. Fuller Company.
 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- J. Polymer-Modified Tile Grout: ANSI A118.7.
1. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
 - a. Unsanded grout mixture for joints 1/8 inch and narrower.
 - b. Sanded grout mixture for joints 1/8 inch and wider.

- K. Joint Grout, Epoxy Type: Provide chemical resistant, water cleanable, tile grouting epoxy, conforming to ANSI A118.3, as follows:
 - 1. Available Product: Laticrete SpectraLock Pro Grout.
 - 2. Colors: A selection of at least fourteen standard colors plus black, white, and natural must be available for Architect's selection.
- L. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- M. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

2.4 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated. Comply with applicable requirements in Section 079200 - JOINT SEALANTS.
 - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
 - 1. Available Products:
 - a. Custom Building Products; 100 Silicone Caulk.
 - b. Dow Corning Corporation; Dow Corning 786.
 - c. GE Silicones; Sanitary 1700.
 - d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - e. Tremco, Inc.; Tremsil 600 White.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
 - 1. Available Products:
 - a. Bostik; Chem-Calk 550.
 - b. Tremco, Inc.; Vulkem 245.
 - c. Pecora Corporation; NR-200 Urexpan.
 - d. Tremco, Inc.; THC-900.

2.5 ANTI-FRACTURE MEMBRANE

- A. Fluid applied anti-fracture membrane: Complying with German national standard (DIN18156, part 2), and STM C627 classification "Extra Heavy". Two component liquid rubber membrane used with 20 mil thick flexible polyvinyl chloride sheeting reinforcing material. Acceptable products include:
1. Waterproof membrane shall be resistant to urine, dilute acid, alkali, sugar, brine, and food waste products.
 2. All materials shall be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured.
 3. Waterproofing ,crack suppression & anti-fracture membranes shall meet the following physical requirements:
 - a. Water Permeability: (at 30ft.hydro/0.9 atmos/91.2kPa)Nil
 - b. Elongation at break (ASTM D-751): 40%
 - c. Service Temperatures: -20[°]to+280[°]F(-28[°]to +137[°]C)
 - d. Tensile breaking strength: 2950psi (20.4MPa;207kg/cm²)
 - e. Bond strength to concrete: 350psi (2.4MPa;24kg/c
 - f. Resistance to chemicals (90 day immersion):
 - 1) Brine solution Not Affected
 - 2) Sugar solution Not Affected
 - 3) Milk Not Affected
 - 4) 10% Acid Not Affected
 - 5) 10% Alkali Not Affected
 - 6) Toluol Softens
 - 7) Urine Not Affected
 - g. Rubber solvents or keytones Not Recommended
 - h. Calcium chloride Excellent
 - i. Aromatic solvents Not Recommended
 - j. Floor Tile Installation Evaluation (ASTM C627-81) 900 cycles
 - k. Service Rating (TCA) Extra Heavy Duty
 4. Acceptable products include:
 - a. Mapei product: "Planicrete W" (urethane based).
 5. Laticrete product "Laticrete 9235 Waterproofing" (non-solvent based).) or LATICRETE Hydroban Waterproofing

2.6 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
 - 2. Verify that required floor-mounted utilities are in correct location.
 - 3. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 4. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 - 5. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Base course at corridors is required to be scribed to provide an even joint pattern on walls.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 - JOINT SEALANTS.
- H. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.
 - 2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

- B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
- C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 INSTALLATION OF CONTROL JOINTS

- A. General: Provide control joints as recommended by tile manufacturer, where indicated on the Drawings, and as directed by the Architect. Where not indicated, provide joints per the following:
 - 1. Interior tilework: 24 to 36 feet in each direction, except where exposed to direct sunlight or moisture.
 - 2. Interior tilework: exposed to direct sunlight or moisture: 12 to 16 feet in each direction.
 - 3. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, and where changes occur in substrate materials.
 - 4. At joint between wall and ceilings.
 - 5. As continuation of expansion joints, control joints, and seismic joints in the building structure which also occur in tile areas.
- B. Locations: Verify exact locations of joints with Architect prior to commencing tile installation.
- C. Control joints:
 - 1. Form control joints neat, straight, and uniformly wide equal to width of normal tile joint. Cut tile neatly and to accurate radius at exposed junction with pipes, and similar items.
 - 2. Extend control joints full thickness of tile, setting bed and reinforcing.
 - 3. Keep open joints free of grout and debris until filled with sealant and backing.

3.6 FLOOR TILE INSTALLATION

- A. General: Install in accordance with ANSI A108.5, and similar to TCA installation method number F122, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Setting materials:
 - 1) Membrane: Anti-fracture membrane (DIN18156, part 2).
 - 2) Bonding coat: Latex modified Portland cement (ANSI A118.4).
 - 2. Grout materials: Acrylic modified Portland cement sanded grout (ANSI A118.6).
- B. Install liquid applied waterproofing membrane with reinforcing as recommended by manufacturer over entire tile substrate area.
- C. Install latex/portland cement mortar bed over cured waterproof membrane to a nominal thickness of 3/32 inch.
- D. Grouting:

1. Allow tile to fully set prior to grouting; do not grout in less than 48 hours after installation of tile.
 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.
- E. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.
- F. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.7 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
1. Glass Wall Tile Installation: Comply with tile manufacturer's recommendations for setting beds and grouts.
 2. Large Format Wall Tile Installation: Comply with tile manufacturer's recommendations for setting beds and grouts.
- a. Substrate Tolerances: Do not exceed 1/8 in. in 10 ft. and 1/16 in. in 2 ft.

3.8 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed. After seven days, cover areas subject to construction traffic with heavy cardboard.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.9 TILE INSTALLATION SCHEDULE

- A. This schedule refers to Tile Installation Methods specified in the TCNA Manual.
- B. Floor Tile Installation Method FT-1: Interior floor installation on concrete; cement mortar bed (thickset) bonded to concrete; TCA F112 and ANSI A108.1A.
 - 1. Thick-Set Mortar.
 - 2. Grout: Polymer-modified unsanded grout.
 - 3. Joint Width: 1/16 inch.
- C. Floor Tile Installation Method FT-2: Interior floor installation on concrete; thin-set mortar; TCA F113 and ANSI A108.5.
 - 1. Thin-Set Mortar: Latex-portland cement mortar.
 - 2. Grout: Polymer-modified unsanded grout.
 - 3. Joint Width: 1/16 inch.
- D. Floor Tile Installation Method FT-3: Interior floor installation on concrete; thin-set mortar, epoxy grout; TCA F115 and ANSI A108.5.
 - 1. Thin-Set Mortar: Latex-portland cement mortar.
 - 2. Grout: Chemical-resistant, water-cleanable, tile-setting and -grouting epoxy.
 - 3. Joint Width: 1/8 inch.
- E. Floor Tile Installation Method FT-4: Interior floor installation on waterproof membrane over concrete; thin-set mortar; TCA F122 and ANSI A108.5.
 - 1. Thin-Set Mortar: Latex-portland cement mortar.
 - 2. Grout: Polymer-modified unsanded grout.
 - 3. Joint Width: 1/16 inch.
- F. Wall Tile Installation Method WT-1: Interior wall installation over sound, dimensionally stable masonry or concrete; thin-set mortar; TCA W202 and ANSI A108.5.
 - 1. Thin-Set Mortar: Latex-portland cement mortar.
 - 2. Grout: Polymer-modified unsanded grout.
 - 3. Joint Width: 1/16 inch.
- G. Wall Tile Installation Method WT-2: Interior wall installation over cementitious backer units; thin-set mortar; TCA W244C and ANSI A108.5.
 - 1. Thin-Set Mortar: Latex-portland cement mortar.
 - 2. Grout: Polymer-modified unsanded grout.
 - 3. Joint Width: 1/16 inch.
- H. Wall Tile Installation Method WT-3: Interior wall and shower-receptor installation over cementitious backer units; thin-set mortar; TCA B415, TCA W244, and ANSI A108.5.
 - 1. Thin-Set Mortar: Latex-portland cement mortar.
 - 2. Grout: Polymer-modified unsanded grout.

3. Joint Width: 1/16 inch.

END OF SECTION

SECTION 093019

PORCELAIN TILE

(Part of Work of Section 090002 - TILE, Trade-Bid Required)

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Furnish and install the following:
 - 1. Porcelain floor tile.
 - 2. Porcelain wall tile.
 - 3. Porcelain tile base and associated trim.
 - 4. Porcelain stair riser and treads tiles and nosing.
 - 5. Installation systems, adhesives, mortars and grouts.
 - 6. Sealant and backing materials for control joints within tiled areas, around all items which penetrate the tiled wall and floor surfaces, and between tile and intersecting dissimilar surfaces and items.
 - 7. Preparation of control joints to receive sealant in tiled work.
 - 8. Anti-fracture membrane.
- B. Perform drilling and cutting in tile surfaces, as required to accommodate penetrating items of other trades, from templates and instructions furnished by the respective trades.
- C. Substrate preparation.
- D. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Division 3 Section "Cast-In-Place Concrete": for concrete slab and floor substrates.
 - 2. Division 9 Section "Ceramic Tile": for mosaic floor tile and ceramic wall tile, and related work.
 - 3. Division 9 Section "Quarry Tile": for quarry floor tile and related work.
 - 4. Division 09 Section "Rubber Tile".
 - 5. Division 09 Section "Carpet".
 - 6. Division 09 Section "Vinyl Composition Tile".
 - 7. Division 09 Section "Vapor Mitigation at Slabs"

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Division 1 Section "References".
- B. ANSI:
 - 1. ANSI A108 Series/A118 Series - American National Standards for Installation of Ceramic Tile.
 - 2. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.
- C. TCNA (HB) - Handbook for Ceramic, Glass and Stone Tile Installation; Tile Council of North America.
- D. ISO 13007 - International Standards Organization; classification for Grout and Adhesives.

1.5 SUBMITTALS

- A. Submit the following under provisions of Division 1 Section "Submittal Procedures".
 - 1. Product data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Include maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
 - 2. Selection samples:
 - a. Manufacturer's sample boards for each type and color group of tile specified, grout colors, and sealant colors, for selections by the Architect.
 - 3. Verification samples:
 - a. Mount tile and apply grout on one 32 by 32 inch, or 36 by 36 inch sized cement backer board, for each tile type and selected color, to indicate color and texture variations, tile flatness and joint size variations.
 - b. Trim shapes and base, in selected colors in types and shapes indicated for project conditions.
 - c. Granite threshold, 12 inch long samples in shaped profile.
 - 4. Grade Certificates: Manufacturer's Master Grade Certificates submitted prior to shipment of tile to project.
- B. LEED Submittal – refer to Division 1 Section "LEED Documentation Requirements".
 - 1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
 - 2. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project.
 - 3. LEED Action Plans: Provide preliminary submittals indicating how the following requirements will be met:
 - a. Waste management plan complying with Division 1 Section "Construction Waste Management."
 - b. List of proposed materials with recycled content.
 - c. List of proposed regionally manufactured materials and/or regionally extracted, harvested, or recovered materials.

1.6 QUALITY ASSURANCE

- A. Conform to ANSI/TCA A 137.1 and TCA Handbook for Ceramic Tile Installation.

- B. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
 - C. Tiles delivered to the job or installed in the work which do not fall within the accepted color and texture range demonstrated by the samples shall be removed from the site and replace with acceptable materials.
 - D. Installation materials: Materials must be compatible and from one source, single source responsibility for waterproofing, installation, Mortars and grouts. Job-site mixtures of sand Portland cement and site dilution of additives shall not be permitted.
- 1.7 DELIVERY, STORAGE AND HANDLING
- A. Deliver tile in manufacturer's sealed cartons, grade-sealed by the manufacturer in accordance with ANSI A 137.1, with grade-sealed unbroken, and clearly marked as to contents, color, and quantity.
 - B. Store and protect containers above floor level, keep dry until ready for use.
 - C. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.
- 1.8 ENVIRONMENTAL CONDITIONS
- A. Do not install setting or grouting materials in a closed, unventilated environment. Ventilate propane or fossil fuel heaters to prevent damage to tile work from carbon-dioxide build up.
 - B. Maintain ambient temperatures between 50 (10° C) and 80 (26° C) degrees Fahrenheit in tiled areas, during installation of mortar materials and for 7 days after completion.
 - 1. When temperature of substrate exceeds 90 (32° C) degrees Fahrenheit, contact manufacturer for instructions.
- 1.9 SEQUENCING AND SCHEDULING
- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- 1.10 WARRANTY
- A. Provide 2 year, non pro-rated warranty under provisions of Section 01780 - CLOSEOUT SUBMITTALS. Extended warranty shall provide for cracking, breakage or failure of tile due to defective workmanship.
 - 1. Materials must be compatible and from one source, single source responsibility for waterproofing, installation, mortars and grouts. Job-site mixtures of sand Portland cement and site dilution of additives shall not be permitted.
 - B. Special Warranty: The Contractor warrants the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period of 5 years. This special warranty extends the period of limitations contained in the General Conditions. Have the warranty countersigned by the installer and manufacturer.
 - C. The manufacturer of installation systems, adhesives, grouts and mortars shall provide a comprehensive non pro-rated written twenty five(25) year systems warranty against

defective products which covers replacement materials and labor costs for demolition, tile accessories, and installation systems.

1. Warranty to provide for tile lifting or separation from substrate, and setting bed/grout deterioration, when products have been installed with referenced TCA setting systems using specified setting and grout materials.

- D. Provide 2 year, non pro-rated warranty under provisions of Division 1 Section "Closeout Submittals". Extended warranty shall provide for cracking, breakage or failure of tile due to defective workmanship.

1.10 PRE-INSTALLATION CONFERENCE

- A. Pre-installation conference: At least three weeks prior to commencing the work attend a meeting at the jobsite to discuss conformance with requirements of specification and job site conditions. Representatives of owner, architect, general contractor, tile subcontractor, Tile Manufacturer, Installation System Manufacturer and any other parties who are involved in the scope of this installation must attend the meeting.

1.11 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra materials in, an amount equal to 3 percent of tile and trim of each color, finish and type installed.
- B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 FLOOR TILE

- A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:
 1. Daltile Corp.
 2. Crossville Inc.
 3. Porcelanosa USA
- B. Basis of Design: Preliminary color selection upon approval during construction.
 1. PP-1: Daltile "Imagica", Haze IG97
 2. PP-2: Daltile "Imagica", Cosmo IG96
 3. PP-3: Daltile "Imagica", Midnight IG98
- C. Size: nominal 12 by 24 inches and 6 by 48 inches.
- D. Thickness: 3/8"
- E. Recommended Joint Width: 1/8"
- F. Tile Pattern: As indicated on Drawings

G. Special Shapes: As indicated on Drawings

H. Location: As indicated on Drawings

2.2 WALL TILE

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:

1. Porcelanosa USA
2. Daltile Corp.
3. Atlas Concorde

B. Basis of Design: Preliminary color selection upon approval during construction.

1. PWT-1: Porcelanosa USA, Deco Boston Topo 100179275 - P34708431 Size: 12"x35"
2. PWT-2: Porcelanosa USA, Boston Topo 100179290 - P34708451 Size: 12"x35"
3. PWT-3: Porcelanosa USA, Cubia Silver 100144348 - V14400261 Size: 13"x40"
4. PWT-4: Daltile "Chord", Canon Grey CH22 - Satin Size: 24x48

C. Thickness: 3/8"

D. Recommended Joint Width: 1/16"

E. Tile Pattern: As indicated on Drawings

F. Special Shapes: As indicated on Drawings

G. Location: As indicated on Drawings

2.3 STAIR TREADS AND RISERS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:

1. Daltile Corp.
2. Crossville Inc.
3. Porcelanosa USA

B. Basis of Design: Basis of Design: Preliminary color selection upon approval during construction.

1. PP-4: Daltile "Chord", Canon Grey CH22 - Unpolished
2. PP-5: Daltile "Chord", Rhythm Brown CH23 - Unpolished

C. Size: nominal 12 by 24 inches.

D. Thickness: 3/8"

E. Recommended Joint Width: 1/8"

F. Location: As indicated on Drawings

2.2 SETTING MATERIALS

A. Waterproofing areas exposed to water:

Acceptable products:

1. Hydroban, Manufactured by LATICRETE International, inc.
2. 8+9, Manufactured by Ardex Americas
 - a. Waterproofing Membrane to be thin, cold applied, single component liquid and load bearing. Reinforcing fabric to be non-woven rot-proof specifically intended for waterproofing membrane. Waterproofing Membrane to be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured. It shall be certified by IAPMO and ICC approved as a shower pan liner and shall also meet the following physical requirements:
 - b. Hydrostatic Test (ASTM D4068): Pass
 - c. Elongation @ break (ASTM D751): 20-30%
 - d. System Crack Resistance (ANSI A118.12): Pass (High)
 - e. 7 day Tensile Strength (ANSI A118.10): >265 psi (1.8 MPa)
 - f. 7 day Shear Bond Strength (ANSI A118.10) >200 psi (1.4 MPa)
 - g. 28 Day Shear Bond Strength (ANSI A118.4): >214 psi (1.48 – 2.4 MPa)
 - h. Service Rating (TCA/ASTM C627): Extra Heavy
 - i. Total VOC Content: < 0.05 mg/m³

B. Anti-Fracture Membrane:

Acceptable products:

1. Hydroban, Manufactured by LATICRETE International, inc
2. Planicrete W (urethane based), Manufactured by Mapei
3. 8+9, Manufactured by Ardex Americas
 - a. Membrane to be thin, cold applied, single component liquid and load bearing. Reinforcing fabric (if required or used) to be non-woven, rot-proof specifically intended for crack suppression membrane. Materials to be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured. Crack Suppression Membrane shall also meet the following physical requirements:
 - b. Elongation @ break (ASTM D751): 20-30%
 - c. System Crack Resistance (ANSI A118.12) Pass (High)
 - d. 7 day Tensile Strength (ANSI A118.10): 265 – 300 psi (1.8 – 2.0 MPa)
 - e. 7 day Shear Bond Strength (ANSI A118.10) 200 – 275 psi (1.4 – 1.9 MPa)
 - f. 28 Day Shear Bond Strength (ANSI A118.4): >214 – 343 psi (1.48 – 2.4 MPa)
 - g. Service Rating (TCA/ASTM C627): Extra Heavy
 - h. Total VOC Content: < 0.05 mg/m³

C. Non-Sag Thinset Mortar (all wall Tile installations):

Acceptable product:

1. 255 MultiMAX thinset Mortar, Manufactured by LATICRETE International, inc.
2. Ultra light, Manufactured by Mapei

3. Full Flex, Manufactured by TEC
 4. X77, Manufactured by Ardex Americas
 - a. Non sag, Latex Portland Cement Thin Bed Mortar for thin set and slurry bond coats to be weather, frost, shock resistant, non-flammable and meet the following physical requirements:
 - b. Shear Bond to Porcelain (ANSI A118.4): >300 psi (17.2 MPa)
 - c. Smoke & Flame Contribution (ASTM E84 Modified): 0
 - d. ISO 13007-2 4.4.4 >1MPa (145psi)
 - e. Sag on walls (EN 1308) <0mm
 - f. Total VOC Content: < 0.05 mg/m³
- D. Medium Bed Thinset Mortar (all Floor Tile installations over 12" x 16"):
Acceptable products:
1. 220 Marble and Granite Mortar gauged with 333 Superflexible Admix, Manufactured by LATICRETE International, inc.
 2. X77, Manufactured by Ardex Americas
 - a. Latex Portland Cement Thin Bed Mortar for thin set and slurry bond coats to be weather, frost, shock resistant, non-flammable and meet the following physical requirements:
 - b. Shear Bond to Porcelain (ANSI A118.4): >400 psi (17.2 MPa)
 - c. Compressive Strength (ANSI 118.4) >3600 psi (24.8MPa)
 - d. Bond strength (ANSI A118.4): >500 psi (3.1 MPa)
 - e. Smoke & Flame Contribution (ASTM E84 Modified): 0
 - f. ISO 13007-2 4.4.4 >1MPa (145psi)
 - g. Total VOC Content: < 0.05 mg/m³
- E. Self Leveling:
Acceptable products:
1. 86 Self Leveling Underlayment, Manufactured by LATICRETE International, inc.
 2. Smooth Start, Manufactured by Tec
 3. Ultraplan MB with Primer UP, Manufactured by Mapei
 - a. Self-Leveling Underlayment shall be mixed with water to produce a pumpable, fast setting, free flowing cementitious underlayment which can be poured from a feather-edge to 1 ½" (38mm) thick in one pour.
 - b. 4 Hour Compressive Strength (ANSI A118.4 Mod.): >1500 psi (10.3MPa)
 - c. 1 Day Compressive Strength (ANSI A118.4 Mod.): >2800 psi (19.3MPa)
 - d. 28 Day Compressive Strength (ANSI A118.4 Mod.): >4300 psi (29.7MPa)
 - e. Tensile Strength (ANSI A118.7) : >500 psi (3.5MPa)
 - f. Time To Foot Traffic: 3 – 4 Hours
 - g. Total VOC Content: < 0.05 mg/m³

2.5 GROUTING MATERIALS

- A. Epoxy Grout:
1. SpectraLOCK Pro, Manufactured by LATICRETE International, inc.
 2. 100% Solids Mortar and Grout, Manufactured by Tec
 3. Kerapoxy, Manufactured by Mapei

4. WA Epoxy, Manufactured by Ardex Americas
- B. Epoxy Grout (Commercial/Residential) shall be non-toxic, non-flammable, non-hazardous during storage, mixing, application and when cured and shall meet the following physical requirements:
 1. Compressive Strength (ANSI A118.3): 3500 psi (24 MPa)
 2. Shear Bond Strength (ANSI A118.3): 1000 psi (6.9 MPa)
 3. Tensile Strength (ANSI A118.3): 1100 psi (7.6 MPa)
 4. Thermal Shock (ANSI A118.3): >500 psi (3.5 MPa)
 5. Water Absorption (ANSI A118.3): < 0.5 %
 6. Vertical Joint Sag (ANSI A118.3): Pass
 7. Total VOC Content: < 0.05 mg/m³
 8. Cured Epoxy Grout to be chemically and stain resistant to ketchup, mustard, tea, coffee, milk, soda, beer, wine, bleach (5% solution), ammonia, juices, vegetable oil, brine, sugar, cosmetics, and blood, as well as chemically resistant to dilute acids and dilute alkalis.

2.6 TRIM AND ACCESSORIES

- A. Prefabricated Trim Profiles:
 1. Manufacturers:
 - a. Schluter Systems L.P.
 - b. Blanke Corp.
 - c. Ceramic Tool Company, Inc.
 2. Continuous edge trim: Profile with square visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer
 - a. Basis of design: "QUADEC" as manufactured by Schluter Systems L.P.
 - b. Corners: Provide with matching inside corners, outside corners, and internal connectors.
 - c. Material and Finish: Brush Chrome Anodized Aluminum.
 3. Transition Profiles: Profile with sloped exposed surface, 5/32" (4mm) tall leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - a. Basis of design: "RENO-U" as manufactured by Schluter Systems L.P.
 - b. Material and Finish: Brushed Stainless Steel.
 - c. Height: Height as required.
 4. Movement and Expansion Joints: Extruded aluminum, or extruded rigid PVC profile, joined by a soft CPE movement joint material, thermoplastic rubber insert or metal interface. Profile includes integral perforated anchoring legs with trapezoidal openings.
 - a. Basis of design: "DILEX" series profiles as manufactured by Schluter Systems L.P.
 - b. Material and Finish: As required.
 - c. Height: As required.

5. Stair Nosings: , roll-formed stainless steel profile with ribbed 1-3/16" wide exposed surface with rounded leading edge, and integrated trapezoid-perforated anchoring leg.
 - a. Basis of design: "TREP-E" series profiles as manufactured by Schluter Systems L.P.
 - b. Material and Finish: As selected by architect.
 - c. Height: As required.
 - d. End Caps: Provide matching end caps.
- B. Joint sealant for general application: Joint Sealer shall be horizontal-self-leveling, 2-component type: Pouring grade self-leveling multi-component urethane sealant, conforming to FS TT-S-000227E, Type I, Class A, and ASTM C 920, with a minimum movement capability of plus minus 25 percent, equal to the following:
 1. Mameco International, Inc., product "Vulkem 245/255".
 2. Sika Corp, Lyndhurst NJ.; product, "Sikaflex 2CSL".
 3. Sonneborn Building Products Inc., Minneapolis MN.; product, "SL2".
 4. Tremco, Beachwood OH.; product, "THC-900".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Verify that all concrete substrates are at least 28 calendar days old, completely cured and free of negative hydrostatic conditions or moisture problems.
- B. Beginning of installation means acceptance of substrate and site conditions.

3.2 PREPARATION

- A. During the operation of work of this Section, protect in-place finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- B. Ensure that all anchors, plugs, electrical and mechanical work to be in or underneath tile have been installed.
- C. Vacuum clean existing substrate surfaces.
- D. Seal concrete substrate cracks with filler; level concrete substrate to acceptable flatness tolerances.
 1. The use of PVA bonding agents or gypsum based leveling materials is prohibited.
- E. Apply conditioner or primer to surfaces as recommended by adhesive manufacturer.

3.3 INSTALLATION - GENERAL REQUIREMENTS

- A. Installation Standards: The American National Standard Specifications for the Installation of Ceramic Tile, 1992 edition (ANSI A108), is hereby made a part of this specification. All work of this Section shall be installed in accordance with the requirements contained in referenced ANSI A108 standards, and as additionally specified below, and in accordance with the manufacturer's specifications of those products used.
- B. Installation Methods: Schedule of substrate conditions, generic type of tile used, with appropriate setting and grouting methods are listed at end of this Section.
 - 1. Use trowel shapes and sizes as recommended by setting materials manufacturer.
 - 2. Clean porcelain tile backs and remove manufacturer's residue.
 - 3. Back-butter tiles as required to provide coverage.
- C. Tile Patterns and types: Tile patterns are shown on the Drawings, if more information is required, obtain the necessary information from the Architect. Do not interrupt tile pattern around openings.
- D. Tile Layout and installation
 - 1. Layout tile on room axis, leaving equal sized border units of not less than one-half tile width.
 - 2. Medium set tile in prepared 1/2" slab recess.
 - 3. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align base and wall joints.
 - 4. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, full without voids, cracks, excess mortar, or excess grout.

3.4 INSTALLATION OF SEALANT AND CONTROL JOINTS

- A. General: Provide control joints where indicated on the Drawings, and as directed by the Architect. Where not indicated, provide joints per the following:
 - 1. Install joints in accordance with TCA EJ-171, which shall have precedence.
 - 2. Interior tilework: 24 to 36 feet in each direction, except where exposed to direct sunlight or moisture.
 - 3. Interior tilework exposed to direct sunlight or moisture: 8 to 12 feet in each direction.
 - 4. Exterior tilework: 8 to 12 feet in either direction.
 - 5. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, and where changes occur in substrate materials.
 - 6. At perimeter walls in rooms and spaces larger than 12 feet on one side.
 - 7. As continuation of expansion joints, control joints, and seismic joints in the building structure which occur in tile areas.
- B. Locations: Verify exact locations of joints with Architect prior to commencing tile installation.
- C. Control joints:
 - 1. Form control joints neat, straight, and uniformly wide equal to width of normal tile joint. Cut tile neatly and to accurate radius at exposed junction with pipes, and similar items.
 - 2. Extend control joints full thickness of tile, setting bed and reinforcing.

- 3. Keep open joints free of grout and debris until filled with backing material and sealant.
- D. Installation of pre-fabricated movement joints: Install per manufacturer's printed instructions and in accordance with EJ-171.
- E. Installation of sealant and backer materials: Perform in accordance with manufacturer's instructions.

3.5 FLOORING INSTALLATION

- A. General: Install in accordance with ANSI A108.5, TCA installation method number F113-02, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Setting materials: (ANSI A118.4).
 - 2. Grout materials: Epoxy grout (ANSI A118.3).
- B. Install TCA uncoupling system as recommended by manufacturer.
- C. Install self-leveling bed as required to provide level substrate.
- D. Install latex modified mortar to a minimum thickness of 3/32 inch.
- E. Install tile ensuring mortar coverage of at least 80 percent on back of tile.
 - 1. Clean porcelain tiles (backs) and remove manufacturer's residue.
 - 2. Back-butter tile to ensure mortar coverage.
- F. Grouting:
 - 1. Allow tile to fully set prior to grouting; do not grout in less than 48 hours after installation of tile.
 - 2. Grout tile joints in accordance with ANSI A108.6 and as additionally specified.

3.6 BASE TILE INSTALLATION - THIN-SET

- A. General: Install in accordance with ANSI A108.5, TCA installation method number W243, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Primer: Synthetic latex emulsion as recommended by mortar manufacturer.
 - 2. Setting materials: Dry-set mortar.
 - 3. Grout materials: Acrylic modified Portland cement (nonsanded) grout (ANSI A118.6).
- B. Concrete masonry unit surfaces, as recommended by mortar manufacturer. Install latex Portland cement mortar bond coat to a thickness recommended by manufacturer. Refer to TCA-W202-02
- C. Grouting:
 - 1. Allow tile to fully set prior to grouting; do not grout in less than 24 hours after installation of tile.
 - 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.7 INSTALLATION - GROUT

- A. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.
- B. Force the maximum amount of the approved grout into joints in accordance with pertinent recommendations contained in ANSI A108.10 and for epoxy grouts, ANSI A108.6.
- C. Fill in joints of cushion-edge tile to depth of the cushion; fill joints of square-edge tile flush with the surface.
- D. Fill all gaps and skips. Do not permit mortar or mounting mesh to show through grouted joints.
- E. Provide hard finished grout that is uniform in color, smooth and without voids, pin holes, or low spots.
- F. Remove all excess grout immediately after installation thereof, wash and rinse tile free from grout film, and tool grout to a uniform density throughout.
- G. Apply approved grout sealer in accordance with manufacturer's instructions.

3.8 REPAIR

- A. Replace cracked chipped, broken, and otherwise defective tiles.
- B. Remove work not complying with requirements of the Contract Documents or the referenced standards, and promptly replace with work that does comply.

3.9 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of mortar, grout, and other materials installed under this Section, and wash completed tile-work.
 - 1. Do not use acid or acid cleaners to clean tile.
 - 2. When tile is thoroughly clean and dry, polish glazed tile with clean dry cloths.

3.10 PROTECTION

- A. Do not permit traffic over finished floor surface until grout and tile materials are fully set, pursuant to manufacturer's written instructions and not less than 72 hours. Protect floor surfaces with heavy red-rosin paper or kraft paper.

3.11 INSTALLATION SCHEDULE – FLOORS

- A. Tile type and field condition: Dry Floors, Porcelain Paver Tile.
 - 1. Substrate condition: Concrete.
 - 2. Installation method: TCA F113-09
 - 3. Waterproofing: TCA Uncoupling System meeting ANSI A118.10

3.12 INSTALLATION SCHEDULE – BASE

- A. Tile type and field condition: Dry Floors, Porcelain Paver Tile.

1. Substrate condition: Concrete Masonry Unit. (CMU)
2. Installation method: TCA W202-09

END OF SECTION

SECTION 095100

ACOUSTICAL CEILINGS

(Part of Work of Section 090003 - ACOUSTICAL TILE, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Acoustical ceiling tiles and panels.
 - 2. Metal ceilings.
 - 3. Custom ceilings.
 - 4. Suspended acoustical clouds.
 - 5. Metal edge moldings and trims.
 - 6. Suspension systems, grid systems and ceiling hangers.
 - 7. Acoustical sealant at edge moldings at acoustical ceilings.
 - 8. Coordination with mechanical and electrical trades to ensure that ceilings layouts are symmetrical and have evenly and consistently spaced ceiling mounted equipment, fixtures, and components.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 092110 - GYPSUM BOARD ASSEMBLIES for gypsum board ceilings and soffits.
 - 2. Division 21 - FIRE SUPPRESSION for fire-suppression components located in ceilings.
 - 3. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for air handling and distribution components located in ceilings.
 - 4. Division 26 - ELECTRICAL for light fixture and alarm system components located in ceilings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For acoustic ceilings, submit product-specific Type III EPDs.
2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 1: For acoustic ceilings, submit corporate sustainability reports (CSR).
 - c. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: For acoustic ceilings, submit evidence of reclamation and recycling programs.
 - 2) Recycled Content: Submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For acoustic ceilings, submit Health Product Declarations (HPD) or Declare product labels.
4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For sealants, submit test results, including TVOC emissions and VOC content.
 - b. For acoustic ceilings, submit GreenGuard Gold certification.
 - c. For wet-applied products, submit volume used.

C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension members.
2. Method of attaching hangers to building structure. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Minimum Drawing Scale: 1/4 inch = 1 foot.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6 inch square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch long Samples of each type, finish, and color.

- E. Asbestos Certification: Manufacturer's written certification that acoustical ceiling products contain no asbestos (0.0000%). Product labels indicating that it is the user's responsibility to test the products for asbestos are unacceptable and sufficient cause for rejection of the product on site.
- F. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Acoustical Ceiling Panels: Obtain each type through one source from a single manufacturer.
 - 2. Suspension Systems: Obtain each type through one source from a single manufacturer.
 - 3. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - 3. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 4. Surface-Burning Characteristics: Provide acoustical panels complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.
- C. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong Ceilings.
 - 2. CertainTeed Ceilings.
 - 3. USG.
- B. Sustainable Design Performance Requirements:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Type III EPD.
 - 2. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
 - 3. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.

2.3 ACOUSTICAL CEILING ASSEMBLIES

- A. General Schedule:
 - 1. Acoustical Suspended Ceilings: Acoustical lay-in panels.
 - 2. Suspended Gypsum Board Ceilings
 - 3. Specialty Suspended Ceilings
 - a. Suspended noise transmission reducing ceiling assemblies at the High Bay Vocational Shops – see details
 - b. Suspended acoustical “clouds” at Auditorium
 - c. Open Mesh Ceiling Panels systems at Auditorium (MCT)
 - d. Suspended Perforated Linear Metal ceiling (LMC) where indicated.

- e. Suspended extruded aluminum vertical blade system (EAVB), suspended from ACT grid above.

4. Ceiling Suspension Components

- a. Suspension Systems.
- b. Suspended Ceiling Sound Isolation; spring and neoprene-type.
- c. Vertical Edge Trim at "clouds" etc. – extruded aluminum

2.4 ACOUSTICAL CEILING PANELS

- A. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:

- 1. Armstrong World Industries
- 2. USG
- 3. Certainteed

B. Acoustical Panels Type ACT-1:

- 1. Surface Texture: Fine
- 2. Composition: Mineral Fiber
- 3. Color: White
- 4. Size: 24IN x 24IN
- 5. Edge Profile: Square Lay-in 15/16" for interface with Prelude XL 15/16" Exposed Tee grid.
- 6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.75.
- 7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35.
- 8. Flame Spread: ASTM E 1264; Class A (UL)
- 9. Light Reflectance White Panel: ASTM E 1477; 0.90
- 10. Dimensional Stability: HumiGuard Plus
- 11. Recycle Content: Post-Consumer - 0% - 1% Pre-Consumer Waste - 75% - 76%
- 12. Acceptable Product: Ultima Square Lay-In, 1910 as manufactured by Armstrong World Industries; or approved equal by USG, or Certainteed.

C. Acoustical Panels Type ACT-2:

- 1. Surface Texture: Fine
- 2. Composition: Mineral Fiber
- 3. Color: White
- 4. Size: 24IN x 24IN
- 5. Edge Profile: FLB 9/16" for interface with Suprafine XL 9/16" Exposed Tee grid.
- 6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.85
- 7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35.
- 8. Flame Spread: ASTM E 1264; Class A (UL)
- 9. Light Reflectance White Panel: ASTM E 1477; 0.86
- 10. Dimensional Stability: HumiGuard Plus

11. Recycle Content: Post-Consumer - 12% Pre-Consumer Waste - 59%
12. Acceptable Product: Calla, Square Tegular 2824 as manufactured by Armstrong World Industries; or approved equal by USG, or Certainteed.

D. Acoustical Panels Type ACT-3:

1. Surface Texture: Fine
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24IN x 24IN
5. Edge Profile: Square Lay-In 15/16" for interface with Prelude Plus XL Fire Guard 15/16" Exposed Tee grid with G60 hot-dip galvanized steel with prefinish.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.80.
7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35.
8. Flame Spread: ASTM E 1264; Class A (UL)
9. Light Reflectance White Panel: ASTM E 1477; 0.86
10. Dimensional Stability: HumiGuard Plus
11. Recycle Content: Post-Consumer - 0% Pre-Consumer Waste - 76%
12. Acceptable Product: Ultima Health Zone High NRC, 1445 as manufactured Armstrong World Industries; or approved equal by USG, or Certainteed.

E. Acoustical Panels Type ACT-4:

1. Surface Texture: Fine
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24IN x 24IN
5. Edge Profile: Square Lay-In 15/16" for interface with Prelude Plus XL Fire Guard 15/16" Exposed Tee grid with G60 hot-dip galvanized steel with prefinish.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.55.
7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35.
8. Flame Spread: ASTM E 1264; Class A (UL)
9. Light Reflectance White Panel: ASTM E 1477; 0.79
10. Dimensional Stability: HumiGuard Plus
11. Recycle Content: Post-Consumer - 0% Pre-Consumer Waste - 76%
12. Acceptable Product: Clean Room FL, 1715 as manufactured by Armstrong World Industries; or approved equal by USG, or Certainteed.

F. Acoustical Panels Type ACT-5:

1. Surface Texture: Fine
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24IN x 72IN
5. Edge Profile: FLB 9/16" for interface with Suprafine XL 9/16" Exposed Tee grid.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.80

7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35.
8. Flame Spread: ASTM E 1264; Class A (UL)
9. Light Reflectance White Panel: ASTM E 1477; 0.88
10. Dimensional Stability: HumiGuard Plus
11. Recycle Content: Post-Consumer - 1% Pre-Consumer Waste - 75%
12. Acceptable Product: Ultima High NRC, 1437 as manufactured by Armstrong World Industries; or approved equal by USG, or Certainteed .

G. Acoustical Panels Type ACT-6:

1. Surface Texture: Fine
2. Composition: Mineral Fiber
3. Color: Tech Black
4. Size: 24IN x 24IN
5. Edge Profile: Square Lay-in 15/16" for interface with Prelude XL 15/16" Exposed Tee grid.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.85
7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35.
8. Flame Spread: ASTM E 1264; Class A (UL)
9. Dimensional Stability: HumiGuard Plus
10. Recycle Content: Post-Consumer - 1% Pre-Consumer Waste - 73%
11. Acceptable Product: Calla, 2820 as manufactured by Armstrong World Industries; or approved equal by USG, or Certainteed .
12. Acceptable Product: MetalWorks, 6461M1 as manufactured by Armstrong World Industries; or approved equal by USG, or Certainteed.

2.5 METAL CEILINGS

A. Acoustical Panels Type MCT-1:

1. Surface Texture: Smooth
2. Composition: Metal
3. Color: White
4. Size: 24IN x 24IN
5. Edge Thickness: 2 1/4"
6. Edge Profile: Flush Tegular 15/16" for interface with Prelude XL 15/16" Exposed Tee Grid.
7. Noise Reduction Coefficient (NRC): 0
8. Profile Detail: Flat
9. Flame Spread: ASTM E 1264; Class A
10. Light Reflectance White Panel: ASTM E 1477; 0.77
11. Recycled Content: Post-Consumer -0% Pre-Consumer Waste - 25%

B. Ceiling Panel Type MCT-2A:

1. Basis of Design: Armstrong MetalWorks Mesh – Welded Wire
2. Surface Texture: Smooth
3. Composition: Metal

4. Color: Copper (Preliminary color selection upon approval during construction.)
5. Size: 24IN x 24 IN
6. Edge Profile: Square Lay-In 15/16 in for interface with Prelude XL 15/16" Exposed Tee Grid.
7. Perforation Option: 3 Cell Welded
8. Flame Spread: ASTM E1264; Non-Combustible.
9. Recycle Content: Post-Consumer – 0% Pre-Consumer-25%
10. Acceptable Product: MetalWorks Mesh - Welded Wire, 6133AM No added formaldehyde as manufactured by Armstrong World Industries, or approved equal by CertainTeed or USG.

C. Ceiling Panel Type MCT-2B:

1. Basis of Design: MetalWorks Mesh – Welded Wire with Armstrong Infusion Lay-in Panels over the mesh panels.
2. Surface Texture: Smooth
3. Composition:
 - a. MetalWorks Mesh: Metal
 - b. Infusion: Polycarbonate
4. Color: Preliminary color selection upon approval during construction.
 - a. MetalWorks Mesh: Copper
 - b. Infusion: To be determine by Architect from the Manufacturer's full range of colors
5. Size: 24IN x 24 IN
6. Edge Profile: Square Lay-In 15/16 in for interface with Prelude XL 15/16" Exposed Tee Grid.
7. Perforation Option: 3 Cell Welded (MetalWorks Mesh only)
8. Flame Spread: ASTM E1264; Non-Combustible.
9. Acceptable Product: MetalWorks Mesh - Welded Wire, 6128AM with Infusions Lay-in, 5915 as manufactured by Armstrong World Industries, or approved equal by CertainTeed or USG.

D. Ceiling Panel Type LMC-1:

1. Basis of Design: Armstrong MetalWorks Linear
2. Surface Texture: Smooth
3. Composition: Metal
4. Color: Dark Cherry FXDC (Preliminary color selection upon approval during construction.)
5. Size: 12IN x 96IN
6. Edge Profile: Square with extended flange
7. Perforation Option: Microperforated, Round-Diagonal
8. Sabin: N/A
9. Flame Spread: ASTM E 1264; Class A (FM)
10. Recycle Content: Post-Consumer – 0% Pre-Consumer-25%
11. Acceptable Product: METALWORKS Linear, 5571 No added formaldehyde as manufactured by Armstrong World Industries or approved equal by CertainTeed or USG

E. Metal Baffles Ceiling Type MBC: Provide MetalWorks Blades – Classics as manufactured by Armstrong World Industries, Inc.; or approved equal by USG, or CMC, LLC.

1. Surface Texture: Smooth
2. Composition: Metal

3. Color: To be determine by Architect from the manufacturer's full range of colors including RAL colors.
4. Size: 12" High x 2" Thick
5. Perforation Option: M15 Round - Diagonal
6. Sabin: ASTM C 423; 2.5
7. Flame Spread: ASTM E 1264; Class A (HPVA).
8. Light Reflectance (LR) White Panel: ASTM E 1477; 0.77.
9. Dimensional Stability: Standard, HumiGuard Plus.
10. Recycle Content: 98%
11. Acceptable Product: METALWORKS Blades – Classics Custom Size VP500, no added formaldehyde as manufactured by Armstrong World Industries.
12. Suspension System: Prelude XL, painted 360 degrees
13. Metal Panel Accessories:
 - a. MetalWorks Blades Attachment Clip
 - b. MetalWorks Blades Alignment Device
 - c. MW Blades – 2" Thick Field Cut End Cap

F. Extruded Aluminum Vertical Blade (EAVB) Ceiling System: Blade Components (applied in ceiling areas designated as EAVB).

1. Basis of design: "Fin Mate III" by Gordon Inc.
2. Blades Sizes and Spacing
 - a. EAVB-8: Shall be 8" deep and spaced every 6" O.C.
 - b. EAVB-12: Shall be 12" deep and spaced every 8" O.C.
3. Blades are attached to EAVB Grid and must be compatible with the EAVB Grid.
4. Finish: Power Coat. Color to be selected by Architect from full range of standard colors.

2.6 CUSTOM CEILINGS

A. Ceiling Panel Type CP-1:

1. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
 - a. Sky Acoustics Inc.
 - b. Clipso Americas.
 - c. Decoustic
2. Basis of Design: Sky Acoustics Inc. Custom Supercluster Acoustical Ceiling Panel.
 - a. Suspended pre-fabricated Acoustical Panels Panel Type: 1-1/8" thick Curved/Shaped Acoustical Ceiling Panel with "6 high curved and straight perimeter design return.
3. Panel Sizes: As indicated on drawings

4. Panel Composition: 1" (25mm Medium Density 6-7 PCF (96 – 112 KCM) Fiberglass Core + 1/16" (2mm) High Density 16 – 20 PCF (256 – 320 KCM) fiberglass layer laminated to the face + back + coated veil finish laminated to face and back of panel.
5. Approximate Panel Weight: 0.87 PSF (4.25 KSM) - based on 4'x8'x1 1/8" (1.22m x 2.44m x 28mm) panel size – coated finish.
6. Nominal Thickness: 1 1/8 (28mm) – coated finish
Other thicknesses available: 2 1/4" (57mm) – coated finish.
7. Surface Color/Finish: To be determine by Architect from the manufacturer's full range of colors and finish options.
8. Edges: Coated to match panel face.
9. Mounting System: Ceiling Mounting System: Sky Acoustics Direct suspended - 'Z'clip Mounted at back of the panels with 18 gauge curved carrying channels to connect the furring channels and to receive the suspension. Curved C-channel supplied by Sky Acoustics
10. Lighting Reflectance White Panel: ASTM E 1477-98a, 90% for Pure White
11. Noise Reduction Coefficient (NRC): ASTM C423; Classified with UL label on product carton 0.90.
12. Frame Spread: ASTM E 84; Class A.

B. Ceiling Panel Type CP-2:

1. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
 - a. Clipso Americas.
 - b. Barrisol USA.
 - c. Newmat
2. Basis of Design: Aeroceiling with Integrated Lighting by Clipso.
3. Size: As indicated on drawings
4. Composition: Fabric
5. Fabric: Polyester knitted fabric with polyurethane coating, translucent-2 layers, translucency to be determined.
6. Flame Spread: 0 ASTM E 84-05, Class A
7. Smoke Developed: 45 ASTM E 85-05, Class A
8. Color: To be determine by Architect from the manufacturer's full range of colors.
9. Frame: Self-supporting Aluminum frame CPA60 Kit.
10. LED Lighting by Clipso

2.7 SUSPENDED ACOUSTICAL CLOUDS

- A. Provide acoustical cloud assemblies as indicated on drawings.
- B. Suspensions Wire: ceiling blades shall be independently suspended using aircraft cables and quick release adjusters.
 1. #12 Aircraft Cable: "Armstrong Item AC1210", Color: Black
 2. Height Adjustable hardware with attachment clips: "Armstrong ACHC", color black

- a. Provide one at 11" from edge
- b. Provide one at 24" OC.

C. Anchorage

- 1. Manufacturer's recommended deck hole anchors, fasteners, and other attachment accessories suitable for various mounting substrates.
- 2. Metal finish trim cap; color: black.

2.8 METAL SUSPENSION SYSTEMS

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

- 1. Structural Classification: Intermediate-duty system.
- 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
- 3. Face Design: Flat, flush.
- 4. Cap Material: Steel or aluminum cold-rolled sheet.
- 5. Color: White, prefinished.
- 6. Grid Face Width: As specified with ACT type.
- 7. Recycled Content: Use minimum recycled content of 25%.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

- 1. Anchors in Concrete: Anchors with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency; zinc-plated for Class SC1 service.
 - a. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

- 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - a. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 diameter wire.

D. Hold-Down Clips: At vestibules and areas subject to wind uplift, provide manufacturer's standard hold-down clips spaced 24 inches on all cross tees.

2.9 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - 1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 - 3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
- B. Suspension Trim: Subject to compliance with requirements, provide one of the following:
 - 1. Armstrong World Industries, Inc.; Axiom.
 - 2. CertainTeed Ceilings; Approved equal.
 - 3. USG Interiors, Inc.; Compasso.

2.10 ACOUSTICAL SEALANT

- A. Acoustical Sealant, for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, joint sealant, recommended for sealing interior concealed joints to reduce airborne sound transmission.
 - 1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. OSI (a division of Henkel); Pro-Series SC-175.
 - b. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - c. Pecora Corp.; BA-98.
 - d. Specified Technologies, Inc. (STI); Smoke N Sound Acoustical Sealant.
 - e. USG; SHEETROCK Acoustical Sealant.
 - 2. Low-Emitting Materials: Provide adhesives and sealants in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. VOC Content, Architectural Sealants: 250 g/L or less.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified

in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 6. Do not attach hangers to steel deck tabs.
 - 7. Space hangers not more than 48 o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - 2. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096400

WOOD FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Field-finished wood flooring.
 - 2. Factory-finished wood flooring.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for substrate.
 - 2. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for wood base.

1.3 PERFORMANCE REQUIREMENTS

- A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.
 - 1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Sourcing of Raw Materials:

- a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
- b. Option 2, Leadership Extraction Practices:
 - 1) Wood Products: Wood products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.
- 2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For wood composite materials, submit test results, including TVOC emissions.
 - b. For floor coatings, submit VOC content and GreenGuard Gold certification.
 - c. For wet-applied products, submit volume used.
- C. Shop Drawings: Show installation details including location and layout of each type of wood flooring and accessory.
- D. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

1.5 QUALITY ASSURANCE

- A. Source Limitations: For field-finished wood flooring, obtain each species, grade, and cut of wood from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
- B. Comply with applicable National Wood Flooring Association (NWFA, formerly NOFMA) grading rules for species, grade, and cut.
- C. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. To set quality standards for installation, install mockup of floor area as shown on Drawings.
 - 2. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area as shown on Drawings.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood flooring materials in unopened cartons or bundles.
- B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.

- C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.7 PROJECT CONDITIONS

- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
 - 1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
 - 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
 - a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
 - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

1.8 EXTRA MATERIALS (ATTIC STOCK)

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Wood Flooring: Equal to 2 percent of amount installed for each type of wood flooring indicated.
 - 2. Stair Treads: One tread for each stair width.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 FIELD-FINISHED WOOD FLOORING

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Salvaged and reclaimed wood is excluded from certified wood requirements.

- B. Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content, tongue and groove and end matched, and with backs channeled.
 - 1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Wide Plank Floors.
 - b. Harris Tarkett Wood Floors.
 - c. Kentucky Wood Floors.
 - 2. Species: Maple, as selected by the Architect.
 - 3. Grade: Select & Better
 - 4. Cut: Quarter/rift sawn.
 - 5. Thickness: 25/32 inch.
 - 6. Face Width: 2-1/4 in.
 - 7. Length: Random-length strips complying with applicable grading rules.
- C. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

2.3 FACTORY-FINISHED WOOD FLOORING

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Salvaged and reclaimed wood is excluded from certified wood requirements.
- B. Composite Wood, General: CARB II compliant or made with binder containing no added formaldehyde (NAF).
- C. Engineered-Wood Flooring: HPVA EF, except bonding agent contains no urea formaldehyde.
 - 1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anderson Hardwood Floors.
 - b. Armstrong World Industries, Inc.
 - c. EcoTimber.
 - d. Gammapar.
 - e. Mannington Mills, Inc.
 - f. Tarkett.
 - 2. Species: Maple.
 - 3. Grade: Grade A.
 - 4. Thickness: 3/8 inch
 - 5. Construction: Three ply.
 - 6. Face Width: 3 inches.
 - 7. Length: Manufacturer's standard.
 - 8. Edge Style: Square.

9. Finish: UV urethane or acrylic impregnated.
 - a. Color: As selected by Architect from manufacturer's full range.

2.4 ACCESSORY MATERIALS

- A. Wood Subfloor: As specified in Section 061000 - ROUGH CARPENTRY.
- B. Vapor Retarder: ASTM D 4397, fluid-applied membrane, to be selected by Architect.
- C. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.
- D. Wood Flooring Adhesive: As recommended by flooring and adhesive manufacturers for application indicated.
 1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 2. VOC Content: Not more than 100 g/L.
 3. Do not use adhesives that contain urea formaldehyde.
 4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
- E. Fasteners: Non-corrosive type, as recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring."
- F. Cork Expansion Strip: Composition cork strip.
- G. Metal Edge Strips: Angle or L-shape, height to match flooring thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for wood flooring applications; extruded aluminum exposed-edge material, with clear anodized satin finish.
 1. Available Manufacturer: Schluter Systems.
- H. Trim: In same species and grade as wood flooring, unless otherwise indicated.
 1. Threshold: Tapered on each side and routed at bottom of one side to accommodate wood flooring.
 2. Reducer Strip: 2 inches wide, tapered on 1 side, and in thickness matching wood flooring.
- I. Cleaning Materials: Provide low-emitting cleaning solutions as recommended by NOFMA.

2.5 FIELD FINISH MATERIALS

- A. Wood Finish: Provide UV resistant sealer and water-based polyurethane finish system.
 1. Low-Emitting Materials: Provide wood finish in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- a. VOC Content Limits:
 - 1) Clear Wood Finish, Varnish: 350 g/L.
 - 2) Clear Wood Finish, Sanding Sealer: 350 g/L.
 - 3) Clear Wood Finish, Lacquer: 550 g/L.
 - b. Methylene chloride and perchloroethylene may not be intentionally added to paints and coatings.
2. Sanding Sealer (Waterborne): For clear, transparent look.
- a. Basic Coatings; Hydroline Sealer.
 - b. Bona US; NordicSeal.
 - 1) Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
 - c. Vermont Natural Coatings; PolyWhey 3000 Wood Floor Sealer.
3. Wood Stain: Not used.
4. Wood Coating, Clear Polyurethane Finish:
- a. Basic Coatings; StreetShoe NXT, matte finish.
 - b. Bona US; BonaTraffic HD, Commercial Matte finish.
 - 1) Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
 - c. Vermont Natural Coatings; PolyWhey 3500 Wood Floor Finish, matte finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
 - 1. Verify that substrates comply with tolerances and other requirements specified in other Sections.
 - 2. For adhesively applied wood flooring, verify that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Substrate Moisture Testing, General: Perform tests recommended by manufacturer or, if none, comply with applicable recommendations in NWFA/NOFMA's "Installation Guidelines: Wood Flooring."
 - 1. Proceed with installation only after substrates pass testing.

- C. Concrete Moisture Testing: Perform anhydrous calcium chloride test per ASTM F 1869, as follows:
 - 1. Perform tests so that each test area does not exceed 200 sq. ft. and perform not less than 2 tests in each installation area with test areas evenly spaced in installation area.
 - 2. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - 3. Perform alkalinity and adhesion tests recommended in writing by manufacturer or, if none, according to NWFA's "Installation Guidelines: Wood Flooring." Proceed with installation only after substrates pass testing.

3.2 PREPARATION

- A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
 - 1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- B. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA/NOFMA's "Installing Hardwood Flooring", 1997 edition.
- B. Engineered-Wood Flooring: Set in adhesive.
- C. Wood Subfloor: Install according to requirements in Section 061000 - ROUGH CARPENTRY.
- D. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch.
- E. Vapor Retarder:
 - 1. Wood Flooring Nailed to Concrete: Install flooring over a layer of fluid applied vapor retarder product, turned up behind baseboards.

3.4 FIELD FINISHING

- A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.

1. Comply with applicable recommendations in NWFA/NOFMA's "Installing Hardwood Flooring", 1997 edition.
- B. Fill and repair wood flooring seams and defects.
- C. Cover and protect wood flooring before finishing.
- D. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
 1. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.
 2. First Coat: Apply sanding sealer.
 3. Second Coat: Apply sanding sealer, if recommended by manufacturer. Sand lightly.
 - a. Apply stains to achieve an even color distribution matching approved Samples.
 4. Third, Fourth and Fifth Coat: Apply polyurethane finish. Sand lightly between coats.
- E. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.5 PROTECTION

- A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
 1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION

SECTION 096460

WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wood athletic flooring assemblies.
 - 2. Field finishing of work of this Section, including striping and line work as indicated.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for substrate.
 - 2. Section 116620 - ATHLETIC EQUIPMENT for floor plate and sleeve assemblies.
 - 3. Division 12 Section "Telescoping Bleachers": for bleacher rolling path and imposed loads requiring additional reinforcing and support under the wood athletic floor.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood sports-floor assemblies.
- B. Shop Drawings: Show installation details including location and layout of each type of floor assembly and accessory. Include the following:
 - 1. Expansion provisions and trim details.
 - 2. Layout, colors, widths, and dimensions of game lines and markers.
 - 3. Locations of floor inserts for athletic equipment installed through flooring assembly.
- C. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work.

1. Include sample sets showing the full range of normal color and texture variations expected in wood flooring.
2. Include sample sets showing finishes and game-line paint and marker paint colors applied to wood flooring.

D. LEED Submittal:

1. Product Data for Credit EQ 4.1: For interior adhesives and sealants applied inside the weatherproofing system and applied on-site, including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4.1: For interior adhesives, sealants and sealant primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' (now the Department of Public Health) "*Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers*", including 2004 Addenda.
3. Product Data for Credit EQ 4.2: For interior paints and coatings applied inside the weatherproofing system and applied on-site, including printed statement of VOC content.
4. Laboratory Test Reports for Credit IEQ 4.2: For interior paint and coating products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' (now the Department of Public Health) "*Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers*", including 2004 Addenda.
5. Credit EQ 4.4: Manufacturer's product data for each composite wood product and adhesive used indicating that the product contains no added urea formaldehyde.
6. Laboratory Test Reports for Credit IEQ 4.4: For composite-wood products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' (now the Department of Public Health) "*Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers*", including 2004 Addenda.
7. Credit MR 7: Chain-of-custody certificates signed by manufacturers certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
 - a. Include statement indicating costs for each certified wood product.

E. Qualification Data: For Installer.

F. Maintenance Data: For wood sports-floor assemblies and finish systems to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For field-finished wood flooring, obtain each species, grade, and cut of wood from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Floor System Manufacturer Qualifications

1. Manufacturer shall be an established firm experienced in field and have been in wood athletic flooring business or a minimum of ten (10) years.
2. Manufacturer shall be a member in good standing of the Maple Flooring Manufacturers Association (MFMA).

C. Floor Contractor/Installer Qualifications and Certifications

1. Flooring contractor shall be a firm experienced in flooring field and authorized by manufacturer.
2. Floor Installer shall be an MFMA Accredited Installer for the manufacturer they represent
3. Submit a list of at least three completed projects of similar magnitude and complexity.
4. Floor Contracting Company and field personnel shall be trained by Flooring Manufacturer and Finish Manufacturer on proper installation and finishing processes

B. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut.

C. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. To set quality standards for installation, install mockup of floor area as shown on Drawings.
2. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area as shown on Drawings.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood flooring materials in unopened cartons or bundles.
- B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
- C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.6 PROJECT CONDITIONS

- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
 - a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
 - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

- C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

1.7 WARRANTY

- A. Warranty shall be prepared and submitted in accordance with Division 01 Section "Warranties".
 - 1. Manufacturer shall warrant the flooring system material to be free from manufacturing material and workmanship defects for a period no less than one (1) year.
 - 2. Guarantee shall include Total System Performance Guarantee, annually renewable one (1) year extensions, up to 40 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Basis of Design: Conner Sports Flooring Rezillbase SP-11,
 - 2. Robbins Eclipse Floating Floor
 - 3. Action Excel NR.

2.2 SUBFLOOR SYSTEM

- A. Plywood Underlayment: APA rated, C-D Plugged, exterior glue, tongue and groove, two layers, 11/32 inch thick.
- B. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.
 - 1. Type: Recycled rubber or thermoplastic rubber.

2.3 WOOD FLOORING

- A. Strip Flooring: Northern hard maple (*Acer saccharum*), kiln dried, random length, tongue and groove, and end matched.
 - 1. Grade: MFMA-RL Second and Better.
 - 2. Cut: Flat.
 - 3. Thickness: 25/32 inch.
 - 4. Face Width: 2-1/4 inches.
 - 5. Backs: Channeled (kerfed) for stress relief.
 - 6. Preservative Treatment: Clear, penetrating, water-repellent wood preservative that protects against mold, mildew, staining, and decay fungi; complying with MFMA's written recommendations and applied by immersion.

2.4 ACCESSORY MATERIALS

- A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils thick.
- B. Resilient Wall Base: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches; with premolded outside corners.
- C. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by sports-floor manufacturer.
- D. Adhesives: Manufacturer's standard for application indicated.
 - 1. Concrete Primers: Manufacturer's standard for application indicated.
 - 2. Use adhesive and primer, if any, that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer and MFMA approved.
 - 1. Type: MFMA Group 5, Water Based Finishes; polyurethane.
 - 2. Floor-Sealer Formulation: Pliable, penetrating type.
 - 3. Finish-Coat Formulation: Formulated for gloss finish and multicoat application.
 - 4. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.
 - a. Provide 4 color center court logo, and game lines in 4 colors to define the following:
 - 1) 1 full basketball court with school logo and school team name
 - 2) 2 cross-court basketball courts
 - 3) 1 full court volleyball courts
 - 4) 2 cross-court volleyball courts
 - 5) Both out-of-bounds end lines (4'-0") with text to read "Wahconah Regional High School"
 - 5. VOC content: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
 - b. Game-Line and Marker Paint: VOC content of not more than 150 g/L.
- F. Metal Saddle: Extruded aluminum saddle threshold, ¼ inch (6 mm) high, width as shown on Drawings, length equal to width of door opening and full width at transitions between floor materials.
 - 1. Acceptable Manufacturers:
 - a. Pemko
 - b. National Guard Products
 - c. Zero International
 - d. Or Equal
 - 2. Finish: Aluminum; color as selected by Architect from manufacturer's full range.

3. Provide solid threshold without factory-drilled holes.
4. Product: Pemko, Saddle Threshold 270 Series, or equal by approved manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect concrete slab for proper tolerance and dryness, and report any discrepancies to the general contractor and architect in writing. Slab will be level to within 1/8" (3mm) in a 10' (3m). Moisture content of the concrete slab shall not exceed 4% or vapor transmission exceeds 4.5 pounds per 1,000 square feet (2.20 kg per 100 square meters).
- B. All work required to put the concrete subfloors in acceptable condition shall be the responsibility of the general contractor.
- C. Subfloor shall be broom cleaned by general contractor.
- D. Installer shall document all working conditions provided in General Specifications prior to commencement of installation.

3.2 INSTALLATION

- A. Vapor Barrier:
 1. Install polyethylene with joints lapped a minimum of 6" (150mm) and turned up 4" (100mm) at the walls.
- B. Subfloor:
 1. Install Robbins Zero G shock absorbing pad per manufacturer's recommendations over 6 mil poly.
 2. Following manufacturer's guidelines, place Bio-Channel Star subfloor assembly in end-to-end manner, staggering end joints in adjacent rows. Allow for a 1/4" (6mm) gap between panels. Panels shall be placed on a diagonal to the direction of the maple floor. Provide 1-1/2" to 2" (40 to 50mm) expansion void at the perimeter and all vertical obstructions.
 3. Install solid blocking at doorways, under bleachers in the stacked position, and below portable goals.
 4. Install Bleacher Blocking per manufacturer's recommendations.
 5. Place Star anchor channel in each factory-prepared location in the panel.
 6. Anchor each Star Channel in the center pre-drilled hole only, unless trimming at wall or vertical obstruction requires relocation in adjacent location to anchor.
- C. Maple Flooring:
 1. Machine nail maple finish flooring 10" to 12" (150mm to 200mm) O.C. with end joints properly driven up and proper spacing provided for humidity conditions in specific regions. Consult your local Robbins "Certified" contractor. Provide 1 1/2" to 2" (50mm) expansion voids at the perimeter and at all vertical obstructions. Expansion rows shall be evenly distributed with each row of flooring, with each space not exceeding 1/64" (0.4mm).

3.3 FINISHING

A. Sanding:

1. Sand per manufacturer's recommendations.
2. After sanding, buff entire floor using 100 grit screen or equal grit sandpaper, with a heavy-duty buffing machine.
3. Inspect entire area of floor to insure the floor presents a smooth surface without drum stop marks, gouges, streaks or shiners.
4. Vacuum and/or tack floor before first coat of seal.
5. Floor should be clean and completely free of dirt and sanding dust.

B. Finishing:

1. Gymnasiums
 - a. Apply specified combination of seal, gameline paint, and finish in accordance with manufacturer's instructions and these specifications.
 - b. Buff and vacuum and/or tack between each coat after it dries.
 - c. Apply game lines accurately after the buffing and vacuuming the coated surfaces. Layout in accordance with drawings. For game lines, use current rules of association having jurisdiction. Lines shall be straight with sharp edges in colors selected by architect.

3.4 WALL BASE INSTALLATION

- #### A. Install Robbins vent cove base anchored to walls with base cement or screws and anchors. Use pre-molded outside corners and neatly mitered inside corner.

3.5 PROTECTION

- #### A. Protect sports floors during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.

1. Do not cover sports floors after finishing until finish reaches full cure, and not before seven days after applying last finish coat.
2. Do not move heavy and sharp objects directly over sports floors. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over sports floors.
- 3.

3.6 Final Clean up

- #### A. Clean up all unused materials and debris and remove it from the premises.

END OF SECTION

SECTION 096510

RESILIENT FLOORING AND ACCESSORIES

(Part of Work of Section 090005 - RESILIENT FLOORS, Trade-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Resilient floor covering, rubber and luxury vinyl tile.
 - 2. Resilient sheet "flocked" floor covering.
 - 3. Substrate preparation for resilient flooring and accessories.
 - 4. High-performance adhesive suitable for RH and pH measured in substrate.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Division 09 - FINISHES for other flooring types.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED v4 Submittals:
 - 1. Product data for MR Credit 4 Option 1 for products having regional manufacturing and extraction locations.
 - 2. Product data for MR Credit 4 Option 2 for products having recycled content, including documentation indicating percentages by weight of post-consumer and pre-consumer recycled content and sustainable attributes. a. Include statement indicating costs for each product having recycled content. b. Include product data for bio-based content and certification of SMART sustainable product certification.
 - 3. Product data for MR Policy 2 for construction and demolition waste management.

4. Product data for EQ Credit 2 for low emitting adhesives and sealants, including printed statement of VOC content as required by Division 01. 5. Confirm that each product complies with the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers, including 2004 Addenda. If a product specified has not been tested as noted, provide a substitution to the Architect for review and approval of an equal product meeting noted California Department of Health standard.]
 - C. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 1. Show details of special patterns.
 - D. Samples for Verification: Full-size units of each color and pattern of resilient flooring required.
 - E. Maintenance Data: For resilient products to include in maintenance manuals.
- 1.4 QUALITY ASSURANCE
- A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
 1. Must be a Manufacturers Certified Installer.
 2. Proof of valid certification must be submitted to the Construction Manager at Risk (CM-R) and verified by Manufacturer prior to the start of the project.
 3. The Certified Installer must manage and be on site during installation at all times.
 - B. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - C. Mock-Ups: Install at project site a mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, texture and pattern, and workmanship standard. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.
 1. Provide substrate preparation mockups in an area no less than 15' x 15' for Architect's review and approval.
 2. After substrate preparation approval by Architect, provide resilient sheet "flocked" floor covering installation mockups over prepared substrate in an area no less than 10' x 10' for Architect's review and approval.
 3. The contractor shall not proceed with installation until the required mock-up has been approved by Architect.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After post-installation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install resilient products after other finishing operations, including painting, have been completed.

1.7 WARRANTY

- A. Provide warranties, commencing from the date of Substantial Completion, in accordance with Conditions of Contract and Division 01 Section "Warranties".
- B. Manufacturer Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty agreeing to repair or replace sheet "flocked" floor covering that fails within the warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Material manufacturing defects.
 - b. Surface wear and deterioration to the point of wear-through where normal foot and wheeled traffic is occurring or where the material is being properly maintained.
 - c. Failure due to substrate moisture exposure not exceeding 98% relative humidity when tested according to ASTM F2170.
 - 2. Warranty Period: Twenty (20) years commencing on Date of Substantial Completion.
 - 3. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- C. Installation Warranty: Submit the contractor's installation warranty signed by the Construction Manager at Risk (CM-R) and Installer for Owner's Acceptance, agreeing to repair or replace work which has failed as a result of defects in workmanship. Upon notification of such installation deficiencies, within the warranty period, make necessary repairs or replacement at the convenience of the Owner.
 - 1. Warranty Period: Two (2) year limited warranty commencing on Date of Substantial Completion from contractor.
 - 2. Installation warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1.8 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra materials from same production run as products installed.
 - 1. Quantity of extra material is equal to 3% of amount for each color, finish and type installed.
 - 2. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 LUXURY VINYL TILE FLOOR COVERING

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Congoleum Corporation.
 - 3. Mannington Mills, Inc.
 - 4. Tarkett, Inc.
- B. Luxury Vinyl Tile Floor Covering: ASTM F 1700.
 - 1. Thickness: 0.080 inch.
 - 2. Size: 18 by 18 inches.
 - 3. Style and Colors: As indicated on the Finish Schedule.

2.2 RUBBER FLOOR TILE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Bilrite Flooring; AB Pure.
 - 2. Johnsonite, a division of Tarkett.
 - 3. Nora Systems, Inc.
- B. Rubber Floor Tile: ASTM F 1344, Class 1, A or B (Rubber Tile).
 - 1. Thickness: 0.125 inch.
 - 2. Size: 24 by 24 inches nominal.
 - 3. Style and Colors: As indicated on the Finish Schedule.
 - 4. Material Ingredients: Cradle to Cradle (C2C) certification or Declare product label. PVC, phthalate-, chlorine-, and halogen-free.
 - 5. Low-Emitting Materials: FloorScore certification.

2.3 RESILIENT SHEET "FLOCKED" FLOOR COVERING

- A. Description: Flocked high performance broadloom carpet with a 100% nylon type 6.6 wear layer with an intermediate fiberglass layer and a recycled closed cell vinyl cushioned backing.

- B. Manufacturers:
 - 1. Metro Sheet by Forbo Flooring
 - 2. LeadTex by Lianjing
 - 3. PurgoTex by LS Greenflor
- C. Basis of Design: Metro Sheet as manufactured by Forbo Flooring, Inc.
- D. Thickness: 5.3 mm
- E. Size: 79" x 98.4".
- F. Style and Colors: As selected by Architect from manufacturer's full range.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.
 - 1. Ardex, Inc., products "Feather Finish" and "Ardex SD-P".
 - 2. Quikrete Companies, product "Fast-Set Underlayment 1248".
 - 3. Silpro Masonry Systems Inc., product "Ultra Skim and Speedtop"
 - 4. Or equal.
- B. Adhesive: Provide adhesive that is recommended by the flooring manufacturer for 99% internal relative humidity.
 - 1. Basis of Design: Forbo FST 1299, or approved equal.
 - 2. Use adhesives certified as low-emitting materials in accordance with either the Scientific Certification System's Indoor Advantage Gold program, Scientific Certification System's FloorScore program, or GreenGuard's Children and Schools program.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
3. Moisture Vapor Emission Testing:
 - a. Perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in-situ Probes" as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
 - 1) Perform three tests for first 1,000 ft² and at least one additional test for each 1,000 ft².
 - 2) Select test locations to provide information about moisture distribution across the entire concrete floor slab, especially areas of potential high moisture. Include a test location within 3 ft of each exterior wall.
 - b. Do not proceed with flooring installation until results of moisture tests are accepted by flooring and adhesive manufacturer. All test results shall be documented and submitted to the architect for record.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 1. Do not install resilient products until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SHEET INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor coverings.
- B. Unroll floor coverings and allow them to stabilize before cutting and fitting.
- C. Lay out floor coverings as follows:
 1. Maintain uniformity of floor covering direction.
 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
 3. Match edges of floor coverings for color shading at seams.

4. Avoid cross seams.

- D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
- E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:
 - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces, if required by manufacturer.
- J. Integral-Flash-Cove Base: Cove floor coverings up vertical surfaces as indicated on Drawings. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Resilient Stair Accessories:
 - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - 2. Tightly adhere to substrates throughout length of each piece.
 - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.

- a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
 - a. Coordinate selection of floor polish with the Owner's maintenance service.
 - 2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
 - 3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 096516
VINYL SHEET FLOORING

(Part of Work of Section 090005 - RESILIENT FLOORS, Trade-Bid Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

- A. Furnish and install vinyl sheet flooring with all pertinent accessories as required, indicated on Drawings, and/or as specified in this Section.
 - 1. Provide substrate preparation where required including but not limited to grinding down high spots, filling in low spots, skim-coating, smoothing, patching and leveling to specified conditions acceptable by flooring manufacturer.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Division 03 Section "Cast-In-Place Concrete": for concrete substrate designated to receive vinyl sheet flooring finish.
 - 2. Refer to the High Performance Adhesive specified within this section.
 - 3. Division 09 Section "Rubber Wall Base": for finish wall base abutting the rubber flooring.
 - 4. Other Division 09 sections for floor finishes abutting the work of this Section.

1.4 SUBMITTALS

- A. Prepare and submit under the provisions of Division 01 Section "Submittal Procedures".
 - 1. Product data: Submit manufacturer's technical data, installation and maintenance instructions for flooring and accessories.

- a. Certifications: submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.
 - b. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
 - c. Warranty: Warranty documents specified herein.
 2. Shop drawings: scaled drawings showing seaming plan, coving details.
 3. Samples: Submit the manufacturer's standard samples showing full range of colors for flooring, welding rods, and applicable accessories.
- B. LEED Submittals: prepare and submit required documentation for the work of this Section in accordance with USGBC LEED Reference Guide for Building Design and Construction (v4) and Division 01 Section "LEED v4 BD+C: School Requirements".
1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
 2. Building product disclosure and optimization: Provide required documentation to secure the maximum MR credits, including but not limited to:
 - a. Environmental product declarations.
 - b. Sourcing of raw materials.
 - c. Material ingredients.
 3. Project material cost data: Provide invoices, receipts, statements, and other evidence required to document total cost for materials used for Project.
 4. Waste management and disposal records complying with Division 01 Section "Construction Waste Management and Disposal".
 - a. For products diverted from disposal in landfills and incinerators, and where recycled resources are directed back to the manufacturing process. Include a statement indicating percentage of materials diverted and recycled and the costs associated with each.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide resilient flooring manufactured by a firm with a minimum of 10 years' experience with resilient flooring of type equivalent to those specified.
- B. Installer Qualifications: Installer shall be experienced in the vinyl sheet flooring industry and shall have a minimum of five (5) years experiencing in the installation of similar products.
- C. Mock-Ups: Install at project site a mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, texture and pattern, and workmanship standard. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.
1. Provide substrate preparation mock-ups in an area no less than 15' x 15' for Architect's review and approval.
 2. After substrate preparation approval by Architect, provide vinyl sheet flooring installation mock-ups over prepared substrate in an area no less than 10' x 10' for Architect's review and approval.

3. The contractor shall not proceed with installation until the required mock-up has been approved by Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.6 PROJECT CONDITIONS

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Maintain ambient temperatures within range recommended by Johnsonite, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
 1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- C. Maintain the ambient relative humidity between 40% and 60% during installation.
- D. Until Substantial Completion, maintain ambient temperatures within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.7 WARRANTY

- A. Provide warranties, commencing from the date of Substantial Completion, in accordance with Conditions of Contract and Division 01 Section "Warranties".
- B. Manufacturer Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty agreeing to repair or replace sheet vinyl floor covering that fails within the warranty period.
 1. Failures include, but are not limited to, the following:
 1. Material manufacturing defects.
 2. Surface wear and deterioration to the point of wear-through where normal foot and wheeled traffic is occurring or where the material is being properly maintained.
 3. Failure due to substrate moisture exposure not exceeding 98% relative humidity when tested according to ASTM F2170.
 2. Warranty Period: Twenty (20) years commencing on Date of Substantial Completion.
 3. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- C. Installation Warranty: Submit the contractor's installation warranty signed by the Construction Manager at Risk (CM-R) and Installer for Owner's Acceptance, agreeing to repair or replace work which has failed as a result of defects in workmanship. Upon notification of such installation deficiencies, within the warranty period, make necessary repairs or replacement at the convenience of the Owner.
 1. Warranty Period: Two (2) year limited warranty commencing on Date of Substantial Completion from contractor.

2. Installation warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1.8 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra materials from same production run as products installed.
 1. Quantity of extra material is equal to 3% of amount for each color, finish and type installed.
 2. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 HOMOGENOUS SHEET VINYL FLOORING (SV)

- A. Manufacturers: Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
 1. Gerflor USA
 2. Armstrong World Industries, Inc.
 3. Tarkett, Inc.
- B. Basis of Design: Mipolam Affinity as manufactured by Gerflor USA. Designated on the Floor Finish Plans as "SV".
 1. Product Description: Unbacked homogeneous vinyl sheet floor covering complying with ASTM F1913.
 2. Wear-Layer/Overall Thickness: Not less than 0.08 inch (2.0 mm)
 3. Roll Size:
 - a. Roll Width: Rolls to be a minimum width of 6'6" wide.
 - b. Roll Length: rolls to be a minimum length of 66 feet.
 4. Applied Finish: Manufacturer's, factory-applied, permanent, laser and UV-cured.
 5. Max static load limit must exceed 1800 PSI
 6. Residual Indentation: ASTM F1914; Lower than -0.005"
 7. Impact Resistance: ASTM F925; Excellent, results on request
 8. Impact Insulation Class: ASTM E989 (E492); 42
 9. Fire Performance: ASTM E 648; Class 1
 10. Seaming Method: Heat welded.
 11. Sustainable Properties: SCS Floor Score Certified, meets CAL Section 01350, and 100% REACH compliant. Contributes to LEED credits for recycled content, adhesives, low VOC emitting material. EPD Environmental Product Declaration and HPD Health Product Declaration Available.
- C. Colors: (Based on Mipolam Affinity) Up to 10 colors to be used as indicated on drawings.

2.2 SLIP RESISTANT SHEET VINYL FLOORING (SV-SR)

- A. Manufacturer: Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
 1. Altro USA, Inc.
 2. Gerflor USA
 3. Polyflor America, Inc.

4. Or approved equal.
- B. Basis of Design for Slip Resistant Sheet Vinyl Flooring: Stronghold 30 as manufactured by Altro USA, Inc. designated on the Floor Finish Plans as "SV-SR".
1. Complies with requirements for ASTM F1303 Standard Specification for Sheet Vinyl Floor Covering with Backing.
 2. Roll/Sheet Width & Length: 6' feet 7 inches (2 m) x 66 feet.
 3. Wear Layer/Overall Thickness: 3.0 mm (0.12 inches), with non-directional pattern and slip retardant particulate suspended evenly throughout the product thickness.
 4. Backing: non-woven polyester/cellulose, glass fiber reinforcement.
 5. Slip Resistance: ADA compliant, ASTM D 2047 James Machine, SCoF Dry .92 / Wet 0.88 DIN 51130 Ramp Test - R 12
 6. Static Load Limit: ASTM F 970, Standard Test Method for Static Load Limit, Modified – 2000 psi.
 7. Fire Performance: ASTM E 648, Standard Test method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I, ASTM E662 Smoke Development.
 8. Sustainable Properties: Phthalate-free, contains rapidly renewable bio-based content, 100 percent recyclable, SCS FloorScore Certified, meets CAL Section 01350, contributes to LEED credits for recycled content, adhesives, low VOC emitting material. EPD Environmental Product Declaration and HPD Health Product Declaration Available.
- C. Colors: (Based on Stronghold 30) up to 2 colors to be used as indicated on drawings.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.
1. Ardex, Inc., products "Feather Finish" and "Ardex SD-P".
 2. Quikrete Companies, product "Fast-Set Underlayment 1248".
 3. Silpro Masonry Systems Inc., product "Ultra Skim and Speedtop"
 4. Or equal.
- B. Adhesive: Provide adhesive that is recommended by the flooring manufacturer for 98% internal relative humidity. The adhesive shall be included as part of the manufacturer's warranty.
1. Basis of Design for SV: Gerflor Spray Adhesive, or approved equal.
 2. Basis of Design for SV-SR: Altro Ecofix65, , or approved equal.
 3. Use adhesives certified as low-emitting materials in accordance with either the Scientific Certification System's Indoor Advantage Gold program, Scientific Certification System's FloorScore program, or GreenGuard's Children and Schools program.
- C. System Accessories:
1. Vinyl welding rod: Provide vinyl weld rod as supplied by flooring manufacturer and intended for heat welding of seams. Color as selected by Architect.
 2. Cover Former: Provide cover former sized to suit application as supplied by flooring manufacturer.

3. Cap Strip: Acceptable material, sized to suit application: L-shaped profile with 1/8" (3.2mm) wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - a. Manufacturers:
 - 1) Schluter Systems L.P.
 - 2) Blanke Corp.
 - 3) Ceramic Tool Company Inc.
 - 4) Approved equal
 - b. Basis of design: "JOLLY" as manufactured by Schluter Systems L.P.
 - c. Anchoring Leg: Provide with straight anchoring leg, outside corners, and internal connectors.
 - d. Material and Finish: Brushed Chrome Anodized Aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to Johnsonite written instructions to ensure adhesion of Resilient Sheet Flooring.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 3. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, and similar items, must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
 4. Prepare Substrates according to ASTM F 710 including the following:
 - a. Moisture Vapor Emission Testing:
 - 1) Perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in-situ Probes" as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
 - a) Perform three tests for first 1,000 ft² and at least one additional test for each 1,000 ft².
 - b) Select test locations to provide information about moisture distribution

- across the entire concrete floor slab, especially areas of potential high moisture. Include a test location within 3 ft of each exterior wall.
- 2) Do not proceed with flooring installation until results of moisture tests are accepted by flooring and adhesive manufacturer. All test results shall be documented and submitted to the architect for record.b. A pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.
- b. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
- 5. Wood subfloors must have a minimum 18" (45.7 cm) of cross-ventilated space beneath the bottom of the joist.
 - a. The floor must be rigid, free of movement.
 - b. Single wood and tongue and groove subfloors should be covered with ¼" (6.4 mm) or ½" (12.7 mm) APA approved underlayment plywood.
 - 1). Use ¼" (6.4 mm) thick underlayment panels for boards with a face width of 3" (76 mm) or less.
 - 2). Use ½" (12.7 mm) thick underlayment panels for boards with a face width wider than 3" (76 mm).
 - c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.
- B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Floor covering shall not be installed over expansion joints.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Resilient Sheet Flooring:
 - 1. Install with manufacturer's recommended adhesive specified for the site conditions and follow adhesive label for proper use.
 - 2. Install rolls in sequential order following roll numbers on the labels.
 - 3. Reverse sheets unless instructed otherwise in manufacturer's Installation Instructions.
 - 4. Roll the flooring in both directions using a 100-150 pound three-section roller.
 - 5. Heat-weld all seams, vertical and horizontal.
 - 6. When flash-coving, use manufacturer's recommended accessories for cove former, cap, edging and other details.
 - a. Resilient edge and transition strips for Homogeneous Sheet Vinyl Cove Base (SV):

- 1) Install edge strips at all edges of flooring, which would otherwise be exposed.
- 2) Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
 1. No traffic for 24 hours after installation.
 2. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.
- D. Wait 72 hours after installation before performing initial cleaning.
- E. A regular maintenance program must be started after the initial cleaning.

END OF SECTION

SECTION 096523
RUBBER STAIR TREAD, RISER, TILE AND BASE

(Part of Work of Section 090005 - RESILIENT FLOORS, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Rubber stair tread, riser, tile and base.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Division 03 Section "Concrete Floor Resurfacing and Patching": for concrete patching of existing stair treads substrate receiving rubber tread finish.
 - 2. Division 05 Section
 - 3. Other Division 09 sections: for floor finishes abutting and/or related to this Section.

1.4 SUBMITTALS

- A. Prepare and submit under the provisions of Division 01 Section "Submittal Procedures".
 - 1. Product data:
 - a. Manufacturer's technical specifications, installation instructions, and warranties for each type of product indicated.
 - b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content and chemical components.
 - 2. Product schedule: Use same designations indicated on Drawings.
 - 3. Samples:
 - a. Samples for Initial Selection: For each type of product indicated.

- b. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.
 - B. LEED Submittals: prepare and submit required documentation for the work of this Section in accordance with USGBC LEED Reference Guide for Building Design and Construction (v4) and Division 01 Section "LEED v4 BD+C: School Requirements".
 - 1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
 - 2. Building product disclosure and optimization: Provide required documentation to secure the maximum MR credits, including but not limited to:
 - a. Environmental product declarations.
 - b. Sourcing of raw materials.
 - c. Material ingredients.
 - 3. Project material cost data: Provide invoices, receipts, statements, and other evidence required to document total cost for materials used for Project.
 - 4. Waste management and disposal records complying with Division 01 Section "Construction Waste Management and Disposal".
 - a. For products diverted from disposal in landfills and incinerators, and where recycled resources are directed back to the manufacturing process. Include a statement indicating percentage of materials diverted and recycled and the costs associated with each.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide resilient flooring manufactured by a firm with a minimum of 10 years' experience with resilient flooring of type equivalent to those specified.
- B. Installer Qualifications: Installer shall be experienced in the rubber flooring industry and shall have a minimum of five (5) years experiencing in the installation of similar products.
- C. Mock-ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, texture and pattern, and workmanship standard. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.
 - 1. Provide substrate preparation mockups in an area no less than 15' x 15' for Architect's review and approval.
 - 2. After substrate preparation approval by Architect, provide rubber stair system installation mockups over prepared substrate in an area no less than 10' x 10' for Architect's review and approval.
 - 3. The contractor shall not proceed with installation until the required mock-up has been approved by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.7 PROJECT CONDITIONS

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Maintain ambient temperatures within range recommended by Johnsonite, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- C. Maintain the ambient relative humidity between 40% and 60% during installation.
- D. Until Substantial Completion, maintain ambient temperatures within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.8 WARRANTY

- A. Provide warranties, commencing from the date of Substantial Completion, in accordance with Conditions of Contract and Division 01 Section "Warranties".
- B. Manufacturer Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty agreeing to repair or replace rubber stair tread, riser, tile and base products that fails within the warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Material manufacturing defects.
 - b. Surface wear and deterioration to the point of wear-through where normal foot and wheeled traffic is occurring or where the material is being properly maintained.
 - c. Failure due to substrate moisture exposure not exceeding 98% relative humidity when tested according to ASTM F2170.
 - 2. Warranty Period: Twenty (20) years commencing on Date of Substantial Completion.
 - 3. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- C. Installation Warranty: Submit the contractor's installation warranty signed by the Construction Manager at Risk (CM-R) and Installer for Owner's Acceptance, agreeing to repair or replace work which has failed as a result of defects in workmanship. Upon notification of such installation deficiencies, within the warranty period, make necessary repairs or replacement at the convenience of the Owner.
 - 1. Warranty Period: Two (2) year limited warranty commencing on Date of Substantial Completion from contractor.
 - 2. Installation warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1.9 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra materials from same production run as products installed.

1. Quantity of extra material is equal to 3% of amount for each color, finish and type installed.
2. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Trades and Risers: ASTM F 2169.
 1. Nora System, Inc.
 2. Johnsonite, a division of Tarkett.
 3. Roppe Corporation.
 4. Mannington Burke.
- B. Basis Design: Norament 825C by Nora Systems, Inc.
- C. Style and Colors: As indicated on the Floor Finish Legend.
- D. Colors: Up to 8 colors will be selected.
- E. Materials: Rubber, Composition A.
- F. Size: Lengths and depths to fit each stair tread in one piece.
- G. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

2.2 RUBBER STAIR TREAD WITH RISER, TILE AND BASE

- A. Integrated Stair Tread with Riser and Base shall have the following physical characteristics:
 1. Manufactured from a homogeneous composition of 100% synthetic rubber.
 2. Complies with requirements for ASTM F 2169 Standard Specification for Resilient Stair Treads, Type TS, Class 1 and 2, Group 1 and 2.
 3. Hardness: ASTM D 2240 – Not less than 85 Shore A.
 4. Abrasion Resistance: ASTM D 3389 – less than 1 gram weight loss.
 5. ASTM D 2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring of 0.6 or greater.
 6. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I.
 7. Integrated tread and riser.
 8. Visually Impaired treads meet ADA and are California Title 24 Accessibility requirements.
 9. Visually Impaired treads will have 2" wide co-extruded contrasting color insert or 2" wide contrasting color grit tape insert.
 10. Certified Cradle to Cradle, NSF – 332 certified gold, Floor Score certified
- B. Visually Impaired Solid Color Rubber Integrated Stair Tread with Riser and Base
 1. Raised Round Pattern.

2. 2" height hinged Square Nose, tapering .210" to .153".
3. 20" overall width including 13" tread depth with 7" integrated riser.
4. 2" wide contrasting solid color rubber insert.
5. Tread length(s) shall be as indicated on Drawings and field verified.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based formulation manufactured and warranted by a reputable manufacturer.
 1. Ardex, Inc., products "Feather Finish" and "Ardex SD-P".
 2. Quikrete Companies, product "Fast-Set Underlayment 1248".
 3. Silpro Masonry Systems Inc., product "Ultra Skim and Speedtop"
 4. Or equal.
- B. Adhesives: Provide adhesive that is recommended by the flooring manufacturer for slab conditions 98% and over internal relative humidity. The adhesive shall be included as part of the manufacturer's warranty.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 3. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, or other similar writing instruments, must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.

4. Prepare Substrates according to ASTM F710 including the following:
 - a. Moisture Testing: Perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in-situ Probes" as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
 - 1) Perform three tests for first 1,000 ft² and at least one additional test for each 1,000 ft².
 - 2) Select test locations to provide information about moisture distribution across the entire concrete floor slab, especially areas of potential high moisture. Include a test location within 3 ft of each exterior wall.
 - 3) Do not proceed with flooring installation until results of moisture tests are accepted by flooring and adhesive manufacturer. All test results shall be documented and submitted to the architect for record.
 - b. Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
 5. Wood steps/substrates:
 - a. The substrate must be rigid, free of movement.
 - b. Single wood and tongue and groove substrate should be covered with 1/4" (6.4 mm) or 1/2" (12.7 mm) APA approved underlayment plywood.
 - 1). Use 1/4" (6.4 mm) thick underlayment panels for boards with a face width of 3" (76 mm) or less.
 - 2). Use 1/2" (12.7 mm) thick underlayment panels for boards with a face width wider than 3" (76 mm).
 - c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.
 - B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
 - C. Floor covering shall not be installed over expansion joints.
 - D. Do not install resilient products until they are same temperature as the space where they are to be installed.
 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.
- 3.3 RUBBER STAIR TREAD WITH RISER, TILE AND BASE INSTALLATION
- A. Comply with manufacturer's written instructions for installing resilient accessories.
 - B. Rubber Stair Tread, Tile and Nosing:

1. Use Johnsonite #930 Epoxy Caulking Compound to strengthen nosing and fill irregularities in substrates to conform to tread nosing.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Resilient edge and transition strips:
 1. Install edge strips at all edges of flooring, which would otherwise be exposed.
 2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.
- C. Resilient edge and transition strips:
 1. Install edge strips at all edges of flooring, which would otherwise be exposed.
 2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.
- D. Perform the following operations immediately after completing resilient product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- E. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION

SECTION 096530
RUBBER WALL BASE

(Part of Work of Section 090005 - RESILIENT FLOORS, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Rubber wall base.
 2. Rubber transition accessories.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
1. Division 04 Section "Concrete Masonry Units": for concrete masonry unit substrate receiving rubber wall base finish.
 2. Division 09 Section "Gypsum Boards": for gypsum board wall construction receiving resilient wall base finish.
 3. Division 09 - Finishes: for various finish flooring abutting wall base.

1.4 REFERENCES

- A. ASTM International:
1. F 1861 Standard Specification for Resilient Wall base
 2. E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
 3. E 662 Test Method for Specific Density of Smoke Generated by Solid Materials.
 4. F 925 Standard Test Method for Resistance to Chemicals of Resilient Flooring.
 5. F 137 Standard Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus
- B. Other Referenced Documents

1. National Fire Protection Association (NFPA): NFPA 255, Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source
2. National Fire Protection Association (NFPA) 258 Test Method for Specific Density of Smoke Generated by Solid Materials.

1.5 SUBMITTALS

A. Prepare and submit under the provisions of Division 01 Section "Submittal Procedures".

1. Product Data: manufacturer's technical product specifications for each type of product indicated; installation instructions; warranties.
2. Shop drawings: Product Schedule: Use same designations indicated on Drawings.
3. Samples:
 - a. for Initial Selection: For each type of product indicated.
 - b. for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.

B. LEED Submittals: prepare and submit required documentation for the work of this Section in accordance with USGBC LEED Reference Guide for Building Design and Construction (v4) and Division 01 Section "LEED v4 BD+C: School Requirements".

1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
2. Building product disclosure and optimization: Provide required documentation to secure the maximum MR credits, including but not limited to:
 - a. Environmental product declarations.
 - b. Sourcing of raw materials.
 - c. Material ingredients.
3. Project material cost data: Provide invoices, receipts, statements, and other evidence required to document total cost for materials used for Project.
4. Waste management and disposal records complying with Division 01 Section "Construction Waste Management and Disposal".
 - a. For products diverted from disposal in landfills and incinerators, and where recycled resources are directed back to the manufacturing process. Include a statement indicating percentage of materials diverted and recycled and the costs associated with each.

1.6 QUALITY ASSURANCE

A. Mock-ups:

1. Provide substrate preparation mockups in 10' x 4" size for Architect's review and approval. Mockup shall include both inside and outside corners.
2. The contractor shall not proceed with installation until the required mockup has been approved by Architect.

B. Installer Qualifications: Installer shall have a minimum of five (5) years experiencing in the installation of similar products.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Roppe, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.8 PROJECT CONDITIONS

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Maintain ambient temperatures within range recommended by Roppe, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- C. Maintain the ambient relative humidity between 40% and 60% during installation.
- D. Until Substantial Completion, maintain ambient temperatures within range recommended by Roppe, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.9 WARRANTIES

- A. Provide warranties, commencing from date of Substantial Completion, in accordance with Conditions of Contract and Division 01 Section "Warranties".
 - 1. Provide Manufacturer Warranty against any defect in manufacturing materials or workmanship for periods no less than:
 - a. Product Warranty: 1 year.
 - b. Wear Warranty: 3 years.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
 - 1. Roppe Corporation, Fostoria, OH.
 - 2. Johnsonite, Inc. Chagrin Falls, OH.
 - 3. Mannington Burke.
 - 4. Or equal as approved by Architect.

2.2 RUBBER WALL BASE

- A. Basis of Design - Type T. S. Roppe Pinnacle Rubber Base:
 - 1. Wall Base: ASTM F 1861.
 - 2. Style and Colors: As indicated on the Finish Legend.
 - 3. Type (Material Requirement): TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic.)
 - 4. Shape: Coved.

5. Minimum Thickness: 0.125 inch.
6. Height: 4 inches.
7. Lengths: 100' rolled coil.
8. Outside Corners: Premolded.
9. Inside Corners: Premolded.
10. Surface: Smooth.

B. Basis of Design - Type T. S. Roppe Pinnacle Long Toe Rubber Base:

1. Wall Base: ASTM F 1861.
2. Style and Colors: As indicated on the Finish Legend.
3. Type (Material Requirement): TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic.)
4. Shape: Coved Long Toe.
5. Minimum Thickness: 0.125 inch.
6. Height: 4 inches.
7. Toe Length: 1"
8. Lengths: 4' sections.
9. Outside Corners: Premolded.
10. Inside Corners: Premolded.
11. Surface: Smooth.
12. Location: as indicated on drawings

C. Basis of Design - Type T. S. Roppe Pinnacle No Toe Rubber Base:

1. Wall Base: ASTM F 1861.
2. Style and Colors: As indicated on the Finish Legend.
3. Type (Material Requirement): TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic.)
4. Shape: Coved Long Toe.
5. Minimum Thickness: 0.125 inch.
6. Height: 4 inches.
7. Toe Length: 1"
8. Lengths: 120' Coils
9. Outside Corners: Premolded.
10. Inside Corners: Premolded.
11. Surface: Smooth.
12. Location: as indicated on drawings

D. Accessories: Premolded end stops of same material, size and color as base. Job-form all external and internal corners from base material; pre-molded corner pieces will not be acceptable.

E. Colors: Up to 8 colors will be selected.

F. Provide Rubber Wall Base with the following physical characteristics:

1. Manufactured from a thermoplastic rubber formulation.
2. Meets performance requirements for ASTM F 1861 Standard Specification for Resilient Wall Base, Type TP, Group 1 (solid).
3. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I.

4. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, Class A, Smoke <450.
5. Flexibility: Does not crack, break, or show any signs of fatigue when bent around a 1 1/4" diameter cylinder when tested according to ASTM F 137 Standard Test Method for Flexibility of Resilient Flooring Materials protocols.
6. Color Stability: Meets or exceeds ASTM F 1861 requirements for color stability when tested to ASTM F 1515 Standard Test Method for Measuring Light Stability of Resilient Flooring protocols.
7. Phthalate-free.

2.3 DECORATIVE RUBBER WALL BASE

- A. Basis of Design - Type TP Roppe Contours Rubber Base
 1. Wall Base: ASTM F 1861.
 2. Style: Vertical #65, PV6065.
 3. Colors: As indicated on the Finish Legend.
 4. Type (Material Requirement): TP (rubber, thermoplastic.)
 5. Shape: Sculptured
 6. Minimum Thickness: 0.375 inch.
 7. Height: 6 inches.
 8. Lengths: 8 feet sections, 40 feet per carton.
 9. Surface: Smooth.
- B. Surface Burning: ASTM E84/NFPA 255, Class AC. Flammability/Critical Radiant Flux: ASTM E648 / NFPA 253, Class 1 (>0.45 Watts per sq. cm.), .082 W/cm2D. Smoke Density: ASTM E662/NFPA 258, Passes (<450), 157 (flaming) - 197 (non-flaming)

2.4 RUBBER TRANSITION ACCESSORIES

- A. Basis of Design: Roppe Rubber Accessories
- B. Description: Accessories includes wide variety of trims, moldings, transitions, reducers, edge guards, thresholds and adapters, and cove caps.
- C. Material: Rubber
 1. ASTM E84 - Surface Burning: Class B
 2. ASTM E648 (NFPA 253) - Critical Radiant Flux: Class I, > 0.45 W/cm2
 3. ASTM E662 (NFPA 258) - Smoke Density: Passes, <450
- D. Profile and dimensions: As indicated on drawings.

2.5 INSTALLATION MATERIALS

- A. Filler for patching, smoothing and leveling substrates: Low VOC Portland cement-based latex underlayment acceptable to wall base manufacturer, equal to the following:
 1. Ardex, Inc., products "Feather Flash" and "Ardex SD-P".
 2. Quikrete Companies, product "Fast-Set Underlayment 1248".
 3. Silpro Masonry Systems Inc., product "Masco Latex Cement".
 4. Or equal.
- B. Adhesives: as recommended by Roppe to meet site conditions.
 1. Roppe #1100 Wall Base Adhesive

- C. Caulking: colored caulking acceptable to wall base manufacturer.
- D. Transition and edge strips:
 - 1. General: Homogeneous rubber, of profiles required for thickness of abutting materials.
 - 2. Edge strips: Tapered or bull nose edge.
 - 3. Colors: Match or contrast with the flooring, as selected by the Architect from standard colors available, of width shown on the drawings.
- E. Cleaning material: Domestic neutral floor detergent having a pH 7 or pH 8, as recommended by the flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
- B. Prepare substrates according to manufacturer's written instructions to ensure adhesion of rubber wall base.
 - 1. Prepare substrates to be smooth, rigid, flat, level, permanently dry, clean and free of foreign materials such as paint, dust, grease, oils, solvent, and all other contaminants that may interfere with adhesive bond.
 - 2. Remove, by light sanding and grinding, all protruding edges, high spots, bumps and ridges. Ensure that substrate is free from paint, varnish, wax, oil, or other foreign matter.
 - 3. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound. Skim-coat substrate where necessary.
 - 4. Vacuum clean substrates to be covered by resilient products immediately before installation.
- C. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with Manufacturer's written instructions for installing resilient wall base.

- B. Install base on solid backing, bond to vertical substrate with continuous contact at horizontal and vertical surfaces.
 - 1. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - 2. Scribe to fit to doorframes and other interruptions.
 - 3. Apply primers as recommended by adhesive manufacturer's written instructions.
 - 4. Spread only enough adhesive to permit installation of materials before initial set. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates. Do not stretch resilient base during installation.
 - 5. Install external and internal corners in accordance with manufacturers specific instructions. Install preformed corners if available before installing straight pieces. Cope corners and fit neatly.
 - 6. Fill voids with plastic filler along the top edge of the resilient wall base on masonry or other similar irregular substrate surfaces.
- C. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

3.4 CLEANING AND PROTECTION

- A. Resilient base: Install base on solid backing, bond to vertical substrate with continuous contact at horizontal and vertical surfaces. Apply wall base to walls, columns, casework , supports and other permanent fixtures in areas where base is required.
 - 1. Install in lengths as long as practical(not less than 8'-0").
 - 2. Scribe to fit to doorframes and other interruptions.
 - 3. Form all external and internal corners in accordance with manufacturers written instructions. Cope inside corners and fit neatly.
 - 4. Fill voids with plastic filler along the top edge of the resilient wall base on masonry surfaces or other similar irregular substrates.
- B. Resilient edge and transition strips:
 - 1. Install edge strips at all edges of flooring, which would otherwise be exposed.
 - 2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.
- C. Comply with Manufacturer's written instructions for cleaning and protection of resilient products.
- D. Perform the following operations immediately after completing resilient base installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Damp-mop surfaces to remove marks and soil.
 - 3. Repair or replace defective or damaged installed products.
- E. Protect resilient base from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- F. Cover resilient wall base until Substantial Completion.

END OF SECTION

SECTION 096543
LINOLEUM SHEET FLOORING

(Part of Work of Section 090005 - RESILIENT FLOORS, Trade-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Linoleum Sheet Flooring
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

1.3. RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specifications Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Division 03 Section "Cast-In-Place Concrete": for cast-in-place concrete, concrete toppings, and moisture mitigation admixture.
 - 2. Division 09 Section "Rubber Wall Base": for abutting rubber wall base.
 - 3. Division 09 - Finishes: for various abutting flooring finishes.

1.4 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM F 2195 Standard Specification for Linoleum Sheet Floor Covering.
 - 2. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 3. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
 - 4. ASTM F 1861 Standard Specification for Resilient Wall Base.
 - 5. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 6. ASTM F 1482 Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.

7. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 8. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 9. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 10. ASTM E 492 Standard Test Method for Laboratory Measurement of Impact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine.
 11. ASTM E 989 Standard Classification for Determination of Impact Insulation Class (IIC).
- B. National Fire Protection Association (NFPA):
1. NFPA 253 Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 2. NFPA 258 Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- C. International Standards and Training Alliance (INSTALL):
1. INSTALL Resilient Certification.
Follow Manufacture recommendations

1.5 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide flooring which has been manufactured, fabricated and installed to performance criteria certified by manufacturer without defects, damage, or failure.

1.6 SUBMITTALS

- A. Make submittals in accordance with Conditions of the Contract and Division 01 "Submittal Procedures" Section.
1. Product data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.
 2. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors, patterns and textures.
 3. Samples: Submit selection and verification samples for finishes, colors, and textures.
- B. Quality Assurance Submittals: Submit the following:
1. Certification of compliance: Letter of compliance signed by manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.
 2. Manufacturer's Instructions: Manufacturer's installation instructions.
 3. Manufacturer's Field Reports: Manufacturer's field reports specified herein.
- C. Sustainable Submittals
1. Product data for Credit MR 4.1 and Credit MR 4.2 for products having recycled content, including documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.

- a. Include statement indicating costs for each product having recycled content.
 2. Product data for Credit MR6 for products having rapidly renewable content, including documentation indicating percentages by weight of rapidly renewable content as required by Division 01.
 - a. Include statement indicating costs for each product having Rapidly Renewable content.
 3. Product data for Credit EQ 4.1 for adhesives and sealants, including printed statement of VOC content as required by Division 01.
 4. Confirm that each product complies with the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers, including 2004 Addenda. If a product specified has not been tested as noted, provide a substitution to the Architect for review and approval of an equal product meeting noted California Department of Health standard.
 5. Product data and certification of SMART sustainable product certification pursuant to LEED innovation credit.
- D. Closeout Submittals: Submit the following:
 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
 2. Warranty: Warranty documents specified herein. Limited 20 year warranty - see manufactures information and coordinate with Division 1 Quality Assurance Section.
- E. LEED Submittals: prepare and submit required documentation for the work of this Section in accordance with USGBC LEED Reference Guide for Building Design and Construction (v4) and Division 01 Section "LEED v4 BD+C: School Requirements".
 1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
 2. Building product disclosure and optimization: Provide required documentation to secure the maximum MR credits, including but not limited to:
 - a. Environmental product declarations and Health Product Declarations.
 - b. Sourcing of raw materials.
 - c. Material ingredients.
 3. Project material cost data: Provide invoices, receipts, statements, and other evidence required to document total cost for materials used for Project.
 4. Waste management and disposal records complying with Division 01 Section "Construction Waste Management and Disposal".
 - a. For products diverted from disposal in landfills and incinerators, and where recycled resources are directed back to the manufacturing process. Include a statement indicating percentage of materials diverted and recycled and the costs associated with each.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
 - 1. Engage installer certified as a [Forbo "Associate Mechanic" or INSTALL certified Resilient Installer (standard installations)] [Forbo "Master Mechanic" (complex installations)].
 - 2. Certificate: Submit certificate indicating installer qualification.
- B. Regulatory Requirements:
 - 1. Fire Performance Characteristics: Provide resilient linoleum sheet flooring with the following fire performance characteristics as determined by testing products in accordance with ASTM method indicated below by a certified testing laboratory or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Critical Radiant Flux: Class 1 Rating per NFPA 253 (ASTM E 648) (0.45 watts/cm² or greater).
 - b. Smoke Density: Less than 450 per NFPA 258 (ASTM E 662).
- C. Mock-Ups:
 - 1. Provide substrate preparation mockups in 15' x 15' size for Architect's review and approval. (As shown on the drawing)
 - 2. After substrate preparation approval by Architect, provide rubber tile flooring installation mockups over prepared substrate in 10' x 10' size for Architect's review and approval. (As shown on the drawing)
 - 3. Dry lay mockup is required for two classrooms - consisting of design, pattern of all colors used in pattern, cut and place to show entire pattern design, showing a net fit seam. Location of mockup to be determined in field. After mockup is approved, Linoleum Flooring Patterns will be released for ordering material for entire project.
 - 4. The contractor shall not proceed with installation until the required mockup has been approved by Architect.
- D. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.
- E. Pre-Installation Testing: Conduct pre-installation testing as follows: [Specify testing (i.e., bond test, pH test, etc).]

1.8 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with Division 1 Product Requirements Sections.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1. Material should be stored in areas that are fully enclosed and weathertight. The permanent HVAC should be fully operational, controlled and set at a minimum of 68° F (20° C) for at least 48 hours prior to the installation.

1.9 PROJECT CONDITIONS

- A. Environmental Requirements/Conditions: In accordance with manufacturer's recommendations, areas to receive flooring should be clean, fully enclosed and weathertight. The permanent HVAC must be fully operational, controlled and set at a minimum of 68o F (20o C) for a minimum of seven days prior to, during, and seven days after the installation. The flooring material should be conditioned in the same manner for at least 48 hours prior to the installation. Areas to receive flooring shall be adequately lighted to allow for proper inspection of the substrate, installation and seaming of the flooring, and for final inspection.
- B. Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during, and after installation as recommended by manufacturer.
 1. Temperature Conditions: 68o F (20o C) for a minimum of seven days prior to, during, and seven days after the installation.
- C. Existing Conditions: [Specify existing conditions affecting product use and installation.]
- D. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.10 SEQUENCING AND SCHEDULING

- A. Finishing Operations: Install tile flooring after finishing operations, including painting and ceiling operations, have been completed.
- B. Concrete Curing: Do not install tile flooring over concrete substrates until substrates have cured and are dry to bond with adhesive as determined by resilient flooring manufacturer's recommended bond, and pH test.
 1. Flooring installer shall have the responsibility for carrying out the manufacturer's recommended bond, moisture test, and pH test prior to commencing installation.
 2. Submit test results and report any unsatisfactory conditions to Construction Manager and Architect.

1.11 WARRANTY

- A. Provide warranties, commencing from the date of Substantial Completion, in accordance with Conditions of Contract and Division 01 Section "Warranties".
- B. Manufacturer Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty agreeing to repair or replace sheet linoleum floor covering that fails within the warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Material manufacturing defects.

- b. Surface wear and deterioration to the point of wear-through where normal foot and wheeled traffic is occurring or where the material is being properly maintained.
 - c. Failure due to substrate moisture exposure not exceeding 98% relative humidity when tested according to ASTM F2170.
 - 2. Warranty Period: Twenty (20) years commencing on Date of Substantial Completion.
 - 3. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- C. Installation Warranty: Submit the contractor's installation warranty signed by the Construction Manager at Risk (CM-R) and Installer for Owner's Acceptance, agreeing to repair or replace work which has failed as a result of defects in workmanship. Upon notification of such installation deficiencies, within the warranty period, make necessary repairs or replacement at the convenience of the Owner.
 - 1. Warranty Period: Two (2) year limited warranty commencing on Date of Substantial Completion from contractor.
 - 2. Installation warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1.12 MAINTENANCE

- A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 01 Closeout Submittals (Maintenance Materials) Section.
 - 1. Quantity: Furnish quantity of flooring units equal to 3% of amount installed.
 - 2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

PART 2 - PRODUCTS

2.1 MANUFACTURES

- A. Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
 - 1. Tarkett
 - 2. Gerflor
 - 3. Forbo Flooring, Inc. Hazleton, PA

2.2 LINOLEUM SHEET RESILIENT FLOOR COVERING

- A. Linoleum Sheet Flooring and Adhesive:
 - 1. Description: Homogeneous linoleum sheet made primarily of natural materials consisting of linseed oil, wood flour, and rosin binders, mixed and calendared onto natural jute backing. Pattern and color shall extend throughout total thickness of material.

2. Basis of Design: "Marmoleum Marbled Linoleum Sheet and Linoleum Adhesive" as manufactured by Forbo Flooring, Inc., Hazleton, PA.
3. Width: 2 Meters (79")
4. Length: 32 Meters (105 Linear Feet)
5. Gauge: 2.5mm (1/10")
6. Backing: Jute
7. Patterns and Colors: Provide up to 12 colors in custom random patterns as selected by Architect.
8. Adhesive: Forbo Sustain 100 Adhesive, or approved equal.
9. Net Fit Seams: All Marmoleum sheet products shall be installed utilizing net fit seams.
10. Topshield 2 Finish: Applied during the manufacturing process.

2.3 ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.
 1. Ardex, Inc., products "Feather Finish" and "Ardex SD-P".
 2. Quikrete Companies, product "Fast-Set Underlayment 1248".
 3. Silpro Masonry Systems Inc., product "Ultra Skim and Speedtop"
 4. Or equal.

2.4 RELATED MATERIALS

- A. Related Materials: Refer to other sections for related materials as follows:
 1. Resilient Flooring Accessories: Refer to Division 9 Finishes Sections for resilient flooring accessories.
 2. Expansion Joint Covers: Refer to other specification section for expansion joint covers to be used with resilient flooring.

2.5 SOURCE QUALITY

- A. Source Quality: Obtain flooring product materials from a single manufacturer.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

3.2 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.
 1. Perform manufacturer's recommended bond test, bond test, and pH test, prior to commencing the installation.

- B. Material Inspection: In accordance with manufacturer's installation requirements, visually inspect materials prior to installation. Material with visual defects shall not be installed and shall not be considered as a legitimate claim.
- C. Moisture Testing: As specified in Division 03 Section "Cast-In-Place Concrete". No further moisture testing shall be required prior to installation of the resilient floor coverings.

3.3 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during work of this Section.
- B. Surface Preparation:
 - 1. General: Prepare floor substrate in accordance with manufacturer's instructions.
 - 2. Floor Substrate: Floors shall be sound, smooth, flat, permanently dry, clean, and free of all foreign materials including, but not limited to, dust, paint, grease, oils, solvents, curing and hardening compounds, sealers, asphalt and old adhesive residue.
 - 3. Concrete Floor Substrate: Concrete floor substrate shall have a minimum compressive strength of 3,000 psi. Refer to Division 03 Section "Cast-In-Place Concrete" for patching and repairing crack materials, and leveling compounds with portland cement based compounds.
 - 4. Moisture Vapor Emission Testing:
 - a. Perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in-situ Probes" as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
 - 1) Perform three tests for first 1,000 ft² and at least one additional test for each 1,000 ft².
 - 2) Select test locations to provide information about moisture distribution across the entire concrete floor slab, especially areas of potential high moisture. Include a test location within 3 ft of each exterior wall.
 - b. Do not proceed with flooring installation until results of moisture tests are accepted by flooring and adhesive manufacturer. All test results shall be documented and submitted to the architect for record.

3.4 INSTALLATION

- A. Adhesive Flooring Installation: Begin laying sheet at the starting point, ensuring that the sheet is laid exactly along the layout lines. The sheet must be installed into wet adhesive, do not spread the adhesive in an area larger than the sheet can be installed while the adhesive is still wet. The successful installation of sheet border is best accomplished by following one of two strategies. (1) When laying out sheet, determine the edge of a field sheet a comfortable distance from each wall and then snap chalk lines around the perimeter of the room. When spreading adhesive, use these lines as a guide to stop spreading adhesive and install the field tile up to the adhesive spread lines. Once the field tiles have been installed, the border tiles and be "dry" fitted (before spreading the adhesive). After the border sheet have been cut, adhesive can be applied in the area of the border tiles and the tiles can be placed immediately into the wet adhesive. (2) Plan the sequence of spreading adhesive so that the border sheet can be cut and placed into the adhesive before the adhesive working time has been exceeded. Immediately after installation, roll the tile with a 100 pound roller in both directions and repeat as necessary to ensure adequate transfer of adhesive to the backing.

1. Adhesive Material Installation: Use trowel as recommended by flooring manufacturer for specific adhesive. Spread at a rate of approximately 150 ft²/gallon, as recommended by flooring manufacturer.

B. Installation Techniques:

1. Where demountable partitions and other items are indicated for installation on top of finished flooring, install flooring before these items are installed.
2. Scribe, cut, fit flooring to butt tightly to vertical surfaces, permanent fixtures and built-in furniture, including pipes, outlets, edgings, thresholds, nosings, and cabinets.
3. Extend flooring into toe spaces, door reveals, closets, and similar openings.
4. Install flooring on covers for telephone and electrical ducts, and similar items occurring within finish floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers.
5. Do not install resilient flooring over expansion joints. Use expansion joint covers manufactured for use with resilient flooring. Refer to other specification sections for expansion joint covers.
6. Adhere resilient flooring to substrate without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed installation.
 - a. Use adhesive applied to substrate in compliance with flooring manufacturer's recommendations, including those for trowel notching, adhesive mixing, and adhesive open and working times.
7. Roll resilient flooring as required by resilient flooring manufacturer.
8. Heat-weld all seams, vertical and horizontal.

C. Finish Flooring Patterns: As indicated or as selected by Architect.

3.5 FIELD QUALITY REQUIREMENTS

A. Manufacturer's Field Services: Upon Owner's request and with at least 72 hours notice, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

1. Site Visits: schedule the following min. site visits.
 - a. Monitor manufacturer's recommended bond, moisture test, and pH test.
 - 1). Additional site visits resulted from failed substrate moisture and/or pH tests shall be borne by Construction Manager.
 - b. Substrate preparation.
 - c. Mock up installation.
 - d. Interim installation.
 - e. Warranty inspection prior to Substantial Completion.

3.6 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

1. Remove visible adhesive and other surface blemishes using cleaning methods recommended by floor manufacturer.
 2. Sweep and vacuum floor after installation.
 3. Do not wash floor until after time period recommended by flooring manufacturer.
 4. Damp mop flooring to remove black marks and soil.
- B. Resilient edge and transition strips:
1. Install edge strips at all edges of flooring, which would otherwise be exposed.
 2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.

3.7 PROTECTION

- A. Protection: Protect installed product and finish surfaces with heavy duty kraft paper from damage during construction. Remove and legally dispose of protective covering at time of Substantial Completion.

3.8 INITIAL MAINTENANCE PROCEDURES

- A. General: Include in Contract Sum Amount cost for initial maintenance procedures, and execute procedures after flooring installation as recommended by flooring manufacturer.
- B. Initial maintenance "Starter Kit" supplied by manufacturer. Initial maintenance to be conducted by flooring contractor.
- C. Drying Room Yellowing: Expose installed linoleum to either natural or artificial light to allow "drying room yellowing" (the film is a natural occurrence of the oxidation of the linseed oil in linoleum products) on installed linoleum flooring to disappear prior to initiating temporary protection procedures.

END OF SECTION

SECTION 096560

RESILIENT ATHLETIC FLOORING

(Part of Work of Section 090005 - RESILIENT FLOORS, Trade-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Rubber Athletic Floor - Tile
 - 2. Rubber Athletic Floor - Sheet
 - 3. Vinyl Athletic Flooring
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for substrate.
 - 2. Section 096460 - WOOD ATHLETIC FLOORING.
 - 3. Division 09 – FINISHES for various a butting floor finishes.
 - 4. Section 116620 - ATHLETIC EQUIPMENT for floor plate and sleeve assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives and glues used at Project site, documentation including printed statement of VOC content.
 - 2. Product Data for Credit IEQ 4.2: For interior paints used at Project site, documentation including printed statement of VOC content.
 - 3. Product Data for Credit IEQ 4.3: For interior flooring used at Project site, documentation including printed statement of VOC content and compliance with FloorScore Standard.

- C. Shop Drawings: Show installation details and locations of the following:
 - 1. Border tiles.
 - 2. Floor patterns.
 - 3. Locations of floor inserts for athletic equipment.
- D. Samples for Verification: For each type, color, and pattern of floor covering indicated, 12-inch-square Samples of same thickness and material indicated for the Work.
- E. Qualification Data: For resilient athletic flooring installer.
- F. Maintenance Data: For floor coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall be manufacturer's approved for the requirements of the project, experienced in the resilient athletic flooring industry and shall have a minimum of five (5) years experiencing in the installation of similar products.
- B. Mockups:
 - 1. Provide substrate preparation mockups in 15'x15' size for Architect's review and approval. (As shown on the drawing)
 - 2. After substrate preparation approval by Architect, provide rubber tile flooring installation mockups over prepared substrate in 10'x10' size for Architect's review and approval. (as shown on the drawing)

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store materials to prevent deterioration. Store tiles on flat surfaces and rolls upright.

1.6 PROJECT CONDITIONS

- A. Adhesively Applied Products:
 - 1. Maintain temperatures within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor coverings during the following time periods:
 - a. 48 hours before installation, unless longer period is recommended in writing by manufacturer.
 - b. During installation.
 - c. 48 hours after installation, unless longer period is recommended in writing by manufacturer.
 - 2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
 - 3. Close spaces to traffic during floor covering installation.

4. Close spaces to traffic for 48 hours after floor covering installation, unless manufacturer recommends longer period in writing.
- B. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 ATHLETIC FLOORING

- A. Provide the following types:
 1. Rubber Athletic Floor - Tile
 - a. Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
 - i. Johnsonite, Inc.
 - ii. Nora System, Inc.
 - iii. Mondo America Inc.
 - b. Designated on drawings as ASF.
 - c. Basis of Design Johnsonite Inertia Tile
 - i. Tile Size: 24" x 24".
 - ii. Edges: Slide Lock.
 - iii. Thickness 3/8" thick.
 - iv. Standard Colors: Speckled Colors with Hammered Texture
 2. Rubber Athletic Floor – Cleat Resistant Tile
 - a. Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
 - iv. Johnsonite, Inc.
 - v. Nora System, Inc.
 - vi. Or equal.
 - b. Designated on drawings as RT-ATH.
 - c. Basis of Design Johnsonite Triumph Tile
 - i. Tile Size: 24" x 24".
 - ii. Edges: Slide Lock.
 - iii. Thickness: 3/8 thick.
 - iv. Standard Colors: Speckled Colors with Hammered Texture

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.

1. Ardex, Inc., products "Feather Finish" and "Ardex SD-P".
2. Quikrete Companies, product "Fast-Set Underlayment 1248".
3. Silpro Masonry Systems Inc., product "Ultra Skim and Speedtop"
4. Or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
 3. Moisture Vapor Emission Testing:
 - a. Perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in-situ Probes"; as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
 - 1) Perform three tests for first 1,000 ft² and at least one additional test for each 1,000 ft².
 - 2) Select test locations to provide information about moisture distribution across the entire concrete floor slab, especially areas of potential high moisture. Include a test location within 3 ft of each exterior wall.
 - b. Do not proceed with flooring installation until results of moisture tests are accepted by flooring and adhesive manufacturer. All test results shall be documented and submitted to the architect for record.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation, unless manufacturer recommends a longer period in writing.
 - 1. Do not install floor coverings until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOOR COVERING INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit floor coverings to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings, unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on floor coverings. Use nonpermanent, nonstaining marking device.
- E. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and floor covering manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 FLOOR TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
- B. Discard broken, cracked, chipped, or deformed tiles.
- C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered.
 - 1. Lay tiles in pattern of colors and sizes indicated.

3.5 CLEANING AND PROTECTING

- A. Perform the following operations immediately after completing floor covering installation:
 - 1. Remove adhesive and other blemishes from floor covering surfaces.
 - 2. Sweep and vacuum floor coverings thoroughly.
 - 3. Damp-mop floor coverings to remove marks and soil.
 - a. Do not wash floor coverings until after time period recommended in writing by manufacturer.
- B. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Do not move heavy and sharp objects directly over floor coverings. Protect floor coverings with plywood or hardboard panels to prevent damage from storing or moving objects over floor coverings.

END OF SECTION

SECTION 096600

TERRAZZO FLOORING

(Part of Work of Section 070001 - TERRAZZO, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Thin-set epoxy terrazzo.
 - 2. Thin-set, precast epoxy terrazzo base.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for sealants installed with terrazzo.

1.3 PERFORMANCE REQUIREMENTS

- A. Wet Dynamic Coefficient of Friction: For flooring exposed as a walking surface, provide products with the following values as determined by testing identical products per ANSI/ NFSI B101.3 - 2012 Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials, or ANSI 326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials - 2017. Testing by other methods or earlier editions of the specified test method is not acceptable.
 - 1. Wet Dynamic Coefficient of Friction: Not less than 0.43.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:

1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
 - C. Shop Drawings: Include terrazzo fabrication and installation requirements. Include plans, elevations, sections, component details, and attachments to other Work. Show layout of the following:
 1. Divider and control- and expansion-joint strips.
 2. Base and border strips.
 3. Abrasive strips.
 4. Precast terrazzo jointing and edge configurations.
 5. Terrazzo patterns.
 - D. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the Work in size indicated below:
 1. Epoxy Terrazzo: 6-inch-square samples.
 2. Precast Epoxy Terrazzo: 6-inch-square samples.
 3. Accessories: 6-inch-long samples of each exposed strip item required.
 - E. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
 - F. Qualification Data: For Installer.
 - G. Maintenance Data: For epoxy terrazzo to include in maintenance manuals.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: A qualified installer (applicator) who is acceptable to epoxy terrazzo manufacturer to install manufacturer's products.
 1. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.
 - B. Source Limitations: Obtain primary terrazzo materials through one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.
 - C. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of aggregate from one source with resources to provide materials of consistent quality in appearance and physical properties.

- D. NTMA Standard: Comply with NTMA Guide Specification and written recommendations for terrazzo type indicated unless more stringent requirements are specified.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to terrazzo including, but not limited to, the following:
 - 1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review special terrazzo designs and patterns.
 - 4. Review dust-control procedures.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
- B. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
- C. Close spaces to traffic during epoxy terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
- D. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.
 - 1. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Degussa./SKW-MBT; Equal.
 - 2. Crossfield Products Corp., Dex-O-Tex Division; Equal.
 - 3. General Polymers Corporation; Terrazzo 1100.
 - 4. Key Resin; Equal.
 - 5. Master Terrazzo Technologies, LLC; Equal.
 - 6. TEC, Inc., an H. B. Fuller Company; Equal.

2.3 EPOXY TERRAZZO

- A. Thickness: 3/8 inch.
- B. Materials:
 - 1. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate crack preparation and reflective crack reduction.
 - 2. Primer: Product of manufacturer recommended for substrate and use indicated.
 - 3. Epoxy Resin: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
 - 4. Glass Chips: Complying with NTMA standards for mix indicated and containing no deleterious or foreign matter.
 - 5. Divider-Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.
 - 6. Finishing Grout: Resin based.
 - 7. Seal Coat: Slip resistant, thin-coat terrazzo sealer of or approved by terrazzo manufacturer.
- C. Mix: Comply with NTMA's "Guide Specification for Epoxy Terrazzo" and manufacturer's written instructions for component proportions and mixing.
 - 1. Color and Pattern: As indicated on the Finish Schedule.

2.4 DIVIDER AND ACCESSORY STRIPS

- A. Thin-Set Divider Strips: Angle or T type, 1/4 inch deep.
 - 1. Material: White zinc alloy.
 - 2. Top Width: 1/8 inch.
- B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.
- C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
 - 1. Base bead and base dividers.
 - 2. Nosings for stair treads and landings.
 - 3. Edge beads for exposed edges of terrazzo.

2.5 MISCELLANEOUS ACCESSORIES

- A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.
 - 1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2. VOC Content: 50 g/L or less.
3. Do not use adhesives that contain urea formaldehyde.
4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

B. Anchoring Devices:

1. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.

C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

E. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant penetrating-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.

2.6 PRECAST EPOXY TERRAZZO

A. Precast Epoxy Terrazzo Base Units: 1/4 inch thick; cast in maximum lengths possible, but not less than 36 inches ; with rounded, finished top edge.

1. Type: Coved with minimum 3/4-inch radius.
2. Height: As indicated.
3. Outside Corner Units: With finished returned edges at outside corner.
4. Color and Pattern: Match adjacent terrazzo flooring

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:

1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
 - c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
2. Verify that concrete substrates are visibly dry and free of moisture.
3. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
4. Moisture Vapor Emission Testing:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, or as otherwise required in writing by manufacturer of flooring.
5. Relative Humidity Testing:
 - a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.
6. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.

C. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

D. Installation of terrazzo indicates acceptance of surfaces and conditions.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

A. General:

1. Comply with NTMA's written recommendations for terrazzo and accessory installation.

2. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
 3. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet noncumulative.
 4. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
 5. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
- B. Thickness: 3/8 inch nominal.
- C. Flexible Reinforcing Membrane:
1. Prepare and prefill substrate cracks with membrane material.
 2. Install membrane to produce full substrate coverage in areas to receive terrazzo.
 3. Reinforce membrane with fiberglass scrim.
 4. Prepare membrane according to manufacturer's written instructions before applying substrate primer.
- D. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.
- E. Strip Materials:
1. Divider and Control-Joint Strips:
 - a. Locate divider strips in locations indicated.
 - b. Install control-joint strips in locations indicated.
 - c. Install control-joint strips with 1/4-inch gap between strips, and install sealant in gap.
 - d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 2. Accessory Strips: Install accessory strips as required to provide a complete installation.
 3. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch higher than terrazzo surface.
- F. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.
- G. Repair: Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.
- 3.4 PRECAST TERRAZZO INSTALLATION
- A. Install precast terrazzo units using method recommended NTMA and manufacturer unless otherwise indicated.

- B. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8-inch maximum in length, height, or width; noncumulative.
- C. Do not install units that are chipped, cracked, discolored, or not properly finished.
- D. Seal joints between units with joint compound matching precast terrazzo matrix.

3.5 CLEANING AND PROTECTION

- A. Cleaning:
 - 1. Remove grinding dust from installation and adjacent areas.
 - 2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.
- B. Sealing:
 - 1. Seal surfaces according to NTMA's written recommendations.
 - 2. Apply sealer according to sealer manufacturer's written instructions.
- C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 096710

RESINOUS FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Epoxy flooring systems.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for sealants installed at joints in resinous flooring systems.
 - 2. Division 04 Section "Concrete Masonry Units": for masonry wall receiving integrated epoxy cove base finish.
 - 3. Division 0 Section "Joint Sealants": for sealing the joint between epoxy flooring integral cove base and abutting dissimilar materials.
 - 4. Division 09 Section "Ceramic Tiling": for abutting stone thresholds at door openings.
 - 5. Section 09 – Finishes: for various abutting flooring and wall finishes.
 - 6. Division 22 Section "Plumbing": for floor drains and plumbing fixtures penetrating the finish flooring; trench drains requiring continuous resinous flooring finish.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. LEED Submittals:
 - 1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

2. Building product disclosure and optimization: Provide required documentation to secure the maximum MR credits, including but not limited to:
 - a. Environmental product declarations.
 - b. Sourcing of raw materials.
 - c. Material ingredients.
 3. Project material cost data: Provide invoices, receipts, statements, and other evidence required to document total cost for materials used for Project.
- C. Shop Drawings: Provide floor plans, to scale matching Architectural Plans, which indicate extent of each different resinous flooring system including system type, color and pattern, degree of slip resistance, and dimensioned locations of control joints and seams where systems meet.
1. Provide enlarged details, at minimum 3 inch = 1 foot scale, indicating conditions at walls, door frames, pits, curbs, equipment pedestals, and the like.
- D. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.
- E. Material Certificates: For each resinous flooring component, signed by manufacturer.
- F. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- G. Maintenance Data: For resinous flooring to include in maintenance manuals.
- H. Test Results: For field testing of substrate, signed by installer.
- 1.4 QUALITY ASSURANCE
- A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.
 2. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- C. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Apply full-thickness mockups on 48-inch- square floor area selected by Design Professional.

- a. Include 48-inch length of integral cove base.
 2. Simulate finished lighting conditions for Design Professional's review of mockups.
 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Pre-installation Conference: Prior to installation of flooring, meet at the Project site with the Manufacturer's Representative, the Installer, the Architect, the Owner's Representative and the Owner's Testing Agency. Record discussions and furnish copy to each participant. Topics to be discussed shall include, but not be limited to:
1. Existing and new slab conditions
 2. Owner's Testing Agency results of mandatory testing
 3. Surface preparation
 4. Required room temperatures
 5. Ventilation
 6. Step-by-step application procedures
 7. Curing time and methods
 8. Protection of completed Work
- E. Testing:
1. ASTM E 1907 Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
 - a. ASTM F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor Using Anhydrous Calcium Chloride
 - b. ASTM D 4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
 - c. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in situ Probes
 2. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 3. ASTM D 4501 Standard Test Method for Shear Strength of Adhesive Bonds Between Rigid Substrates by the Block-Shear Method
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
 - B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.
- 1.6 PROJECT CONDITIONS
- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
 1. Maintain ambient air temperature between 65oF and 85oF.

2. Type I Concrete substrate shall be properly cured for a minimum of 30 days. Type III Concrete shall be properly cured for a minimum of 7 days.
 - B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
 - C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- 1.7 WARRANTY
- A. Manufacturer shall furnish a single, written warranty covering 100% of the material and labor costs protecting the client from delamination, disbondment, and osmotic/hydrostatic failure for a period of three (3) years from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Dur-A-Flex, Inc. Sherwin Williams.
 2. Sherwin Williams.
 3. Stonhard, Inc.
- B. VOC Content of Liquid-Applied Flooring Components: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.2 RESINOUS FLOORING SYSTEM

- A. Basis of Design: 1/4" Hybri-Flex AQ as manufactured by Dur-A-Flex.
 1. Color: Up to 4 colors as selected by Architect.
 2. Wearing Surface: Textured for slip resistance.
 3. Integral Cove Base: 4 inches high with 1 inch radius with zinc or plastic "J" bead.
 4. Overall System Thickness: 1/4 inch.
 5. VOC: Less than 100 g/l.
 6. Moisture Vapor Limit: 20lbs./1,000 sq.ft./24 hour per ASTM F-1869 or 99%RH per ASTM F-2170.
- B. System Components: Manufacturer's standard components which are compatible with each other and as follows:
 1. Topping: Dur-A-Flex, Inc. Poly-Crete SL resin, hardener and SL aggregate.
 2. The quartz aggregate shall be Dur-A-Flex, Inc. Q28 colored quartz.
 3. Broadcast coat: Dur-A-Glaze #4 resin and hardener.
 4. Grout and topcoat: Dur-A-Flex, Inc. Accelera resin and hardener.

2.3 ACCESSORY MATERIALS

- A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 - 1. Roughen concrete substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
 - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
 - 3. Verify that concrete substrates are dry:
 - a. Moisture Vapor Emission Testing:
 - 1) Perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in-situ Probes" as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
 - a) Perform three tests for first 1,000 ft² and at least one additional test for each 1,000 ft².
 - b) Select test locations to provide information about moisture distribution across the entire concrete floor slab, especially areas of potential high moisture. Include a test location within 3 ft of each exterior wall.
 - 2) Do not proceed with flooring installation until results of moisture tests are accepted by flooring and adhesive manufacturer. All test results shall be documented and submitted to the architect for record.
 - 4. Verify that concrete substrates have neutral pH and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply reinforcing membrane to substrate cracks.
- D. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
 - 1. At top of base provide stainless steel "J" bead.
- E. Apply self-leveling slurry body coat(s) in thickness indicated for flooring system.
 - 1. Broadcast aggregates and, after resin is cured, remove excess aggregates to provide surface texture indicated.
- F. Apply troweled or screeded body coat(s) in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.
- G. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.
- H. Accessories:
 - 1. Provide flooring system with fiberglass scrim for maximum tensile strength and crack isolation.
 - 2. Provide flooring system with antimicrobial agent.
 - 3. Fiberglass reinforcing tape and bond breaker to bridge over wall/floor joint.
 - 4. Provide termination satin anodized aluminum L-strip at all open edges and top of integral wall base.
 - 5. Sanitary sealant at top of integral cove base and fill 1/8" to 1/4" gap around floor drains.
 - 6. Stainless steel "J"bead at top of cove base: equal to schluter.

3.3 CLEANING AND PROTECTING

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
- B. Cure the resinous flooring system materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of the installation and prior to completion of the curing process.
- C. Protect the resinous flooring system from damage and wear during other phases of the construction operation, using temporary coverings as recommended by the manufacturer, if required. Remove temporary covering just prior to final inspection.
- D. Clean the resinous flooring system just prior to final inspection, using materials and procedures suitable to the system manufacturer.
- E. Some cleaners will affect the color, gloss or texture of your polymer floor surfaces. To determine how your cleaner will perform, first test each cleaner, in a small area, utilizing your cleaning technique. This precaution will demonstrate the effect of your cleaner and technique. If no deleterious effects are observed, continue with the procedure. If deleterious effects do occur, modify the cleaning material and/or procedure. For recommendations regarding types of cleaners, contact the 1/8" Decorative Broadcast Epoxy Flooring System manufacturer.

END OF SECTION

SECTION 096813

TILE CARPETING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Carpet tile.
 - 2. Carpet accessories.
 - 3. Substrate preparation for carpet and accessories.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 096510 - RESILIENT FLOORING AND ACCESSORIES for resilient wall base and accessories installed with carpet.
 - 2. Division 03 Section "Cast-In-Place Concrete": Concrete substrate to receive carpet, and concrete sealer admixtures.
 - 3. Division 09 "Resilient Flooring and Accessories" sections: for resilient wall base where indicated in conjunction with carpeting, and for floor finishes abutting and/or related to carpeting.
 - 4. Other Division 09 sections: for floor finishes abutting and/or related to this tile carpeting.
 - 5. Divisions 26 and 27: for electrical and telecommunications receptacles, voice/data/video outlets, devices occurring in floor.

1.3 REFERENCES

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:
 - 1. American Society for Testing and Materials (ASTM):
 - a. E84 – Test Method for Surface Burning Characteristics of Building Materials.

- b. E648 – Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

2. The Carpet and Rug Institute:

- a. CRI Carpet Installation Standard - 2011.
- b. NFPA 253 - Test for Critical Radiant Flux of Floor Covering Systems.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

B. LEED Submittals:

1. MRc2, Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):

If project needs the product specific EPD for LEED point totals, then delete options for the industry-wide EPDs.

- a. Option 1: For carpets, submit industry-wide (generic) EPDs or product specific Type III EPDs.

2. MRc3, Building Product Disclosure and Optimization, Sourcing of Raw Materials:

- a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
- b. Option 1: For carpets, submit corporate sustainability reports (CSR).
- c. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: For carpets, submit evidence of reclamation and recycling programs.
 - 2) Recycled Content: For carpet, submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

3. MRc4, Building Product Disclosure and Optimization, Material Ingredients:

- a. Option 1, Material Ingredient Reporting: For carpets, submit Cradle to Cradle (C2C) certifications (v2 Basic or v3 Bronze level) or Health Product Declarations (HPD) or Declare product labels.
- b. Option 2, Material Ingredient Optimization: For carpets, submit Cradle to Cradle (C2C) certifications (v2 Gold Platinum or v3 Silver Gold Platinum).

4. EQc2, Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.

- a. For carpets, submit test results, including TVOC emissions and VOC content, or Carpet and Rug Institute (CRI), Green Label Plus certifications.
 - b. For adhesives, submit test results, including TVOC emissions and VOC content, or GreenGuard Gold certifications.
 - c. For wet-applied products, submit volume used.
- C. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - 2. Carpet type, color, and dye lot.
 - 3. Seam locations, types, and methods.
 - 4. Type of subfloor.
 - 5. Type of installation.
 - 6. Pattern type, repeat size, location, direction, and starting point.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.
 - 10. Transition details to other flooring materials.
- D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch-long Samples.
- E. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.
- F. Sample Warranties: For special warranties.
- G. Maintenance Data: For carpet to include in maintenance manuals specified in Division 01. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.5 QUALITY ASSURANCE

- A. Installer Qualification: Firm with not less than 5 consecutive years of experience in installation of commercial carpeting of type, quantity and installation methods similar to work of this section. Flooring contractor possessing Contract for the product installation shall not sub-contract the labor without written approval of the Project Manager. Flooring contractor will be responsible for proper product installation, including floor testing and preparation as specified by the manufacturer and JOB CONDITIONS herein. Flooring contractor to provide Owner a written installation warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of one year after job completion.
- B. Manufacturer's Qualifications: Firm (carpet mill) with not less than 5 consecutive years of production experience with carpet similar to type specified in this section; whose published

product literature clearly indicates general compliance of products with requirements of this section. Obtain each type of product from one source and by a single manufacturer.

- C. Carpeting Standard: Comply with the Carpet and Rug Institute's "CRI Carpet Installation Standard," 2011 edition, formerly CRI 104 "Standard For Installation Specification Of Commercial Carpet."
- D. Dye Lots: All carpet of the same type in continuous areas shall be from the same dye lots.
- E. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- F. Mockups: Before installing carpet, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with CRI Carpet Installation Standard, Section 5, "Storage and Handling."
- B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.
- C. Before beginning installation, inspect all goods to verify all goods uniformity, quality, color and texture against the approved samples. It shall also be inspected for defects, color variations, or shipping damage. Defective and danged materials shall be immediately replaced at no additional cost to the Owner.
 - 1. Carpet tiles shall be inspected to insure that carpet tiles are from the same dye lot.
- D. The contractor shall not proceed with installation until the required mock up has been approved by Architect.

1.7 PROJECT CONDITIONS

- A. General: Comply with CRI Carpet Installation Standard, Section 7, "Site Conditions."
- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.
- D. Where demountable partitions, equipment, or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 WARRANTY

- A. Provide certified copies of the following manufacturer's product warranties:
 - 1. Lifetime Face Fiber Wear
 - 2. Lifetime Staining/Soiling Resistance
 - 3. Lifetime Color Pattern Permanency
 - 4. Lifetime Delamination of Backing
 - 5. Lifetime Edge Ravel
 - 6. Lifetime Tuft Bind
 - 7. Lifetime Floor Compatibility
 - 8. Lifetime Antistatic
 - 9. Lifetime Antimicrobial Protection
 - 10. Lifetime Flammability
 - 11. Lifetime Cushion Resiliency
 - 12. Lifetime Dimensional Stability
 - 13. Lifetime Floor Release
 - 14. Lifetime Moisture Resistance
- B. Warranty shall be sole source responsibility of the manufacture. Second source warranties or warranties that involve parties' other than the manufacturer is unacceptable.
- C. General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- D. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
 - 1. Warranty Period: Ten years from date of Substantial Completion.
- E. Installers Warranty: The Contractor (Installer) shall fully guarantee the installation against defects in workmanship, seaming and loss of adhesion to floor for a period of one (1) year from the date of Substantial Completion. Upon written notice, the Installer shall repair or replace the affected area at no cost to MDC.

1.9 EXTRA MATERIALS (ATTIC STOCK)

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet: Tiles equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
1. Mannington Commercial
 2. Milliken Carpet
 3. Mohawk.
 4. Tandus Centiva.
 5. Or equal.
- B. Basis of Design Tile : Preliminary color selection upon approval during construction.
1. CPT-1: Consequence 2.0 Sequel as manufactured by Milliken Carpet
 - a. Color: Lake SEQ106-107
 2. CPT-2: Consequence 2.0 Outcome as manufactured by Milliken Carpet
 - a. Color: Lake OUT106-107
 3. CPT-3: Edge Lit as manufactured by Milliken Carpet
 - a. Color: Mercury EDG107-133
 4. CPT-4: Edge Lit as manufactured by Milliken Carpet
 - a. Color: Ultraviolet EDG138-249

2.2 CARPET TILE CHARACTERISTICS

1. Construction: Tufted loop pile
2. Face Fiber: Type 6,6 Nylon.
3. Tile Size: 39.4" x 39.4"
4. Dye Method: Yarn Dyed or Injection Dyed solution.
5. Pile Density: 5400 minimums.
6. Gauge: 1/10" minimum.
7. Surface Pile Weight: 20 oz./sq. yd. minimum.
8. Stitches per Inch: 8.00" minimum.
9. Backing System: Manufacturer's standard PVC-Free cushion backing
10. Antimicrobial Treatment: Lifetime Warranted built in protection
11. Critical Radiant Flux Classification: Not less than 0.45 W/sq.cm.
12. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC-165, per AATCC-165.
13. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) per AATCC-16.
14. Stain Resistance: AATCC-175, must pass Acid Red 40 spot test with an 8 or better.
15. Dimensional Stability: Aachen Method Din 54318, 0.2% or less per ISO 2551.
16. Smoke Density: < or = 450 flaming.

17. Static Generation: AATCC 134 w/neolite < or = 3.5KV at 20% r.h.
18. Flame-Spread and Flammability:
 - a. Carpet flammability shall meet federal Flammability Standards CPSC FF 1-70, when tested in accordance with ASTM D2959-70T (Methenamine Pill Test).
19. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement based formulation provided by carpet tile manufacturer.
20. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and recommended by carpet tile manufacturer for releasable installations.
21. Indoor Air Quality Control: Carpet tile and adhesive shall be CRI Green Label Plus certified by published class (product type) and certification number.
22. Water intake for Manufacturing and Finishing purposes must not exceed 1 gallon per square meter.
23. Additional Manufacturer Warranties: Lifetime Face Fiber Wear, Lifetime Color Pattern Permanency, and Lifetime Moisture Resistance
24. Pattern and Color: Understanding the importance of pattern and color for aesthetics, as well as appearance retention and maintainability, the Architect reserves the right to reject any product or manufacturer based solely on pattern and color considerations.

2.3 PERFORMANCE REQUIREMENTS

A. LEED Requirements:

1. MRc2, Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):

If project needs the product specific EPD for LEED point totals, then delete options for the industry-wide EPDs.

 - a. Option 1: Provide carpet with industry-wide (generic) EPDs or product specific Type III EPDs.
2. MRc3, Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. Option 1: Provide carpets from manufacturers with corporate sustainability reports (CSR).
 - b. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: Provide carpets from manufacturers with reclamation and recycling programs.
 - 2) Recycled Content: Provide carpets manufactured with recycled content.
3. MRc4, Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: Provide carpets with Cradle to Cradle (C2C) certifications (v2 Basic or v3 Bronze level) or Health Product Declarations (HPD) or Declare product labels.

- b. Option 2, Material Ingredient Optimization: Provide carpets with Cradle to Cradle (C2C) certifications (v2 Gold Platinum or v3 Silver Gold Platinum).
 - 4. EQc2, Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
- B. Other Sustainable Design Performance Requirements:

The following is optional. Owner may prefer to be PVC-free. PVC and SBR content may necessitate IAQ testing per Eqc4.

- 1. Do not permit polyvinyl chloride (PVC) or styrene butadiene rubber (SBR) carpet backing materials.

2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the carpet manufacturer.
- A. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by carpet manufacturer.

The following items are required for LEED v4:

- 1. Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 2. Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
- 3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.

Adhesives films and tapes may be used in lieu of adhesive spread:

- B. Adhesive Film, for Carpet Tiles: Pressure sensitive adhesive, applied on one side of a polyester film, recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General: Do not start work until work of other trades are substantially completed. Inspect surfaces to receive carpet and verify that all such work is complete to the point where this installation may properly commence. In the event of discrepancy, notify General Contractor. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved. Start of carpet installation indicates acceptance of subfloor conditions and full responsibility for completed work.

- B. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- C. Examine carpet for type, color, pattern, and potential defects.
- D. Concrete Subfloors: Comply with CRI Carpet Installation Standard, Section 9, "Testing Concrete Substrates." Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet manufacturer.
 - 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI Carpet Installation Standard, Section 7.3, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
 - 3. Moisture Vapor Emission Testing:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, or as otherwise required in writing by manufacturer of flooring.
 - 4. Relative Humidity Testing:
 - a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.
 - 5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
- C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

- D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Comply with CRI Carpet Installation Standard, Section 18, "Modular Carpet," and with carpet tile manufacturer's written installation instructions.
 - 1. Installation Method, for Adhesive: Partial glue down; install periodic tiles with releasable, pressure-sensitive adhesive.
 - 2. Installation Method, for Adhesive Film: Free lay; apply adhesive film squares at corners of tiles.
 - a. Do not install tiles with adhesive film at stair and ramp locations.
 - b. Do not install tiles with adhesive film over existing carpets.
 - 3. Installation Method, for No Adhesives: Free lay; press tiles firmly.
 - a. Do not install tiles without adhesive at stair and ramp locations.
 - b. Do not install tiles without adhesive over existing carpets.
 - 4. Carpet Tile Pattern: As directed by Architect.
 - 5. Maintain dye lot integrity. Do not mix dye lots in same area.
- B. Install pattern parallel to walls and borders.
- C. Do not bridge building expansion joints with carpet.
- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element and HEPA filter.
- B. Protect installed carpet to comply with CRI Carpet Installation Standard, Section 20, "Protecting Indoor Installations."

- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 096816

SHEET CARPETING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Carpet sheet, for direct glue-down installation.
 - 2. Carpet accessories.
 - 3. Substrate preparation for carpet and accessories.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 096510 - RESILIENT FLOORING AND ACCESSORIES for resilient wall base and accessories installed with carpet.
 - 2. Division 03 Section "Cast-In-Place Concrete": Concrete substrate to receive carpet, and concrete sealer admixtures.
 - 3. Division 09 "Resilient Flooring and Accessories" sections: for resilient wall base where indicated in conjunction with carpeting, and for floor finishes abutting and/or related to carpeting.
 - 4. Other Division 09 sections: for floor finishes abutting and/or related to this sheet carpeting.
 - 5. Divisions 26 and 27: for electrical and telecommunications receptacles, voice/data/video outlets, devices occurring in floor.

1.3 REFERENCES

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:
 - 1. American Society for Testing and Materials (ASTM):
 - a. E84 – Test Method for Surface Burning Characteristics of Building Materials.

- b. E648 – Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

2. The Carpet and Rug Institute:

- a. CRI Carpet Installation Standard - 2011.
- b. NFPA 253 - Test for Critical Radiant Flux of Floor Covering Systems.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

B. LEED Submittals:

1. MRc2, Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):

If project needs the product specific EPD for LEED point totals, then delete options for the industry-wide EPDs.

- a. Option 1: For carpets, submit industry-wide (generic) EPDs or product specific Type III EPDs.

2. MRc3, Building Product Disclosure and Optimization, Sourcing of Raw Materials:

- a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
- b. Option 1: For carpets, submit corporate sustainability reports (CSR).
- c. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: For carpets, submit evidence of reclamation and recycling programs.
 - 2) Recycled Content: For carpet, submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

3. MRc4, Building Product Disclosure and Optimization, Material Ingredients:

- a. Option 1, Material Ingredient Reporting: For carpets, submit Cradle to Cradle (C2C) certifications (v2 Basic or v3 Bronze level) or Health Product Declarations (HPD) or Declare product labels.
- b. Option 2, Material Ingredient Optimization: For carpets, submit Cradle to Cradle (C2C) certifications (v2 Gold Platinum or v3 Silver Gold Platinum).

4. EQc2, Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.

- a. For carpets, submit test results, including TVOC emissions and VOC content, or Carpet and Rug Institute (CRI), Green Label Plus certifications.
 - b. For adhesives, submit test results, including TVOC emissions and VOC content, or GreenGuard Gold certifications.
 - c. For wet-applied products, submit volume used.
 - C. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - 2. Carpet type, color, and dye lot.
 - 3. Seam locations, types, and methods.
 - 4. Type of subfloor.
 - 5. Type of installation.
 - 6. Pattern type, repeat size, location, direction, and starting point.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.
 - 10. Transition details to other flooring materials.
 - D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings.
 - 1. Sheet Carpet: 12-inch- square Sample.
 - a. Carpet Seam: 6-inch Sample.
 - 2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch-long Samples.
 - E. Product Schedule: Use same room and product designations indicated on Drawings.
 - F. Sample Warranties: For special warranties.
 - G. Maintenance Data: For carpet to include in maintenance manuals specified in Division 01. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualification: Firm with not less than 5 consecutive years of experience in installation of commercial carpeting of type, quantity and installation methods similar to work of this section. Flooring contractor possessing Contract for the product installation shall not sub-contract the labor without written approval of the Project Manager. Flooring contractor will be responsible for proper product installation, including floor testing and preparation as specified by the manufacturer and JOB CONDITIONS herein. Flooring contractor to provide Owner a written installation warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of one year after job completion.

- B. Manufacturer's Qualifications: Firm (carpet mill) with not less than 5 consecutive years of production experience with carpet similar to type specified in this section; whose published product literature clearly indicates general compliance of products with requirements of this section. Obtain each type of product from one source and by a single manufacturer.
- C. Carpeting Standard: Comply with the Carpet and Rug Institute's "CRI Carpet Installation Standard," 2011 edition, formerly CRI 104 "Standard For Installation Specification Of Commercial Carpet."
- D. Dye Lots: All carpet of the same type in continuous areas shall be from the same dye lots.
- E. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- F. Mockups: Before installing carpet, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with CRI Carpet Installation Standard, Section 5, "Storage and Handling."
- B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.7 PROJECT CONDITIONS

- A. General: Comply with CRI Carpet Installation Standard, Section 7, "Site Conditions."
- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.
- D. Where demountable partitions, equipment, or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 WARRANTY

- A. Provide certified copies of the following manufacturer's product warranties:
 - 1. Lifetime Warranty against excessive surface wear
 - 2. Lifetime Latent Defects Warranty
 - 3. Lifetime Delamination Warranty
 - 4. Lifetime Edge Ravel Warranty
 - 5. Lifetime Floor Compatibility Warranty

6. Lifetime Antistatic Guarantee
 7. Lifetime Antimicrobial Properties
- B. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.
- C. General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- D. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
1. Warranty Period: Ten years from date of Substantial Completion.
- 1.9 EXTRA MATERIALS (ATTIC STOCK)
- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
1. Mannington Commercial
 2. Milliken Carpet
 3. Tandus Centiva.
 4. Or equal.
- B. Basis of Design Sheet: Preliminary color selection upon approval during construction.
1. CPT-5: Googie Telejector as manufactured by Mannington Commercial.
 - a. Construction: Patterned Loop
 - b. Face Fiber: Antron® Legacy™ Type 6,6 Nylon
 - c. Dye Method: Solution/Yarn
 - d. Gauge: 5/64 (50.39 per 10 cm)
 - e. Stitches: 1 0.33 (40.67 per 10 cm)
 - f. Density: 7,058 (262.26 kg/m3)
 - g. Pile Thickness: 0.102" (2.59 mm)

- h. Weight: 20 oz/yd² (678 g/m²)
- i. Backing: Integra® HP
- j. Size/Width: 12'-6" (3.81 m)
- k. Color: Aquatomic 31645

2. CPT-6: Googie Phenomena as manufactured by Mannington Commercial.

- a. Construction: Patterned Loop
- b. Face Fiber: Antron® Legacy™ Type 6,6 Nylon
- c. Dye Method: Solution/Yarn
- d. Gauge: 5/64 (50.39 per 10 cm)
- e. Stitches: 10 (39.37 per 10 cm) Per Inch
- f. Density: 7,659 (284.59 kg/m³)
- g. Pile Thickness: 0.094" (2.39 mm)
- h. Weight: 20 oz/yd² (678 g/m²)
- i. Backing: Integra® HP
- j. Size/Width: 12'-6" (3.81 m)
- K. Color: Aquatomic 31645

2.2 SHEET CARPET CHARACTERISTICS

- 1. Construction: Tufted loop pile
- 2. Face Fiber: Antron Lumena Nylom 6,6
- 3. Size: 6' Roll
- 4. Dye Method: Solution Dyed
- 5. Gauge: 5/64 gauge minimum
- 6. Stitches: 12.0 stitches Per Inch
- 7. Pile Height: 0.187 inch
- 8. Backing System: Powerbond ethos Cushion
- 9. Fade Resistance: Minimum rating 4 using AATCC 175
- 10. Soil Resistance: Manufacturer Approved Technology
- 11. Stain Resistance: Minimum rating of 6 using AATCC 175
- 12. Indoor Air Quality: Registered CRI Green Label Plus
- 13. Environmental: Minimum sustainable carpet assessment NSF140 Gold or Platinum Certified
- 14. Pattern and Color: Understanding the importance of pattern and color for aesthetics, as well as appearance retention and maintainability, the Architect reserves the right to reject any product or manufacturer based solely on pattern and color considerations.

2.3 PERFORMANCE REQUIREMENTS

- A. Test reports for the following performance assurance testing to be submitted upon request. Submitted results shall represent average results for production goods of the referenced style.

All products must meet requirements listed below.

- 1. Flooring Radiant Panel
ASTM E-648 / NFPA 253: Class 1 (CRF: 0.45 watts/sq cm or greater)
- 2. Federal Flammability
CPSC FF 1-70: Passes
- 3. Smoke Density
ASTM E-662 / NFPA 258: < 450 Flaming Mode

4. Electrostatic Propensity
AATCC 134 (Step & Scuff): 3.0 kV or less
5. Static Coefficient of Friction
ASTM C-1028: Passes ADA Requirements for Accessible Routes (minimum 0.60)
6. Delamination of Cushion of Pile Floor Coverings
ASTM D-3936: No Delamination
7. Light fastness
AATCC 16E: > 4 @ 100 hours solution dyed>>>
8. TARR
Severe Traffic: 3.5 minimum>>> <<<All other applications: 3.0 minimum>>>
9. Moisture Barrier
Moisture Penetration by Impact @ 10 psi: No penetration of backing and seam after 10,000 impacts.
10. Air Flow Barrier
Air Permeability of Textile Fabrics: No Air Flow (0.0 cu. ft/min) through backing and seam.
11. Seam Integrity
Moisture Penetration by Impact @ 10 psi at Seams: No penetration after 10,000 impacts.
The British Spill test is not an acceptable measurement of moisture barrier.
12. Seam Integrity
No seam separation after 50,000 cycles per Phillips Chair Test.

B. LEED Requirements:

1. MRc2, Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):

If project needs the product specific EPD for LEED point totals, then delete options for the industry-wide EPDs.

 - a. Option 1: Provide carpet with industry-wide (generic) EPDs or product specific Type III EPDs.
2. MRc3, Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. Option 1: Provide carpets from manufacturers with corporate sustainability reports (CSR).
 - b. Option 2, Leadership Extraction Practices:
 - 1) Extended Producer Responsibility: Provide carpets from manufacturers with reclamation and recycling programs.
 - 2) Recycled Content: Provide carpets manufactured with recycled content.
3. MRc4, Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: Provide carpets with Cradle to Cradle (C2C) certifications (v2 Basic or v3 Bronze level) or Health Product Declarations (HPD) or Declare product labels.
 - b. Option 2, Material Ingredient Optimization: Provide carpets with Cradle to Cradle (C2C) certifications (v2 Gold Platinum or v3 Silver Gold Platinum).

4. EQc2, Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.

C. Other Sustainable Design Performance Requirements:

The following is optional. Owner may prefer to be PVC-free. PVC and SBR content may necessitate IAQ testing per Eqc4.

1. Do not permit polyvinyl chloride (PVC) or styrene butadiene rubber (SBR) carpet backing materials.

2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the carpet manufacturer.
- B. Adhesive: Provide adhesive that is recommended by the flooring manufacturer for 98% internal relative humidity. The adhesive shall be included as part of the manufacturer's warranty.
 1. Basis of Design: Mannington universal Sealer with Integra adhesive or approved equal.
 2. Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
 4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
- C. Seaming Adhesive, for Sheet Carpet: Provide seaming adhesive recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
 1. Basis of Design: Mannington MT800 Seam Sealer or approved equal. Seaming Adhesive, for Sheet Carpet: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General: Do not start work until work of other trades are substantially completed. Inspect surfaces to receive carpet and verify that all such work is complete to the point where this installation may properly commence. In the event of discrepancy, notify General Contractor. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved. Start of carpet installation indicates acceptance of subfloor conditions and full responsibility for completed work.
- B. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other

conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

- C. Examine carpet for type, color, pattern, and potential defects.
- D. Concrete Subfloors: Comply with CRI Carpet Installation Standard, Section 9, "Testing Concrete Substrates." Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet manufacturer.
 - 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI Carpet Installation Standard, Section 7.3, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
 - 3. Moisture Vapor Emission Testing:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, or as otherwise required in writing by manufacturer of flooring.
 - 4. Relative Humidity Testing:
 - a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.
 - 5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
- C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install product in accordance with Manufacturer's installation instructions.
- B. Direct-Glue-Down Installation: Comply with CRI Carpet Installation Standard, Section 13, "Direct Glue-Down Installation."
 - 1. Carpet Sheet, Stair Installation: Comply with CRI Carpet Installation Standard, Section 17, "Carpet on Stairs" for glue-down installation.
 - 2. Comply with carpet sheet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Install pattern parallel to walls and borders.
- D. Do not bridge building expansion joints with carpet.
- E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Layout product and locate seams in accordance with shop drawings.
 - 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic. Minimize cross seams.
 - 2. Do not locate seams perpendicular through door openings.
 - 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
 - 4. Locate change of color or pattern between rooms under door centerline.
 - 5. Provide monolithic color, pattern, and texture match within any one area.
- H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- I. Completed product is to be smooth and free of bubbles, puckers, and other defects.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element and HEPA filter.
- B. Protect installed carpet to comply with CRI Carpet Installation Standard, Section 20, "Protecting Indoor Installations."

- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 097200

WALL COVERINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Vinyl Wall Covering.
 - 2. Rigid Vinyl Wall Covering
 - 3. Custom Wall Covering.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 099000 - PAINTING AND COATING for primers.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives and glues used at Project site, documentation including printed statement of VOC content.
 - 2. Product Data for Credit IEQ 4.2: For interior paints used at Project site, documentation including printed statement of VOC content.
- C. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.
- D. Samples for Verification: Full width by 3 ft. long section of wall covering.

1. Sample from same print run or dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.
 - E. Product Schedule: For wall coverings. Use same designations indicated on Drawings.
 - F. Qualification Data: For qualified testing agency.
 - G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.
 - H. Maintenance Data: For wall coverings to include in maintenance manuals.
- 1.4 QUALITY ASSURANCE
- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Surface-Burning Characteristics: As follows, per ASTM E 84:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 2. Fire-Growth Contribution: Textile wall coverings tested according to NFPA 265 and complying with test protocol and criteria in the 2003 IBC.
 - B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F 1141.
- 1.5 PROJECT CONDITIONS
- A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.
 - C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 VINYL WALL COVERING (VWC-1)

- A. Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
- B. Wolf Gordon, Inc.
 - 1. MDC Len-Tex Contract
 - 2. Koroseal
 - 3. Wolf Gordon.
 - 4. Approved equal
- C. Basis of Design: Wolf Gordon, Hammersmith.
- D. Physical Properties:
 - 1. Material: Vinyl
 - 2. Collection: London Chic
 - 3. Content: 100% Vinyl
 - 4. Backing: Osnaburg
 - 5. Width: 54"
 - 6. Weight: 20.3 oz per linear yard
 - 7. Color: TBD
- E. Performance Properties:
 - 1. Fire rating: Class A, as per ASTM E84
 - 2. Federal Specifications: Meets or exceeds CCC-W-408D
 - 3. Low VOC Emitting:
 - a. Meets California 01350 standard for low VOC emission.
 - b. Free of calcium, formaldehyde, mercury and solvents.
 - c. Printed with solvent free inks.
 - d. GREENGUARD Indoor Air Quality Certified for low VOC emissions.

4. Warranty: 5 years manufacturer warranty.

2.2 RIGID VINYL WALL COVERING (VWC-2)

- A. Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
 1. Gerflor USA
 2. Bioclad
 3. Palram
 4. Takiron
 5. Approved equal.
- B. Basis of Design (VWC-2): Gerflor - Mipolam Vinyl Wall Coloring, Decoshock, Color: TBD
- C. Physical Properties:
 1. Material: Non-porous antibacterial decorative rigid wall panel and corner pieces.
 2. Collection: Mipolam Vinyl Wall Covering Decoshock
 3. Content: 100% Vinyl
 4. Surface Lightly embossed texture conceals scratches from impact
 5. Seaming Method Heat welded
 6. Thickness: 0.08 inch
 7. Weight: 0.57 lbs/sf
 8. Color: TBD
- D. Performance Properties:
 1. Fire rating: Class A, as per ASTM E84
 2. Federal Specifications: Meets or exceeds CCC-W-408D
 3. Impact resistance: Meets ASTM D5420
 4. Stain Resistance: ASTM D543
 5. Chemical
 6. Low VOC Emitting:

- a. Meets California 01350 standard for low VOC emission.
 - b. Use of Harmful Chemicals: Complies with MRc4 LEED v4
 - c. GREENGUARD Indoor Air Quality Certified for low VOC emissions.
7. Warranty: 10 years manufacturer warranty.

2.3 CUSTOM WALL COVERING (VWC-3)

- A. Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
- 1. Knoll Textiles
 - 2. Wolf Gordon
 - 3. MDC
- B. Basis of Design: Knoll Textiles, Bespoke Wall with custom colors
- C. Physical Properties:
- 1. Content: 100% Vinyl
 - 2. Backing: Osnaburg (Polyester/Cotton)
 - 3. Width: 50 in.
 - 4. Weight: 20 oz
- D. Performance Properties:
- 1. Fire rating: Class A, as per ASTM E84
 - 2. ASTM F793 Type II Wallcovering
 - 3. Colorfastness Wet: 4.5
 - 4. Colorfastness Dry: 3.5
 - 5. Lightfastness 40 hrs: 4.5
 - 6. Clean Air: Gold
- E. Color and Pattern Repeat: Custom

2.4 PRODUCTS, GENERAL

- A. Provide rolls of each type of wall covering from same print run or dye lot.
- B. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the following:
- 1. ASTM F 793 for strippable wall coverings that qualify as Category V, Type II, Commercial Serviceability products.

2.5 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.

1. Adhesive shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Primer/Sealer: Mildew resistant, complying with requirements in Section 099000 - PAINTING AND COATING and recommended in writing by wall-covering manufacturer for intended substrate.
- C. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall-covering manufacturer.
- D. Seam Tape: As recommended in writing by wall-covering manufacturer.
- E. Heat Welding Rod: CR-40 As supplied by indoor Wall Manufacturer. Color shall blend with wall panel color.
- F. Inside and Outside Corners:
 1. To be used with Clean Corner System heat welded to wall panels
- G. Caulking and Sealant Compounds:
 1. Apply Silicone Caulk as directed by manufacturer

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.

3. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
4. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.
- G. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

3.3 INSTALLATION

1. General: Comply with wall covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply. Take necessary precautions to minimize noise, odors, dust and inconvenience during installation.
- B. Vinyl Wal Covering:
 1. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.
 2. Install strips in same order as cut from roll.
 3. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
 4. Match pattern 6 ft. above the finish floor.
 5. Install seams vertical and plumb at least 6 in. from outside corners and 6 in. from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.
 6. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
 7. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.
- C. Rigid Vinyl Wall Covering:
 1. Allow for expansion around all cut outs.

2. Fit panels to door frames unless otherwise indicated.
3. Locate seams as shown on approved Shop Drawings
4. Adhered Wall Panels: Attach products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and wall panel manufacturer instructions.
5. Wall Panel Seams: Finish seams to produce surfaces flush with adjoining wall surfaces. Rout joints and use heat welding rod to permanently and seamlessly fuse sections together.

3.4 CLEANING

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 097730

INTERIOR WALL PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the GENERAL REQUIREMENTS AND COVENANTS - DIVISION I, and the SPECIAL PROVISIONS - DIVISIONS IIA and IIB, which are hereby made a part of this Specification Section.
- B. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the Work of this Section.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Decorative Wood Wall Panels with trim and attachment system.
 - 2. Decorative Metal Sheet Panels with trim and attachment system.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the Massport Sustainable Design Standards and Guidelines. Refer to Section 018113, SUSTAINABLE DESIGN REQUIREMENTS for additional requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 092110 - GYPSUM BOARD ASSEMBLIES for secondary support framing supporting wall panels.

1.3 REFERENCES

- A. ASTM D638 - 10 Standard Test Method for Tensile Properties of Plastics.
- B. ASTM D790 - 10 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- C. ASTM E84 - 12 Standard Test Method for Surface Burning Characteristics of Building Materials
- D. NEMA Standards Publication LD3-2005. High pressure decorative laminates.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.

B. Sustainable Design Submittals:

1. Product Data: For adhesives and glues used at Project site, documentation including printed statement of VOC content.

C. Shop Drawings: Show fabrication and installation layouts of wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, and accessories.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Panels: 12 inches square.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wall panel through one source from a single manufacturer.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

C. Manufacturer's Qualifications: Sufficient plant facilities to provide quality and quantity of materials as required without delaying progress of the work.

D. Installer: Proven professional installer with a minimum of 5 years of documented experience.

E. Mock-ups: Provide installation mock-ups for each wall panel type, showing transition between the panels with the abutting wall finishes. See drawings for the location and size of the required Mock-ups.

1. Approved mock-ups may become part of the completed work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, wall panels, and other manufactured items so as not to be damaged or deformed. Package wall panels for protection during transportation and handling.

B. Unload, store, and erect wall panels in a manner to prevent bending, warping, twisting, and surface damage.

PART 2 - PRODUCTS

2.1 DECORATIVE WOOD WALL PANELS

A. Manufacturers: Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:

1. Smith & Fong Company

2. CSI Wall Panels
3. Approved equal

B. Basis of Design:

1. IWP-2: Plyboo Plywood as manufactured by Smith & Fong Company
 - a. Material: 100% Bamboo (FSC Certified)
 - b. Panel Thickness: 3/4"
 - c. Panel Size: 4'x8' or 4'x10' panels cut to sizes as shown on drawings.
 - d. Surface Pattern: Smooth
 - e. Color: Stain color to be determined by Architect
 - f. Edge Profile: Straight edge
2. IWP-3: Plyboo Linear Line Panel as manufactured by Smith & Fong Company
 - a. Material: 100% Bamboo (FSC Certified)
 - b. Panel Thickness: 3/4"
 - c. Panel Size: 4'x8' or 4'x10' panels cut to sizes as shown on drawings.
 - d. Surface Pattern: Vertical Linear Ridged
 - e. Color: Stain color to be determined by Architect
 - f. Edge Profile: Straight edge
3. IWP-4: Plyboo Fractal as manufactured by Smith & Fong Company
 - a. Material: 100% Bamboo (FSC Certified)
 - b. Panel Thickness: 3/4"
 - c. Panel Size: 4'x4' panels cut to sizes as shown on drawings.
 - d. Surface Pattern: Vertical Linear Ridged
 - e. Panel Pattern: As shown on drawings.
 - f. Color: Stain color to be determined by Architect
 - g. Edge Profile: Straight edge
4. Base/Core Composition: REALCORE™; Species: Moso bamboo (Phyllostachys Pubescens)
5. Standards/Certifications: CARB II, NAF/FSC 100%
6. Flame Spread: ASTM E84; Class B
7. Emission Testing: Section 01350 Protocol: No VOC's with chronic REL's (reference exposure level) detected, passes office, school and residential.

C. Hardware:

1. Panel Trim:
 - a. Horizontal: Monarch EPS-H075-R, 1/16" hidden reveal. Black satin finish
 - b. Vertical: Monarch EPS-H075-R, 1/16" hidden reveal. Black satin finish
 - c. Refer to Drawings for additional details, extrusions, and shapes to match drawings and provide for a complete installation.
2. Hardware and Trim Material:

- a. Aluminum - Heavy weight extruded aluminum 6063-T5 alloy and prefinished at the factory.

- 1) Exposed Aluminum Perimeter Trim - Clear satin anodized.

- a) Outside Edge Trim: Monarch EPS-ET075-C
 - b) Outside Corner Trim: Monarch EPS-OC075-C
 - c) Inside Corner Trim: Monarch EPS-ET075-N

2.2 DECORATIVE SHEET METAL PANELS (IWP-5)

- A. Manufacturers: Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:

- 1. McNichols Co.
 - 2. Moz Design, Inc.
 - 3. Accurate Perforating Co.
 - 4. Or equal.

- B. Basis of design: Mc Nichols Perforated Metal

- 1. Item Number: 178R006331
 - 2. Product Line: Perforated Metal
 - 3. Hole Type: Slotted
 - 4. Material: Aluminum, Alloy 3003-H14
 - 5. Thickness: .0630" Thick (14Gauge)
 - 6. Hole Pattern: 1/8" x 1" Round-End Slot, Side Staggered
 - 7. Product Form Sheet:
 - 8. Size: See architectural drawings.
 - 9. Color Powder coat finish color to be determined by Architect.

2.3 PERFORMANCE REQUIREMENTS

- A. Meets or exceeds NEMA requirements.
- B. Low VOC Emitting: GREENGUARD Indoor Air Quality Certified for low VOC emissions.

2.4 FABRICATION

- A. All framing, panels, hardware and accessories shall be factory finished and ready to install except for field fabrication as required by jobsite and perimeter conditions.
- B. Field fabrication shall be allowed where necessary but shall be kept to an absolute minimum. Refinish field cut panel edges in accordance with manufacturer's instruction before installation.
- C. For all cut-outs, drill corners for a minimum 1/8" radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Conditioning: Panels must be allowed to acclimate to a balanced environment in the installation location for 72 hours prior to installation.
- B. Protect existing surfaces with drop cloths.
- C. Except as directed by the architectural drawings, before installing, examine panels and arrange to achieve best combination of color, pattern, texture and grain.

3.3 WALL PANEL INSTALLATION

- A. General: Install wall panels in accordance with manufacturer's recommendations and approved submittals. Install with orientation, sizes, and locations indicated on Drawings. Install panels and fixing system as per shop drawings and specification.
 - 1. Assure installed hardware to be straight, plumb and level.
 - 2. Anchor units rigidly and securely in place.
 - 3. Cut sheets to meet existing supports.
- B. Fasten supports and trim using recommended drill-tipped screws anchored into studs or other solid substrate at 32" (80 cm) c/c max. Where hardware cannot be installed with screws, fasten with adhesive in accordance with the manufacturer's recommendations. Pre-drilling should not be necessary. Use die line on extrusions for screw placement guide and fasten securely.
- C. Avoid contamination of the panel faces with adhesives, solvents or cleaners during installation.

3.4 CLEANING AND PROTECTION

- A. On completion of wall panel installation, clean finished surfaces as recommended by wall panel manufacturer. Maintain in a clean condition during construction.
- B. Replace wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 098120

SPRAYED ACOUSTIC INSULATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Spray-applied acoustic insulation, cellulose.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design. Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS (LEED) and Section 018115 - SUSTAINABLE DESIGN REQUIREMENTS (PASSIVE HOUSE) for certification level and certification requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations including plans, elevations and relationship to adjacent construction.
- C. Samples: Minimum 6 by 6 inch sample for appearance.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Finish Mockups: Apply mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Simulate finished lighting conditions for review of mockups.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

- A. Comply with manufacturer's recommendations for application temperature.

PART 2 - PRODUCTS

2.1 SPRAY-APPLIED ACOUSTIC INSULATION, CELLULOSE

- A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications), chemically treated for flame-resistance, processing, and handling characteristics.
 - 1. Basis of Design: International Cellulose Corporation; K-13.
 - 2. Color: Light grey.
 - 3. Thickness: As indicated on the Drawings.
 - 4. NRC Rating: ASTM C423, NRC 0.80, at 1 inch thick.
 - 5. Surface Burning Characteristics: ASTM E84/UL 723, Class 1/A, flame spread 25 or less, smoke developed 50 or less.
 - 6. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD).
 - 7. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.
 - 8. Primer (Required): Manufacturer's recommended primer for substrate indicated.
 - a. VOC Content: 200 g/L or less.
 - b. Methylene chloride and perchloroethylene may not be intentionally added to paints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, for conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Apply spray-applied insulation according to manufacturer's written instructions and approved submittals.
- B. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied for vertical applications, make flush with face of studs by using method recommended by insulation manufacturer.

3.3 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove overspray from door frames, windows, and other surfaces.

END OF SECTION

SECTION 098430

SOUND-ABSORBING PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fabric wrapped acoustical wall panels.
 - 2. Wood fiber acoustical panels.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking.
 - 2. Section 095100 - ACOUSTICAL CEILINGS for acoustical ceiling panels supported by exposed suspension system and tested for noise reduction.
 - 3. Division 03 Section "Precast Architectural Concrete": for precast concrete substrate.
 - 4. Division 04 Section "Concrete Masonry Units": for cmu substrate.
 - 5. Division 06 Section "Misc. Rough Carpentry": for blocking, nailers, and grounds where required to support the cementitious wood fiber panels.
 - 6. Division 09 Section "Gypsum Boards": for abutting drywall substrate.
 - 7. Division 10 Section "Vegetated Green Wall"
 - 8. Division 23 Section "Heating Ventilation and Air Conditioning."

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM C635 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. ASTM E1264 Standard Classification for Acoustical Ceiling Products.

B. Ceilings and Interior Systems Construction Association (CISCA):

1. CISCA Code of Practices.

C. LEED v4 BD+C: School.

1.4 DEFINITIONS

- A. NRC: Noise reduction coefficient.

1.5 SUBMITTALS

- A. Product Data: For each type of panel edge, core material, and mounting indicated.

- B. LEED Submittals: prepare and submit required documentation for the work of this Section in accordance with USGBC LEED Reference Guide for Building Design and Construction (v4) and Division 01 Section "LEED v4 BD+C: School Requirements".

1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
2. Building product disclosure and optimization: Provide required documentation to secure the maximum MR credits, including but not limited to:

- a. Environmental product declarations.
- b. Sourcing of raw materials.
- c. Material ingredients.

3. Project material cost data: Provide invoices, receipts, statements, and other evidence required to document total cost for materials used for Project.
4. Waste management and disposal records complying with Division 01 Section "Construction Waste Management and Disposal".

- a. For products diverted from disposal in landfills and incinerators, and where recycled resources are directed back to the manufacturing process. Include a statement indicating percentage of materials diverted and recycled and the costs associated with each.

- C. Shop Drawings: For acoustical wall panels. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Include elevations showing panel sizes and direction of fabric weave and pattern matching. Indicate panel edge and core materials.

- D. Coordination Drawings: Show intersections with wall base, electrical receptacles and switches, and other adjacent work.

- E. Samples for Initial Selection: For each type of fabric facing material from acoustical wall panel manufacturer's full range.

- F. Samples for Verification: For the following products. Prepare Samples from same material to be used for the Work.

1. Fabric: Full-width by 36-inch-long Sample from dye lot to be used for the Work, and as follows:
 - a. With specified treatments applied.
 - b. Show complete pattern repeat.
 - c. Mark top and face of fabric.
 2. Panel Edge: 12-inch-long Sample showing edge profile, corner, and finish.
 3. Core Material: 12-inch-square Sample showing corner.
 4. Mounting Device: Full-size Sample.
 5. Sample Panels: No larger than 36 by 36 inches. Show joints and mounting methods.
- G. Product Certificates: For each type of acoustical wall panel, signed by product manufacturer.
- H. Qualification Data: For fabricator and testing agency.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of acoustical wall panel.
- J. Maintenance Data: For acoustical wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.
- K. Warranty: Special warranty specified in this Section.
- 1.6 QUALITY ASSURANCE
- A. Regulatory Requirements and Approvals: [Comply with requirements below.] [Specify applicable requirements of regulatory agencies.].
1. International Code Council (ICC):
 - a. ICC-ES Evaluation Report ESR-1112.
 2. State of California:
 - a. DSA Number PA-008.
 3. Underwriters' Laboratories of Canada (ULC) label.
 - a. Structural Cement-Fiber Unit-535X
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations: Obtain each type of acoustical wall panels through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
1. Prevent soiling, physical damage or wetting.
 2. Store cartons open at each end to stabilize moisture content and temperature.
- B. Comply with fabric and acoustical wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- C. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.
- D. Protect panel edges from crushing and impact.

1.8 PROJECT CONDITIONS

- A. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
- B. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:
1. Relative Humidity: 65 - 75%.
 2. Uniform Temperature: 55 - 70 degrees F (13 - 21 degrees C).
- C. Environmental Limitations: Do not install acoustical wall panels until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- D. Lighting: Do not install acoustical wall panels until a permanent level of lighting is provided on surfaces to receive acoustical wall panels.
- E. Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
- F. Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in performance, materials, or workmanship within specified warranty period.
1. Failure in performance includes, but is not limited to, acoustical performance.
 2. Failures in materials include, but are not limited to, fabric sagging, distorting, or releasing from panel edge; or warping of core.
 3. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BACK-MOUNTED, EDGE-REINFORCED ACOUSTICAL WALL PANELS WITH GLASS-FIBER BOARD CORE AND FABRIC FACING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, the following:
1. Sky Acoustic, Inc.
 2. Decoustics Ltd.
 3. MBI Products Company.
 4. Quiet Concepts, a division of PCI Industries.
 5. Kinetics Noise Control.
 6. Sound Concepts.
 7. Wall Technology, an Owens Corning Company.
- B. Basis of Design: Sky Acoustic, Inc.
- C. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass-fiber board core; with edges chemically hardened and clean tailored corners.
1. Nominal Core Thickness: 1".
 2. Overall System NRC: Not less than 0,90, for Type A mounting per ASTM E 795.
 3. Panel Width: As indicated on Drawings.
 4. Panel Height: Fabricated height as indicated on Drawings
 5. Panel Edge Detail: Clean Tailored Edges
 6. Corner Edge: Square to form continuous profile to match edge detail.
- D. Facing Material: Fabric from same dye lot; color and pattern as selected by Architect from manufacturer's full range.
1. Available Manufacturer: Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, the following:
 - a. Knoll Textiles
 - b. Carnegie
 - c. Maharam

2. FWAP-1 at Auditorium: Preliminary color selection upon approval during construction.
 - a. Manufacturer: Knoll Textile
 - b. Style: Alibi
 - c. Color: To be selected by Architect
3. FWAP-2 at Admin Conference Room: Preliminary color selection upon approval during construction.
 - a. Manufacturer: Knoll Textile
 - b. Style: Bollywood
 - c. Color: To be selected by Architect
4. FWAP-3 at Ensemble and Band: Preliminary color selection upon approval during construction.
 - a. Manufacturer: Knoll Textile
 - b. Style: Photon 2
 - c. Color: To be selected by Architect
5. FWAP-4 at Practice Room: Preliminary color selection upon approval during construction.
 - a. Manufacturer: Knoll Textile
 - b. Style: Photon 2
 - c. Color: To be selected by Architect
6. FWAP-5 at Learning Common :Preliminary color selection upon approval during construction.
 - a. Manufacturer: Knoll Textile
 - b. Style: Bollywood
 - c. Color: To be selected by Architect
- E. Glass-Fiber Board Core: ASTM C 612, Type IA or Types IA and IB; density as specified, unfaced, dimensionally stable, molded rigid board, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
 1. Nominal Core Density: 6 to 7 lb/cu. ft.
- F. Back-Mounting Devices: Concealed on backside of panel, recommended to support weight of panel, and as follows:
 1. As recommended by manufacturer.
- G. Fabrication:
 1. Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.
 2. Acoustical Wall Panels: Panel construction consisting of facing material adhered to[face,] edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.

- a. Glass-Fiber Board: Resin harden areas of core for attachment of mounting devices.
- 3. Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Applied with visible surfaces fully covered.
 - a. Where square corners are indicated, tailor corners.
 - b. Where radius or other nonsquare corners are indicated, attach facing material so there are no seams or gathering of material.
 - c. Where fabrics with directional or repeating patterns or directional weave are indicated, mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.
- 4. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
 - a. Thickness.
 - b. Edge straightness.
 - c. Overall length and width.
 - d. Squareness from corner to corner.
 - e. Chords, radii, and diameters.

2.2 RECYCLED WOOD FIBER AND CEMENTITIOUS PANELS

- A. Basis of Design: Tectum Inc.; Finale Panel, or approved equal.
 - 1. Recycled Content: 70% minimum.
- B. Nominal Core Thickness: 2 inches.
- C. Overall System NRC: Not less than 0.70, for Type A mounting per ASTM E 795.
- D. Panel Size: As indicated on Drawings.
- E. Corner Detail: As indicated on Drawings.
- F. Factory Finish: Manufacturer's factory painted finish; custom color to be selected by Architect. Field painting is not excepted.
- G. Fasteners: Except as otherwise indicated, provide exposed steel drywall screws, to extend at least 1 inch into gypsum board substrate, painted to match panel.

2.3 POLYESTER FIBER ACOUSTIC PANELS (PFAP):

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MDC; Zintra on Zintra Acoustic Panels
 - 2. 3 Form; Hush Clad Sound Absorbing Wall Panel
 - 3. CSI Wall Panels; Soundcore Sheer Acoustic Control with Depth

B. Basis of Design: MDC; Zintra on Zintra Acoustic Panels

1. Constructed: Perforated Polyester fiber panel bonded to another sheet of polyester fiber
2. Thickness: 1/2", 1" and 2" thick as indicated on drawings.
3. Size: As indicated on the drawings up to a maximum 48 inch x 108 inch panel.
4. Edge Detail: Square
5. Sound Absorption (ASTM C423): Noise Reduction Coefficient as follows:
 - a. 1 inch Panel: 0.75 minimum
6. Mounting Accessories: Z-clips
7. Colors: (Based on MDC Zintra) Up to 3 colors to be used as indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces, fabric, substrates, blocking, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.
- C. Match and level fabric pattern and grain among adjacent panels.
- D. Installation Tolerances: As follows:
 1. Variation from Level and Plumb: Plus or minus 1/16 inch.
 2. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.3 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.
- C. Follow manufacturer's instruction for cleaning panels.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Substantial Completion.
- B. Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 099000

PAINTING AND COATING

(Part of Work of Section 090007 - PAINTING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Field painting of exposed interior items and surfaces.
 - 2. Field painting of exposed exterior items and surfaces.
 - 3. Surface preparation for painting.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING for shop priming structural steel.
 - 2. Section 055000 - METAL FABRICATIONS for shop priming ferrous metal.
 - 3. Section 055100 - METAL STAIRS AND RAILINGS for shop priming ferrous metal.
 - 4. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for shop priming interior architectural woodwork.
 - 5. Section 078100 - APPLIED FIREPROOFING for intumescent fire-resistive coatings.
 - 6. Section 081110 - HOLLOW METAL DOORS AND FRAMES for factory priming steel doors and frames.
 - 7. Section 081400 - FLUSH WOOD DOORS for factory finishing.
 - 8. Section 092110 - GYPSUM BOARD ASSEMBLIES for surface preparation of gypsum board.

1.3 DEFINITIONS AND EXTENT

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.
- B. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
- D. Do NOT paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork.
 - b. Acoustical wall panels.
 - c. Toilet enclosures.
 - d. Metal lockers.
 - e. Kitchen appliances.
 - f. Elevator entrance doors and frames.
 - g. Elevator equipment.
 - h. Finished mechanical and electrical equipment.
 - i. Light fixtures.
 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Ceiling plenums.
 - d. Utility tunnels.
 - e. Pipe spaces.
 - f. Duct shafts.
 - g. Elevator shafts.
 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.

- b. Stainless steel.
 - c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.
- 4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
- 5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.4 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
 - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - a. Disclose material ingredients by name and Chemical Abstract Service (CAS) Registry Number.
 - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For paints, submit industry-wide EPDs and product-specific Type III EPDs.
 - 2. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For paints, submit Cradle to Cradle (C2C) certifications, Health Product Declarations (HPD), or Declare product labels.
 - 3. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - a. For field-applied paints and coatings, submit test results, including TVOC emissions and VOC content.
 - b. For paints, submit GreenGuard Gold or SCS Indoor Advantage Gold certifications.
 - c. For wet-applied products, submit volume used.

- C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
 - 1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 - 2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
 - 3. Submit two 8 inch by 12 inch Samples for each type of finish coating for Architect's review of color and texture only.
- D. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- C. Mockups: Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
 - 1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Wall Surfaces: Provide samples on at least 100 sq. ft.
 - b. Small Areas and Items: Architect will designate items or areas required.
 - 2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
 - a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
 - 3. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.

6. Application instructions.
7. Color name and number.
8. VOC content.

- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: Furnish four unopened gallons of each type of paint and coating work, in color and gloss as used for the Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work are listed in the Finish Schedule at the end of this Section.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application

indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Paint Colors (PT-#): Refer to the Finish Schedule on the Drawings.
- D. VOC Content for Interior Paints and Coatings: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Flat Paints and Coatings: 50 g/L (SCAQMD and CARB).
 2. Nonflat Paints and Coatings: 50 g/L (SCAQMD) or 100 g/L (CARB).
 3. Nonflat, High Gloss Paints and Coatings: 50 g/L (SCAQMD) or 150 g/L (CARB).
 4. Dry-Fog Coatings: 50 g/L (SCAQMD) or 150 g/L (CARB).
 5. Primers, Sealers, and Undercoaters: 100 g/L.
 6. Anticorrosive and Antirust Paints Applied to Ferrous Metals (Industrial Maintenance and Rust Preventative Coatings): 100 g/L (SCAQMD) or 250 g/L (CARB).
 7. Zinc-Rich Industrial Maintenance Primers: 100 g/L (SCAQMD) or 340 g/L (CARB).
 8. Pretreatment Wash Primers: 420 g/L.
 9. Floor Coatings: 50 g/L (SCAQMD) or 100 g/L (CARB).
 10. Shellacs, Clear: 730 g/L.
 11. Shellacs, Pigmented: 550 g/L.
 12. Clear Wood Finishes: 275 g/L.
 13. Stains, Exterior: 100 g/L (SCAQMD) or 250 g/L (CARB).
 14. Stains, Interior: 250 g/L.
- E. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions and technical bulletins for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

- b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
 - c. If transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
- 4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
 - a. Exterior Exposed Steel: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
 - b. Interior Exposed Steel, in Humid Environments: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
 - c. Interior Exposed Steel, in Dry Environments: Clean steel surfaces in accordance with SSPC-SP2 or SP3 Hand or Power Tool Cleaning.
- 5. Galvanized Surfaces: Clean galvanized surfaces in accordance with SSPC-SP16 Brush off Blast Cleaning of Galvanized Steel and NonFerrous Metals, to achieve a minimum 1 mil anchor profile.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 - 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
 - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors and doors in wet areas on tops, bottoms, and side edges the same as exterior faces.
 9. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:

1. Switchgear.
2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:

1. The Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Testing agency will perform appropriate tests for the following characteristics as required by the Architect.
3. The Architect may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove

noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 PAINT SCHEDULE

- A. Schedule: Provide products and number of coats specified. Use of manufacturer's proprietary product names to designate colors, materials, generic class, standard of quality and performance criteria and is not intended to imply that products named are required to be used to the exclusion of equivalent performing products of other manufacturers.
- B. Exterior Paint Schedule:
 - 1. Exterior Galvanized Metal (not shop-finished under Section 051200 - STRUCTURAL STEEL FRAMING, Section 055000 - METAL FABRICATIONS, or Section 055100 - METAL STAIRS AND RAILINGS), Aliphatic Acrylic Polyurethane System:
 - a. Surface Preparation: SSPC-SP16 Brush-off Blast of Galvanized Steel.
 - b. One Coat:
 - 1) Tnemec 66HS Hi-Build Epoxoline at 3.0 mils DFT.
 - 2) PPG PMC Amerlock 400 Hi-Build Epoxy at 4.0-5.0 mils DFT.
 - 3) Dupont 25P High Solids at 4.0 mils DFT.
 - 4) International Intergard 475 HS at 5.0 to 10.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 73 Endura-Shield at 3.0 mils DFT.
 - 2) PPG PMC Amercoat 450H Polyurethane at 3.0 mils DFT.
 - 3) Dupont Imron 2.8 Urethane at 3.0 to 4.0 mils DFT.

- 4) International Interthane 990 HS at 3.0 to 4.0 mils DFT.
 2. Exterior Ferrous Metal, Urethane System:
 - a. Surface Preparation: SSPC-SP6.
 - b. One Coat:
 - 1) Tnemec 90G-1K97 at 3 mils DFT; shop applied under other Sections; use for touch up.
 - 2) PPG PMC Amercoat 68 MCZ at 3 mils DFT; shop applied under other Sections; use for touch up.
 - 3) Dupont Urethane Ganicin Zinc Rich Primer 80% zinc load at 3.0 mils DFT.
 - 4) International Interzinc 315 at 2.0 to 3.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 66HS Hi-Build Epoxoline at 3.0 mils DFT.
 - 2) PPG PMC Amerlock 400 Hi-Build Epoxy at 3.0 to 5.0 mils DFT.
 - 3) Dupont 25P High Solids Epoxy at 4.0 to 6.0 mils DFT.
 - 4) International Intergard 475 HS at 4.0 to 8.0 mils DFT.
 - d. And One Coat:
 - 1) Tnemec 73 Endura-Shield at 3.0 mils DFT.
 - 2) PPG PMC Amerlock 450H Polyurethane Topcoat at 3.0 mils DFT.
 - 3) Dupont High Solids Imron Urethane at 4.0 mils DFT.
 - 4) International Interthane 990 HS at 2.0 to 3.0 mils DFT.
 3. Exterior Aluminum (where required), Painted Finish:
 - a. Surface Preparation: Pressure wash with Oakite and sand with 3M Scotch-Brite nylon pads.
 - b. One Coat:
 - 1) Tnemec 66HS Hi-Build Epoxoline at 2.0 mils DFT.
 - 2) PPG PMC Amerlock 400 Hi-Build Epoxy at 2.0 to 3.0 mils DFT.
 - 3) Dupont 25P High Solids at 4.0 mils DFT.
 - 4) International Intergard 475 HS at 5.0 to 10.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 73 Endura-Shield at 2.0 mils DFT.
 - 2) PPG PMC Amercoat 450H Polyurethane at 3.0 mils DFT.
 - 3) Dupont High Solids Imron 2.8 at 4.0 mils DFT.
 - 4) International Interthane 990 HS at 3.0 to 4.0 mils DFT.

C. Interior Paint Schedule, Typical:

 1. Interior Gypsum Wallboard and Plaster, Latex Paint Finish:
 - a. One Coat, Primer:

- 1) Imperial Paints ECOS Interior Wall Primer.
 - 2) Moore Ultra Spec 500 Interior Latex Primer 534.
 - 3) PPG Speedhide Zero VOC Interior Primer 6-4900XI.
 - 4) S-W Harmony Interior Primer B11 series.
 - 5) S-W ProMar 200 HP Zero VOC Interior Primer.
 - b. And Two Coats, Flat Finish: At ceilings and elsewhere as indicated.
 - 1) Imperial Paints ECOS Interior Flat.
 - 2) Moore Ultra Spec 500 Interior Latex Flat 536.
 - 3) PPG Speedhide Zero VOC Interior Latex Flat 6-4110XI.
 - 4) S-W ProMar 400 Zero VOC Interior Flat.
 - c. And Two Coats, Eggshell Finish: At walls and elsewhere as indicated.
 - 1) Imperial Paints ECOS Interior Eggshell.
 - 2) Moore Ultra Spec 500 Interior Latex Low Sheen 537.
 - 3) PPG Speedhide Zero VOC Interior Latex Eggshell 6-4310XI.
 - 4) S-W ProMar 200 HP Zero VOC Interior Eg-Shel.
2. Interior Architectural Woodwork, Finish Carpentry, and Wood Doors (softwoods, paint grade hardwoods, MDF, MDO, and hardwood veneers), Latex Paint Finish:
 - a. One Coat, Primer:
 - 1) Imperial Paints ECOS Interior Wood Primer.
 - 2) Moore Ultra Spec 500 Interior Latex Primer 534.
 - 3) PPG Speedhide Zero VOC Interior Primer 6-4900XI.
 - 4) S-W ProMar 200 HP Zero VOC Interior Primer.
 - b. And Two Coats, Semi-Gloss:
 - 1) Imperial Paints ECOS Interior Satin.
 - 2) Moore Ultra Spec 500 Interior Latex Semi-Gloss 539.
 - 3) PPG Speedhide Zero VOC Interior Latex Semi-Gloss 6-4510XI.
 - 4) S-W ProMar 200 HP Zero VOC Interior Semi-Gloss.
3. Interior Architectural Woodwork, Finish Carpentry and Millwork (hardwoods and hardwood veneers, except paint grade and factory-finished items), Transparent Polyurethane Finish:
 - a. Sand: 120 grit sandpaper.
 - b. Sand: 220 grit sandpaper.
 - c. One Coat, Stain: Not Used.
 - d. And Three Coats, Satin Finish:
 - 1) American Formulating & Manufacturing, Safecoat Polyureseal BP.
 - 2) Imperial Paints ECOS Woodshield Varnish.Moore Benwood Stays Clear Acrylic Polyurethane Low Lustre W423.
 - 4) Vermont Natural Coatings; PolyWhey Natural Furniture Finish.

- e. Sand Between Urethane Coats: 220 grit sandpaper.
- 4. Interior Concrete Masonry Unit (CMU), Latex Paint Finish:
 - a. One Coat, Block Filler:
 - 1) Moore Ultra Spec Hi-Build Masonry Block Filler 571.
 - 2) PPG Speedhide Interior Masonry Hi Fill Latex Block Filler 6-15XI.
 - 3) S-W PrepRite Block Filler B25W25.
 - b. And Two Coats, Eggshell Finish: At walls and elsewhere as indicated.
 - 1) Moore Ultra Spec 500 Interior Latex Low Sheen 537.
 - 2) PPG Speedhide Zero VOC Interior Latex Semi-Gloss 6-4510XI.
 - 3) S-W ProMar 200 HP Zero VOC Interior Eg-Shel.
- 5. Interior Exposed Steel, Joists, Ductwork, Conduit and Similar Items (where indicated), Dry-Fall or Dry-Fog Painted System:
 - a. One Coat:
 - 1) Moore Latex Dry Fall Flat 395 at 2.5 to 3.0 mils DFT.
 - 2) PPG Speedhide Super Tech WB Interior Dry-Fog Latex 6-725XI Flat at 2.0 to 2.5 mils DFT.
 - 3) S-W WB Pro Industrial Waterborne Acrylic Dryfall Flat B42 series at 2.5 to 3.0 mils DFT.
 - 4) Tnemec 115 WB Unibond at 2.5 to 3.0 mils DFT.
- 6. Interior Concrete Floor, Clear Exposed Sealer (Silicate type):
 - a. One Coat:
 - 1) Curecrete Chemical; Ashford Formula.
 - 2) Tnemec (Chem Probe); Series 629 CT Densifier.
 - 3) WR Meadows; Liqui-Hard.
 - 4) Laticrete; L&M Seal Hard.
 - 5) Prosoco; Consolidack LS.
- D. Interior Paint Schedule, High Performance and Specialty Systems:
 - 1. Interior Gypsum Wallboard and Plaster at Toilet Rooms, and Other Wet Areas, Urethane Coating:
 - a. Surface Preparation: Cured, clean and dry, free of surface contaminants.
 - b. One Coat:
 - 1) Tnemec 201 Epoxoprime at 3.0- 4.0 mils DFT.
 - 2) PPG PMC Amerlock Sealer at 3.0 to 4.5 mils DFT.
 - 3) Dupont Hi-Solids Colar primer at 3.0 to 4.0 mils DFT.
 - 4) International Interseal 670 HS at 3.0 to 4.0 mils DFT.

- c. And One Coat:
 - 1) Tnemec 280 Tneme-glaze at 6.0 to 8.0 mils DFT.
 - 2) PPG PMC Amercoat 351 Epoxy at 6.0 to 8.0 mils DFT.
 - 3) Dupont 100 % Solids Epoxy at 8.0-10.0 mils.
 - 4) International Interseal 670 HS at 3.0 to 4.0 mils DFT.
 - d. And One Coat:
 - 1) Tnemec 1080 or 1081 Endurashield WB at 3.0 to 3.5 mils DFT.
 - 2) PPG PMC AmerShield VOC at 2.0 to 3.0 mils DFT.
 - 3) Dupont WB Urethane at 3.5 to 4.0 mils DFT.
 - 4) International Water Borne Urethane at 3.0 to 4.0 mils DFT.
- 2. Interior Metals (Not specified to receive other coating systems/not shop finished), Epoxy Painted Finish:
 - a. One Coat: Approved primer, in shop under other Sections (where specified). If not shop primed, provide primer recommended by finish coating manufacturer.
 - b. And One Coat:
 - 1) Tnemec 1029 Enduratone at 2.0 mils DFT.
 - 2) PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT.
 - 3) Dupont 25P at 3.0 to 4.0 mils DFT.
 - 4) International Interseal 670 HS at 3.0 mils DFT.
 - c. And One Coat:
 - 1) Tnemec 1029 Enduratone at 2.0 to 3.0 mils DFT.
 - 2) PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT.
 - 3) Dupont High Solids Acrylic Coating 3.0 mils DFT.
 - 4) International Intercryl 530 at 3.0 to 4.0 mils DFT.
- E. Mechanical and Electrical Work: Paint all exposed items throughout the project except factory finished items with factory-applied baked enamel finishes which occur in mechanical rooms or areas, and excepting chrome or nickel plating, stainless steel, and aluminum other than mill finished. Paint all exposed ductwork and inner portion of all ductwork. Same as specified for other interior metals, hereinabove.

END OF SECTION

SECTION 101100

VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Markerboards.
 - 2. Tackboards.
 - 3. Marker wall coverings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for custom wood trim for visual display surfaces.
 - 2. Section 099000 - PAINTING AND COATING for primers under marker wall covering.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Manufacturers' product data for interior adhesives and sealants used at Project site, including printed statement of VOC content.
 - 2. Composite wood manufacturer's product data for each composite wood product used indicating that the bonding agent contains no added urea formaldehyde. Adhesive manufacturer's product data for each adhesive used indicating that the adhesive contains no added urea formaldehyde.
- C. Samples: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:

1. Actual sections of visual display surfaces.
 2. Fabric swatches fabric-faced tack assemblies.
- D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Show location of panel joints.
 2. Show location of special-purpose graphics for visual display surfaces.
 3. Include sections of typical trim members.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.
- F. Maintenance Data: For visual display surfaces to include in maintenance manuals.
- 1.4 QUALITY ASSURANCE
- A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display units vertically with packing materials between each unit.
- 1.6 PROJECT CONDITIONS
- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
 2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

- A. Basis-of-Design Products: Refer to the Finish Schedule on the Drawings.

2.2 MARKERBOARD ASSEMBLIES

- A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.021-inch-thick, porcelain-enamel face sheet.
1. Available Manufacturers:
 - a. AACRO Products, Inc.
 - b. Claridge Products & Equipment, Inc.
 - c. Peter Pepper Products.
 - d. MooreCo; Best-Rite Manufacturing.
 - e. Steelcase Company; PolyVision products.
 2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing with binder containing no added urea formaldehyde.
 3. Fire Rating: ASTM E 84, Class A.
 4. Color: White, low gloss finish.
 5. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
- B. Glass Markerboards: 6-mm tempered glass markerboard, with smooth polished edge and eased corners; color coated on back surface.
1. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.
 2. Mounting: Round, stainless-steel standoffs, holding glass approximately 1 inch from wall surface; mounted in notches in standoffs at top and bottom edges of markerboard.
 3. Color and Surface: As selected by the Architect.
 4. Marker Tray: Glass, supported by stainless-steel clips.

2.3 TACKBOARD ASSEMBLIES

- A. Linoleum Resilient Tackboard: Uni-color linoleum resilient homogeneous tackable surface consisting of linseed oil, granulated cork, rosin binders and dry pigments calendared onto a natural burlap backing with integral color throughout with surface-burning characteristics indicated.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Forbo Industries; Bulletin Board.
 - b. WallTalkers; Tac-wall.
 2. Thickness: 1/4 inch.

3. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard backing with binder containing no added urea formaldehyde.
4. Fire Rating: ASTM E 84, Class A.
5. Colors: Refer to Finish Schedule.

B. Fabric-Wrapped Tackboard:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Claridge Products & Equipment, Inc.
 - b. Egan Visual Inc.
 - c. MooreCo; Best-Rite Manufacturing.
 - d. Peter Pepper Products.
 - e. Steelcase Company.
2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard backing with binder containing no added urea formaldehyde.
3. Fire Rating: ASTM E 84, Class A.
4. Fabric Facing Material, Colors and Patterns: Refer to Finish Schedule.

2.4 VISUAL DISPLAY WALL COVERINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Best-Rite Manufacturing.
 2. Egan Visual Inc.
 3. Marsh Industries, Inc.; Visual Products Group.
 4. Omnova Solutions Inc.; Decorative Products; Commercial Wallcovering.
 5. WallTalkers; a division of RJF International Corporation.
- B. Visual Display Wall Covering: Intended for use with dry-erase markers and as a projection surface and consisting of moderate-gloss, plastic film bonded to fabric backing; not less than 0.020-mil total thickness.
1. Surface Graphics: 2-inch-square grid.
 2. Color: As selected by Architect from manufacturer's full range.
- C. Magnetic Visual Display Wall Covering: Intended for use with dry-erase markers and magnetic aids and consisting of moderate-gloss plastic film bonded to ferrous-powdered fabric backing; not less than 0.025-mil total thickness.
1. Color: As selected by Architect from manufacturer's full range.
- D. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099000 - PAINTING AND COATING and recommended in writing by wall covering manufacturer for intended substrate.

2.5 ACCESSORIES

- A. Aluminum Frames and Trim: Factory-applied, fabricated from not less than 0.062-inch-thick, extruded aluminum; of size and shape indicated.
 - 1. Chalk/Marker Tray: Manufacturer's standard, continuous tray.
- B. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific visual display surfaces and substrate application, as recommended in writing by visual display surface manufacturer.
 - 1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
- C. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.

2.7 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.
- B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.

3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
 - 1. Join adjacent wall panels with concealed steel splines for smooth alignment.
 - 2. Where markerboards abut, install with clean, trimless butt joints.

3.4 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION

SECTION 101400

SIGNAGE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SECTION INCLUDES

- A. The work of this Section consists of the following sign categories:
 - 1. Exterior
 - a. Building identification
 - b. Miscellaneous regulatory and identification signs
 - c. Miscellaneous specialty signs
 - 2. Interior
 - a. Room, office and area identification
 - b. Informational
 - c. Directional
 - d. Regulatory
 - e. Dedication
 - f. Miscellaneous specialty signs
- B. The items below are included as part of this specification.
 - 1. General sign type drawings, including overall sign shape, size and graphic layout
 - 2. Mounting drawings, showing mounting heights and relationships to site and/or building elements
 - 3. Detailed sign type drawings, indicating type styles, symbols, dimensioned graphic layouts, methods of graphic application, colors, and primary materials
 - 4. Construction drawings, showing fabrication and mounting details
 - 5. Preliminary sign schedule, listing sign location number, sign type, sign message, quantity and notes of clarification, if any
 - 6. Sign location plans, indicating the location of each sign with its number

1.3 RELATED SECTIONS

1.4 ACTION SUBMITTALS

- A. The sign contractor shall submit the following to the general contractor prior to fabrication, under the provisions of Section 01330 SUBMITTAL PROCEDURES

1. Construction shop drawings for all sign types showing shape, size, type styles, symbols, dimensioned graphic layouts, methods of graphic application, colors, materials, and fabrication and mounting details
2. Sign mounting drawings showing mounting heights and relationship to site and/or building elements
3. Final sign message schedule
 - a. The sign contractor will meet with the architect, owner and general contractor, as directed and as necessary, to confirm all text and graphic content for each sign element; the sign contractor will amend the preliminary sign message schedule included in these construction documents, as necessary
 - b. As part of this sign message schedule review process, particular attention should be directed to the room numbering system, with all room numbers and names being reviewed and verified with architect and owner
 - c. The resulting sign message schedule will be submitted by the sign contractor for approval, and will list each individual sign, together with a unique sign location number, sign type designation, sign message and graphic content, quantity, and notes of clarification, if any.
4. Sign location plans indicating the location of each sign with its number
5. Two full size printed layouts of artwork proofs for each sign type and each unique layout
6. Two samples of the following Sign Types: 11, 12, 18, 24, and 30. Sample letter of Sign Type 32. Partial corner samples for the following Sign Types: 32, and 63.
7. Two color chip samples of each color and finish of exposed materials, minimum 4" x 4", applied to actual sign material substrates
8. Two printed samples of full-scale graphic image (corner only on the specified material: glass film, wall covering, perforated film, or high-pressure laminate pane) of the following Sign Type: 35.

- B. All signage samples are to be delivered for review and approval in a single submission package.

1.5 INFORMATION SUBMITTALS

- A. The sign subcontractor shall submit the names of five projects, completed in the last three years, which are similar in scope to this project. The sign subcontractor shall provide information for each project including contact name, telephone number, and email address.

1.6 SIGN CONTRACTOR QUALIFICATION

- A. Subject to compliance with requirements, pre-qualified acceptable signage subcontractors include, but are not limited to, the following:
1. Poblocki Sign Company Northeast
4 Industrial Park Road
Medway, MA 02053
508-533-9000
www.poblocki.com
 2. Poyant Signs Incorporated
125 Samuel Barnet Boulevard
New Bedford, MA 02745
800-544-0961

www.poyantsigns.com

3. Sign Works Group, Inc.
60 Arsenal Street
Watertown, MA 02472
617-924-0292
4. Welch Architectural
7 Lincoln Avenue
Scarborough, ME 04074
207.883.6200
www.welchsign.com

1.7 REGULATORY REQUIREMENTS

- A. Provide all signs in accordance with, and as required by Federal, state, or local building code or ordinances including ADAAG – Americans with Disabilities Act Accessibility Guidelines, 2010 Standards, as issued by the US Department of Justice. Code compliant signage shall include, but not be limited to, building egress, elevator operation, fire safety regulations, and health and safety requirements.

1.8 COORDINATION

- A. The sign contractor will notify the general contractor of any special anchoring provisions, such as blocking, to be made in walls and ceilings prior to sign installation. The notifications will be timely, before walls and ceilings are closed.

1.9 PERMITS

- A. The sign contractor will obtain any permits required for signs, if these permits are separate from the basic building permit obtained by the general contractor.

PART 2 - PRODUCTS

2.1 SIGNAGE GENERAL

- A. The room numbers and text shown on the sign schedule are preliminary and are subject to revision.
- B. The products, fabricators, manufacturers, and materials shown for each sign type is intended to be the basis for design. Equal sign products from other manufacturers may be submitted to the architect for approval prior to bidding. All work will be as shown on the construction drawings.

2.2 EXTERIOR SIGNS

- A. Site ID. Site ID will be fabricated and installed by sign subcontractor. Site ID sign will consist of fabricated aluminum panels and surface mounted dimensional letters. Fabricated panels will consist of welded structural frame and faces, and shall be free of surface deflections and distortions. Product will be used for Sign Type 64.
- B. Metal Letters and Logo. Illuminated metal letters and logo will be manufactured by Steel Art Company of Norwood MA, www.steelartco.com. Metal letters will be cut with a CNC controlled

abrasive waterjet cutting system. All letter and graphic forms shall have sharp inside and outside corners. Product will be used for Sign Types 50.

- C. Flush Wall Mount Plaque. Flush wall mount plaques will be fabricated and installed by sign contractor. Flush wall mount plaques will consist of acrylic plaques with digitally printed graphics, Thermoformed plaques with raised graphics and Braille, and mounting adhesives. All components to be cut on CNC equipment and all dimensional and alignment tolerances shall not exceed +/- .005". Sign mounts to exterior wall with recessed shim plate. Product will be used for Sign Types 56 and 60.
- D. Fabricated Aluminum Panel. Fabricated aluminum panels will be fabricated and installed by sign contractor. Fabricated aluminum panel sign will consist of aluminum face and fabricated aluminum frame. Sign mounts to exterior wall. Product will be used for Sign Type 56A.
- E. Vinyl Graphics. Vinyl graphics will be fabricated and installed by sign contractor. Surface applied vinyl graphics will be applied to designated building surfaces. Product will be used for Sign Types 58, 59, 60A, 61.
- F. Post and Panel. Post and panel signs will be fabricated and installed by sign contractor utilizing extrusions and components manufactured by Sign Comp of Grand Rapids MI, www.signcomp.com. Sign extrusions and components will include Sign Comp Series 3 round post, post cap, sign panel frame, and post filler strip. Text and symbols will be applied to sign panel faces with surface applied vinyl graphics. Products will be used for Sign Types 63.

2.3 INTERIOR SIGNS

- A. Flush Wall Mount Plaque. Flush wall mount plaques will be fabricated and installed by sign contractor. Flush wall mount plaques will consist of acrylic plaques with digitally printed graphics, insert plaques with removable paper inserts, Thermoformed plaques with raised graphics and Braille, and mounting adhesives. All components to be cut on CNC equipment and all dimensional and alignment tolerances shall not exceed +/- .005". Product will be used for Sign Types 11-23 and 24G.
- B. Project Wall Mount Plaque. Project wall mount plaque will be fabricated and installed by sign contractor. Project wall mount plaques will consist of aluminum panels with digitally printed graphics and aluminum mounting brackets. Product will be used for Sign Types 24-24F.
- C. Acrylic Graphics Panel. Graphics panel will be fabricated and installed by sign contractor. Graphics panel will consist of acrylic panel with digitally printed graphics. Panel mounts to designated architectural surface with mounting adhesives. Product will be used for Sign Type 30 and 36.
- D. Metal Letters and Graphics. Metal letters and graphics will be manufactured by Steel Art Company of Norwood MA, www.steelartco.com. Metal letters and graphics will be cut with a CNC controlled abrasive waterjet cutting system. All letter and graphic forms shall have sharp inside and outside corners. Product will be used for Sign Type 32.
- E. Dedication Plaque. Dedication plaque will be fabricated and installed by sign contractor. Dedication plaque will consist of aluminum plate with fine horizontal satin grain finish and protective clear coat finish. Graphics to be direct UV cured digital print. Plaque mounts to designated surface with full-size acrylic backer. Product will be used for Sign Type 40.

- F. Existing Dedication Plaque. Signage subcontractor will be responsible for re-installing existing school dedication plaque. Product will be used for Sign Type 40A.
- G. Graphics Panel. Graphics panel will be fabricated and installed by sign contractor. Graphics panel will consist of high-pressure laminate panel with digitally printed graphics. Panel mounts to designated architectural surface with Gyford mounting hardware. Product will be used for Sign Types 33.
- H. Vinyl Graphics. Vinyl graphics will be fabricated and installed by sign contractor. Surface applied vinyl graphics will be applied to designated building surfaces with spacers. Product will be used for Sign Types 35 and 37.

2.4 BASIS FOR DESIGN

- A. The product(s) shown for each sign type is intended to be the basis for design. Equal sign products from other manufacturers may be submitted to the architect for approval prior to bidding. All work will be as shown on the construction drawings.

2.5 QUANTITIES

- A. Exterior sign types:

Type 50	Exterior Entry ID	1
55	Exterior Fire Dept Regulatory	1
56	Exterior Door ID, small	20
56A	Exterior Door ID	12
57	Exterior Door ID, large	7
58	Exterior Vinyl Door Number	26
59	Exterior Visitor Info, Vinyl	1
60	Exterior Regulatory	5
60A	No Smoking Vinyl	1
61	No Parking Vinyl	7
63	Exterior Directional	5
64	Site ID	1

- B. Interior sign types:

Type 11	Room ID	162
12	Office ID w/insert	50
14	Restroom ID	56
15	Support Space ID	219
16	Stair ID	26
17	Stair Level ID	32
17A	Stair Landing Regulatory	25
18	Elevator Evacuation Notice	8
19	Elevator Machine Room	3
20	Regulatory / Info	5
23	Interior Fire Department Regulatory	1
24	Safety Sign, Eye Wash, flag	8
24A	Safety Sign, Shower, flag	9
24B	Safety Sign, Power, flag	9
24C	Safety Sign, Fire Extinguisher, flag	9
24D	Safety Sign, Fire Ext & Blanket	9

24E	Safety Sign, Data Sheets, flag	7
24F	Safety Sign, First Aid Kit, flag	7
24G	Safety Sign, Goggles	7
30	Corridor Directional	22
32	Major Destination ID, letters	4 sets
33	Shop Sign, wall mount	20
35	Vinyl Wall Mural	3
36	Fire Annunciator Diagram	1
37	Interior Vinyl Door Number	26
40	Dedication Plaque	1
40A	Existing Dedication Plaque	1

2.6 MATERIALS

A. The following is a list of primary materials to be used on this project:

1. Acrylic shall clear Acrylite cast acrylic sheet, smooth both faces, as manufactured by Evonik Industries, Parsippany, NJ, www.acrylite.net.
2. Polycarbonate shall be clear, matte finish one face, as manufactured by Sheffield Plastics, Sheffield, MA., www.sheffieldplastics.com.
3. Paint shall be acrylic polyurethane MAP, as manufactured by Matthews Paint, Delaware, OH, www.matthewspaint.com.
4. Foam tape shall be 4416, as manufactured by 3M Company, St. Paul, MN, www.3M.com.
5. VHB foam tape shall be 4950, as manufactured by 3M Company, St. Paul, MN, www.3M.com.
6. Silicone adhesive shall be 732 Multipurpose RTV Sealant, as manufactured by Dow Corning, Midland, MI, www.dowcorning.com.
7. Pressure sensitive vinyl graphic film shall be Scotchcal 77125 Electrocut Graphic Film, as manufactured by 3M Company, St. Paul, MN, www.3M.com.
8. Expanded PVC shall be manufactured by Komatex, Huntsville, AL, www.kommerlingusa.com.
9. Graphic panel shall be manufactured by iZone Imaging, Temple, TX, www.izoneimaging.com
10. Dibond panel shall be manufactured by 3A Composites, Horgen, Switzerland www.display.3acomposites.com/dibond
11. Metal standoffs and other specialty mounting hardware shall be manufactured by Gyford Standoff Systems, Reno, NV, www.standoffsystems.com

B. All other secondary materials shall be as shown on the construction drawings.

2.7 FABRICATION STANDARDS

- A. All graphic elements, including text and symbols, will be reproduced from computer generated digital artwork. All vector artwork created for graphic reproduction will be output at a minimum resolution of 1200 dpi. All computer generated non-vector artwork will be saved at 300 dpi, at full size, and will be output at a minimum resolution of 1200 dpi.
- B. All graphic elements, including text and symbols, will be reproduced with sharp inside and outside corners and edges. No rounded corners or edges shall be permitted.
- C. All graphic elements will be produced in such a manner that all edges and corners of letterforms, symbols, color bands, rules, and borders, are true and clean. All printed inks shall be applied evenly without pinholes, scratches, or orange-peel texture.

- D. All painted components will be spray finished in such a manner that exposed surfaces are free of dust under the paint surface, orange-peel texture, runs, color streaks, or build-up at edges. Sharp edges and corners will be broken prior to painting. All surfaces shall be prepared, primed, and finished in accordance with the published application instructions of the paint manufacturer.
- E. Colors and metal finishes will be selected by the architect from the standard offering of each manufacturer. Custom colors, if desired, will be shown on sign construction drawings.
- F. Type styles and symbols will be as shown on the general and detailed sign type drawings.
- G. All Braille on tactile signs shall be accurate Grade 2 translations, and shall conform to the provisions of ADAAG and ICC/ANSI A117.1 with regard to size, position, spacing, and profile (domed top) characteristics.
- H. All fabrication workmanship shall be of best quality in every particular, complete in every detail, and strictly in accordance with best practices. All exposed and fabricated joints shall be tight and completely smooth. All sign faces shall be free of cupping, oil-canning, or other deflections.

2.8 PACKAGING

- A. Every effort should be made to use biodegradable and recyclable packaging materials.
- B. Pack each sign so as to prevent scratches and surface damage.
- C. See 3.7 for disposal of waste.

2.9 WARRANTY

- A. All products will be guaranteed against defects in materials and workmanship for a period of three years from the date of installation. Warranty is void if product is not maintained according to the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, HANDLING

- A. If stored at the site, all materials will be in an elevated, dry location, protected by a waterproof covering. The location will be coordinated with the general contractor.

3.2 ENVIRONMENTAL CONDITIONS

- A. Store all adhesives at room temperatures of no less than 55 degrees.

3.3 SITE INSPECTION

- A. Examine mounting surfaces, areas, and conditions with the general contractor present. Check for compliance with requirements for installation, and other factors affecting the performance of the work.

3.4 INSTALLATION

- A. Install all signs, according to the manufacturer's recommendations, and as shown on the construction drawings.
- B. Install all signs plumb and level at specific locations shown on the sign location plans and construction drawings.
- C. Exposed fasteners will not be permitted, unless specifically shown and required on the construction drawings, or approved by the architect.
- D. All signs will be shop-fabricated, and where practical, delivered to the site completely assembled. All signs that cannot be delivered fully assembled shall be erected and assembled so that all parts fit accurately with hairline joints.

3.5 PROJECT SCHEDULE

- A. All work will be performed in accordance with a schedule approved by the general contractor. The sign contractor shall assume that all signs will be installed in two separate phases occurring within a period of 36 months.
- B. All sign installation work will be completed prior to occupancy permit inspections. Temporary signs are not included

3.6 CLEANING

- A. Clean all signs following installation with a mild, non-streaking, wall cleaning solution for normal dirt and finger prints. Care should be taken not to scratch the sign surface.

3.7 WASTE MANAGEMENT

- A. Separate and recycle materials and packaging in accordance with the project Waste Management Plan.
- B. Remove from the site any materials and packaging not included in the Waste Management Plan.

3.8 RE-ORDER PROCESS

- A. Upon completion of the installation, the sign contractor will submit as-built drawings, and maintenance instructions to the facility representative.
- B. The sign contractor will supply to the facility representative re-order instructions for replacement of sign parts such as name strips, and for the ordering of new signs.

END OF SECTION

Summary

Sign Type	Sign Type Name	Quantity	Notes
11	Room ID	162	
12	Office ID with Insert	50	
14	Restroom ID	56	
15	Support Space ID	219	
16	Stair ID	26	
17	Stair Level ID	32	
17A	Stair Landing Regulatory	25	
18	Elevator Evacuation Notice	8	
19	Elevator Machine Room	3	
20	Regulatory / Info	5	
23	Int Fire Dept. Regulatory	1	
24	Safety Sign Eye Wash, Flag	9	
24A	Safety Sign Shower, Flag	9	
24B	Safety Sign Power, Flag	9	
24C	Safety Sign Fire Extinguisher, Flag	9	
24D	Safety Sign, Fire Extinguisher & Blanket	9	
24E	Safety Sign, Data Sheets Flag	7	
24F	Safety Sign, First Aid Kit Flag	7	
24G	Safety Sign, Goggles, Wall Mount	7	
30	Corridor Directional	22	
32	Major Destination ID	4	Metal Letters, Interior
33	Shop Sign, Wall Mount	20	
35	Vinyl Wall Mural	3	
36	Fire Annunciator Diagram	1	
37	Int Vinyl Door Number	26	
40	Dedication Plaque	1	
40A	Existing Dedication Plaque	1	
50	Exterior Entry ID	1	Metal Letters, Exterior
55	Exterior Fire Dept Regulatory	1	
56	Exterior Door ID Small	20	
56A	Exterior Door ID	12	
57	Exterior Door ID Large	7	
58	Ext Vinyl Door Number	26	Columbine numbering

Sign Type	Sign Type Name	Quantity	Notes
59	Exterior Visitor Info, Vinyl	1	
60	Exterior Regulatory	5	
60A	No Smoking, Vinyl	1	
61	No Parking Vinyl	7	
63	Exterior Directional	5	Posts and Panel
64	Site ID	1	
TOTAL		818	

Sign Schedule

Number	Type	Message	Status	Notes	Quantity
01-001	23		Active		1
01-002	55		Active		1
01-003	58		Active		1
01-004	60A		Active		1
01-005	59		Active		1
01-006	37		Active		1
01-007	36		Active		1
01-008	11		Active		1
01-009	12		Active		1
01-010	12		Active		1
01-011	12		Active		1
01-012	12		Active		1
01-013	12		Active		1
01-014	12		Active		1
01-015	12		Active		1
01-016	12		Active		1
01-017	12		Active		1
01-018	12		Active		1
01-019	14		Active		1
01-020	14		Active		1
01-021	11		Active		1
01-022	11		Active		1
01-023	11		Active		1
01-024	11		Active		1
01-025	11		Active		1
01-026	58		Active		1
01-027	56A		Active		1
01-028	37		Active		1
01-029	40A		Active		1
01-030	40		Active		1
01-031	32		Active		1
01-032	11		Active		1
01-033	20		Active		1

Number	Type	Message	Status	Notes	Quantity
01-034	15		Active		1
01-035	37		Active		1
01-036	56		Active		1
01-037	58		Active		1
01-038	37		Active		1
01-039	56		Active		1
01-040	58		Active		1
01-041	37		Active		1
01-042	56		Active		1
01-043	58		Active		1
01-044	15		Active		1
01-045	15		Active		1
01-046	15		Active		1
01-047	15		Active		1
01-048	16		Active		1
01-049	17		Active		1
01-050	17A		Active		1
01-051	17		Active		1
01-052	37		Active		1
01-053	58		Active		1
01-054	56A		Active		1
01-055	58		Active		1
01-056	56A		Active		1
01-057	56		Active		1
01-058	37		Active		1
01-059	15		Active		1
01-060	15		Active		1
01-061	15		Active		1
01-062	15		Active		1
01-063	15		Active		1
01-064	12		Active		1
01-065	14		Active		1
01-066	14		Active		1
01-067	58		Active		1
01-068	56		Active		1
01-069	37		Active		1

Number	Type	Message	Status	Notes	Quantity
01-070	30		Active		1
01-071	19		Active		1
01-072	15		Active		1
01-073	15		Active		1
01-074	11		Active		1
01-075	14		Active		1
01-076	15		Active		1
01-077	24C		Active		1
01-078	24		Active		1
01-079	24A		Active		1
01-080	24B		Active		1
01-081	24D		Active		1
01-082	56A		Active		1
01-083	56		Active		1
01-084	58		Active		1
01-085	37		Active		1
01-086	15		Active		1
01-087	15		Active		1
01-088	11		Active		1
01-089	14		Active		1
01-090	14		Active		1
01-091	33		Active		1
01-092	33		Active		1
01-093	11		Active		1
01-094	15		Active		1
01-095	15		Active		1
01-096	14		Active		1
01-097	24B		Active		1
01-098	24A		Active		1
01-099	24C		Active		1
01-100	24		Active		1
01-101	24G		Active		1
01-102	24E		Active		1
01-103	24D		Active		1
01-104	24F		Active		1
01-105	58		Active		1

Number	Type	Message	Status	Notes	Quantity
01-106	57		Active		1
01-107	56		Active		1
01-108	37		Active		1
01-109	58		Active		1
01-110	57		Active		1
01-111	56		Active		1
01-112	37		Active		1
01-113	24		Active		1
01-114	24G		Active		1
01-115	24E		Active		1
01-116	24D		Active		1
01-117	24C		Active		1
01-118	24A		Active		1
01-119	24B		Active		1
01-120	24F		Active		1
01-121	15		Active		1
01-122	15		Active		1
01-123	15		Active		1
01-124	15		Active		1
01-125	14		Active		1
01-126	15		Active		1
01-127	15		Active		1
01-128	15		Active		1
01-129	11		Active		1
01-130	15		Active		1
01-131	33		Active		1
01-132	11		Active		1
01-133	15		Active		1
01-134	15		Active		1
01-135	15		Active		1
01-136	37		Active		1
01-137	56		Active		1
01-138	56A		Active		1
01-139	58		Active		1
01-140	56A		Active		1
01-141	56A		Active		1

Number	Type	Message	Status	Notes	Quantity
01-142	58		Active		1
01-143	37		Active		1
01-144	15		Active		1
01-145	15		Active		1
01-146	15		Active		1
01-147	15		Active		1
01-148	14		Active		1
01-149	14		Active		1
01-150	11		Active		1
01-151	15		Active		1
01-152	15		Active		1
01-153	15		Active		1
01-154	33		Active		1
01-155	15		Active		1
01-156	15		Active		1
01-157	15		Active		1
01-158	15		Active		1
01-159	24D		Active		1
01-160	24C		Active		1
01-161	24A		Active		1
01-162	24		Active		1
01-163	24B		Active		1
01-164	15		Active		1
01-165	11		Active		1
01-166	14		Active		1
01-167	15		Active		1
01-168	15		Active		1
01-169	15		Active		1
01-170	15		Active		1
01-171	15		Active		1
01-172	24A		Active		1
01-173	24D		Active		1
01-174	24		Active		1
01-175	24B		Active		1
01-176	24C		Active		1
01-177	24E		Active		1

Number	Type	Message	Status	Notes	Quantity
01-178	24G		Active		1
01-179	24F		Active		1
01-180	37		Active		1
01-181	56A		Active		1
01-182	57		Active		1
01-183	58		Active		1
01-184	15		Active		1
01-185	33		Active		1
01-186	15		Active		1
01-187	11		Active		1
01-188	15		Active		1
01-189	15		Active		1
01-190	24A		Active		1
01-191	24D		Active		1
01-192	24		Active		1
01-193	24B		Active		1
01-194	56A		Active		1
01-195	56A		Active		1
01-196	57		Active		1
01-197	37		Active		1
01-198	56A		Active		1
01-199	58		Active		1
01-200	24C		Active		1
01-201	24G		Active		1
01-202	24E		Active		1
01-203	24F		Active		1
01-204	14		Active		1
01-205	15		Active		1
01-206	15		Active		1
01-207	11		Active		1
01-208	15		Active		1
01-209	33		Active		1
01-210	11		Active		1
01-211	14		Active		1
01-212	15		Active		1
01-213	15		Active		1

Number	Type	Message	Status	Notes	Quantity
01-214	15		Active		1
01-215	30		Active		1
01-216	37		Active		1
01-217	58		Active		1
01-218	58		Active		1
01-219	56		Active		1
01-220	17		Active		1
01-221	37		Active		1
01-222	16		Active		1
01-223	17A		Active		1
01-224	17		Active		1
01-225	16		Active		1
01-226	30		Active		1
01-227	11		Active		1
01-228	15		Active		1
01-229	12		Active		1
01-230	15		Active		1
01-231	14		Active		1
01-232	12		Active		1
01-233	14		Active		1
01-234	15		Active		1
01-235	11		Active		1
01-236	15		Active		1
01-237	14		Active		1
01-238	14		Active		1
01-239	15		Active		1
01-240	15		Active		1
01-241	14		Active		1
01-242	12		Active		1
01-243	15		Active		1
01-244	15		Active		1
01-245	15		Active		1
01-246	15		Active		1
01-247	11		Active		1
01-248	16		Active		1
01-249	17A		Active		1

Number	Type	Message	Status	Notes	Quantity
01-250	17		Active		1
01-251	37		Active		1
01-252	56		Active		1
01-253	58		Active		1
01-254	17		Active		1
01-255	11		Active		1
01-256	12		Active		1
01-257	14		Active		1
01-258	14		Active		1
01-259	15		Active		1
01-260	15		Active		1
01-261	15		Active		1
01-262	12		Active		1
01-263	14		Active		1
01-264	15		Active		1
01-265	15		Active		1
01-266	16		Active		1
01-267	17		Active		1
01-268	17A		Active		1
01-269	15		Active		1
01-270	11		Active		1
01-271	30		Active		1
01-272	15		Active		1
01-273	11		Active		1
01-274	35		Active		1
01-275	35		Active		1
01-276	35		Active		1
01-277	15		Active		1
01-278	14		Active		1
01-279	14		Active		1
01-280	32		Active		1
01-281	11		Active		1
01-282	30		Active		1
01-283	19		Active		1
01-284	15		Active		1
01-285	15		Active		1

Number	Type	Message	Status	Notes	Quantity
01-286	15		Active		1
01-287	16		Active		1
01-288	17A		Active		1
01-289	17		Active		1
01-290	37		Active		1
01-291	17		Active		1
01-292	56		Active		1
01-293	58		Active		1
01-294	37		Active		1
01-295	11		Active		1
01-296	12		Active		1
01-297	15		Active		1
01-298	15		Active		1
01-299	14		Active		1
01-300	15		Active		1
01-301	11		Active		1
01-302	15		Active		1
01-303	15		Active		1
01-304	15		Active		1
01-305	11		Active		1
01-306	11		Active		1
01-307	14		Active		1
01-308	14		Active		1
01-309	11		Active		1
01-310	11		Active		1
01-311	20		Active		1
01-312	11		Active		1
01-313	16		Active		1
01-314	17		Active		1
01-315	17A		Active		1
01-316	15		Active		1
01-317	58		Active		1
01-318	56		Active		1
01-319	17		Active		1
01-320	37		Active		1
01-321	17A		Active		1

Number	Type	Message	Status	Notes	Quantity
01-322	17		Active		1
01-323	16		Active		1
01-324	11		Active		1
01-325	15		Active		1
01-326	33		Active		1
01-327	37		Active		1
01-328	56		Active		1
01-329	57		Active		1
01-330	58		Active		1
01-331	61		Active		1
01-332	61		Active		1
01-333	61		Active		1
01-334	61		Active		1
01-335	58		Active		1
01-336	56		Active		1
01-337	17		Active		1
01-338	37		Active		1
01-339	17A		Active		1
01-340	17		Active		1
01-341	16		Active		1
01-342	11		Active		1
01-343	33		Active		1
01-344	15		Active		1
01-345	15		Active		1
01-346	14		Active		1
01-347	24G		Active		1
01-348	24F		Active		1
01-349	24E		Active		1
01-350	24D		Active		1
01-351	24A		Active		1
01-352	24		Active		1
01-353	24B		Active		1
01-354	24C		Active		1
01-355	15		Active		1
01-356	15		Active		1
01-357	15		Active		1

Number	Type	Message	Status	Notes	Quantity
01-358	33		Active		1
01-359	11		Active		1
01-360	15		Active		1
01-361	15		Active		1
01-362	15		Active		1
01-363	14		Active		1
01-364	12		Active		1
01-365	24		Active		1
01-366	24D		Active		1
01-367	24E		Active		1
01-368	24A		Active		1
01-369	24B		Active		1
01-370	24G		Active		1
01-371	24C		Active		1
01-372	24F		Active		1
01-373	37		Active		1
01-374	56		Active		1
01-375	56A		Active		1
01-376	58		Active		1
01-377	61		Active		1
01-378	15		Active		1
01-379	15		Active		1
01-380	15		Active		1
01-381	15		Active		1
01-382	19		Active		1
01-383	15		Active		1
01-384	15		Active		1
01-385	15		Active		1
01-386	15		Active		1
01-387	11		Active		1
01-388	15		Active		1
01-389	11		Active		1
01-390	15		Active		1
01-391	15		Active		1
01-392	15		Active		1
01-393	15		Active		1

Number	Type	Message	Status	Notes	Quantity
01-394	15		Active		1
01-395	16		Active		1
01-396	17		Active		1
01-397	17A		Active		1
01-398	11		Active		1
01-399	12		Active		1
01-400	14		Active		1
01-401	12		Active		1
01-402	15		Active		1
01-403	33		Active		1
01-404	11		Active		1
01-405	14		Active		1
01-406	15		Active		1
01-407	15		Active		1
01-408	15		Active		1
01-409	15		Active		1
01-410	15		Active		1
01-411	15		Active		1
01-412	15		Active		1
01-413	37		Active		1
01-414	57		Active		1
01-415	56		Active		1
01-416	58		Active		1
01-417	61		Active		1
01-418	24F		Active		1
01-419	24C		Active		1
01-420	24B		Active		1
01-421	24G		Active		1
01-422	24E		Active		1
01-423	24A		Active		1
01-424	24		Active		1
01-425	24D		Active		1
01-426	37		Active		1
01-427	61		Active		1
01-428	57		Active		1
01-429	56		Active		1

Number	Type	Message	Status	Notes	Quantity
01-430	58		Active		1
01-431	11		Active		1
01-432	58		Active		1
01-433	50		Active		1
01-434	63		Active		1
01-435	63		Active		1
01-436	63		Active		1
01-437	63		Active		1
01-438	63		Active		1
01-439	64		Active		1
01-440	60		Active		1
01-441	60		Active		1
01-442	60		Active		1
01-443	60		Active		1
01-444	60		Active		1
02-001	11		Active		1
02-002	16		Active		1
02-003	17		Active		1
02-004	17A		Active		1
02-005	16		Active		1
02-006	17		Active		1
02-007	11		Active		1
02-008	20		Active		1
02-009	11		Active		1
02-010	11		Active		1
02-011	11		Active		1
02-012	11		Active		1
02-013	11		Active		1
02-014	12		Active		1
02-015	11		Active		1
02-016	11		Active		1
02-017	18		Active		1
02-018	15		Active		1
02-019	11		Active		1
02-020	15		Active		1
02-021	15		Active		1

Number	Type	Message	Status	Notes	Quantity
02-022	15		Active		1
02-023	15		Active		1
02-024	11		Active		1
02-025	30		Active		1
02-026	15		Active		1
02-027	11		Active		1
02-028	15		Active		1
02-029	15		Active		1
02-030	15		Active		1
02-031	17A		Active		1
02-032	17		Active		1
02-033	16		Active		1
02-034	15		Active		1
02-035	15		Active		1
02-036	11		Active		1
02-037	15		Active		1
02-038	14		Active		1
02-039	33		Active		1
02-040	11		Active		1
02-041	11		Active		1
02-042	11		Active		1
02-043	15		Active		1
02-044	15		Active		1
02-045	11		Active		1
02-046	11		Active		1
02-047	12		Active		1
02-048	12		Active		1
02-049	11		Active		1
02-050	15		Active		1
02-051	15		Active		1
02-052	15		Active		1
02-053	14		Active		1
02-054	15		Active		1
02-055	11		Active		1
02-056	33		Active		1
02-057	12		Active		1

Number	Type	Message	Status	Notes	Quantity
02-058	12		Active		1
02-059	15		Active		1
02-060	33		Active		1
02-061	14		Active		1
02-062	15		Active		1
02-063	15		Active		1
02-064	15		Active		1
02-065	15		Active		1
02-066	11		Active		1
02-067	11		Active		1
02-068	14		Active		1
02-069	11		Active		1
02-070	15		Active		1
02-071	15		Active		1
02-072	15		Active		1
02-073	15		Active		1
02-074	33		Active		1
02-075	30		Active		1
02-076	11		Active		1
02-077	11		Active		1
02-078	14		Active		1
02-079	11		Active		1
02-080	11		Active		1
02-081	30		Active		1
02-082	16		Active		1
02-083	17		Active		1
02-084	17A		Active		1
02-085	32		Active		1
02-086	11		Active		1
02-087	20		Active		1
02-088	18		Active		1
02-089	12		Active		1
02-090	12		Active		1
02-091	12		Active		1
02-092	15		Active		1
02-093	12		Active		1

Number	Type	Message	Status	Notes	Quantity
02-094	15		Active		1
02-095	11		Active		1
02-096	12		Active		1
02-097	12		Active		1
02-098	12		Active		1
02-099	12		Active		1
02-100	11		Active		1
02-101	15		Active		1
02-102	15		Active		1
02-103	11		Active		1
02-104	15		Active		1
02-105	15		Active		1
02-106	15		Active		1
02-107	14		Active		1
02-108	11		Active		1
02-109	30		Active		1
02-110	14		Active		1
02-111	30		Active		1
02-112	30		Active		1
02-113	11		Active		1
02-114	15		Active		1
02-115	15		Active		1
02-116	15		Active		1
02-117	17A		Active		1
02-118	17		Active		1
02-119	16		Active		1
02-120	11		Active		1
02-121	20		Active		1
02-122	11		Active		1
02-123	11		Active		1
02-124	32		Active		1
02-125	16		Active		1
02-126	17		Active		1
02-127	17A		Active		1
02-128	15		Active		1
02-129	15		Active		1

Number	Type	Message	Status	Notes	Quantity
02-130	15		Active		1
02-131	16		Active		1
02-132	17		Active		1
02-133	17A		Active		1
02-134	11		Active		1
02-135	11		Active		1
02-136	11		Active		1
02-137	11		Active		1
02-138	11		Active		1
02-139	15		Active		1
02-140	11		Active		1
02-141	14		Active		1
02-142	11		Active		1
02-143	11		Active		1
02-144	11		Active		1
02-145	11		Active		1
02-146	11		Active		1
02-147	11		Active		1
02-148	11		Active		1
02-149	30		Active		1
02-186	15		Active		1
03-001	17A		Active		1
03-002	17		Active		1
03-003	16		Active		1
03-004	15		Active		1
03-005	30		Active		1
03-006	18		Active		1
03-007	11		Active		1
03-008	14		Active		1
03-009	11		Active		1
03-010	14		Active		1
03-011	11		Active		1
03-012	11		Active		1
03-013	15		Active		1
03-014	11		Active		1
03-015	11		Active		1

Number	Type	Message	Status	Notes	Quantity
03-016	16		Active		1
03-017	17		Active		1
03-018	17A		Active		1
03-019	15		Active		1
03-020	30		Active		1
03-021	15		Active		1
03-022	33		Active		1
03-023	11		Active		1
03-024	15		Active		1
03-025	15		Active		1
03-026	15		Active		1
03-027	15		Active		1
03-028	15		Active		1
03-029	15		Active		1
03-030	15		Active		1
03-031	15		Active		1
03-032	11		Active		1
03-033	11		Active		1
03-034	11		Active		1
03-035	14		Active		1
03-036	15		Active		1
03-037	15		Active		1
03-038	12		Active		1
03-039	11		Active		1
03-040	15		Active		1
03-041	15		Active		1
03-042	15		Active		1
03-043	15		Active		1
03-044	15		Active		1
03-045	14		Active		1
03-046	11		Active		1
03-047	33		Active		1
03-048	12		Active		1
03-049	12		Active		1
03-050	12		Active		1
03-051	12		Active		1

Number	Type	Message	Status	Notes	Quantity
03-052	15		Active		1
03-053	33		Active		1
03-054	11		Active		1
03-055	15		Active		1
03-056	15		Active		1
03-057	15		Active		1
03-058	15		Active		1
03-059	14		Active		1
03-060	11		Active		1
03-061	15		Active		1
03-062	11		Active		1
03-063	30		Active		1
03-064	17A		Active		1
03-065	17		Active		1
03-066	16		Active		1
03-067	18		Active		1
03-068	11		Active		1
03-069	11		Active		1
03-070	15		Active		1
03-071	30		Active		1
03-072	11		Active		1
03-073	15		Active		1
03-074	15		Active		1
03-075	15		Active		1
03-076	15		Active		1
03-077	11		Active		1
03-078	15		Active		1
03-079	15		Active		1
03-080	15		Active		1
03-081	11		Active		1
03-082	14		Active		1
03-083	30		Active		1
03-084	11		Active		1
03-085	15		Active		1
03-086	11		Active		1
03-087	16		Active		1

Number	Type	Message	Status	Notes	Quantity
03-088	17		Active		1
03-089	17A		Active		1
03-090	16		Active		1
03-091	17		Active		1
03-092	17A		Active		1
03-093	11		Active		1
03-094	11		Active		1
03-095	11		Active		1
03-096	11		Active		1
03-097	11		Active		1
03-098	11		Active		1
03-099	15		Active		1
03-100	14		Active		1
03-101	11		Active		1
03-102	11		Active		1
03-103	11		Active		1
03-104	15		Active		1
03-105	11		Active		1
03-106	11		Active		1
03-107	11		Active		1
03-108	30		Active		1
03-109	11		Active		1
04-001	18		Active		1
04-002	11		Active		1
04-003	14		Active		1
04-004	11		Active		1
04-005	12		Active		1
04-006	12		Active		1
04-007	15		Active		1
04-008	12		Active		1
04-009	12		Active		1
04-010	12		Active		1
04-011	12		Active		1
04-012	12		Active		1
04-013	11		Active		1
04-014	14		Active		1

Number	Type	Message	Status	Notes	Quantity
04-015	15		Active		1
04-016	15		Active		1
04-017	14		Active		1
04-018	11		Active		1
04-019	11		Active		1
04-020	17A		Active		1
04-021	17		Active		1
04-022	16		Active		1
04-023	15		Active		1
04-024	30		Active		1
04-025	15		Active		1
04-026	15		Active		1
04-027	15		Active		1
04-028	11		Active		1
04-029	15		Active		1
04-030	15		Active		1
04-031	11		Active		1
04-032	33		Active		1
04-033	11		Active		1
04-034	15		Active		1
04-035	11		Active		1
04-036	14		Active		1
04-037	15		Active		1
04-038	15		Active		1
04-039	15		Active		1
04-040	11		Active		1
04-041	12		Active		1
04-042	12		Active		1
04-043	11		Active		1
04-044	15		Active		1
04-045	12		Active		1
04-046	15		Active		1
04-047	12		Active		1
04-048	15		Active		1
04-049	12		Active		1
04-050	11		Active		1

Number	Type	Message	Status	Notes	Quantity
04-051	15		Active		1
04-052	33		Active		1
04-053	15		Active		1
04-054	11		Active		1
04-055	33		Active		1
04-056	15		Active		1
04-057	30		Active		1
04-058	14		Active		1
04-059	15		Active		1
04-060	11		Active		1
04-061	11		Active		1
04-062	17A		Active		1
04-063	17		Active		1
04-064	16		Active		1
04-065	18		Active		1
04-066	11		Active		1
04-067	11		Active		1
04-068	11		Active		1
04-069	15		Active		1
04-070	14		Active		1
04-071	15		Active		1
04-072	15		Active		1
04-073	15		Active		1
04-074	15		Active		1
04-075	15		Active		1
04-076	17A		Active		1
04-077	17		Active		1
04-078	16		Active		1
04-079	11		Active		1
04-080	11		Active		1
04-081	30		Active		1
04-082	11		Active		1
04-083	11		Active		1
04-084	11		Active		1
04-085	15		Active		1
04-086	11		Active		1

Number	Type	Message	Status	Notes	Quantity
04-087	14		Active		1
04-088	11		Active		1
04-089	11		Active		1
04-090	11		Active		1
04-091	11		Active		1
04-092	11		Active		1
04-093	30		Active		1
04-094	11		Active		1
04-095	11		Active		1
04-096	56		Active		1
04-097	18		Active		1
04-098	11		Active		1
04-099	11		Active		1
04-100	11		Active		1
04-101	11		Active		1
04-102	14		Active		1
04-103	17A		Active		1
04-104	17		Active		1
04-105	56		Active		1
04-106	11		Active		1
04-107	18		Active		1
04-108	11		Active		1
04-109	11		Active		1
04-110	14		Active		1
04-111	14		Active		1
04-112	11		Active		1
04-113	16		Active		1
04-114	17		Active		1
04-115	17A		Active		1

SECTION 102110

TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Phenolic-core toilet compartments and screens, floor-mounted and overhead braced.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 102800 - TOILET ACCESSORIES for partition mounted accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. LEED Submittals:
 - 1. Product data indicating percentage by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include a statement indicating costs for each product having recycled content.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of cutouts for compartment-mounted toilet accessories.
- D. Samples for Verification: Of each type of color and finish required for units, prepared on 6-inch-square Samples of same thickness and material indicated for Work.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index:[25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions of Massachusetts Architectural Access Board and the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG) for compartment door operating hardware and compartments designated as accessible."
- C. Regulatory Requirements: Comply with applicable provisions of ICC A117.1 and the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG) for compartment door operating hardware and compartments designated as accessible."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.6 COORDINATION

- A. Coordinate with the work of Section 061000 - ROUGH CARPENTRY for locations requiring wood blocking or flat plate reinforcing within partitions for compartment mounting.

PART 2 - PRODUCTS

2.1 PHENOLIC-CORE UNITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Accurate Partitions Corporation.
 - 2. Bradley Corporation; Mills Partitions.
 - 3. Flush Metal Partition Corp.
 - 4. General Partitions Mfg. Corp.
 - 5. Global Steel Products Corp.
 - 6. Knickerbocker Partition Corporation.
 - 7. Metpar Corp.
- B. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately

laminated), and with eased and polished edges. Provide minimum 3/4-inch-thick doors and pilasters and minimum 1/2-inch-thick panels.

1. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
2. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

C. Urinal-Screen Construction:

1. Flat-Panel Urinal Screen: Wall-mounted, matching panel construction.

D. Brackets and Fittings: Manufacturer's standard design.

1. Full-Height (Continuous) Type Brackets: Stainless steel.
2. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
3. Stainless-Steel Finish: No. 4 bright, directional polish on exposed faces. Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.

E. Phenolic-Panel Finish: Apply one color in each room.

1. Color: As selected by Architect from manufacturer's full range.
2. Core Color: Manufacturer's standard dark color core.
3. Core Color: Manufacturer's through-color core matching face sheet.

2.2 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.
2. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. Floor-Mounted, Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, in-swinging doors for standard toilet compartments and 36-inch-wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Floor-Mounted, Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Wall-Hung Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION

SECTION 102120

CUBICLE CURTAINS AND TRACKS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Curtain tracks and curtain carriers, manual operation.
 - 2. Cubicle curtains.
- B. Sustainable Design Intent: Refer to Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking for mounting items requiring anchorage.

1.3 PERFORMANCE REQUIREMENTS

- A. Curtains: Provide curtain fabrics with the following characteristics:
 - 1. Fabrics are launderable to a temperature of not less than 160 deg F.
 - 2. Fabrics are flame resistant and are identical to those that have passed NFPA 701, with no chemical flame retardants, when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

1.4 SUBMITTALS

- A. Product Data: For each product indicated.
 - 1. Include durability, laundry temperature limits, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.

CUBICLE CURTAINS AND TRACKS

- a. For fabric curtain materials, submit GreenGuard Gold certification.
 - C. Shop Drawings: Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
 - 1. Include details on blocking.
 - D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - 4. Coordinate with other Division 09 Sections for ceilings.
 - E. Samples for Initial Selection: For each type of curtain material indicated.
 - F. Samples for Verification: For each type of product required, prepared on Samples of size indicated below.
 - 1. Curtain Fabric: 12-inch-square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
 - 2. Mesh Top: Not less than 4 inches square.
 - 3. Curtain Track: Not less than 4 inches long.
 - 4. Curtain Carrier: Full-size unit.
 - G. Curtain and Track Schedule: Use same designations indicated on Drawings.
 - H. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.
 - I. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.
- 1.5 PROJECT CONDITIONS
- A. Environmental Limitations: Do not install cubicles until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 CURTAIN TRACKS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AR Nelson.
 - 2. Crowder, K. N. Manufacturing, Inc.
 - 3. Cubicle Curtain Factory.
 - 4. General Cubicle Company, Inc.
 - 5. InPro Corporation.
 - 6. Silent Gliss USA Inc.
- B. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4 inch high; with minimum wall thickness of 0.062 inch.
 - 1. Basis of Design: AR Nelson; Model No. 1100CT, suspended cubicle track.
 - 2. Finish: Clear anodized.
- C. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
 - 1. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel hook.
 - 2. Exposed Fasteners: Stainless steel.
 - 3. Concealed Fasteners: Stainless steel.

2.2 CURTAINS

- A. Healthier Hospitals Initiative (HHI): Products shall comply with requirements of Safer Chemicals Challenge: Healthy Interiors.
 - 1. Furniture and furnishings shall eliminate the use of formaldehyde, perfluorinated compounds, polyvinyl chloride (PVC), antimicrobials, and all flame retardants.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Architex.
 - 2. Carnegie.
 - 3. Maharam.
- C. Cubicle Curtain Fabric: Curtain manufacturer's standard, 100 percent Trevira CS polyester, inherently and permanently flame resistant, stain resistant, and antimicrobial, without added treatments.
 - 1. Color and Pattern: As selected by the Architect from manufacturer's full range.
- D. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.
- E. Mesh Top: No. 40 nylon mesh, minimum. White color.

- F. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

2.3 CURTAIN FABRICATION

- A. Fabricate curtains to comply with the following requirements:
 - 1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.
 - 2. Length: Equal to floor-to-ceiling height, with 20-inch mesh top, and minus distance above the finished floor at bottom as follows:
 - a. Cubicle Curtains: 12 inches.
 - 3. Top Hem: Not less than 1 inch and not more than 15 1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched.
 - 4. Mesh Top: Top hem not less than 1 inch and not more than 15 1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/25 inch triple thickness, top hem of curtain fabric.
 - 5. Bottom Hem: 1 inch double thickness and single lock stitched.
 - 6. Side Hems: Not less than 1/2 inch and not more than 15 1/4 inches wide, with double turned edges, and single lock stitched.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install tracks level and plumb, according to manufacturer's written instructions. Provide track fabricated from one continuous length.
 - 1. Curtain Track Mounting: As indicated on Drawings.
- B. Surface Track Mounting: Fasten surface mounted tracks at intervals of not less than 24 inches. Fasten support at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
 - 1. Mechanically fasten directly to bottom of concrete deck with anchor screws.
 - 2. Mechanically fasten directly to finish ceiling with toggle bolts.
 - 3. Mechanically fasten to suspended ceiling grid with screws.
- C. Suspended Track Mounting: Install track with suspended supports at intervals of not more than 84 inches. Fasten support at each splice and tangent point of each corner. Secure ends of track to wall with flanged fittings or brackets.
- D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

- E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.
- F. Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

3.3 PROTECTION

- A. Protect installed recessed track openings with nonresidue adhesive tape to prevent construction debris from impeding carrier operation. Remove tape prior to Substantial Completion.

END OF SECTION

SECTION 102210

WIRE MESH PARTITIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wire mesh fabrications for the following applications:
 - a. Standard-duty interior partitions.
 - b. Standard-duty interior ceilings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055100 - METAL STAIRS AND RAILINGS for railing systems requiring wire mesh railing insert panels.
 - 2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 3. Section 102215 - CHAIN LINK PARTITIONS for panels at Garage.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wire mesh items.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: 12-by-12-inch panel constructed of specified frame members and wire mesh. Show method of finishing members at intersections.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire mesh items crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of construction contiguous with wire mesh items by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish location dimensions and proceed with fabricating wire mesh items without field measurements. Coordinate with adjacent construction to ensure that actual location dimensions correspond to established dimensions.

1.6 COORDINATION

- A. Coordinate installation of anchorages for wire mesh items supported or anchored to permanent construction. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Acorn Wire & Iron Works, Inc.
 - 2. Jesco Industries, Inc.
 - 3. King Wire Partitions, Inc.
 - 4. Miller Wire Works, Inc.
 - 5. Standard Wire & Steel Works.
 - 6. Wire Crafters, Inc.

2.2 MATERIALS

- A. Steel Wire: ASTM A 510.
- B. Steel Plates, Channels, Angles, and Bars: ASTM A 36/A 36M.
- C. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- D. Steel Pipe: ASTM A 53/A 53M, Schedule 40, unless another weight is indicated or required by structural loads.
- E. Square Steel Tubing: Cold-formed structural-steel tubing, ASTM A 500.
- F. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
- G. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts.

- H. Postinstalled Expansion Anchors in Concrete: With capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- I. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated and fabricated from corrosion-resistant materials; with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by wire mesh construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

2.3 STANDARD-DUTY WIRE MESH PARTITIONS

- A. Mesh: 0.135-inch-diameter, intermediate-crimp steel wire woven into 1-1/2-inch diamond mesh.
- B. Vertical Panel Framing: 1-1/4-by-5/8-by-0.0966-inch cold-rolled, C-shaped steel channels with 1/4-inch- (6-mm-) diameter bolt holes spaced not more than 18 inches o.c. along center of framing.
- C. Horizontal Panel Framing: 1-by-1/2-by-1/8-inch cold-rolled steel channels.
- D. Horizontal Panel Stiffeners: 1-by-1/2-by-1/8-inch cold-rolled steel channels with wire woven through, or two 1-by-3/8-by-1/8-inch cold-rolled steel channels bolted or riveted toe to toe through mesh.
- E. Top Capping Bars: 2-1/4-by-1-inch cold-rolled steel channels.
- F. Posts for 90-Degree Corners: 1-1/4-by-1-1/4-by-1/8-inch steel angles with 1/4-inch- diameter bolt holes aligning with bolt holes in vertical framing; with floor anchor clips.
- G. Posts for Other-Than-90-Degree Corners: Manufacturer's standard steel pipe or tubing with 1/4-inch- diameter bolt holes aligning with bolt holes in vertical framing.
- H. Floor Shoes: Steel, cast iron, or cast aluminum, 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.
- I. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/4-by-1/2-by-1/8-inch steel channels or C-channels, banded with 1-1/4-by-1/8-inch flat steel bar cover plates on 3 sides, and with 1/8-inch-thick angle strike bar and cover on strike jamb.
 - 1. Hinges: Full-surface type, 3-by-3-inch steel, 1-1/2 pairs per door; bolted, riveted, or welded to door and jamb framing.
 - 2. Cylinder Lock: Mortise type with cylinder specified in Section 087100 - DOOR HARDWARE operated by key outside and recessed knob inside.
- J. Accessories:
 - 1. Sheet Metal Base: 0.0598-inch- thick, cold-rolled steel sheet.
 - 2. Adjustable Filler Panels: 0.0598-inch- thick, cold-rolled steel sheet; capable of filling openings from 2 to 12 inches.
 - 3. Wall Clips: Manufacturer's standard, cold-rolled steel sheet.

- K. Finishes for Interior Locations: Powder-coated finish, color as selected.

2.4 WIRE MESH CEILINGS

- A. Mesh, Framing, and Stiffeners: Fabricated from same mesh and framing as wire mesh partition panels.
- B. Perimeter Partition Supports: 1-1/2-by-1-1/2-by-1/8-inch steel angle, with 1/4-inch-diameter bolt holes aligned for bolting to top of wire mesh partitions and to sides of wire mesh ceiling panels.
- C. Wall Supports: 1-1/2-by-1-1/2-by-1/8-inch steel angle punched for attachment to wall and wire mesh ceiling panels.
- D. Intermediate Supports: Steel I-beam, as recommended by manufacturer.
- E. Intermediate Support Posts: 2-by-2-by-1/8-inch steel pipe or tubing.
- F. Finishes: Match adjacent wire mesh partitions.

2.5 FABRICATION

- A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-size components as recommended by wire mesh item manufacturer. Provide bolts, hardware, and accessories as required for complete installation.
 - 1. Fabricate wire mesh items to be readily disassembled.
 - 2. Welding: Weld corner joints of framing and grind smooth.
- B. Standard Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.
 - 1. Mesh: Securely clinch mesh to framing.
 - 2. Framing: Fabricate framing with mortise and tenon corner construction.
 - a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
 - b. Fabricate partition and door framing with slotted holes for connecting adjacent panels.
 - 3. Fabricate wire mesh partitions with 3 inches of clear space between finished floor and bottom horizontal framing.
 - 4. Doors: Align bottom of door with bottom of adjacent panels.
 - a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.
 - 5. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

2.6 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish wire mesh items after assembly.
 - 2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Powder-Coated Finish: Apply manufacturer's standard baked finish, complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine floors for suitable conditions where wire mesh items will be installed.
- C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Wire Mesh Partitions:
 - 1. Anchor wire mesh partitions to floor with 3/8-inch-diameter, postinstalled expansion anchors at 12 inches o.c. through anchor clips located at each post and corner. Shim anchor clips as required to achieve level and plumb installation.
 - 2. Anchor wire mesh partitions to walls at 12 inches o.c. through back corner panel framing.
 - 3. Secure top capping bars to top framing channels with 1/4-inch- diameter "U" bolts spaced not more than 28 inches o.c.
 - 4. Provide line posts at locations indicated.
 - 5. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.
 - 6. Install doors complete with door hardware.
 - 7. Install security windows complete with window hardware.
 - 8. Weld or bolt sheet metal bases.
 - 9. Bolt accessories to wire mesh partition framing.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors to operate easily without binding.
- B. Check and readjust operating hardware items just before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work including doors and framing that are warped, bowed, or otherwise unacceptable.
- C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint; paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION

SECTION 102220

FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Manually-operated, single and paired-panel partitions.
 - 2. Electrically-operated, continuously hinged panel partitions.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for framing and supports.
 - 2. Section 061000 – ROUGH CARPENTRY for concealed blocking.
 - 3. Division 26 - ELECTRICAL for electrical service and connections for motor operators, controls, and limit switches; and for system disconnect switches.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Provide operable panel partitions capable of withstanding the effects of earthquake motions determined according to Code requirements.
- B. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound Transmission Requirements: Operable panel partition assembly tested in a full-scale opening, 14 by 9 feet for laboratory sound transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
 - C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - D. Setting Drawings: For embedded items and cutouts required in other work, including support-beam punching template.
 - E. Samples for Verification: For each type of finish, covering, or facing indicated, prepared on Samples of size indicated below.
 - 1. Applied Facing: Full width by not less than 8-inch-long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
 - F. Product Test Reports: Based on evaluation of comprehensive tests performed by a certified testing agency, for each operable panel partition.
 - G. Maintenance Data: For operable panel partitions to include in maintenance manuals.
 - 1. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - 2. Seals, hardware, track, carriers, and other operating components.
 - 3. For electric operator.
 - H. Warranty: Special warranty specified in this Section.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - B. Fire-Test-Response Characteristics: Provide operable panel partitions with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 450 or less.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify operable panel partition openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal wear.
 - 2. Panel Warranty Period: Two years from date of Substantial Completion.
 - 3. Track Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hufcor, Inc.
 - 2. Moderco.
 - 3. Modernfold.

2.2 MATERIALS

- A. Steel Frame: Steel sheet, manufacturer's standard nominal specified thickness for uncoated steel.

- B. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard thickness.
- C. Gypsum Board: ASTM C 1396.

2.3 OPERABLE PANELS

- A. Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- B. Dimensions: Fabricate operable panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
- C. STC: Not less than 50.
- D. Panel Closure: Manufacturer's standard.
- E. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

2.4 SEALS

- A. General: Provide types of acoustical seals indicated that produce operable panel partitions complying with acoustical performance requirements and the following:
 - 1. Manufacturer's standard seals.
 - 2. Seals made from materials and in profiles that minimize sound leakage.
 - 3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
- B. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous PVC acoustical seal.
- C. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
 - 1. Automatically Operated: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than 2-inches between retracted seal and floor finish.

2.5 FINISH FACING

- A. General: Provide finish facings that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

- B. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-B for type indicated; Class A.
- C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.6 SUSPENSION SYSTEMS

- A. Suspension Tracks: Steel or aluminum adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
- C. Track Intersections, Switches, and Accessories: As required for type of operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.
- D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish, unless otherwise indicated.
- E. Steel Finish: Factory-applied, corrosion-resistant, protective coating, unless otherwise indicated.

2.7 ELECTRIC OPERATORS

- A. General: Provide factory-assembled electric operation system of size and capacity recommended and provided by operable panel partition manufacturer for partition specified; with electric motor and factory-prewired motor controls, speed reducer, chain drive, remote-control stations, control devices, and accessories required for proper operation. Include wiring from motor control to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
- B. Comply with NFPA 70.
- C. Control Equipment: Complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
- D. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1.
- E. Remote-Control Stations: Two single-key-operated, constant-pressure control stations located remotely from each other on opposite sides and opposite ends of partition run. Wire in series to require simultaneous activation of both key stations to operate partition. Each three-position control station labeled "Open," "Close," and "[Off] [Stop]." Provide two keys per station.

- F. Obstruction-Detection Devices: Provide each motorized operable panel partition with automatic safety sensor indicated. Activation of sensor causes operator to immediately shut off motor.
 - 1. Sensor Edge: Contact-pressure-sensitive safety edge along partition's leading edge.
- G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop operable panel partition at fully extended and fully stacked positions.

2.8 ACCESSORIES

- A. Pass Doors: Fabricated to comply with recommendations in Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)." Swinging door built into and matching panel materials, construction, acoustical qualities, finish, and thickness, complete with frames and operating hardware. Hinges finished to match other exposed hardware.
 - 1. Single Pass Door: 36 by 80 inches with the following:
 - a. Door Seals: Mechanically operated floor seal on panels containing pass doors.
 - b. Door Hardware: Provide panic hardware, concealed door closers, and other hardware components as required and as indicated on drawings.
 - c. Exit Sign: Recessed, self-illuminated.
 - d. Lock: Key-operated lock cylinder, keyed to master key system, operable from both sides of door. Include two keys per lock.
- B. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs. Hinges in finish to match other exposed hardware.
 - 1. Manufacturer's standard method to secure pocket door in closed position.
- C. Electric Interlock: Provide each motorized operable panel partition with electric interlocks at locations indicated, to prevent operation of operable partition under the following conditions:
 - 1. On pocket door, to prevent operation if pocket door is not in fully open position.
 - 2. On partitions at location of convergence by another partition, to prevent operation if merging partitions are in place.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.
- C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

3.3 ADJUSTING

- A. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware, electric operator, and other moving parts.
- B. Adjust pass doors and pocket doors to operate smoothly and easily, without binding or warping. Check and readjust operating hardware. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.4 FIELD QUALITY CONTROL

- A. Light Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids; adjust partitions for acceptable fit.
- B. NIC Testing: The Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- C. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than the NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
- D. Testing Extent: Testing agency shall randomly select one operable panel partition installation(s) for testing.
- E. Repair or replace operable panel partitions within areas where test results indicate partitions do not comply with requirements, and retest partitions.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of repaired, replaced, or additional work with specified requirements.

3.5 CLEANING

- A. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner Project Manager's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION

SECTION 102610

CORNER GUARDS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Corner guards.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for steel angle type guards, custom fabricated.
 - 2. Section 087100 - DOOR HARDWARE for metal armor, kick, mop, and push plates.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Corner Guards: 12 inches long.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain corner guards from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

PART 2 - PRODUCTS

2.1 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated from 1-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Balco, Inc.
 - b. Boston Retail Products.
 - c. Construction Specialties, Inc.
 - d. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - e. Korogard Wall Protection Systems; Division of RJF International Corporation.
 - f. Nystrom Building Products.
 - g. Pawling Corporation.
 - 2. Material: ASTM A 240, Stainless steel, Type 304.
 - a. Thickness: Minimum 0.0781 inch.
 - b. Finish: Directional satin, No. 4.
 - 3. Wing Size: Nominal 3-1/2 by 3-1/2 inches.
 - 4. Height: Refer to Drawings.
 - 5. Corner Radius: 1/8 inch.
 - 6. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.
- B. Fasteners: Stainless-steel screws, compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 FABRICATION

- A. Fabricate units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Fabricate components with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.
- C. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

2.3 METAL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Remove tool and die marks and stretch lines or blend into finish.
 - 2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

- B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.4 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, polished finish indicated, free of cross scratches.
 - 1. Run grain of directionally textured finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4 finish.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine walls to which units will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. General: Install units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - 1. Provide mounting hardware, anchors, and other accessories required for a complete installation.

3.4 CLEANING

- A. Immediately after completion of installation, clean corner guards and accessories using a low VOC, non-ammonia-, non-chlorine, and non-solvent-based, household cleaning agent.

END OF SECTION

SECTION 102800

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Toilet accessories as scheduled on the Drawings. Coordinate with Owner for accessories provided by Owner.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for blocking.
 - 2. Section 088000 - GLAZING for frameless mirrors.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated on Drawings.
 - 2. Identify products using designations indicated on Drawings.
- C. Maintenance Data: For toilet accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.
- C. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 104100

EMERGENCY ACCESS AND INFORMATION CABINETS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fire department key vault box.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for substrate.
 - 2. Section 061000 - ROUGH CARPENTRY for wood blocking.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each product and system used. Provide manufacturer's certifications stating that products and systems comply with requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorage, connections and accessory items. Provide installation templates for work installed by others.
- C. Contractor's Review: Before commencing work, submit signed statement that Contract Documents have been reviewed with a qualified representative of supplier/manufacturer, and that selected materials and construction are proper, compatible, and adequate for application shown.

PART 2 - PRODUCTS

2.1 FIRE DEPARTMENT KEY VAULT BOX

- A. Fire Department Key Vault Box: Provide at building entrance; location shall be acceptable to local Fire Department.
 - 1. Basis of Design: Knox Company; Model 3200 Knox-Box, Recessed Mounted Type.
 - 2. Finish: Weather resistant TGIC polyester powder coat, color as selected by local Fire Department.
 - 3. Locking: Provide lock and keys acceptable to local Fire Department.
 - 4. Building Alarm Interface: Provide tamper switch interface with building alarm system.
 - 5. Accessories:
 - a. Provide manufacturer's standard recessed mounting kit, for installation in specified construction.
 - b. Provide alarm tamper switches, UL listed.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Rough-In Work: Examine installation of walls and other conditions under which work is to be installed; verify dimensions of services and substrates before fabricating work.
- B. Notify Contractor of unsatisfactory locations and dimensions of other work and of unsatisfactory conditions for proper installation of equipment. Do not proceed with fabrication and installation until unsatisfactory dimensions and conditions have been corrected in manner satisfactory to Installer.

3.2 FIRE DEPARTMENT KNOX BOX INSTALLATION

- A. General: Set each item of equipment securely in place, level, and adjust to correct height, 4 ft. - 0 in. AFF, unless otherwise required by local Fire Department.
- B. Anchor to supporting substrate where indicated and where required for sustained operation and use without shifting or dislocation. Conceal anchorage where possible. Seal perimeter joints in accordance with Section 079200 - JOINT SEALANTS.

3.3 CLEANING

- A. After completion of installation and other major work remove protective coverings, if any, and clean equipment, internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed-metal surfaces and touch-up painted surfaces. Replace work that cannot be successfully restored.

END OF SECTION

SECTION 104313

AUTOMATIC EXTERNAL DEFIBRILLATOR (AED) CABINETS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Automatic external defibrillator (AED) cabinets.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking.
 - 2. Division 26 - ELECTRICAL for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized shade operation.
 - 3. Division 28 - ELECTRONIC SAFETY AND SECURITY for door alarm connection and opening monitoring connection.

1.3 COORDINATION

- A. Coordinate size of AED cabinets to ensure compatibility with Owner-furnished AED devices.
- B. Coordinate fire-rating of AED cabinets with fire-rated partitions to ensure partition fire-rating is maintained.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

1. Show locations and details for installing electrical wiring, alarm and monitoring components and switches.
2. Wiring Diagrams: Power, alarm and monitoring wiring.

1.5 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Source Limitations: Obtain AED cabinets through one source from a single manufacturer.
- C. Fire-Rated AED Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and protect defibrillator cabinets and related materials using means and methods that will prevent damage, deterioration, or loss.
- B. Deliver components in manufacturer's original packaging, properly labeled for identification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, products which may be incorporated into the Work include, but are not limited to, the following:
 1. JL Industries, Inc.
 2. Larsen's Manufacturing Company.
 3. Potter Roemer; Div. of Smith Industries, Inc.
 4. Zoll Medical Corporation.
- B. Basis-of-Design: Subject to compliance with requirements, provide JL Industries 1400 Series Lifestart Series recessed AED cabinets, or comparable products from available manufacturers, as approved by Architect.
 1. Cabinet Style: Recessed.
 2. Size: 14 inches high by 14 inches wide by 6-3/4 inches deep, unless otherwise indicated.
 3. Components:
 - a. Tub Material: Stainless steel.
 - b. Tub Material: Cold-rolled steel.
 - c. Door and Trim Construction: Flush doors with 5/8 inch door stop attached by continuous hinge and equipped with zinc-plated with roller catch.

- 1) Finish: Factory-applied ground and polished finish; #4 directional satin finish.
- 2) Finish: Factory-applied powder coat finish; color as selected by Architect from manufacturer's full range.
- 3) Door Style: Fully-tempered glazing; pull and AED signage.
- d. Trim Style and Depth: 3/8-inch flat trim.
- e. Trim Dimensions: 1-3/4 inch face trim on door and frame.
4. Fire Rating: As indicated for partition type on Drawings.
5. Alarms: 85 db alarm (audible) alarm, battery operated. Alarm stays on 2-minutes after door is closed.
6. Alarm Contacts: Contact devices, coordinate with Owner's existing alarm systems.
7. Cabinet Lettering: AED identifying decal, as selected by Architect from manufacturer's full line.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed, and blocking where surface mounted cabinets will be installed.
 1. Notify the Architect, in writing of conditions detrimental to proper and timely completion of the installation.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
- B. Install cabinets in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
 1. Prepare recesses in walls for defibrillator cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
 2. Securely fasten cabinets to structure, square and plumb, to comply with manufacturer's instructions.
 3. Maintain fire ratings where cabinets are recessed into fire-rated wall systems.
 4. Verify alarm is in proper working order and coordinate any additional security connections required with Owner's security personnel.
- C. Cabinet Lettering: Install on face of glass surface.

3.3 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as defibrillator cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

- B. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace cabinets that cannot be restored to factory finished appearance. Use only materials and procedures recommended or furnished by cabinet manufacturer.
- E. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 104400

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Portable fire extinguishers.
 - 2. Fire-protection cabinets for portable fire extinguishers.
 - 3. Mounting brackets for fire extinguishers.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 099000 - PAINTING AND COATING for field painting fire-protection cabinets.
 - 2. Division 21 - FIRE PROTECTION for fire hose valves and standpipes.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each item.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

FIRE-PROTECTION SPECIALTIES

- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 FIRE-PROTECTION CABINET

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. JL Industries, Inc.
 - 2. Larsen's Manufacturing Company.
 - 3. Nystrom Building Products.
 - 4. Potter Roemer; Div. of Smith Industries, Inc.
- B. Cabinet Type: Suitable for fire extinguisher.
- C. Cabinet Material: Enameled-steel sheet.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - 1. Trimless with Plaster Stop: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as plaster stop. If wall condition does not allow for trimless with plaster stop, provide flat 5/16 inch trim of same material as the cabinet box.
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- F. Door Material: Steel sheet with baked enamel finish, color as selected.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Tempered glass.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- J. Accessories:
 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material.
 - a. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- B. Examine fire extinguishers for proper charging and tagging. Contractor shall be responsible for fire extinguisher tagging by a certified service technician located within 75 miles of the project.
 - 1. Remove and replace damaged, defective, or undercharged units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated on the Drawings and acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
- D. Identification: Apply vinyl lettering at locations indicated.

3.4 INSTALLATION OF FIRE-RATED CABINETS

- A. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
- B. Seal through penetrations with firestopping sealant as specified in Section 078410 - PENETRATION FIRESTOPPING.

3.5 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 105110

METAL LOCKERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Metal wardrobe lockers.
 - 2. Metal athletic lockers.
 - 3. Locker benches.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for furring, blocking, and shims required for installing metal lockers and concealed within other construction before metal locker installation.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show base, top, trim and other accessories.
 - 2. Include locker identification system.
- C. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain metal lockers and accessories through one source from a single manufacturer.
- C. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with Massachusetts Architectural Access Board requirements and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:
 - 1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
 - 2. Recessed openings.
 - 3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate size and location of bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ALL-WELDED, CORRIDOR METAL LOCKERS

- A. Available Manufacturers:
 - 1. List Industries Inc.; Marquis Protector Single-Point Latch Corridor Lockers.
 - 2. Lyon Workspace Products; All-Welded Lockers.

3. Penco Products, Inc., Subsidiary of Vesper Corporation; All-Welded Lockers.
 - B. Locker Arrangement: Single, double, and triple tier.
 - C. Body: Assembled by welding body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:
 1. Tops, Bottoms, and Sides: 0.0528 inch thick.
 2. Backs: 0.0428 inch thick.
 3. Shelves: 0.0528 inch thick, with double bend at front and single bend at sides and back.
 - D. Frames: Channel formed; fabricated from 0.0528-inch-thick, cold-rolled steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
 - E. Locker Base: Structural channels, formed from 0.0528-inch-thick, cold-rolled steel sheet; welded to front and rear of side-panel frames.
 - F. Doors: One-piece; fabricated from 0.0677-inch-thick, cold-rolled steel sheet; formed into channel shape with double bend at vertical edges, and with right-angle single bend at horizontal edges.
 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
 2. Door Style: Louvered vents.
 - G. Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
 - H. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.
 - I. Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:
 1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
 - J. Accessories:
 1. Continuous Sloping Tops: Fabricated from minimum 0.0428-inch-thick, cold-rolled steel sheet; approximately 20-degree pitch.
 2. Recess Trim: Fabricated from 0.0428-inch-thick, cold-rolled steel sheet.
 3. Filler Panels: Fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet.
 4. Boxed End Panels: Fabricated from 0.0528-inch-thick, cold-rolled steel sheet.
 - K. Finish: Baked enamel or powder coat, color as selected.
- 2.2 ALL-WELDED ATHLETIC METAL LOCKERS
- A. Basis of Design: Gearboss, or approved equal.

- B. Available Equal Manufacturers:
 - 1. All-Welded, Athletic Metal Lockers:
 - a. Lyon Workspace Products; All-Welded Expanded Metal Lockers.
 - b. Penco Products, Inc., Subsidiary of Vesper Corporation; All-Welded Lockers.
 - c. Republic Storage Systems Company; All-Welded Ventilated Lockers.
- C. Locker Style: Football Type.
- D. Body: Assembled by welding riveting or bolting body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:
 - 1. Tops and Bottoms: 0.0528 inch thick, with single bend at edges.
 - 2. Backs: 0.0428 inch thick.
 - 3. Shelves: 0.0528 inch thick, with double bend at front and right-angle single bend at sides and back.
- E. Frames: Channel formed; fabricated from 0.0528-inch-thick, cold-rolled steel sheet or 0.0966-inch-thick steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
- F. Locker Base: Structural channels, formed from 0.0528-inch-thick, cold-rolled steel sheet; welded to front and rear of side-panel frames.
- G. Perforated Doors: One-piece, fabricated from 0.0677-inch-thick, cold-rolled steel sheet with manufacturer's standard diamond perforations; formed into channel shape with double bends.
 - 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
- H. Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
- I. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.
 - 1. Single-Point Latching: Nonmoving latch hook. Equip each door with 1 latch hook, fabricated from minimum 0.1116-inch-thick steel; welded midway up full-height door strike; with resilient silencer.
- J. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latch mechanism that consists of steel rods or bars that engage main locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.
- K. Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:

1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

L. Accessories:

1. Legs: Fabricated from 0.0677-inch-thick, cold-rolled steel sheet; welded to bottom of locker.
2. Continuous Base: Fabricated from 0.0677-inch-thick, cold-rolled steel sheet.
3. Continuous Sloping Tops: Fabricated from minimum 0.0428-inch-thick, cold-rolled steel sheet; approximately 20-degree pitch.
4. Recess Trim: Fabricated from 0.0428-inch-thick, cold-rolled steel sheet.
5. Filler Panels: Fabricated from 0.0428-inch-thick, cold-rolled steel sheet.

- M. Finish: Baked enamel or powder coat, color as selected.

2.3 LOCKER BENCHES

- A. General: Provide locker benches fabricated by same manufacturer as metal lockers.

- B. Bench Tops: Manufacturer's standard 1-piece units, of the following material, minimum 9-1/2 inches wide by 1-1/4 inches thick, with rounded corners and edges:

1. Laminated maple with one coat of clear sealer on all surfaces, and one coat of clear lacquer on top and sides.

- C. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors.

2.4 FABRICATION

- A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.

- B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

- C. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections, with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.

- D. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

- E. Coat Rods: Fabricated from steel; nickel plated.

- F. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch (9 mm) high.

- G. Continuous Base: Formed into channel or Z profile for stiffness, and fabricated in lengths as long as practicable to enclose base and base ends of metal lockers; finished to match lockers.
- H. Continuous Sloping Tops: Fabricated in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers.
 - 1. Sloped top corner fillers, mitered.
- I. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practicable; finished to match lockers.
- J. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.
- K. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
 - 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- L. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
 - 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- M. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.5 STEEL SHEET FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
- C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.
- D. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
 - 2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
 - 3. Anchor back-to-back metal lockers to floor.
- B. All-Welded Metal Lockers: Connect groups of all-welded metal lockers together with standard fasteners, with no exposed fasteners on face frames.
- C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
- D. Fixed Locker Benches: Provide not less than 2 pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION

SECTION 107110

EXTERIOR SUN CONTROL DEVICES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Exterior sunshades.
 - a. Curtainwall sunshades, supported by curtainwall per Section 084410 - GLAZED ALUMINUM CURTAIN WALLS.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
 - 2. Section 084410 - GLAZED ALUMINUM CURTAIN WALLS.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
- B. LEED Submittal:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 - 2. Product Data for Credit MR 5: For products having regional materials, documentation indicating percentages of building materials and products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site.

EXTERIOR SUN CONTROL DEVICES

- a. Include statement indicating costs for each product having regional materials.
- C. Shop Drawings: For sun control systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer registered in the jurisdiction where the Project is located responsible for their preparation.
 - 2. Include details of attachment to aluminum framing systems.
 - 3. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sun control systems.
- G. Maintenance Data: For sun control systems to include in maintenance manuals.
- H. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Preparation of data for sun control systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

1.5 WARRANTY

- A. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Airline Products Co.
 - 2. Airolite Co.

3. C/S Group.
4. Ruskin Manufacturing Co.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 4. Structural Profiles: ASTM B 308/B 308M.
 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Fasteners, Anchors and Inserts: Provide stainless steel or aluminum fasteners, anchors and inserts, as recommended by the manufacturer. Conceal from view to greatest extent possible. Finish exposed items to match sun control systems.

2.3 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of systems, as specified in Section 079200 - JOINT SEALANTS.
- B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.4 FABRICATION

- A. Shop fabricate work to the greatest extent possible. Fabricate work to be truly straight, plumb, level and square. Maintain equal blade spacing from blade to blade and from blade to frame. Use welded connections wherever possible.
- B. Form aluminum shapes before finishing.
- C. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

2.5 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: Match Section 084110 – ALUMINUM ENTRANCES AND STOREFRONT.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints to produce hairline joints free of burrs and distortion.
 4. Rigidly secure nonmovement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
- B. Metal Protection:
 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components plumb and true in alignment with established lines and grades, without warp or rack.

END OF SECTION

SECTION 111300

LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Dock bumpers.
 - 2. Elevating dock.
 - 3. Dock seals.
 - 4. Transparent-strip door curtains.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete work for recessed loading dock equipment.
 - 2. Section 055000 - METAL FABRICATIONS for framing and supports for strip door curtains.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, rated capacities, operating characteristics, furnished specialties, accessories, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, details, and attachments to other work.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

LOADING DOCK EQUIPMENT

- C. Qualification Data: For Installer

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each type of loading dock equipment through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle dock equipment in a manner to avoid significant or permanent damage to fabric or frame.
 - 1. Comply with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish heights of loading docks and proceed with fabricating loading dock equipment without field measurements. Coordinate loading dock construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate installation of anchorages for loading dock equipment. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM 36/A 36M.
- B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from steel plate complying with ASTM A 572/A 572M, Grade 55 (380).
- C. Steel Tubing: ASTM A 500, cold formed.
- D. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- E. Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried.
- F. Pressure-Treated Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried, and pressure treated with waterborne preservatives to comply with AWP C2.

2.2 DOCK BUMPERS

- A. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Floor Products (AFCO).
 - 2. Chalfant Dock Equipment.
 - 3. Durable Corporation.
 - 4. 4Front Engineered Solutions.
- B. Laminated-Tread Bumpers: Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch-diameter, steel supporting rods that are welded at one end to 1/4-inch-thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch of tread plies extending beyond the face of closure angles.
- C. Anchorage Devices: Hot-dip galvanized steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated.

2.3 ELEVATING DOCK

- A. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advance Lifts, Inc.
 - 2. Blue Giant Equipment Corporation.
 - 3. Pentalift Equipment Corporation.
 - 4. SPX Dock Products - Kelley.
- B. General: Built-in, scissors-type, single-leg, hydraulic dock lift of capacity, size, and construction indicated; complete with controls, safety devices, and accessories required.
 - 1. Basis-of-Design: Pentalift Model HED81015.
- C. Standard: MH 29.1.
- D. Rated Capacity: 15000 lbs.
- E. Platform: Nonskid, safety-tread heavy steel deck plate.
 - 1. Platform Size: 96 in. by 120 in.
 - 2. Platform Guarding: Comply with requirements in MH 29.1.

3. Fixed Handrails: Equip lift with handrails on two sides of platform with a single, removable chain across each end. Provide handrails not less than 39 inches high with midrail and 4-inch-high kick plate at bottom.
- F. Bridge: Nonskid, safety-tread steel plate.
- G. Function: Dock lifts shall compensate for differences in height between truck bed and loading platform.
 1. Vertical Travel: 59 in.
 2. Low Height: 15 in.
 3. Raised Height: 71 in.
 4. Hinged Throw-Over Bridges Operation: Manual.
- H. Hydraulic Operating System: Self-contained, electric, hydraulic power unit for raising and lowering lift; of size, type, and operation needed for capacity of lift indicated; controlled from a remotely located push-button station.
 1. Remote-Control Station: Multibutton control station of the constant-pressure type with UP and DOWN push buttons. Controller shall consist of magnetic motor starter with three-pole adjustable overloads and 24-V control transformer with 4-A, fused secondary prewired to terminal strips and enclosed in NEMA ICS 6, Type 12 box.
 - a. Upper-Travel-Limit Switch: Equip unit with manufacturer's standard, adjustable, upper-travel-limit switch.
- I. Accessories:
 1. Access Chain End: Access chains for guard rails/lip post on fixed end.
 2. Guard Rail: Pocket Style 42 in. high c/w mid-rail and 4 in. kick plate; Side B 120 in. long, Side D 120 in. long.
 3. Lip RE: Split 84 in. wide by 24 in. long steel lip on 96 in. Side A.
 4. Reinforced Platform: 40,000 lbs Roll-Over capacity. Roll-over capacity in fully lowered position only. Include uprights on frame to support platform over-hang
 5. Toe Guards: Bevel Toe Guards Included In Net Price
 6. Hydraulic Velocity Fuse: Prevents free fall if the hydraulic hose is severed.
 7. Safety Striping: Full perimeter safety striping
 8. Trip Bars: Electrically interlocked perimeter bar suspended around platform, stops downward travel of table when activated by coming into contact with an obstruction.
 9. Power Unit Extra Hydraulic Hose: 10 ft of hose.
 10. Primary Control Extra Cord: 10 ft of cord.
- J. Construction: Fabricate lift from structural-steel shapes rigidly welded and reinforced for maximum strength, safety, and stability. Design assembly to withstand deformation during both operating and stored phases of service. Provide mounting brackets and removable lifting eyes for ease of installation.
- K. Dock Lift Finish: Hot-dip galvanized.
 1. Toe Guards: Paint yellow to comply with ANSI Z535.1.

2.4 FOAM-PAD LOADING DOCK SEALS

- A. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Blue Giant Equipment Corporation.
 - 2. Pentalift Equipment Corporation.
 - 3. Kelley.
- B. General: Dock seals consisting of fabric-covered foam pads designed to compress 4 to 5 inches under pressure of truck body to form an airtight seal at jambs and head of loading dock openings; of type, size, and construction indicated.
- C. Stationary Head Pad and Jamb Pads: Height and depth as selected, sized for opening width.
- D. Construction: Consisting of single- or double-ply, coated, fabric-covered, urethane-foam core with supporting frame. Fabricate jamb and head pads of same depth and sized for opening width.
 - 1. Steel Support Frame: Hot-dip galvanized steel channel frame of manufacturer's standard weight, shape, and finish; with steel mounting hardware.
 - 2. Guide Strips: Coated nylon guide strips on jamb pads.
 - 3. Pleated Protectors: On face of jamb pads of overlapping layers of coated fabric attached to base fabric.
 - 4. Reinforcing: Manufacturer's standard reinforcing over cover fabric on dock seal.
 - 5. Vinyl-Coated Nylon Cover Fabric: Minimum total weight of 40 oz./sq. yd. Color: As selected by Architect from manufacturer's full range.

2.5 TRANSPARENT-STRIP DOOR CURTAINS

- A. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Chalfant Dock Equipment.
 - 2. Chase Doors.
 - 3. Pawling Corporation.
- B. General: Door curtains consisting of overlapping strips suspended from top of opening to form a sealed door curtain. Provide strips of length required to suit opening height and with sufficient number in unit to close opening width with overlap indicated.
- C. Strip Material: Curved, clear, transparent, extruded PVC. Fabricate strips for manufacturer's standard method of attachment to overhead mounting system indicated.
 - 1. Standard Grade: Designed to withstand temperature range of 0 to plus 150 deg F (minus 18 to plus 66 deg C).
- D. Mounting: Refer to Drawings and Section 055000 – METAL FABRICATIONS.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish loading dock equipment after assembly and testing.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123/A 123M for iron and steel loading dock equipment.
 - 2. ASTM A 153/A 153M for iron and steel hardware for loading dock equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of loading dock equipment.
- B. Examine roughing-in for electrical systems for loading dock equipment to verify actual locations of connections before equipment installation.
- C. Examine walls and floors of pits for suitable conditions where recessed loading dock equipment is to be installed. Pits shall be plumb and square and properly sloped for drainage from back to front of loading dock.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate size and location of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.

3.3 INSTALLATION

- A. General: Install loading dock equipment, including accessories as required for a complete installation.
- B. Dock Bumpers: Attach dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.
 - 1. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.

- C. Dock Lifts: Attach dock lifts securely to loading platform.
- D. Transparent-Strip Door Curtains: Attach door-curtain mounting system to lintel with screw anchors or toggle bolts. Mount curtain strips to achieve overlap indicated.

3.4 ADJUSTING AND CLEANING

- A. Adjust loading dock equipment for proper, safe, efficient operation.
- B. Test dock lifts for vertical travel within operating range indicated.
- C. Restore marred, abraded surfaces to their original condition.

END OF SECTION

SECTION 113300

RETRACTABLE STAIRS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Retractable/disappearing stairs for ceilings.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking and framing.
 - 2. Section 087100 - DOOR HARDWARE for rim cylinder locks and master keying.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for gypsum board ceilings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Safety Performance: Provide products which comply with ANSI A14.9, Ceiling Mounted Disappearing Climbing Systems - Safety Requirements.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. ASTM E 119 for horizontal access doors and frames.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 PRODUCTS, FIRE-RATED

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work are the following or approved equal:
 - 1. Fire-Rated Ceiling Access Door with Integral Folding Stairway Model SS/AL, by Precision Ladders, LLC.
- B. Retractable/Disappearing Stair Unit:
 - 1. Provide unit with 61 to 63 degree angle frame.
 - 2. Door Panel: 20 ga steel door panel, with insulation, full width, continuous piano hinge, and set flush with stairway frame.
 - 3. Frame: 1/8 in formed steel channel.
 - 4. Capacity: 500 lbs. min., for not greater than 12 ft high; 300 lbs. min., for 12 ft. - 1 inch and higher.
 - 5. Stringers and Treads: Extruded aluminum side rails with serrated treads and handrail.
 - 6. Hardware: Manufacturer's standard, with continuous weatherstripping.
 - 7. Ceiling Height and Rough Opening: As indicated on Drawings. Treads are full width of opening.
 - 8. Accessories: Provide manufacturer's standard steel pole for operation and keyed cylinder lock.
 - 9. Finish: Manufacturer's standard mill finish on aluminum components. Shop primed finish on steel door panel and frame for finish painting per Section 099000 - PAINTING AND COATING.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine rough opening in ceiling for correct opening dimensions and squareness.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing retractable stairs.
- B. Install plumb and true, and rigidly anchored to supporting construction with appropriate fasteners and anchor devices.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 114000

FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Sections, apply to this Section.

1.2 SCOPE

- A. Attention is directed to the detailed Item Specifications, which provide for minimum acceptable products. Item Specifications paragraphs may indicate materials or components that exceed the manufacturer's standards and are required for this project.
- B. Cooperate and coordinate with others engaged on the project in order that work will progress on schedule.
- C. Work to be performed under this Section is shown on Foodservice Equipment Drawings.
- D. Install materials furnished under this Section, other than materials that are expressly noted for installation under other Sections. Installation work shall be performed by workmen compatible with those existent on the project site. Equipment shall be of the latest design; new and unused, unless indicated otherwise in the Item Specifications, complete with all standard parts for normal operations and including such accessories or materials as may be required to comply with these Specifications.
- E. This Specification is to further describe and supplement the applicable Drawings. What is called for by either the Drawings and/or these Specifications shall be furnished and installed as part of this work. Any questions relative to discrepancies or omissions shall be submitted to the Architect.
- F. Provide neatly punched openings or cutouts required to permit passage of plumbing and electrical services by related trades and to accommodate mounted switches and receptacles in the equipment.
 - 1. Work in this Section shall include but shall not be limited to the following:
 - 2. Catalog items of equipment.
 - 3. Fabricated equipment other than catalog items.
 - 4. Plumbing trim consisting of mechanical system components required for standard operation of equipment items such as faucets and waste outlets. Vacuum breakers shall be furnished for equipment where water is introduced less than 2 in. above flood level.
 - 5. Electrical equipment forming an integral part of equipment items such as electric motors, heating elements, controls, switches, starters, temperature regulators and internal wiring to a control panel or switch, if mounted on the equipment.
- G. Sustainable Design Intent: Comply with project requirements intended to achieve a rating, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council.

FOODSERVICE EQUIPMENT

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Finished floor and walls, structural supports for all ceiling supported equipment, acoustical ceilings and related building.
- B. Connecting piping, waste lines, traps and vent piping, complete with shut-off valves to all the equipment, and the rough-in for sanitary waste, domestic water, floor drains and plumbing fixtures except those provided under this Section, and related mechanical work.
- C. Exhaust ventilating systems complete with blowers, ductwork, hangers, access panels, and insulation between the exhaust collars and the exhaust blowers.
- D. External wiring; the mounting and wiring of motor starters, solenoid valves, switches and receptacles not integral with the equipment; mounting and wiring of walk-in refrigerated room ceiling mount light fixtures; wiring of walk-in refrigerated room interior evaporator coils; connecting conduit, and external connections to equipment to the building electrical distribution system.

1.4 SUBMITTALS

- A. Submit Shop Drawings for approval in accordance with the General Conditions.
- B. Stub-in drawings shall indicate the layout of equipment and dimensioned locations of all services to the equipment.
 - 1. Hand drawn scale: 1/2 inch = 1'-0".
 - 2. CAD drawn scale: 1/4 inch = 1'-0".
 - 3. Stubbed services shall include electrical, hot and cold water, floor drains or floor sinks, solid wastes and exhaust collar connections. Point of connection services shall include steam supply, condensate return, gas connection and indirect waste connections. Service dimensions shall include height measured from finish floor.
 - 4. Electrical and plumbing services shall be indicated and coordinated on the same drawing.
 - 5. Call-outs for each stub point indicated at the point, or clearly keyed to a schedule on the same drawing.
 - 6. Special conditions plan shall include all floor recesses, curbs and special wall construction indicated and dimensioned
- C. Fabrication drawings shall be furnished for non-catalog items, showing plans, elevations and full construction details with gauges, components, fasteners, erection and connections. Drawings shall be to the minimum scale of 3/4 in. = 1 ft., 0 in.
- D. Standard items of equipment, not built-in or part of other assemblies shall be submitted for approval in the form of bound catalog cuts. Each cut shall include a clearly marked item number, a listing of all optional accessories and finishes, and connection data.
- E. Catalog Cuts shall include letters of approval, under a separate binder, indicating compliance with M.G.L. c. 142 and 248 CMR. Only products and materials that have been listed by the Board as Product-approved shall be used for plumbing and gas fitting work performed in the Commonwealth of Massachusetts.

1. Catalog Cuts shall include operation manuals for all existing foodservice equipment that is scheduled for reuse and that requires gas fitting work performed in the Commonwealth of Massachusetts.
 - F. Mechanical refrigeration system submittal shall include the firm name and address of the installation contractor and name of the qualified installer.
 - G. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible. Kitchen Equipment Contractor shall clearly indicate that items are Energy Star rated both on the submittal cover sheet and manufacturer cut sheets.
 - H. Failure to comply with approved shop drawings shall be cause for rejection of an improperly built assembly.
- 1.5 SAMPLES
- A. If the bidder's proposed equipment fabricator is unknown to the Consultant's office, immediately after award of contract, submit the following samples for selection and approval:
 1. Section of table showing edge, bullnose, framing, fasteners, gusset, leg, and foot, all assembled.
 2. Drawer assembly (will be returned for use on this project).
 - B. Work delivered to the job shall match approved samples.
- 1.6 GUARANTEES AND WARRANTIES
- A. New equipment furnished for this facility shall be guaranteed for a period of not less than one calendar year beginning on the date of final acceptance of the work of this Section. In the case of a manufacturer whose standard warranty exceeds this period the longer period shall apply. Self-contained refrigeration units for reach-in refrigerators, freezers, ice cream chests and ice machines shall carry a five-year replacement warranty for the sealed unit. The guarantee shall protect against defective material, design and workmanship.
 - B. In addition to the guarantee called for under the General Conditions, this Contractor shall further agree that in the event of failure of any system or item of equipment or improper functioning of specified work during the guarantee period, he shall have "on call" competent service personnel available to make the necessary repairs or replacements of specified work promptly at no cost to the Owner. In the event that replacement of an entire item is required, the Owner will have the option of full use of the defective equipment until a replacement has been delivered and completely installed.
 - C. Furnish manufacturer's warranty for each item of standard equipment and a warranty on fabricated equipment. Submit guarantees and warranties to the Architect in accordance with conditions found in "Demonstration and Operating Instructions" paragraphs, contained in Part 3, this Section.

1.7 REGULATORY AGENCIES

- A. Work shall be in accordance with the governing health, building and safety, and fire protection codes and regulations.
- B. Standards of the National Sanitation Foundation (NSF) shall serve as guidelines for the work of this Section.
- C. Electric equipment and accessories shall conform to the standards of the National Electric Manufacturers Association (NEMA), Underwriters Laboratories, Inc. (UL) or Electrical Testing Station (ETS).
- D. Steam generating equipment and accessories shall conform to the standards of the American Society of Mechanical Engineers (ASME).
- E. Gas fired equipment and accessories shall conform to the standards of the American Gas Association (AGA) and the American National Standards Institute (ANSI) Z83.11.
- F. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible.
- G. BOARD OF STATE EXAMINERS OF PLUMBERS AND GAS FITTERS: Board Required Product-approval. Only products and materials that have been listed by the Board as Product-approved shall be used for plumbing and gas-fitting work performed in the Commonwealth and governed by M.G.L. c. 142 and 248 CMR.

1.8 EQUALITY OF MATERIALS AND EQUIPMENT

- A. The base bid shall contain no substitutions to these drawings or specifications. Bidders may offer substitute equipment in a separate proposal, indicating the proposed model and sum to be added or deducted if the alternate item is accepted by the Owner. Each line item shall include delivery, installation and taxes. Decisions to accept or reject a piece of equipment shall be made by the Owner, and all decisions shall be final.

PART 2 - PRODUCTS

2.1 MATERIALS AND FINISHES

- A. General
 - 1. Metals shall be free from defects impairing strength, durability or appearance, made of new materials with structural properties to withstand strains and stresses to which normally subject.
 - 2. Stock materials, patterns, products and methods of fabrication shall be approved provided that they conform to the requirements specified under Item Specifications.
- B. Stainless Steel
 - 1. Stainless steel shall be non-magnetic corrosion resistant chromium-nickel steel, Type 302 or 304 (18-8 Alloy), polished to a Number 4 finish where exposed, unless otherwise noted. Minimum gauges shall be as specified under Item Specifications.

C. Galvanized (Galvannealed) Steel

1. Galvannealed steel shall be commercial quality with tight coat of zinc galvanizing metal applied to a soft steel sheet, subsequently passed through a 1200 degree F. oven, resulting in a spangle free paintable surface. Minimum gauges shall be as specified under Item Specifications.

D. Plastic Laminate Materials

1. The laminate facing shall be GP-50, .050 in. thick, general purpose, high pressure, decorative plastic laminate that meets or exceeds the requirements of NEMA Publication LD3-1985, and NSF Standard 35. The plastic laminate exposed surfaces shall be provided in accordance with the specified manufacturer, finish and color. Balancing sheet shall be backing grade GP-28 in matching color at semi-exposed and BK-20 unfinished where hidden.
2. Plastic laminate covered surfaces shall be factory fabricated with 3/4 in. thick core having plastic laminate facing on both faces and all edges, laminated with waterproof glue under pressure in accordance with the plastic laminate manufacturer's specifications.
3. The core shall be medium density phenolic resin particleboard conforming to ANSI A208.1, Type 2-M-2, 45 pound per cubic foot density minimum.
4. Provide veneer core plywood or solid hardwood edge banding for doors and vertical dividers or panels where hardware is attached to casework.
5. Hinges shall be articulated, spring loaded type equal to Grass CST65-170-F or Stanley, with quantity adequate to support the door without deformation. Do not provide handles on plastic laminate clad doors.

2.2 CONSTRUCTION

A. General

1. Flat metal work items of equipment, such as tables, sinks, or counter tops, and other non-catalog items described under Item Specifications, shall be manufactured by a food service equipment fabricator who has the plant, personnel and engineering facilities to properly design, detail and manufacture high quality food service equipment.
2. The equipment fabricator shall be subject to the approval of the Architect, Owner and Consultant. Refer to Paragraph 1.05, Samples.
3. Fabricated foodservice equipment shall be manufactured by one manufacturer, of uniform design, material and finish.
4. Equipment shall conform to the applicable requirements of current Federal, State, and Local Codes and Regulations.

B. Welding

1. The words "weld", "welded" or "welding" as used in this Section of the Specification shall mean that metal joints shall be continuously welded and the exposed parts ground smooth and polished to match adjoining surfaces. Welding electrodes shall match the material being welded.
2. Where spot welding is specified, the welds shall be a maximum spacing of 3 in. on center.
3. Where tack welding is specified, the pieces welded shall have 1/2 in. minimum lengths of welding material at 4 in. on center maximum spacing.

C. Grinding, Polishing and Finishing

1. Exposed welding joints shall be ground flush with the adjoining material and neatly finished to harmonize therewith. Wherever material has been depressed or sunken by a welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surfaces and, if necessary, again welded and ground to eliminate low spots. Ground surfaces shall be polished or buffed to a degree consistent with good workmanship. Coves shall be ground and polished to match adjoining material.
2. Care shall be exercised in grinding operations to avoid excessive heating of metal and discoloration. Abrasives, wheels, and belts used in grinding stainless steel shall be iron free and shall have not been used on carbon steel. The texture of the final polishing operation shall be uniform and smooth. Grain direction shall be uniform, uni-directional for a total length of material. Cross grains and random polishing are not acceptable.
3. The general finish of equipment shall be consistent throughout the job. Brake ends shall be free of open texture or orange peel appearance, and where brake work mars the uniform finish of the material, the marks shall be removed by grinding and polishing, and finishing. Sheared edges shall be free of burrs, projections or fins to eliminate all danger of laceration. Mitered or bullnosed corners shall be neatly finished with the underedge of the material neatly ground to a uniform condition and in no case will overlapping material be acceptable. The equipment surfaces, where exposed, shall be finished to a grained Number 4 (satin) finish unless otherwise specified. An exposed surface shall include an inside surface, which is exposed to view when a swinging or sliding door is opened. Underside of shelves need not be satin finish unless otherwise specified.
4. Excessive distortion caused by welding shall be cause for rejection for that item of equipment.

2.3 BUY-OUT COMPONENTS

- A. CASTERS: 5 in. diameter polyurethane tired, swivel, plate or stem mount to suit application, 300 pound capacity, brakes only if specified, NSF approved; Component Hardware C-21-3050 (plate/no brake), C21-3051 (plate/brake) C23-3350 (stem/no brake) or C23-3351 (stem/brake), or equal by Kason, or PDI Atlanta.
- B. COUNTER LEGS: Stainless steel, 6 in. to 7-3/4 in. height adjustment; Component Hardware A72-0811, or A77-5048, or equal by Kason, or PDI Atlanta.
- C. DOOR AND DRAWER PULLS: Stainless steel, full grip type with beveled edge, NSF approved for stud mounting in device, in horizontal attitude to meet NSF requirements; Component Hardware P63-1012, or equal by Kason, or PDI Atlanta.
- D. DOOR HINGES: Stainless steel, lift off type, swedged knuckle for minimum clearance, nylon bearings; Component Hardware M75-1002 or equal by Kason, or PDI Atlanta.
- E. DRAWER PANS: Molded plastic or fiberglass, 20 in. by 20 in. by 5 in. deep, NSF approved; Component Hardware S80-2020, or equal by Kason, or PDI Atlanta.
- F. DRAWER SLIDES: Stainless steel, NSF approved, full extension, 200 pound capacity with stainless steel ball bearing wheels; Component Hardware S-52 series, or equal by Kason, or PDI Atlanta.
- G. FAUCET SETS, DECK MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on

swivel nozzle or swivel gooseneck to suit the application; T&S Brass B-0221 or B-0321, or equal by Component Hardware, Chicago, or Fisher.

- H. FAUCET SETS, POTWASHING SINK: Chrome plated cast bronze with removable cartridges, 3/4 in. passages, eccentric flanged female inlets on 8 in. centers with LL street EL inlets with locknuts, four prong handles, 12 in. swing spout; T&S Brass B-0290 or equal by Component Hardware, Chicago, or Fisher.
- I. FAUCET SETS, SPLASH MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on 12 in. swing spout; T&S Brass, B-0231-CC or equal by Component Hardware, Chicago, or Fisher. Provide each with a mounting kit.
- J. GUSSETS: Stainless steel, stepped side, fully closed, NSF approved, mild steel interior reinforcement, wide flange for welding to framing, set screw anchor for leg; Component Hardware A20-0206C, or equal by Kason, or PDI Atlanta.
- K. LEG AND BULLET FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-6272-C, or equal by Kason, or PDI Atlanta.
- L. LEG AND FLANGED FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with 3-1/2 in. diameter flange and two holes for securing to floor, minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-4272-C, or equal by Kason, or PDI Atlanta.
- M. NUTS: Zinc plated "Pal Nuts" with integral cap and lockwasher; Component Hardware Q-34-1024 or equal by Kason, or PDI Atlanta.
- N. SEALANT: Sealant for sealing equipment to walls or filling crevices between components. All materials listed below that are used in the building interior must not exceed the following requirements:
 - 1. South Coast Air Quality Management District (SCAQMD) Rule #1168
 - 2. For interior adhesives and sealants applied within the weatherproof barrier, submit a printed statement of VOC content.
- O. SOUND DEADENING BASINS: Component Hardware Q75-1366 or equal by Kason, or PDI Atlanta.
- P. SOUND DEADENING TOPS AND SHELVES: Component Hardware Q85-5225, or equal by Kason, or PDI Atlanta, "Tacky Tape" installed between all channel or angle reinforced tops, drainboards or undershelves.
- Q. WASTE OUTLETS, CRUMB CUP: Stainless steel body, removable crumb cup stopper, gasket, coupling nut and sealing washer, 1-1/2 in. IPS, and optional 4 in. long nickel plated brass tailpiece with gasket; Component Hardware E38-1010, or equal by Kason, or PDI Atlanta.
- R. WASTE OUTLETS, LEVER OPERATED: Cast stainless steel rotary type with 1-1/2 in. NPS and 2 in. NPS threads, and removable beehive crumb-cup; Component Hardware DSS-8000 or equal by Component Hardware, Chicago, or Fisher.

- S. WELD STUDS: Copper flashed steel with 10-24 threads, length to suit; Component Hardware Q-36, or equal by Kason, or PDI Atlanta.
- T. GFCI RECEPTACLES: Pass & Seymour 2095-W, 115 volt, 20 amp GFCI Duplex Receptacle or equal.

2.4 FABRICATED COMPONENTS

A. Box Type Cabinet Construction

- 1. Sheet metal cabinet bases of box type construction shall be fabricated without general interior framing. Structural strength shall be achieved by the gauge of the metal and the formed angle and channel edges and corners. Vertical sections shall be closed. Cabinet base shall be fabricated of 18 gauge minimum of material specified at Item Specifications. Mount on counter legs or base as specified.
- 2. Intermediate shelf shall be fabricated of 16 gauge stainless steel with rear and sides turned up 1-1/2 in. tight to the cabinet sides. The front edge of shelf shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees and shelf spot welded in place. Reinforce underside with longitudinal 14 gauge channel on the centerline.
- 3. Bottom shelf shall be fabricated of 16 gauge stainless steel similar to the intermediate shelf except that the front edge shall be formed into a full width 1-1/2 in. by 4 in. welded in boxed channel. Rear edge shall be fitted with a full width channel. Underside shall be reinforced.

B. Counters and Drainboards

- 1. Counters, table tops and drainboards shall be 14 gauge stainless steel, of NSF construction, with edges per Item Specifications. Metal tops shall be made of the largest pieces available and shall appear as one piece with all field and shop joints reinforced and welded, ground and polished. Short pieces of metal will not be acceptable. Counter bends shall be not less than 1/8 in. radius. Wherever a fixture has a waste or drain outlet, the surface shall pitch toward the outlet.
- 2. Counters, table tops and drainboards shall be reinforced with channel or angle frame as specified in the Item Specifications. Framing shall be secured to the underside with sound deadening material sandwiched between the surfaces, weld studs, and nuts.
- 3. Wherever bolts or screws are welded to the underside of trim or tops, neatly finish the reverse side of the weld uniform with the adjoining surface of the trim or top. Depressions at these points will not be acceptable. Raise dimples and depressions by peening, or heating and shrinking, and grind and polish to present a flat surface.

C. Crossrails

- 1. Crossrails shall be not less than 1-1/4 in. outside diameter 16 gauge stainless steel tubing welded, ground and polished to a Number 4 finish. Crossrails shall be welded to legs at a height of 10 in. above finished floor, and shall extend from left to right between front legs, unless otherwise specified, and from front to back between all legs.

D. Drawer Assembly

- 1. Drawer assemblies shall consist of a removable drawer pan set in a removable 16 gauge stainless steel channel shaped drawer support frame with gusset plate reinforced corners.

2. Support frame shall have double pan front cover consisting of boxed 18 gauge stainless steel outer shell with welded corners, flush mounted recessed stainless steel pull, 20 gauge stainless steel back shell tack welded to outer shell with fiberglass sound deadening between. Drawer shall be provided with rubber bumpers to quiet closing. Support drawer frame on full extension drawer slides.
3. Drawer shall be suspended from table in a three-sided, 16 gauge stainless steel enclosure with flanged-in bottom edges, banded lower front, flanged-out front side and top edges. All sharp corners shall be broken and any exposed exterior threads of slide mounting bolts shall be provided with solid metal acorn nuts.
4. Component Hardware S91-0020 with thermoplastic pan is considered as equivalent to the above specified construction.

E. Edges

1. Marine: Bumped up 1/2 in. at 45 degrees and turned down 1-1/2 in. and in 1/2 in. at 45 degrees; corners welded and square.
2. Raised roll: Coved up and rolled 180 degrees on a 1-1/2 in. diameter with 3 in. height; corners welded and rounded or coved.
3. Rolled: Rolled 180 degrees on a 1-1/2 in. diameter; corners welded and bullnosed.
4. Short (6 inch) splash on counters and tables: Coved up 6 in., turned back to wall or equipment 1 in. and down 1/2 in.; ends welded closed. Secure tight to face of wall with clips unless specified otherwise and seal joint.
5. Tall (10 inch) splash on preparation sinks, dishtables, counter, and tables: Coved up 8-1/2 in., turned back to wall or equipment 1-1/2 in. at 45 degrees and down 1/2 in.; ends welded closed. Secure 3 in. off face of wall with brackets unless specified otherwise.
6. Turn down: Turn down 2 in. and in 1/2 in. at 45 degrees; corners welded and square.

F. Framing of Tops, Drainboards, Undershelves

1. Channel: Reinforce with 1 in. by 4 in. by 1 in. 14 gauge galvannnealed steel channels; stainless steel if exposed to view. Channels shall run front-to-back at all legs and longitudinally on the centerline. Cross and longitudinal members shall be welded into a single assembly at intersections and sharp corners shall be broken. Framing shall be secured to underside of tops with pairs of weld studs. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. The following specified angle framing is considered superior to channel framing and may be used in its place.
2. Angle: 1-1/2 in. by 1-1/2 in. by 1/8 in. perimeter angle frame with crossmembers not over 30 in. on center. Framing shall be secured to top with weld studs, 18 in. on center maximum with three minimum studs on any single face of a table. Perimeter angle frame that is exposed to normal view, shall be stainless steel. Crossmembers and framing not unexposed to normal view shall be iron. Corners of angle frame shall be mitered, or notched and brake formed to form a closed corner. Corner gusset plates used for mounting of leg gussets shall be 1/8 in. thick and sealed to underside of the top. Iron framework joints shall be ground smooth, and shall be painted with a minimum of two coats of aluminum lacquer after degreasing. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. Channel framing shall not be considered equal to specified angle framing.
3. Sound deaden all horizontal framed surfaces with material sandwiched between the framing and the bottom of the surface.

G. Hinged Doors

1. Hinged doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle, and an adjustable tension door catch equal to Component Hardware M22-2430. Doors shall close against the bottom shelf and flush with body of equipment.
2. Louvered hinged doors for ventilation shall be fabricated of the same components and provided with a full perimeter 3 in. wide channel reinforcing frame on the interior face. Remaining face shall be die punched with drip-proof louvers fully utilizing the remaining flat metal or a stainless steel flattened expanded metal grille per Item Specifications.

H. Sinks and Sink Inserts

1. Unless otherwise specified, sinks including sink inserts built into tops of fixtures, shall be made of 14 gauge stainless steel with all vertical and horizontal corners rounded to a radius of approximately 3/4 in. with the intersections meeting in a spherical section. Sinks shall be integrally welded to fixture tops.
2. Sinks with two or more compartments shall have full height, 1 in. thick double wall partitions consisting of two pieces of stainless steel back-to-back so fabricated that each compartment will be a deep bowl with coved corners. Partitions shall be welded in place to the bottom, front and back of the sink with smooth rounded coved corners. Top edges of the partitions shall be continuously welded. The front of the sinks shall consist of a stainless steel smooth, flush apron, same gauge as the sinks. Bottom and rear of partitions shall be closed. Sink dimensions contained in Item Specifications are inside dimensions.
3. Sinks shall be provided with integral 14 gauge stainless steel drainboards when specified. Drainboards and sink basins shall be pitched toward waste outlets and shall be self draining. The underside of all sink basins shall sound deadened. Sink units shall be provided with an integral splash at walls. Provide the necessary holes for the mounting of faucet sets.

I. Sliding Doors

1. Sliding doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle. Provide sliding doors with nylon roller bearing sheaves and overhead track components equal to Component Hardware B58-5523 and 5513 sheaves, B57 track, B62-1093 nylon door guides and B60-1086 door stops.

J. Undershelves

1. Undershelf in an open type table shall be 16 gauge stainless steel unless otherwise noted. Edges shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees with corners notched out to fit legs to which shelf shall be welded from underside. Line up all edges of shelf with centerline of legs. Reinforce underside with longitudinal 14 gauge channel on the centerline.

K. Wall Brackets

1. Dish tables, sinks and counters with sinks shall be securely anchored 3 in. off the face of the wall unless specified otherwise. Brackets shall be "Z" shaped and fabricated of 3 in.

wide, 14 gauge stainless steel. Brackets shall be secured in a vertical attitude to the rear of equipment backsplash with weld studs, and to the wall with appropriate fasteners.

2. Counters that are specified tight-to-wall shall be secured in a hidden manner with steel clips, and the wall/fixture joint shall be sealed.

L. Wall Shelves

1. Wall shelves shall be fabricated of 16 gauge stainless steel, size per Item Specifications, with back and ends raised 1-1/2 in., front edges of ends angled back, all corners broken, and front turned down 1-1/2 in., and in 1/2 in. at 45 degrees. Shelf corners shall be welded, ground and polished. Mount shelf 1 in. off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48 in. on center maximum. Flag brackets shall have a web angle of 30 degrees, measured from horizontal.

2.5 ELECTRICAL EQUIPMENT AND WIRING

- A. Under this Section, items of equipment having mounted electrical motors, electrical heating units, lighting fixtures, controllers, control stations, switches, receptacles and the like shall be internally wired as specified herein, terminating at a junction box mounted on the equipment and left ready for connection to the building electrical distribution system by the Electrical Contractor. Extra ceiling mount light fixtures for refrigerated rooms shall be delivered to Electrical Contractor for field installation and wiring. Connections to evaporator coils mounted inside refrigerated rooms shall be wired by the Electrical Contractor.
- B. Provide openings or cutouts required to accommodate the switches and receptacles in the specified work, and the wiring in conduit from terminal blocks in junction boxes.
- C. Electrically operated equipment and fabricator wiring shall conform to the requirements of Underwriter's Laboratories, Inc. Motors over one horsepower shall be equipped with overload protection.
- D. Furnish wiring diagrams for equipment as requested by the Architect or Contractor.

2.6 ITEM SPECIFICATIONS

Item A01

STORAGE SHELVING, FIVE-TIER

Quantity - 13

Make - Metro Super Adjustable Super Erecta or equal by ISS or Cambro

Item A02

DUNNAGE RACK

Quantity - Seven

Make - New Age 2000 Series or equal by Channel or Kelmax

Item A03

MOBILE SHELVING UNIT, FOUR-TIER

Quantity - 23

Make - MetroMax Q*C166 or equal by Cambro or Fermod

Item A04
DUNNAGE RACK, MOBILE
Quantity - Six
Make - New Age 1200 Series or equal by Channel or Kelmax

Item A05
PAN RACK, MOBILE
Quantity - Eight
Make - New Age 1332*C166 or equal by Channel
Size - 20-1/2 in. by 26 in. by 69 in. high
Capacity - Fifteen 18 in. by 26 in. pans on 4 in. centers
Description - Rack shall be fabricated of welded extruded aluminum 1 in. by 1 in. by .070 in. tubular uprights and framing, and 1-1/4 in. by 1-5/8 in. by .100 in. angle pan slides with corners chamfered and deburred. Gussets of 1-1/2 in. by 1-1/2 in. by 5/8 in. angle aluminum shall be welded to the bottom inside angles where horizontal bracing meets vertical uprights. Mount on platform type, 5 in. polyurethane tired swivel casters.

Item A06
UTILITY CART
Quantity - Five
Make - Lakeside 521 or equal by Channel or Kelmax
Size - 32-5/8 in. by 19-3/8 in. by 34-1/2 in.
Description - Cart shall be all standard NSF construction, stainless steel throughout, with top and bottom shelves supported by an angle frame, and mounted on two 8 in. fixed and two 5 in. swivel casters.
Capacity of cart to be 650 pounds.

Item A07
WALK-IN COOLER
Make - American Panel or equal by Bally or Thermo-Kool
Size - 19'-1-1/2" x 9'-5-1/2" x 7'-10" high minimum inside dimensions; 7'-8" high after finished floor is installed by the General Contractor
Power - 1.1 KW - 120/60/1 to light fixtures, temperature monitor/alarm, and door defrost heater strip
Installation, Construction, Materials and Accessories - See Item A08
Guarantee - See Item A08

Item A08
WALK-IN FREEZER
Make - American Panel or equal by Bally or Thermo-Kool
Size - 20'-0" x 11'-9" x 7'-10" high minimum inside dimensions; 7'-8" high after finished floor is installed by the General Contractor.
Power - 1.3 KW - 120/60/1 to light fixtures, temperature monitor/alarm, door defrost heater strip, and pressure relief port
Installation - The walk-in refrigerated room shall be installed in a 7" deep ID recess (below finished floor). Recess depth allows 1" for use of leveling sand; 4" for the insulated floor panels; 2" for finished floor and setting bed that shall be carried in from the adjacent room and level to same. The finished floor and setting bed shall be furnished and installed by the General Contractor, and shall have coved joints at all walls, turned up a minimum of 4" inside and out. The unit shall be set level on a bed of clean, dry mason's sand. Shims are not acceptable for leveling material.
Construction - All standard construction per the manufacturer, modified to meet the specific following points:

- Walls to be 4" thick with CFC free urethane foam insulation, UL Class 1 rated

- Cam type locking devices
- 36" x 80" minimum door clearance
- Polished hardware (hinges and latch to match)
- Three hinges on doors (to include one Kason 1248 spring assist hinge per door)
- Leveraged pull handle (mechanical advantage type, Kason 1236 or equal)
- Quarter turn inside safety release lever handle mechanism (not screw type)
- Prewired door sections with heater wires and light fixtures and switches
- Kason 1806 LED light fixtures or Kason 1808 LED light fixtures
- Dial type thermometers at doors
- Model IC+ (with dry contacts) temperature and HACCP monitoring system at doors. Cooler and freezer alarms to interconnect with access control system for alert monitoring. Provide each system with a pair of 22 gauge low voltage wires. Wires shall be installed by the Controls Contractor. Wires shall run from the dry contacts to the access control panel. Kitchen Equipment Contractor to verify length prior to purchasing. To avoid false triggering, provide a shielded two-conductor cable with the shield connected to the receiving equipment.
- NSF construction throughout with exception of buried floor panels
- Interior and exterior faces of doors and exposed exterior walls shall be provided with aluminum diamond tread plate protective material to a height of 48" above finished floor. Hold diamond plating up 6" from the finish floor to accommodate the coved base.

Minimum materials - Interior and exterior wall surfaces shall be clad with .038" pebble finished aluminum. The ceiling shall be finished in white polyester over 24 gauge galvanized steel. Interior floor shall be 14 gauge galvanized steel.

Accessories - Freezer shall be provided with an electrically heated pressure relief port. Each door shall be provided with a heated vision panel, 14-1/2" x 23" constructed of three panels of tempered unbreakable glass, electrically heated, with sealed air spaces between. Provide matching trim strips and closure panels to adjoining surfaces, fabricated per details, made of largest pieces available to minimize number of joints, and installed in accordance with NSF Brochure 770202, Installation Manual for Walk-in Refrigerators and Freezers. Provide sixteen total extra Kason 1806 LED OR Kason 1808 LED light fixtures for mounting in the rooms and deliver to Electrical Contractor for field installation.

Guarantee - The walk-in refrigerated room panels shall be guaranteed for a period of ten (10) years from the date of approved installation for defects in materials and workmanship when subjected to normal use and service; remainder of rooms for one year.

Item A09

MECHANICAL REFRIGERATION SYSTEM

Quantity - Three

Make - Heatcraft, Bohn, Larkin, Climate Control, Chandler

Scope - Furnish and install complete refrigeration systems for the walk-in refrigerated rooms in accordance with the plans. The systems shall include condensing units, evaporator coils, piping, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted refrigeration practice.

Important: The installation work shall be performed by a fully qualified refrigeration contractor employing a certified mechanic fully trained in the installation of commercial refrigeration systems. Submittal shall list the installing company and the qualified system installer.

Piping - Furnish and install the interconnecting piping between the condensing units and their respective unit coolers. Piping shall be installed in a neat and workmanlike manner with adjustable hangers spaced at no more than ten foot intervals on horizontal runs; six foot intervals, vertical runs.

Line sizes shall be in accordance with ASHRAE standards and best refrigeration practice to assure proper feed to evaporator, avoid excessive pressure drop, and prevent excessive amounts of lubricating oil from being trapped in any part of the system. Line sizing shall be such that it will protect

the compressor from loss of lubrication at all times, prevent liquid refrigerant from entering the compressor during operating or idle time, and maintain a clean and dry system.

Refrigeration piping shall be Type L, ACR grade, hard drawn seamless copper tubing, wrought type copper fittings, and silver soldered joints. Precharged lines are not acceptable.

Furnish and install sleeves for refrigerant and evaporator drain piping wherever piping passes through a wall or ceiling. Sleeves shall be non-conductive gray plastic tubing, with interior dimension sized at least 1/4" larger than piping, and shall be neatly packed with brine putty after installation.

Furnish and install condensate drain piping from the unit cooler to an open drain. Piping shall consist of not less than 7/8" Type L copper tubing, supported 36" on center maximum, in such a way that there will be 1" clearance between the wall and the tubing. Provide a union or slip fitting at the connection to the evaporator drain pan to allow easy disassembly for service and cleaning. Drain piping shall be pitched 4" to the foot and carried through the wall of the refrigerated area. It shall be trapped to prevent entry of warm air and insects to the refrigerated rooms and discharged to a floor drain with the code required air gap. The exposed drain piping shall be spray painted.

Provide an electric drainline heater tape in the freezer, with a length equal to five wraps per foot of length of the drainline located within the freezer compartment. Wrap and secure in accordance with manufacturer's recommendations.

Provide chrome plated escutcheon plates at all exposed points where piping penetrates the wall or ceilings.

Insulation - Suction lines for refrigerated rooms having a temperature above freezing shall be covered with 3/4" wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

Suction lines for refrigerated rooms having a temperature below freezing shall be covered with 1" wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

The insulation shall be applied to these lines in accordance with manufacturer's recommendations, and as they are being installed so that insulation will not be split. All joints shall be completely sealed with overlapping, cemented material to prevent the formation of frost on the lines.

Controls - Each evaporator shall be provided with an iNtelliGen electronic control as manufactured by Heatcraft Refrigeration. Provide each system with a pair of twisted 24 gauge low voltage wires, Belden 9841 or equal. Wires shall be installed by the Controls Contractor. Wires shall run from the dry contacts at the evaporators to the access control panel. Kitchen Equipment Contractor to verify length prior to purchasing. To avoid false triggering, provide a shielded two-conductor cable with the shield connected to the receiving equipment. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit.

Refrigerant Testing - The entire system shall be pressure and leak tested at no less than 100 PSIG, cleaned and dehydrated by maintaining a vacuum of 500 microns or lower for a period of twelve hours. The required operating charge of refrigerant and oil, if necessary, shall be added and the entire system tested for performance. Each system shall be clearly marked as to the type refrigerant required.

Guarantee - The equipment shall be guaranteed to maintain the specified temperatures. All mechanical refrigeration equipment shall be mechanically guaranteed for a period of one year after date of

acceptance by the Owner. The emergency service shall be provided free of charge, whenever necessary on a 24 hour, seven day-per-week basis during the guarantee period.

Any leaks that occur during the first year of operation after acceptance by the Owner, shall be repaired and the necessary refrigerant added at no expense to the Owner.

The year's service shall be provided by the installing company, and under no circumstances will the service policy be sublet to another refrigeration contractor. The name of the installer/service agency for the guarantee period shall be located at a prominent place on the condensing units.

The condensing units shall be provided with an additional four year parts warranty to commence upon the completion of the aforementioned guarantee, bringing the total parts warranty to five years.

Condensing Units - The condensing units shall consist of an EC energy saving motor with variable speed controller, compressor, refrigerant condenser, liquid receiver, compressor service valves, and a dual high-low pressure control. The units shall be as manufactured by Heatcraft Refrigeration.

The condensing units shall be outdoor type, wall mountable, and quiet type with an approximate 51 to 63 decibel rating at 100 percent fan speed. The compressor shall be Microchannel Coil Technology scroll type per schedule, and fitted with gold coated aluminum fin condenser, suction service valve, discharge service valve, compressor contactor, high and low pressure controls, receiver with fusible plug, liquid shut-off valve and charging port, mounted non-fused disconnect switch, waterproof electrical control box, discharge line vibration eliminator, weather resistant UL painted steel cabinet, access guard, liquid line assembly, suction line filter and vibration eliminator, crankcase heater, and 1-1/2" high raised steel base.

Mount on roof per drawings with structural supports, roof penetrations and weatherproofing provided by the General Contractor. Mount with clearance above roof deck per Manufacturers recommendation.

Evaporator Coils - Each evaporator shall be provided with iNtelliGen electronic control as manufactured by Heatcraft Refrigeration, thermostatic expansion valve, and solenoid valve. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit. iNtelliGen Controls to include iIC integration card for BMS connection direct to evaporator controls.

The freezer shall be provided with an automatic electric defrost system consisting of two evaporator coils as indicated in the schedule. Evaporators shall be low profile type six fins per inch complete with variable speed EC energy saving fan motors with controller. Coils shall be NSF and UL Listed.

The cooler shall be provided with two evaporator coils as indicated in the schedule. Evaporators shall be low profile type six fins per inch complete with EC energy saving fan motors. Coils shall be NSF and UL Listed.

Furnish and install 1/4" minimum diameter stainless steel threaded mounting rods for the hanging of the evaporator coils, with stainless steel washers and nuts on the interior ends, and reinforcing angle at the exterior top of the room. Plated steel running thread is not acceptable.

Refrigeration Equipment Schedule

Cooler (A07)	Room Temp: +35 degrees F			TD: 10 degrees F	
<u>Condensing unit (A09a)</u>	<u>Amps</u>	<u>Ref</u>	<u>BTU/hour</u>	<u>Evap Temp</u>	<u>Cond Temp</u>
BCH0015MCACZ	11.9 - 208/3	448A	13,876	+25 degrees F	+95 degrees F
<u>Evaporator coil (A09b)</u>	<u>BTU/hour</u>	<u>CFM</u>	<u>Fan amps</u>	<u>Defrost amps</u>	<u>Defrost type</u>
BEL0055AS6AM	6,039	610	1.8 - 120/1	NA	Timed ambient
Freezer (A08)	Room Temp: -10 degrees F			TD: 10 degrees F	
<u>Condensing unit (A09c)</u>	<u>Amps</u>	<u>Ref</u>	<u>BTU/hour</u>	<u>Evap Temp</u>	<u>Cond Temp</u>
BCH0025LCACZ	11.9 - 208/3	448A	10,440	-20 degrees F	+95 degrees F
<u>Evaporator coil (A09d)</u>	<u>BTU/hour</u>	<u>CFM</u>	<u>Fan amps</u>	<u>Defrost amps</u>	<u>Defrost type</u>
BEL0080BS6EE	8,400	1,371	1.0 - 208/1	9.5 - 208/1	Timed electric
<u>Condensing unit (A09e)</u>	<u>Amps</u>	<u>Ref</u>	<u>BTU/hour</u>	<u>Evap Temp</u>	<u>Cond Temp</u>
BCH0025LCACZ	11.9 - 208/3	448A	10,440	-20 degrees F	+95 degrees F
<u>Evaporator coil (A09f)</u>	<u>BTU/hour</u>	<u>CFM</u>	<u>Fan amps</u>	<u>Defrost amps</u>	<u>Defrost type</u>
BEL0080BS6EE	8,400	1,371	1.0 - 208/1	9.5 - 208/1	Timed electric

Item A09a
COOLER REMOTE CONDENSING UNIT
Specified as part of Item A09

Item A09b
COOLER EVAPORATOR COIL
Specified as part of Item A09

Item A09c
FREEZER REMOTE CONDENSING UNIT
Specified as part of Item A09

Item A09d
FREEZER EVAPORATOR COIL
Specified as part of Item A09

Item A09e
FREEZER REMOTE CONDENSING UNIT
Specified as part of Item A09

Item A09f
FREEZER EVAPORATOR COIL
Specified as part of Item A09

Item A10
No item

Item A11
No item

Item A12

THREE-COMPARTMENT SINK

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A13

WALL SHELF

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A14

DISPOSER CONTROL PANEL

Specified as part of Item A14

Item A15

DISPOSER

Make - In-Sink-Erator SS-200-7*C166 or equal by Salvajor or Red Goat

Item A16

HOSE REEL ASSEMBLY

Make - T&S Brass B-1457-7102-01C or equal by Fisher or Reel Craft

Item A17

WAREWASHER, DOOR-TYPE, VENTLESS

Make - Hobart AM16VLT-BAS (Hot Water Sanitizing) or equal by Champion or Stero

Power - 24 amps - 480/60/3

Maximum Water Use - 0.64 Gallons per Rack

Certification - Unit shall be Energy Star compliant

Description - Dishwasher shall be door type with extended hood of all standard construction with 40 rack per hour capacity, 16 gauge stainless steel drawn tank, 18 gauge stainless steel chamber, and 12 gauge stainless steel frame and stainless steel feet, ventless energy recovery, touchscreen controls, WiFi connectivity, two stage filtration, pillarless opening, three-sided hood, pumped drain, door lock, timed wash cycles for 1, 2, 4 or 6 minutes, NSF pot and pan rating for 2, 4, and 6 minute cycles, 70°F rise integral electric booster heater, 27" door opening for 18" x 26" sheet pans or 60-quart, spring counterbalanced chamber, X-shaped revolving, interchangeable upper and lower anti-clogging wash arms, revolving, interchangeable upper and lower rinse arms, slanted, self-locating, one-piece scrap screen and, basket system, automatic fill, door actuated start. Pump shall be stainless steel with stainless steel impeller and shaft, fitted with a stainless steel and carbon ceramic seal, capable of 160 gallon per minute flow and self draining. Motor shall be 2 HP, three phase, squirrel cage, induction-run type with inherent thermal protection, grease packed ball bearings, splashproof design, and ventilated.

Accessories - Single point electrical connection, and four plastic racks; two peg, two flat, sheet pan rack. Provide drain water tempering kit and splash shield for corner installation.

Item A17a

WATER FILTER ASSEMBLY

Make - WaterSpec WS-SSEXT or equal by 3M or Everpure

Description - Unit shall be all standard construction designed for vertical wall mounting per plan and consisting of a mounting bracket, manifold, and filter cartridge with housing. Assembly shall have an operating inlet water temperature range of 35 to 160 degrees Fahrenheit.

Accessories - Provide four spare SS-EXT filter cartridges.

Item A18

CLEAN WARE TABLE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A19

HAND SINK

Quantity - Three

Make - Advance 7-PS-70-CM*C166 or equal by IMC Teddy or Krowne

Description - Units shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36 in. above floor

Accessories - Provide with a splash mounted faucet set with wrist handles (Item A19a), 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap. Provide one unit (adjacent to Item A53) with a welded stainless steel splash on left end.

Item A19a

FAUCET

Quantity - Three

Make - T&S Brass B-0330-04 modified or Fisher 1953 modified, or Encore

Description - Units shall be all standard construction with mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with 119X gooseneck with B-0199-02-F10 aerator tip in lieu of the standard.

Item A20

WASTE BIN

Quantity - Three

No work in this Section. Item to be provided by Owner.

Item A21

No item

Item A22

No item

Item A23

MOBILE WORK TABLE

Quantity - Three

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A24

WASTE BARREL

Quantity - Five

No work in this Section. Item to be provided by Owner.

Item A25

WORK TABLE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A26

COOK'S WORK TABLE WITH SINK AND OVERSHELF

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A27

VENTILATOR DEMAND CONTROL SYSTEM

Make - CaptiveAire DCV-1011 (Job #5465035) or equal by Gaylord or Halton

Item A27a

VENTILATOR CONTROL INTERFACE SCREEN

Specified as part of Item A27

Item A27b

ROOM TEMPERATURE SENSOR

Specified as part of Item A27

Item A28

FIRE SUPPRESSION SYSTEM

Make - Ansul R-102 or equal by Kidde or Pyro-Chem

Item A29

MOBILE OVEN RACK

Specified as part of Item A30

Item A30

COMBINATION OVEN/STEAMER, ROLL-IN

Make - Rational iCombi Pro 20-Half Size G or equal by Blodgett or Alto-Shaam

Accessories - Provide with roll-in rack cart, installation and connection kit, Active Green cleaner tablet 150 pieces/bucket, and Care Tablets bucket of 150 packets

Item A31

DOUBLE CONVECTION OVEN

Make - Blodgett DFG-200-ES Double* C166 or equal by Montague or Southbend

Accessories - Provide a stainless steel finished back panel. Mount on heavy duty swivel casters.

Manifold the two ovens for a single gas connection.

Item A32

CONVEYOR OVEN ON STAND

Make - Lincoln 1116-000-U or equal by Middleby Marshal or TurboChef

Item A33

TEN-PAN STEAMER

Make - Market Forge ETP-10G or equal by Groen or Accutemp

Item A34

FORTY-GALLON TILTING BRAISING PAN

Make - Groen BPP-40GA* C166 or equal by Market Forge or Cleveland

Accessories - Provide unit with a faucet mounting bracket with a double pantry water fill faucet and aerator tip, and BPC pan carrier.

Item A35

SIX-BURNER RANGE WITH OVEN

Make - Vulcan 36S-6BN*C166 or equal by Garland or Southbend

Accessories - Provide with Flame Safety device with manual spark ignition for all open top burners, and oven pilot. Provide a 10" high stainless steel flue riser, and mount on casters.

Item A36

FORTY-GALLON TILTING KETTLE

Make - Groen DH-40A

Accessories - Provide unit with swing spout mixing faucet with aerator tip and bracket, 2" tangent drawoff with 1/4" perforated strainer, Model 51 counterbalanced hinged cover, basket inserts, pan carrier, and a kettle brush kit.

Item A37

EXHAUST VENTILATOR

Make - CaptiveAire 6024 ND-2 (Job #5465035) or equal by Gaylord or Halton

Item A38

EXHAUST VENTILATOR

Make - CaptiveAire 6024 ND-2 (Job #5465035) or equal by Gaylord or Halton

Item A39

UTILITY DISTRIBUTION SYSTEM (UDS)

Make - CaptiveAire UDI (Job #5465035) or equal by Gaylord or Halton

Item A40

FLOOR PAN AND GRATE

Quantity - Two

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A41

No item

Item A42

No item

Item A43

DROP CORD WITH INLINE GFCI

Quantity - Two

Make -World Cords (860/763-2100) Model 88-DC-2003-A4-GM

Power - 20 amps - 120/60/1

Description - Cord shall be all standard construction with female connector body, cord, strain relief, stainless steel ceiling plate, inline GFCI protection with integrated test and reset buttons, and manual reset. Cords shall be adjusted to hang to 78" above floor. Plastic wire ties are not acceptable for this work.

Item A44

MOBILE EQUIPMENT STAND

Quantity - Two

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A45

AUTOMATIC SLICER

Make - Hobart HS9, or equal by Bizerba or Globe

Item A46

TWENTY-QUART MIXER

Make - Hobart HL-200 or equal by Globe or Univex

Item A47

COOK'S WORK TABLE WITH SINK AND OVERSHELF

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A48

WORK TABLE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A49

WATER FILTER ASSEMBLY

Make - 3M ScaleGard HT SF165 Modified or equal by Everpure or Selecto

Description - Unit shall be all standard construction designed for wall mounting and consisting of a mounting bracket, quarter-turn cartridge release mechanism, manifold with integral pressure gauge, integral quarter turn shut-off valve, outlet check valve, filter cartridge with internal prefilter membrane and external scale feeder cartridge. Provide with HF95-CL chloramine reduction filter cartridge in lieu of standard HF65 cartridge.

Accessories - Provide four spare HF95-CL filter cartridges and four spare HF8-S cartridges.

Item A50

No item

Item A51

No item

Item A52

FOOD PROCESSOR

Make - Robot Coupe R301 Ultra*C166 or equal by Berkel or Hobart

Power - 12 amps - 120/60/1 - cord and plug

Description - Combination food cutter shall be all standard construction with 1-1/2 HP direct drive fan cooled capacitor start motor with brake, magnetic interlocks, stainless steel cutter bowl with handle and see-thru lid, continuous feed top unit with attached large feed pusher and two standard discs.

Item A53

PREP TABLE WITH SINKS

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A54

WALL SHELF

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A55

WATER FILTER ASSEMBLY

Make - 3M BREW110 Modified or equal by Everpure or Selecto

Item A56

EXISTING COFFEE BREWER

Make - Bunn

Work - Relocate unit per plan and leave ready for reconnection of service by Related Trades.

Item A57

MICROWAVE OVEN

Make - ACP RCS10TS or equal by Panasonic

Item A58

WORK TABLE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item A59

STAFF LOCKER, THREE-TIER

Quantity - Six

No work in this Section. Item to be provided and installed by General Contractor.

Item B01

HOT HOLDING CABINET, PASS-THRU

Quantity - Two

Make - Victory HS-1D-1-PT-HD

Item B02

MOBILE WORK TABLE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B03

REFRIGERATOR, PASS-THRU

Make - Victory RSA-2D-S1-PT-HD-HC

Item B04

MOBILE WORK TABLE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B05
HOT HOLDING CABINET, PASS-THRU
Make - Victory HS-2D-1-PT-HD

Item B06
HOT HOLDING CABINET, PASS-THRU
Make - Victory HS-1D-1-PT-HD

Item B07
REFRIGERATOR, PASS-THRU
Quantity - Two
Make - Victory RSA-1D-S1-PT-HD-HC

Item B08
WORK TABLE
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B09
No item

Item B10
PANINI GRILL, ALUMINUM PLATE
Make - Star Pro-Max 2.0

Item B11
HAND SINK
Make - Advance 7-PS-70-CM*C166 or equal by IMC Teddy or Krowne
Description - Units shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36 in. above floor
Accessories - Provide with a splash mounted faucet set with wrist handles (Item B11a), 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap.

Item B11a
FAUCET
Make - T&S Brass B-0330-04 modified or Fisher 1953 modified, or Encore
Description - Units shall be all standard construction with mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with 119X gooseneck with B-0199-02-F10 aerator tip in lieu of the standard.

Item B12
WASTE BIN
No work in this Section. Item to be provided by Owner.

Item B13
ENTREE SERVING COUNTER
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B13a
TWO-TIER GLASS FOOD DISPLAY CASE
Make - Versa-Gard VG9

Item B13b
FULL-SERVICE GLASS FOOD PROTECTOR CASE
Make - Versa-Gard VG6S

Item B14
HOT FOOD WELL ASSEMBLY, DROP-IN
Make - MOD400-DM*C166 or equal by Hatco or Alto-Shaam
Size - 57-1/2" x 23-5/8" x 9-3/4" high
Power - 17.3 amps - 3.6 KW - 208/60/1
Description - Modular food warmer shall be all standard construction and shall consist of a stainless steel mounting frame, gasket and locking system, four individually controlled stainless steel 6" deep "wet or dry" hot food wells with 1" thick fiberglass insulation on five sides enclosed in an aluminized steel enclosure, and a mounting panel for installation in the counter apron complete with gasket, infinite heat controls with positive off position, high temperature limit thermostats, and pilot lights. Wells shall be provided with drain outlets factory manifolded with 1" diameter line and a gate valve.
Accessories - Provide with drain valve extension kit and Wellslok extension kit.

Item B15
PREP TOP REFRIGERATOR
Make - Beverage-Air SPE72HC-18 or equal by Continental or True

Item B16
TRASH BIN
Quantity - Four
No work in this Section. Item to be provided by Owner.

Item B17
FILL FAUCET
Quantity - Three
Make - T&S Brass B-0208 or equal by Fisher or Encore
Description - Unit shall be all standard construction with a B-199-02F-12 aerator tip.

Item B18
HOT FOOD WELL ASSEMBLY, DROP-IN
Make - Wells MOD200-DM*C166 or equal by Hatco or Alto-Shaam
Size - 29-1/2" x 23-5/8" x 9-3/4" high
Power - 8.7 amps - 1.8 KW - 208/60/1 - cord and plug (NEMA 6-15P)
Description - Modular food warmer shall be all standard construction and shall consist of a stainless steel mounting frame, gasket and locking system, two individually controlled stainless steel 6" deep "wet or dry" hot food wells with 1" thick fiberglass insulation on five sides enclosed in an aluminized steel enclosure, and a mounting panel for installation in the counter apron complete with gasket, infinite heat controls with positive off position, high temperature limit thermostats, and pilot lights. Wells shall be provided with drain outlets factory manifolded with 1" diameter line and a gate valve.
Accessories - Provide with drain valve extension kit and Wellslok extension kit.

Item B19

DELI SERVING COUNTER

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B19a

FULL-SERVICE GLASS FOOD PROTECTOR CASE

Make - Versa-Gard VG6S

Item B19b

FULL-SERVICE GLASS FOOD PROTECTOR CASE

Make - Versa-Gard VG6S

Item B20

AIR SCREEN GRAB AND GO DISPLAY REFRIGERATOR

Make - Federal LPRSS4 or equal by Structural Concepts or RPI

Item B21

COLD PAN, DROP-IN

Make - Hatco CWB-2*C166 or equal by Atlas or Wells

Size - 32 in. by 27 in. by 25-1/2 in. high

Power - 3.8 amps - 1/5 HP - 120/60/1 - cord and plug

Description - The NSF 7 approved refrigerated drop-in well shall be standard construction per the manufacturer's standard details with an angled interior wall design. Unit shall utilize R-404A refrigerant and consist of aluminized steel housing with a stainless bezel, mounted electronic temperature control, pan support bars for full-size pans, condenser unit (can be rotated), compressor with flexible refrigerant lines, sight glass, service valves, receiver, and dryer/filter.

Accessories - Provide with unmounted control panel for mounting in counter apron. Provide optional five year warranty on the compressor. Provide with 20 in. pan support bars and perforated false bottom.

Item B22

No item

Item B23

TWO-TIER HEATED SHELF

Quantity - Two

Make - Hatco GRSDS/H-36D*C166 or equal

Size - 36" x 24" x 32-1/2" high

Power - 15.1 amps - 1.81 KW - 120/60/1 - cord and plug (NEMA 5-20P)

Description - Unit shall be all standard construction with two heated shelves, one slanted and one flat, with Hardkote finish, constructed of stainless steel and extruded aluminum with tempered glass end panels, incandescent lights, dividers, and thermostatic controls.

Item B24

HEATED SURFACE, DROP-IN

Make - Hatco HBGB-4818*C166 or equal by BSI

Size - 48" x 18" plus perimeter flange

Power - 7.1 amps - 850 watts - 120/60/1 - cord and plug

Description - Black ceramic glass aluminum surface with thermostatic controlled heated base with 100° to 200°F. range, stainless steel flanged edge for drop-in installation, and remote control box.

Accessories - Provide with flush mount control box with lighted power switch for mounting in counter apron.

Item B25

HOT GRAB AND GO SERVING COUNTER

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B25a

CONVERTIBLE GLASS FOOD PROTECTOR WITH WARMER

Make - Versa-Gard VG21-SK / Hatco - GRNH-48

Item B26

AIR SCREEN GRAB AND GO DISPLAY REFRIGERATOR

Make - Federal LPRSS4 or equal by Structural Concepts or RPI

Item B27

ENTREE SERVING COUNTER

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B27a

TWO-TIER GLASS FOOD DISPLAY CASE

Make - Versa-Gard VG9

Item B27b

FULL-SERVICE GLASS FOOD PROTECTOR CASE

Make - Versa-Gard VG6S

Item B28

COLD PAN, DROP-IN

Make - Hatco CWB-2*C166 or equal by Atlas or Wells

Size - 32 in. by 27 in. by 25-1/2 in. high

Power - 3.8 amps - 1/5 HP - 120/60/1 - cord and plug

Description - The NSF 7 approved refrigerated drop-in well shall be standard construction per the manufacturer's standard details with an angled interior wall design. Unit shall utilize R-404A refrigerant and consist of aluminized steel housing with a stainless bezel, mounted electronic temperature control, pan support bars for full-size pans, condenser unit (can be rotated), compressor with flexible refrigerant lines, sight glass, service valves, receiver, and dryer/filter.

Accessories - Provide with unmounted control panel for mounting in counter apron. Provide optional five year warranty on the compressor. Provide with 20 in. pan support bars and perforated false bottom.

Item B29

HOT FOOD WELL ASSEMBLY, DROP-IN

Make - MOD400-DM*C166 or equal by Hatco or Alto-Shaam

Size - 57-1/2" x 23-5/8" x 9-3/4" high

Power - 17.3 amps - 3.6 KW - 208/60/1

Description - Modular food warmer shall be all standard construction and shall consist of a stainless steel mounting frame, gasket and locking system, four individually controlled stainless steel 6" deep "wet or dry" hot food wells with 1" thick fiberglass insulation on five sides enclosed in an aluminized steel enclosure, and a mounting panel for installation in the counter apron complete with gasket, infinite heat

controls with positive off position, high temperature limit thermostats, and pilot lights. Wells shall be provided with drain outlets factory manifolded with 1" diameter line and a gate valve.
Accessories - Provide with drain valve extension kit and Wellslok extension kit.

Item B30
No item

Item B31
No item

Item B32
No item

Item B33
MILK COOLER
Quantity - Two
Make - Beverage-Air SMF58HC-1-S or equal by Continental or True

Item B34
TRAFFIC BARRIER BOLLARD
Quantity - Four
Make - Lawrence Tensabarrier 889 Advance/Universal Base or equal
Size - 38-1/4" high post; 13-1/2" diameter base; 7'-6" maximum belt length
Description - Units shall be all standard construction with satin stainless steel finish, and retractable belts.
Belt color shall be as selected by Architect from standard options.

Item B35
SALAD BAR COUNTER
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B35a
DOUBLE-SIDED SELF-SERVE GLASS FOOD PROTECTOR WITH LIGHTS
Make - Versa-Gard VG7-DS

Item B36
COLD PAN, DROP-IN
Make - Hatco CWB-5*C166 or equal by Atlas or Wells

Item B37
No item

Item B38
No item

Item B39
MOBILE CONDIMENT COUNTER
Quantity - Two
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B40

MOBILE CASHIER STAND

Quantity - Two

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B41

CASHIER TERMINAL

Quantity - Two

No work in this Section. Item to be provided by Owner.

Item B42

No item

Item B43

No item

Item B44

MOP SINK AND SERVICE FAUCET

No work in this Section. Item to be provided and installed by Plumbing Contractor.

Item B45

MOP RACK/SHELF

Make - Advance Tabco K-245 or equal

Size - 24" x 8" x 7-1/2" high, mounted 60" above floor

Description - Unit shall be all standard construction of welded 18 gauge stainless steel type 430 polished satin finish, back and sides turned up 1-1/2", mounted on two die formed wall brackets and furnished with two mop hangers and three rag hooks.

Item B46

DETERGENT STORAGE CABINET

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B47

MOBILE SHELVING UNIT, FOUR-TIER

Make - MetroMax Q*C166 or equal by Cambro or Fermob

Item B48

CLEAN WARE TABLE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B49

EXISTING WAREWASHER, CONVEYOR TYPE

Make - Champion 86 PRO

Power -

Work - Relocate unit per plan, level in place, and leave ready for reconnection of service by Related Trades.

Item B49a

WATER FILTER ASSEMBLY

Make - WaterSpec WS-SSEXT or equal by 3M or Everpure

Description - Unit shall be all standard construction designed for vertical wall mounting per plan and consisting of a mounting bracket, manifold, and filter cartridge with housing. Assembly shall have an operating inlet water temperature range of 35 to 160 degrees Fahrenheit.

Accessories - Provide four spare SS-EXT filter cartridges.

Item B50

STAINLESS STEEL EXHAUST DUCT

Quantity - Two

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B51

HOSE REEL ASSEMBLY

Make - T&S Brass B-1457-7102-01C or equal by Fisher or Reel Craft

Item B52

SOILED TRAY TABLE WITH SCRAP SINK AND INTEGRAL PASS-THRU WINDOW FRAME

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item B53

ROLL-DOWN SHUTTER

Make - Raynor DuraShutter Select/surface mount or equal by Alpine or Cornell

Size - Opening approximately 54" wide x 50" high; verify

Description - Assembly shall be all standard construction and shall consist of a self-coiling rolling counter shutter, all anodized aluminum construction with interlocking extruded slats, extruded aluminum bottom bar with rubber astragal, designed for surface type mounting with extruded guides with wool pile inserts, and complete with recessed inside lifting handles and thumb-turn locks, and complete covers.

Installation - Install with tracks located 1" clear above table surface to permit proper cleaning.

Item B54

WASTE BARREL

No work in this Section. Item to be provided by Owner.

Item B55

HAND SINK

Make - Advance 7-PS-70-CM*C166 or equal by IMC Teddy or Krowne

Description - Unit shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36 in. above floor

Accessories - Provide with a splash mounted faucet set with wrist handles (Item B55a), 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap.

Item B55a

FAUCET

Make - T&S Brass B-0330-04 modified or Fisher 1953 modified, or Encore

Description - Unit shall be all standard construction with mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with 119X gooseneck with B-0199-02-F10 aerator tip in lieu of the standard.

Item B56

WASTE BIN

No work in this Section. Item to be provided by Owner.

Item C01

MOBILE INSULATED ICE CART

Make - Cambro ICS125L

Item C02

WATER FILTER ASSEMBLY

Make - 3M ICE160 Modified or equal by Everpure or Selecto

Item C03

ICE MAKER WITH BIN

Make - Manitowoc IDT0500A/D-570

Item C04

FLOOR PAN AND GRATE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item C05

WALK-IN COOLER

Make - American Panel or equal by Bally or Thermo-Kool

Size - 9'-0" x 12'-10" x 7'-10" high minimum inside dimensions; 7'-8" high after finished floor is installed by the General Contractor

Power - 1.1 KW - 120/60/1 to light fixtures, temperature monitor/alarm, and door defrost heater strip

Installation, Construction, Materials and Accessories - See Item C06

Guarantee - See Item C06

Item C06

WALK-IN FREEZER

Make - American Panel or equal by Bally or Thermo-Kool

Size - 9'-0-1/2" x 12'-10" x 7'-10" high minimum inside dimensions; 7'-8" high after finished floor is installed by the General Contractor.

Power - 1.3 KW - 120/60/1 to light fixtures, temperature monitor/alarm, door defrost heater strip, and pressure relief port

Installation - The walk-in refrigerated room shall be installed in a 7" deep ID recess (below finished floor).

Recess depth allows 1" for use of leveling sand; 4" for the insulated floor panels; 2" for finished floor and setting bed that shall be carried in from the adjacent room and level to same. The finished floor and setting bed shall be furnished and installed by the General Contractor, and shall have coved joints at all walls, turned up a minimum of 4" inside and out. The unit shall be set level on a bed of clean, dry mason's sand. Shims are not acceptable for leveling material.

Construction - All standard construction per the manufacturer, modified to meet the specific following points:

- Walls to be 4" thick with CFC free urethane foam insulation, UL Class 1 rated
- Cam type locking devices
- 36" x 80" minimum door clearance
- Polished hardware (hinges and latch to match)
- Three hinges on doors (to include one Kason 1248 spring assist hinge per door)
- Leveraged pull handle (mechanical advantage type, Kason 1236 or equal)
- Quarter turn inside safety release lever handle mechanism (not screw type)
- Prewired door sections with heater wires and light fixtures and switches
- Kason 1806 LED light fixtures or Kason 1808 LED light fixtures
- Dial type thermometers at doors
- Model IC+ (with dry contacts) temperature and HACCP monitoring system at doors. Cooler and freezer alarms to interconnect with access control system for alert monitoring. Provide each system with a pair of 22 gauge low voltage wires. Wires shall be installed by the Controls Contractor. Wires shall run from the dry contacts to the access control panel. Kitchen Equipment Contractor to verify length prior to purchasing. To avoid false triggering, provide a shielded two-conductor cable with the shield connected to the receiving equipment.
- NSF construction throughout with exception of buried floor panels
- Interior and exterior faces of doors and exposed exterior walls shall be provided with aluminum diamond tread plate protective material to a height of 48" above finished floor. Hold diamond plating up 6" from the finish floor to accommodate the coved base.

Minimum materials - Interior and exterior wall surfaces shall be clad with .038" pebble finished aluminum. The ceiling shall be finished in white polyester over 24 gauge galvanized steel. Interior floor shall be 14 gauge galvanized steel.

Accessories - Freezer shall be provided with an electrically heated pressure relief port. Each door shall be provided with a heated vision panel, 14-1/2" x 23" constructed of three panels of tempered unbreakable glass, electrically heated, with sealed air spaces between. Provide matching trim strips and closure panels to adjoining surfaces, fabricated per details, made of largest pieces available to minimize number of joints, and installed in accordance with NSF Brochure 770202, Installation Manual for Walk-in Refrigerators and Freezers. Provide eight total extra Kason 1806 LED OR Kason 1808 LED light fixtures for mounting in the rooms and deliver to Electrical Contractor for field installation.

Guarantee - The walk-in refrigerated room panels shall be guaranteed for a period of ten (10) years from the date of approved installation for defects in materials and workmanship when subjected to normal use and service; remainder of rooms for one year.

Item C07

MECHANICAL REFRIGERATION SYSTEM

Quantity - Two

Make - Heatcraft, Bohn, Larkin, Climate Control, Chandler

Scope - Furnish and install complete refrigeration systems for the walk-in refrigerated rooms in accordance with the plans. The systems shall include condensing units, evaporator coils, piping, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted refrigeration practice.

Important: The installation work shall be performed by a fully qualified refrigeration contractor employing a certified mechanic fully trained in the installation of commercial refrigeration systems. Submittal shall list the installing company and the qualified system installer.

Piping - Furnish and install the interconnecting piping between the condensing units and their respective unit coolers. Piping shall be installed in a neat and workmanlike manner with adjustable hangers spaced at no more than ten foot intervals on horizontal runs; six foot intervals, vertical runs.

Line sizes shall be in accordance with ASHRAE standards and best refrigeration practice to assure proper feed to evaporator, avoid excessive pressure drop, and prevent excessive amounts of lubricating oil from being trapped in any part of the system. Line sizing shall be such that it will protect the compressor from loss of lubrication at all times, prevent liquid refrigerant from entering the compressor during operating or idle time, and maintain a clean and dry system.

Refrigeration piping shall be Type L, ACR grade, hard drawn seamless copper tubing, wrought type copper fittings, and silver soldered joints. Precharged lines are not acceptable.

Furnish and install sleeves for refrigerant and evaporator drain piping wherever piping passes through a wall or ceiling. Sleeves shall be non-conductive gray plastic tubing, with interior dimension sized at least 1/4" larger than piping, and shall be neatly packed with brine putty after installation.

Furnish and install condensate drain piping from the unit cooler to an open drain. Piping shall consist of not less than 7/8" Type L copper tubing, supported 36" on center maximum, in such a way that there will be 1" clearance between the wall and the tubing. Provide a union or slip fitting at the connection to the evaporator drain pan to allow easy disassembly for service and cleaning. Drain piping shall be pitched 4" to the foot and carried through the wall of the refrigerated area. It shall be trapped to prevent entry of warm air and insects to the refrigerated rooms and discharged to a floor drain with the code required air gap. The exposed drain piping shall be spray painted.

Provide an electric drainline heater tape in the freezer, with a length equal to five wraps per foot of length of the drainline located within the freezer compartment. Wrap and secure in accordance with manufacturer's recommendations.

Provide chrome plated escutcheon plates at all exposed points where piping penetrates the wall or ceilings.

Insulation - Suction lines for refrigerated rooms having a temperature above freezing shall be covered with 3/4" wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

Suction lines for refrigerated rooms having a temperature below freezing shall be covered with 1" wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

The insulation shall be applied to these lines in accordance with manufacturer's recommendations, and as they are being installed so that insulation will not be split. All joints shall be completely sealed with overlapping, cemented material to prevent the formation of frost on the lines.

Controls - Each evaporator shall be provided with an iNtelliGen electronic control as manufactured by Heatcraft Refrigeration. Provide each system with a pair of twisted 24 gauge low voltage wires, Belden 9841 or equal. Wires shall be installed by the Controls Contractor. Wires shall run from the dry contacts at the evaporators to the access control panel. Kitchen Equipment Contractor to verify length prior to purchasing. To avoid false triggering, provide a shielded two-conductor cable with the shield connected to the receiving equipment. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit.

Refrigerant Testing - The entire system shall be pressure and leak tested at no less than 100 PSIG, cleaned and dehydrated by maintaining a vacuum of 500 microns or lower for a period of twelve hours. The required operating charge of refrigerant and oil, if necessary, shall be added and the entire system tested for performance. Each system shall be clearly marked as to the type refrigerant required.

Guarantee - The equipment shall be guaranteed to maintain the specified temperatures. All mechanical refrigeration equipment shall be mechanically guaranteed for a period of one year after date of acceptance by the Owner. The emergency service shall be provided free of charge, whenever necessary on a 24 hour, seven day-per-week basis during the guarantee period.

Any leaks that occur during the first year of operation after acceptance by the Owner, shall be repaired and the necessary refrigerant added at no expense to the Owner.

The year's service shall be provided by the installing company, and under no circumstances will the service policy be sublet to another refrigeration contractor. The name of the installer/service agency for the guarantee period shall be located at a prominent place on the condensing units.

The condensing units shall be provided with an additional four year parts warranty to commence upon the completion of the aforementioned guarantee, bringing the total parts warranty to five years.

Condensing Units - The condensing units shall consist of an EC energy saving motor with variable speed controller, compressor, refrigerant condenser, liquid receiver, compressor service valves, and a dual high-low pressure control. The units shall be as manufactured by Heatcraft Refrigeration.

The condensing units shall be outdoor type, wall mountable, and quiet type with an approximate 51 to 63 decibel rating at 100 percent fan speed. The compressor shall be Microchannel Coil Technology scroll type per schedule, and fitted with gold coated aluminum fin condenser, suction service valve, discharge service valve, compressor contactor, high and low pressure controls, receiver with fusible plug, liquid shut-off valve and charging port, mounted non-fused disconnect switch, waterproof electrical control box, discharge line vibration eliminator, weather resistant UL painted steel cabinet, access guard, liquid line assembly, suction line filter and vibration eliminator, crankcase heater, and 1-1/2" high raised steel base.

Mount on roof per drawings with structural supports, roof penetrations and weatherproofing provided by the General Contractor. Mount with clearance above roof deck per Manufacturers recommendation.

Evaporator Coils - Each evaporator shall be provided with iNtelliGen electronic control as manufactured by Heatcraft Refrigeration, thermostatic expansion valve, and solenoid valve. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit. iNtelliGen Controls to include iIC integration card for BMS connection direct to evaporator controls.

The freezer shall be provided with an automatic electric defrost system consisting of one evaporator coil as indicated in the schedule. Evaporator shall be low profile type six fins per inch complete with variable speed EC energy saving fan motors with controller. Coil shall be NSF and UL Listed.

The cooler shall be provided with one evaporator coil as indicated in the schedule. Evaporator shall be low profile type six fins per inch complete with EC energy saving fan motors. Coil shall be NSF and UL Listed.

Furnish and install 1/4" minimum diameter stainless steel threaded mounting rods for the hanging of the evaporator coils, with stainless steel washers and nuts on the interior ends, and reinforcing angle at the exterior top of the room. Plated steel running thread is not acceptable.

Refrigeration Equipment Schedule

Cooler (C05)	Room Temp: +35 degrees F			TD: 10 degrees F	
<u>Condensing unit (C07a)</u>	<u>Amps</u>	<u>Ref</u>	<u>BTU/hour</u>	<u>Evap Temp</u>	<u>Cond Temp</u>
BCH0010MCACZ	9.5 - 208/3	448A	9,699	+25 degrees F	+95 degrees F
<u>Evaporator coil (C07b)</u>	<u>BTU/hour</u>	<u>CFM</u>	<u>Fan amps</u>	<u>Defrost amps</u>	<u>Defrost type</u>
BEL0095AS6AM	9,992	1,305	1.8 - 120/1	NA	Timed ambient
Freezer (C06)	Room Temp: -10 degrees F			TD: 10 degrees F	
<u>Condensing unit (C07c)</u>	<u>Amps</u>	<u>Ref</u>	<u>BTU/hour</u>	<u>Evap Temp</u>	<u>Cond Temp</u>
BCH0025LCACZ	11.9 - 208/3	448A	10,440	-20 degrees F	+95 degrees F
<u>Evaporator coil (C07d)</u>	<u>BTU/hour</u>	<u>CFM</u>	<u>Fan amps</u>	<u>Defrost amps</u>	<u>Defrost type</u>
BEL0080BS6EE	8,400	1,371	1.5 - 208/1	9.5 - 208/1	Timed electric

Item C07a
COOLER REMOTE CONDENSING UNIT
Specified as part of Item C07

Item C07b
COOLER EVAPORATOR COIL
Specified as part of Item C07

Item C07c
FREEZER REMOTE CONDENSING UNIT
Specified as part of Item C07

Item C07d
FREEZER EVAPORATOR COIL
Specified as part of Item C07

Item C08
MOBILE SHELVING UNIT, FOUR-TIER
Quantity - 18
Make - MetroMax Q*C166 or equal by Cambro or Fermod

Item C09
PAN RACK, MOBILE
Quantity - Four
Make - New Age 1332*C166 or equal by Channel
Size - 20-1/2 in. by 26 in. by 69 in. high
Capacity - Fifteen 18 in. by 26 in. pans on 4 in. centers
Description - Rack shall be fabricated of welded extruded aluminum 1 in. by 1 in. by .070 in. tubular uprights and framing, and 1-1/4 in. by 1-5/8 in. by .100 in. angle pan slides with corners chamfered and deburred. Gussets of 1-1/2 in. by 1-1/2 in. by 5/8 in. angle aluminum shall be welded to the bottom inside angles where horizontal bracing meets vertical uprights. Mount on platform type, 5 in. polyurethane tired swivel casters.

Item C10

UTILITY CART

Quantity - Three

Make - Lakeside 521 or equal by Channel or Kelmax

Size - 32-5/8 in. by 19-3/8 in. by 34-1/2 in.

Description - Cart shall be all standard NSF construction, stainless steel throughout, with top and bottom shelves supported by an angle frame, and mounted on two 8 in. fixed and two 5 in. swivel casters.

Capacity of cart to be 650 pounds.

Item C11

No item

Item C12

No item

Item C13

DUNNAGE RACK

Quantity - Four

Make - New Age 2000 Series or equal by Channel or Kelmax

Item C14

STORAGE SHELVING, FIVE-TIER

Quantity - 12

Make - Metro Super Adjustable Super Erecta or equal by ISS or Cambro

Item C15

MOP SINK AND SERVICE FAUCET

No work in this Section. Item to be provided and installed by Plumbing Contractor.

Item C16

MOP RACK/SHELF

Make - Advance Tabco K-245 or equal

Size - 24" x 8" x 7-1/2" high, mounted 60" above floor

Description - Unit shall be all standard construction of welded 18 gauge stainless steel type 430 polished satin finish, back and sides turned up 1-1/2", mounted on two die formed wall brackets and furnished with two mop hangers and three rag hooks.

Item C17

FRONT LOAD CLOTHES WASHER

Make - UniMac UFNE5BJP115TW01 or equal Wascomat or Speed Queen

Size - 27" x 27-3/4" x 40-1/2" high

Power - 20 amps circuit - 120/60/1 - cord and plug

Water factor - 3.7 gallons/ft3/cycle

Certification - Unit shall be Energy Star compliant and CEE qualified.

Description - Washer shall be all standard front loading construction with white exterior, see-thru door with heavy duty stainless steel hinge, 3.42 cubic foot front loading stainless steel basket, detergent dispensers, electronic controls, three wash/rinse temperatures, and five selectable wash cycles.

Item C18

FRONT LOAD CLOTHES DRYER

Make - UniMac UDEE5BGS173CW01 or equal Wascomat or Speed Queen

Size - 27" x 28" x 40-1/2" high

Power - 30 amps circuit - 120/240/60/1 - cord and plug

Description - Dryer shall be all standard front loading construction with white exterior, 7 cubic foot capacity, galvanized drum, electronic controls, lint filter, and interior light.

Item C19

No item

Item C20

No item

Item C21

THREE-COMPARTMENT SINK

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item C22

WALL SHELF

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item C23

HAND SINK

Make - Advance 7-PS-70-CM*C166 or equal by IMC Teddy or Krowne

Description - Unit shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36 in. above floor

Accessories - Provide with a splash mounted faucet set with wrist handles (Item C23a), 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap.

Item C23a

FAUCET

Make - T&S Brass B-0330-04 modified or Fisher 1953 modified, or Encore

Description - Unit shall be all standard construction with mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with 119X gooseneck with B-0199-02-F10 aerator tip in lieu of the standard.

Item C24

WASTE BIN

No work in this Section. Item to be provided by Owner.

Item C25

EYE/FACE WASH

Make - Guardian Equipment G1814*C166 or equal by Bradley or Speakman

Size - 11-1/2" diameter x 6-7/8" high bowl

Construction - Unit shall be standard construction with stainless steel bowl and lid, cast aluminum, corrosion resistant power coated wall bracket, and flip-top covered spray head assembly with internal flow control and filter.

Accessories - Provide a chrome plated brass tailpiece and trap with 1-1/2" waste connection and a TMV-G3600 thermostatic mixing valve assembly.

Item C26

WATER FILTER ASSEMBLY

Make - 3M DP260 Modified or equal by Everpure or Selecto

Item C27

DETERGENT STORAGE CABINET

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item C28

CLEAN WARE TABLE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item C29

WAREWASHER, RACK CONVEYOR

Make - Hobart CL44eN-BAS R-L*C166, or equal by Meiko or Stero

Size - 43-1/2 in. by 30-1/8 in. by 65-1/2 in. high

Power - 68 amps - 480/60/3

Conveyor speed - 5.6 feet per minute; 202 racks per hour

Maximum Water Usage - 0.62 gallon per rack

Certification - Unit shall be Energy Star compliant

Description - Unit shall be standard construction, double tank, fully automatic, rack conveyor type with 16 gauge stainless steel wash and rinse chambers, welded stainless steel frame and motor supports, stainless steel chambers, housing, insulated inspection doors and legs with adjustable feet. Conveyor structure, tracks, and drive unit to be all stainless steel with a conveyor speed of 5.6 feet per minute. Warewasher to be complete with with 30 KW booster heater, insulated cabinet style doors, dirty water indicator, configurable de-lime notification, top mounted computer controls with "start/stop" button and digital display, NSF approved pot and pan cycle mode, 19-1/2 in. standard chamber height, and and ten plastic racks.

Accessories - Provide with 30 KW internal booster heater, two standard vent hoods with 4 in. by 16 in. stainless steel stacks all welded water tight complete with locking dampers, table limit switch, drain water tempering kit, and four plastic peg racks and two plastic flat racks.

Item C29a

WATER FILTER ASSEMBLY

Make - WaterSpec WS-SSEXT or equal by 3M or Everpure

Description - Unit shall be all standard construction designed for vertical wall mounting per plan and consisting of a mounting bracket, manifold, and filter cartridge with housing. Assembly shall have an operating inlet water temperature range of 35 to 160 degrees Fahrenheit.

Accessories - Provide four spare SS-EXT filter cartridges.

Item C30

STAINLESS STEEL EXHAUST DUCT

Quantity - Two

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item C31

SOILED WARE TABLE WITH SCRAP SINK

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item C32

HOSE REEL ASSEMBLY

Make - T&S Brass B-1457-7102-01C or equal by Fisher or Reel Craft

Item C33

DOUBLE-SIDED RACK SHELF

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item C34

WASTE BARREL

Quantity - Three

No work in this Section. Item to be provided by Owner.

Item C35

No item

Item C36

No item

Item D01

DUAL TEMP, REFRIGERATOR/FREEZER, REACH-IN

Make - Victory RFS-2D-S1-HD-HC

Item D02

PAN RACK, MOBILE

Make - New Age 1332*C166 or equal by Channel

Size - 20-1/2 in. by 26 in. by 69 in. high

Capacity - Fifteen 18 in. by 26 in. pans on 4 in. centers

Description - Rack shall be fabricated of welded extruded aluminum 1 in. by 1 in. by .070 in. tubular uprights and framing, and 1-1/4 in. by 1-5/8 in. by .100 in. angle pan slides with corners chamfered and deburred. Gussets of 1-1/2 in. by 1-1/2 in. by 5/8 in. angle aluminum shall be welded to the bottom inside angles where horizontal bracing meets vertical uprights. Mount on platform type, 5 in. polyurethane tired swivel casters.

Item D03

MICROWAVE OVEN

Make - ACP RCS10TS or equal by Panasonic

Item D04

WORK COUNTER WITH SINK

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item D05

No item

Item D06

WASTE BIN

No work in this Section. Item to be provided by Owner.

Item D07

HAND SINK

Make - Advance 7-PS-70-CM*C166 or equal by IMC Teddy or Krowne

Description - Unit shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36 in. above floor

Accessories - Provide with a splash mounted faucet set with wrist handles (Item D07a), 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap.
Provide with welded stainless steel left end splash

Item D07a

FAUCET

Make - T&S Brass B-0330-04 modified or Fisher 1953 modified, or Encore

Description - Unit shall be all standard construction with mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with 119X gooseneck with B-0199-02-F10 aerator tip in lieu of the standard.

Item D08

No item

Item D09

No item

Item D10

DEMONSTRATION COUNTER

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item D11

TWO-BURNER/GRIDDLE RANGE WITH OVEN

Make - Vulcan 36S-2B24GN or equal by Garland or Southbend

Item D12

EXHAUST VENTILATOR

Make - CaptiveAire 6024 ND-2WI (Job #5465035) or equal by Gaylord or Halton

Item D13

VENTILATOR DEMAND CONTROL SYSTEM

Make - CaptiveAire DCV-1011 (Job #5465035) or equal by Gaylord or Halton

Item D13a

VENTILATOR CONTROL INTERFACE SCREEN

Specified as part of Item D13

Item D13b

ROOM TEMPERATURE SENSOR

Specified as part of Item D13

Item D14
FIRE SUPPRESSION SYSTEM
Make - Ansul R-102 or equal by Kidde or Pyro-Chem

Item D15
MOBILE WORK TABLE
Quantity - 12
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item E01
PAN RACK, MOBILE
Quantity - Four
Make - New Age 1332*C166 or equal by Channel
Size - 20-1/2 in. by 26 in. by 69 in. high
Capacity - Fifteen 18 in. by 26 in. pans on 4 in. centers
Description - Rack shall be fabricated of welded extruded aluminum 1 in. by 1 in. by .070 in. tubular uprights and framing, and 1-1/4 in. by 1-5/8 in. by .100 in. angle pan slides with corners chamfered and deburred. Gussets of 1-1/2 in. by 1-1/2 in. by 5/8 in. angle aluminum shall be welded to the bottom inside angles where horizontal bracing meets vertical uprights. Mount on platform type, 5 in. polyurethane tired swivel casters.

Item E02
VENTILATOR DEMAND CONTROL SYSTEM
Make - CaptiveAire DCV-1011 (Job #5465035) or equal by Gaylord or Halton

Item E02a
VENTILATOR CONTROL INTERFACE SCREEN
Specified as part of Item E20

Item E02b
ROOM TEMPERATURE SENSOR
Specified as part of Item E20

Item E03
FIRE SUPPRESSION SYSTEM
Make - Ansul R-102 or equal by Kidde or Pyro-Chem

Item E04
EXHAUST VENTILATOR
Make - CaptiveAire 6024 ND-2 (Job #5465035) or equal by Gaylord or Halton

Item E05
STAINLESS STEEL WALL FLASHING
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item E06
DONUT FRYER WITH FILTER DRAWER
Make - Pitco 24RUFM

Accessories - Mount on 6" high casters. Provide with electronic ignition, donut dropper bracket, and cover

Item E07

DOUBLE CONVECTION OVEN

Make - Blodgett DFG-200-ES Double* C166 or equal by Montague or Southbend

Size - 38-1/4" x 42-7/8" to include fan motor x 70-5/8" high

Power - (2) 8 amps - 1/3 HP - 120/60/1 - cords and plugs

Rating - 3/4" gas inlet at 100,000 BTU/Hour

Certification - Unit shall be Energy Star compliant

Description - Units shall be all standard construction with stainless steel front, sides and top, porcelain enameled steel interior with 29" x 28-1/4" x 20" high inside dimensions, 1" thick mineral fiber sheet insulation on top, back and sides, dual pane thermal glass windows in coupled doors, removable rack supports capable of holding eleven racks and five chrome plated steel wire racks, electronic ignition with fail-safe controls, solid state digital controls with separate temperature and time settings, timer with buzzer, cook and hold and fan pulse modes, manual gas service cut-off switch, removable dual tube burners, pressure regulators, two speed blowers with thermal overload protection and door interlock, and interior lighting with two 50 watt commercial bake oven lamps. Provide standard three year parts and labor warranty on the total oven and additional five year warranty on the door assembly exclusive of glass, parts only.

Accessories - Mount on heavy duty swivel casters. Manifold the two ovens for a single gas connection.

Provide assembly with a 48" long x 3/4" line size Dormont 1675 KIT2S plastic covered hose assembly with full port gas ball valve, two Supr-Swivels, brass disconnect, 90° street elbow and restraining cable. Mount the nipple on the rear of the oven, and the hose assembly with disconnect device connected to the building supply line.

Item E08

SIX-BURNER RANGE WITH OVEN

Make - Vulcan 36S-6BN* C166 or equal by Garland or Southbend

Accessories - Provide with Flame Safety device with manual spark ignition for all open top burners, and oven pilot. Provide a 10" high stainless steel flue riser, and mount on casters.

Item E09

No item

Item E10

No item

Item E11

MOBILE DOUBLE OVEN RACK

Quantity - Three

Make - Baxter BDRSB-15

Item E12

WATER FILTER ASSEMBLY

Make - 3M ScaleGard HT SF165 Modified or equal by Everpure or Selecto

Description - Unit shall be all standard construction designed for wall mounting and consisting of a mounting bracket, quarter-turn cartridge release mechanism, manifold with integral pressure gauge, integral quarter turn shut-off valve, outlet check valve, filter cartridge with internal prefilter membrane and external scale feeder cartridge. Provide with HF95-CL chloramine reduction filter cartridge in lieu of standard HF65 cartridge.

Accessories - Provide four spare HF95-CL filter cartridges and four spare HF8-S cartridges.

Item E13
ROTATING DOUBLE RACK OVEN
Make - Baxter OV500E2

Item E14
ROLL-IN PROOFER CABINET
Make - Baxter PW1E

Item E15
MOBILE WORK TABLE
Quantity - Two
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item E16
MAPLE TOP WORK BENCH
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item E17
UTENSIL RACK, CEILING MOUNT
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item E18
DOUGH DIVIDER/ROUNDER
Make - Doyon DFS030*C166 or equal by Univex or Empire
Size - 23" x 20" x 54" high
Power - 8 amps - 120/60/1 - cord and plug
Capacity - 30 pieces
Description - Unit shall be all standard construction per manufacturer's specifications with an enamel coated heavy gauge steel body, stainless steel cutting knives, manual motor start with built-in thermal overload protection and a grease bath for rounder mechanism. Tilting head unit for easy cleaning.

Item E19
No item

Item E20
No item

Item E21
FIVE-QUART MIXER
Quantity - Six
Make - Hobart N-50*C166 or equal by Globe or KitchenAid
Power - 2.9 amps - 1/6 HP - 120/60/1 - cord and plug
Description - Mixer shall be all standard construction with gray enamelled exterior, sleeve bearing ventilated drip-proof motor, three speed transmission with agitator speeds of 139, 285 and 591 RPM interlocked to on-off switch, and a manual bowl lift.

Accessories - Provide unit with a stainless steel bowl, wire whip with stainless steel wires and a flat beater.

Item E22

STORAGE SHELVING, FOUR-TIER

Make - Metro Super Adjustable Super Erecta or equal by ISS or Cambro

Item E23

EYE/FACE WASH

Make - Guardian Equipment G1814*C166 or equal by Bradley or Speakman

Size - 11-1/2" diameter x 6-7/8" high bowl

Construction - Unit shall be standard construction with stainless steel bowl and lid, cast aluminum, corrosion resistant power coated wall bracket, and flip-top covered spray head assembly with internal flow control and filter.

Item E24

EXISTING THIRTY-QUART MIXER

Make - Hobart

Work - Relocate unit per plan, level in place, and leave ready for reconnection of service by Related Trades.

Item E25

SINGLE BAR UTENSIL RACK, WALL MOUNTED

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item E26

FILL FAUCET

Make - T&S Brass B-0610*C166 or equal by Fisher or Encore

Description - Faucet assembly shall be all standard construction with 8" centers, 1/2" IPS inlets, built-in check valves, vacuum breaker connection for hose, finger hook, all chrome plated, and provided with a 68" long polished stainless steel hose with hook nozzle, self-closing valve and retaining ring.

Item E27

EXISTING SIXTY-QUART MIXER

Make - Hobart

Work - Relocate unit per plan, level in place, and leave ready for reconnection of service by Related Trades.

Item E28

No item

Item E29

No item

Item E30

DROP CORD REEL

Quantity - 12

No work in this Section. Item to be provided and installed by Electrical Contractor.

Item E31

MAPLE TOP WORK BENCH

Quantity - 12

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item E32

DOUGH SCALE

Quantity - 12

No work in this Section. Item to be provided and installed by FF&E.

Item E33

MOBILE INGREDIENT BIN

Quantity - 24

Make - Rubbermaid 3600 or equal

Size - 13-1/8 in., by 29-1/4 in., by 28 in. high

Capacity - 2.75 cubic feet, 21 gallons

Description - Bin shall be all standard construction with structural foam body, mounted on 3 in. diameter casters and provided with polycarbonate hinged/slide off lid.

Item E34

SLICER, BREAD

Make - Berkel MB

Item E35

WASTE BARREL

No work in this Section. Item to be provided by Owner.

Item E36

PREP TABLE WITH SINKS

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item E37

WALL SHELF

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item E38

ADA COMPLIANT HAND SINK

Make - Advance 7-PS-25 modified or equal by IMC Teddy or Krowne

Size - 20 in. by 24 in. by 13 in. high overall, 14 in. by 16 in. by 5 in. deep sink bowl

Description - Unit shall be all standard stainless steel construction with wall mounting bracket. Mount on wall with rim at 34 in. above floor. Modify faucet holes to be two holes spaced 8 in. apart on center. Delete standard faucet.

Accessories - Deck mounted soap dispenser, 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap.

Item D64a

FAUCET

Make - T&S Brass B-0322-04 modified or equal by Fisher or Encore

Description - Unit shall be all standard construction with deck mounted mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with B-0199-02F-12 aerator tip in lieu of the standard.

Item E39

WASTE BIN

No work in this Section. Item to be provided by Owner.

Item E40

MOBILE SHELVING UNIT, FOUR-TIER

Make - MetroMax Q*C166 or equal by Cambro or Fermod

Item E41

MOBILE EQUIPMENT STAND

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item E42

No item

Item E43

TWENTY-QUART MIXER

Quantity - Two

Make - Hobart HL-200 or equal by Globe or Univex

Power - 8 amps - 1/2HP - 120/60/1 - cord and plug

Description - Mixer frame and body shall be fabricated of welded heavy gauge steel finished in Hybrid Powder coat finish, and provided with a stainless steel splash guard at the column, stainless steel bowl guard with electrical interlock, single point bowl installation with swing-out bowl support, manual bowl lift and an attachment hub with No. 12 taper. Transmission shall be gear driven constant mesh heat treated and hardened gears on similar shafts be mounted in ball bearings with recirculating oil and grease to all gears and shafts. Mixing action shall be planetary and shall have speeds of 59 (stir), 107, 198, 365, agitator RPM speeds as selected by an external dial. Speeds to be selectable on-the-fly and include a soft start and stir speed while lifting the bowl into place and controlled with a 15 minute timer with automatic time recall

Accessories - Provide mixer with a 20 quart stainless steel bowl, one flat "B" beater and one "D" wire loop whip with stainless steel wires.

Item E44

No item

Item E45

MOBILE EQUIPMENT STAND

Quantity - Two

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item F01

WORK TABLE

Quantity - Six

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item F02

DROP CORD REEL

Quantity - Three

No work in this Section. Item to be provided and installed by Electrical Contractor.

Item F03

UTILITY CART

Quantity - Two

Make - Lakeside 521 or equal by Channel or Kelmax

Size - 32-5/8 in. by 19-3/8 in. by 34-1/2 in.

Description - Cart shall be all standard NSF construction, stainless steel throughout, with top and bottom shelves supported by an angle frame, and mounted on two 8 in. fixed and two 5 in. swivel casters. Capacity of cart to be 650 pounds.

Item F04

ADA COMPLIANT PREP STATION TABLE WITH SINK

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item F05

WATER FILTER ASSEMBLY

Make - 3M ScaleGard HT SF165 Modified or equal by Everpure or Selecto

Description - Unit shall be all standard construction designed for wall mounting and consisting of a mounting bracket, quarter-turn cartridge release mechanism, manifold with integral pressure gauge, integral quarter turn shut-off valve, outlet check valve, filter cartridge with internal prefilter membrane and external scale feeder cartridge. Provide with HF95-CL chloramine reduction filter cartridge in lieu of standard HF65 cartridge.

Accessories - Provide four spare HF95-CL filter cartridges and four spare HF8-S cartridges.

Item F06

HAND SINK

Make - Advance 7-PS-70-CM*C166 or equal by IMC Teddy or Krowne

Description - Unit shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36 in. above floor

Accessories - Provide with a splash mounted faucet set with wrist handles (Item F06a), 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap.

Item F06a

FAUCET

Make - T&S Brass B-0330-04 modified or Fisher 1953 modified, or Encore

Description - Unit shall be all standard construction with mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with 119X gooseneck with B-0199-02-F10 aerator tip in lieu of the standard.

Item F07

WASTE BIN

No work in this Section. Item to be provided by Owner.

Item F08

MOBILE WORK TABLE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item F09

COOK'S WORK TABLE WITH SINK

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item F10

MOBILE WORK TABLE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item F11

No item

Item F12

No item

Item F13

EXHAUST VENTILATOR

Make - CaptiveAire 6024 ND-2 (Job #5465035) or equal by Gaylord or Halton

Item F14

EXHAUST VENTILATOR

Make - CaptiveAire 6024 ND-2 (Job #5465035) or equal by Gaylord or Halton

Item F15

UTILITY DISTRIBUTION SYSTEM (UDS)

Make - CaptiveAire UDI (Job #5465035) or equal by Gaylord or Halton

Item F16

EXHAUST VENTILATOR

Make - CaptiveAire 6024 ND-2 (Job #5465035) or equal by Gaylord or Halton

Item F17

EXHAUST VENTILATOR

Make - CaptiveAire 6024 ND-2 (Job #5465035) or equal by Gaylord or Halton

Item F18

FIRE SUPPRESSION SYSTEM

Make - Ansul R-102 or equal by Kidde or Pyro-Chem

Item F19
VENTILATOR DEMAND CONTROL SYSTEM
Make - CaptiveAire DCV-1011 (Job #5465035) or equal by Gaylord or Halton

Item F19a
VENTILATOR CONTROL INTERFACE SCREEN
Specified as part of Item F19

Item F19b
ROOM TEMPERATURE SENSOR
Specified as part of Item F19

Item F20
No item

Item F21
No item

Item F22
DOUBLE TWENTY-QUART TILTING KETTLE
Make - Groen (2)CTDC/3-20-SG
Accessories - Provide with baskets insets and brush kits

Item F23
FORTY-QUART KETTLE WITH DRAIN CART STAND
Make - Groen TDHC-40C
Accessories - Provide unit with swing spout mixing faucet with aerator tip and bracket, lift-off cover, cover holder, basket insert, support stand with drain cart, drain cart plumbing kit, and a kettle brush kit.

Item F24
FORTY-GALLON TILTING BRAISING PAN
Groen - BPP-40GC2T
Accessories - Provide unit with a faucet mounting bracket with a double pantry water fill faucet and aerator tip, and BPC pan carrier, and replacement core probe.

Item F25
SIX-BURNER RANGE WITH OVEN
Make - Vulcan 36S-6BN*C166 or equal by Garland or Southbend
Accessories - Provide with Flame Safety device with manual spark ignition for all open top burners, and oven pilot. Provide a 10" high stainless steel flue riser, and mount on casters.

Item F26
DOUBLE STACKED SMOKER OVEN
Make - Alto-Shaam (2)767-SK

Item F27
COMBINATION OVEN ON MOBILE STAND
Make - Groen BCX-14G
Accessories - Provide with casters for single oven stand

Item F28

TEN-PAN STEAMER

Make - Market Forge ETP-10G or equal by Groen or Accutemp

Item F29

CONVECTION OVEN

Make - Blodgett DFG-200-ES*C166 or equal by Montague or Southbend

Accessories - Provide a stainless steel finished back panel. Mount on 25" stainless steel stand with rack guides and casters.

Item F30

FILL FAUCET

Make - T&S Brass B-0610*C166 or equal by Fisher or Encore

Description - Faucet assembly shall be all standard construction with 8" centers, 1/2" IPS inlets, built-in check valves, vacuum breaker connection for hose, finger hook, all chrome plated, and provided with a 68" long polished stainless steel hose with hook nozzle, self-closing valve and retaining ring.

Item F31

SIX-BURNER RANGE WITH OVEN AND BACKSHELF BROILER

Make - Montague 136-5 / SB36-HB*C166 or equal by Vulcan, Garland, or Southbend

Size - 36" x 36-5/8" x 36" high to work surface

Rating - 1" rear inlet at 252,000 BTU/Hour

Description - Range shall be all standard construction with three cast iron sections, each containing two individually controlled 30,000 BTU/hour star burners, constant burning pilot burners, removable spillover tray and insulated, porcelain enamelled oven, 26" x 28" x 15" high, complete with throttling thermostatic control, automatic ignition and 100% safety pilot, weight counterbalanced door mounted in self lubricating bearings, two rack positions, and one nickel plated oven rack. Front panel shall be stainless steel; ends and rear enamelled steel. Mount on 6" high adjustable stainless steel legs.

Accessories - Provide a 18" high back guard with stainless steel front and ends for receiving mounted broiler, capped manifolds with stainless steel covers on both sides, stainless steel left end panel, stainless steel right end panel, stainless steel back panel. Electronic rangetop pilot ignition and flame failure rangetop safety valves, and electronic oven control. Provide with a mounted SB36-HB salamander broiler, all standard construction per the manufacturers specification, and with stainless steel back panel, stainless steel bottom, and gas interconnect with range.

Item F32

HEAVY DUTY UNDERFIRED BROILER

Make - Montague UFS-30R*C166 or equal by Vulcan, Garland, or Southbend

Size - 30" x 32-7/8" x 36" high to work surface; 41-3/8" high overall 24" x 24" broiling area

Rating - 3/4" gas inlet at 95,000 BTU/hour

Description - Broiler shall be all standard construction with stainless steel front, top rail and trim, enamelled sides, and a steel frame with cabinet base. Unit shall have five individually controlled stainless steel burners with stainless steel radiants, reversible cast iron top grate with removable sections, two position adjustable angled top grid, full width drip tray and grease trough with removable container. Burners to have constant burning pilots.

Accessories - Mount unit on casters and provide with stainless steel ends and back panel.

Item F33

GRIDDLE RANGE WITH OVEN AND BACKSHELF BROILER

Make - Montague 136-8 / SB36-HB*C166 or equal by Vulcan, Garland, or Southbend

Size - 36" x 36-5/8" x 36" high to work surface

Rating - 1-1/4" manifold inlet at 100,000 BTU/Hour

Rating - 3/4" rear inlet at 100 BTU/Hour

Description - Range shall be all standard construction with precision ground steel fry top 36" x 28" x 3/4" thick with 4" high welded splash on rear and sides, heated by four thermostatically controlled cast iron burners rated at 15,000 BTU/hour, constant burning pilot burners, removable spillover tray with tall receiver, and insulated, porcelain enamelled oven, 26" x 28" x 15" high, complete with throttling thermostatic control, automatic ignition and 100% safety pilot, weight counterbalanced door mounted in self lubricating bearings, two rack positions, and one nickel plated oven rack. Front panel shall be stainless steel; ends and rear enamelled steel. Mount on 6" high adjustable stainless steel legs.

Accessories - Provide a 18" high back guard with stainless steel front and ends for receiving mounted broiler, capped manifolds with stainless steel covers on both sides, stainless steel left end panel, stainless steel right end panel, stainless steel back panel. Electronic rangetop pilot ignition and flame failure rangetop safety valves, and electronic oven control. Provide with a mounted SB36-HB salamander broiler, all standard construction per the manufacturers specification, and with stainless steel back panel, stainless steel bottom, and gas interconnect with range.

Item F34

FRYER ASSEMBLY WITH FILTER DRAWER

Make - Pitco 2-SSH55-SSTC-S/FD*C166

Size - 31-1/4" x 34-3/8" x 34" high to rim

Power - 3.4 amps - 120/60/1 - cord and plug (controls)

7 amps - 120/1 - cord and plug (for filter system)

Rating - 1" gas inlet at 160,000 BTU/Hour

Description - Fryers shall be factory assembled into a single unit of all standard construction and shall be complete with stainless steel body, splash, top and fryer pots, blower free atmospheric burner system, self cleaning thermostatically controlled burners and solid state fail-safe thermostats. Mount unit on 10" adjustable legs

Accessories - Provide assembly with four twin sized baskets. Provide unit with a built-in filter drawer system, flush hose and provide 100 filter bags. Mount on legs with casters and provide with stainless steel back, and 12" reversible splash guard.

Item F35

FLOOR PAN AND GRATE

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item F36

No item

Item F37

No item

Item F38

CHEF'S COUNTER ASSEMBLY WITH DOUBLE OVERSHELF AND LOAD CENTER

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida, or Randell Custom

Size - 21 ft., 6 in. by 54 in. by 34 in. high to top of pick-up side cabinet, 36 in. high to prep side; full length by 23 in. deep double overshef per elevation with shelves mounted at 56 in. and 68 in. above floor; 15 in. by 18 in. by 10 in. deep integral work sink basin; 10 in. by 14 in. by 10 in. deep integral sink basin

Power - 200 amps circuit - 120/208/3 supply to mounted load center. Panel to be mounted in an accessible location. Panel to be provided with circuit breakers and main disconnect breaker, pre-wired by the Fabricator in accordance with local, national and UL Codes to all counter assembly mounted receptacles and equipment connections.

Description - Pick-up side shall be all standard construction with 14 gauge stainless steel top and basin and 2-5/8 in. nosing, bottom and partial intermediate shelves per elevation and body to be 22 gauge stainless steel with marine edge at front, integrally welded channel bracing, breaker panel located on the end per plan behind hinged access door. Provide opening in shelf below breaker panel for electrical connection from below. Provide 6 in. high stainless steel splash at sides and rear of basin with front edges of ends angled back. Provide top mount drop-in soap dispenser at hand sink, apron at sink with front mount C-fold paper towel dispenser. Prepare partial cabinet section for built-in drawer warmer (Item F50), Mount on 6 in. high stainless steel with adjustable bullet feet. Provide neatly punched holes in the bottom shelf for passage of drain lines from the dipper well, hot well, and soup wells. Legs mounted to full length channel frame assembly integrally welded to bottom of body assembly. Provide cut-outs in top to accommodate dipper well (F47), soup wells (Item F51) and hot well, (Item F52), and front apron at wells for mounting switches and controls. Provide two interior cabinet mounted GFCI receptacles for the soup wells and a NEMA 6-15R receptacle for the hot well, pre-wired back to the main breaker panel.

Sink section (Item F39) shall be all standard construction with 14 gauge stainless steel top and basin, 22 gauge body with bottom shelf, and finished stainless steel exterior end. Legs to be 6 in. high stainless steel with adjustable bullet foot mounted to full length channel frame assembly which is integrally welded to bottom of body assembly. Provide cut-out in bottom shelf with turned down edge and corners welded at floor sink location. Drain cutout must be large enough to access and remove floor sink grates for cleaning and provided with stainless steel cover with slot for drain pipe.

Prep top refrigerator (Item F40) shall be all standard construction with 14 gauge stainless steel top and raised coldwall pan, 18 gauge stainless steel front and exposed end, coved stainless steel interior rear and bottom, and vacuum formed thermoplastic interior ends and jam, two pairs of refrigerated drawers with each drawer capable of accommodating two 12 in. by 20 in. pans, and magnetic drawer gaskets. Top openings shall be complete with anti-freezing pan assist capable of holding eighteen 1/6 size pans and hinged slide back removable cover. Unit shall be insulated with foamed in place polyurethane and provided with self-contained air-cooled refrigeration systems with expansion valve, thermostatic controls and hot gas condensate evaporator, forced air coil and independent pan control, and interior thermometer. Mount refrigeration compartment at right end and pre-wire back to the main breaker panel.

Hot well section (Item F41) shall be all standard construction with 14 gauge top, three individually and thermostatically controlled electrically heated wells, controls for 1100 watt elements mounted on front of 8 in. deep removable stainless steel plate shelf. Connections to heating elements to be located outside of heated zone to avoid wiring deterioration. Individual wells wired to common junction box and with apron mounted disconnect switch, and pre-wired back to main breaker panel. Provide with deck mount fill faucet. Provide unit with 6 in. high adjustable legs.

Prep top refrigerator (Item F42) shall be all standard construction with 14 gauge stainless steel top and raised coldwall pan, 18 gauge stainless steel front and exposed end, coved stainless steel interior rear and bottom, and vacuum formed thermoplastic interior ends and jam, a pair of refrigerated drawers with each drawer capable of accommodating two 12 in. by 20 in. pans, and magnetic drawer gaskets.

Top openings shall be complete with anti-freezing pan assist capable of holding twelve 1/6 size pans and hinged slide back removable cover. Unit shall be insulated with foamed in place polyurethane and provided with self-contained air-cooled refrigeration systems with expansion valve, thermostatic controls and hot gas condensate evaporator, forced air coil and independent pan control, and interior thermometer. Mount refrigeration compartment at left end and pre-wire back to the main breaker panel.

Work top freezer (Item F43) shall be all standard construction with 14 gauge stainless steel top, 18 gauge stainless steel front and exposed end, coved stainless steel interior rear and bottom, and vacuum formed thermoplastic interior ends and jam, two pairs of refrigerated drawers with each drawer capable of accommodating two 12 in. by 20 in. pans, and magnetic drawer gaskets, and drawer heaters with backup elements to prevent gasket freezing. Unit shall be insulated with foamed in place polyurethane and provided with self-contained air-cooled refrigeration systems with expansion valve, thermostatic controls, automatic defrost, condensate evaporator, and interior thermometer. Mount refrigeration compartment at right end and pre-wire back to the main breaker panel.

Overshelf shall be all standard 16 gauge construction, channel reinforced, edges formed in turndown, made to accept heat lamp assemblies below top shelf, and provide with three point of sale printer mounting shelves, each with enclosed 120/60/1 GFCI receptacle and data receptacle with work boxes and stainless steel cover plates. All receptacles shall be mounted below the shelf by the fabricator and pre-wired through uprights back to the load center. Data receptacles shall be pre-wired back to hub mounted in the load center compartment. Leg assembly to consist of square tubular stainless steel uprights and mounted to countertop and raised rails, and provided with chase at one end per elevation for mounting remote heat lamp controls.

Accessories - Deck mounted faucet set and 2 in. lever waste outlet at work sink. T&S Brass B-0325-WH4 deck mount faucet and strainer type drain outlet at hand sink. Provide a drop-in type soap pump adjacent to hand sink. Provide a B-526 drop-in style C-fold paper towel dispenser for mounting in hand sink counter apron. Provide overshelf with three Hatco GRAH-60D heat lamps (Item F45), all with remote infinite controls. Provide refrigerators with optional five year compressor warranty, and Richlite cutting boards. Provide raised rail sections with adapter bars and full complement of stainless steel 1/6 size pans. Provide hot well section with a single pantry fill faucet and a Richlite cutting board. Wells shall be provided with drain outlets factory manifolded with 1 in. diameter line and a gate valve left ready for extending to the floor drain by the Plumbing Contractor.

Item F39
WORK SINK
Specified as part of Item F38

Item F40
PREP TOP REFRIGERATOR
Specified as part of Item F38

Item F41
STEAM TABLE, THREE-WELL
Specified as part of Item F38

Item F42
PREP TOP REFRIGERATOR
Specified as part of Item F38

Item F43
WORK TOP FREEZER
Specified as part of Item F38

Item F44
HAND SINK
Specified as part of Item F38

Item F45
HEAT LAMP, SHELF MOUNT
Quantity - Three
Make - Hatco GRAH-60D

Item F46
PIZZA OVEN
Make - TurboChef FRE-9600

Item F47
DIPPERWELL AND FAUCET
Make - Krowne 16-150 & 16-151L

Item F48
POS PRINTER
Quantity - Three
No work in this Section. Item to be provided by Owner.

Item F49
POP-UP TOASTER
Quantity - Two
Make - Hatco TPT-208

Item F50
WARMER, DRAWER TYPE
Make - Wells RW-26HD

Item F51
SOUP WELL, DROP-IN
Quantity - Two
Make - Wells SS-10TDUCI-120, or equal by Hatco or Atlo-Shaam
Power - 825 watts each - 120/60/1 - cord and plug
Description - Wells shall be all standard construction, fully insulated, built-in circular type with Wellslok and sealing gasket, one-piece, coved corner stainless steel interior, galvanized steel element outer wrap, and provided with a cord and plug, drain outlet, thermostatic controls with off position, power "on" indicator light, and mounting hardware. Mount the controls per details. Manifold pairs of wells into a single 3/4 in. copper drain line fitted with quarter turn ball type drain valve, clean-out, and leave ready for connection by Plumber.
Accessories - Provide with inserts and hinged lids.

Item F52
HOT FOOD WELL, DROP-IN
Make - Wells MOD100TD

Item F53
ICE CREAM DIPPING CABINET
Make - Master-Bilt DC-4D-SSC
Size - 30-5/8" x 30-1/8" x 34-1/8" high
Capacity - 7.6 cubic feet
Power - 1/4 HP - 120/60/1 - cord and plug
Description - Ice cream chest shall be all standard construction with baked white enamel exterior and stainless steel interior. The operating temperature range 10° F to minus 10° F. Insulated with 2-1/4" of urethane insulation, self-contained thermostatically controlled air cooled refrigeration system using R-134A refrigerant, condensate evaporator, stainless steel lids hinged with handles.
Accessories - Mount unit on casters and provide standard five year compressor warranty.

Item F54
No item

Item F55
No item

Item F56
ADA COMPLIANT HAND SINK
Make - Advance 7-PS-25 modified or equal by IMC Teddy or Krowne
Size - 20 in. by 24 in. by 13 in. high overall, 14 in. by 16 in. by 5 in. deep sink bowl
Description - Unit shall be all standard stainless steel construction with wall mounting bracket. Mount on wall with rim at 34 in. above floor. Modify faucet holes to be two holes spaced 8 in. apart on center. Delete standard faucet.
Accessories - Deck mounted soap dispenser, 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap. Provide stainless steel welded splash on right end.

Item F56a
FAUCET
Make - T&S Brass B-0322-04 modified or equal by Fisher or Encore
Description - Unit shall be all standard construction with deck mounted mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with B-0199-02F-12 aerator tip in lieu of the standard.

Item F57
WASTE BIN
No work in this Section. Item to be provided by Owner.

Item F58
WALL SHELF
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item F59

PREP TABLE WITH SINKS

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item F60

WASTE BARREL

Quantity - Two

No work in this Section. Item to be provided by Owner.

Item G01

CAFE COUNTER

Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item G02

WASTE BIN

Make - Rubbermaid FG295700GRAY

Item G03

PAPER TOWEL DISPENSER, DROP-IN

Make - Bobrick B-526

Item G04

UNDERMOUNT HAND SINK WITH FAUCET AND SOAP DISPENSER

Make - Advance 1014B-05

Item G05

COFFEE BREWER

No work in this Section. Item to be provided and installed by Owner's Vendor.

Item G06

PRE-RINSE UNIT WITH ADD-ON FAUCET

Make - T&S Brass MPJ-8CLN-08-CR

Item G07

UNDERMOUNT WORK SINK

Make - Advance 1620A-10

Item G08

HOT WATER DISPENSER

Make - Bunn H5X Element SST

Item G09

ICE DISPENSER, MANUAL FILL

Make - Servend M-90

Item G10

TRASH BIN

No work in this Section. Item to be provided by Owner.

Item G11
ESPRESSO MACHINE
No work in this Section. Item to be provided by Owner's Vendor.

Item G12
REFRIGERATOR, UNDERCOUNTER
Make - Beverage-Air UCR27AHC

Item G13
CASHIER TERMINAL
No work in this Section. Item to be provided by Owner.

Item G14
REFRIGERATED SERVICE CASE
Make - Structural Concepts NR4847RSV

Item G15
NON-REFRIGERATED SERVICE CASE
Make - Structural Concepts NR4847DSV

Item G16
No item

Item G17
No item

Item G18
REFRIGERATOR, REACH-IN
Make - Victory RSA-1D-S1-HD-HC

Item G19
WAIT STATION COUNTER
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item G20
WALL CABINETS
Quantity - Three
Make - Fabricate per General Construction this Section by SML Stainless Steel Group, LTI Low Temp Industries, or Custom Stainless of Miami Florida

Item G21
WARMER, DRAWER TYPE
Make - Wells RW-26HD

Item G22
CASHIER TERMINAL
No work in this Section. Item to be provided by Owner.

Item H01

ICE MAKER WITH BIN

Quantity - Two

Make - Manitowoc IDT0300A/D-400

Item H02

WALK-IN FREEZER

Make - American Panel or equal by Bally or Thermo-Kool

Size - 7'-1" x 7'-1" x 7'-10" high minimum inside dimensions

Power - 1.3 KW - 120/60/1 to light fixtures, temperature monitor/alarm, door defrost heater strip, and pressure relief port

Installation - The walk-in freezer shall be complete with reinforced insulated floor installed directly on the sub floor prepared by the General Contractor prior to installation of the finished floor and sealed thereto. The freezer shall be provided with finished interior ramp. The ramp edge shall be held up the thickness of the adjacent finished floor and setting bed to provide a flush transition. The finished floor and setting bed shall be furnished and installed by the General Contractor, and shall have coved joints at all exposed exterior walls, turned up a minimum of 4".

Construction - All standard construction per the manufacturer, modified to meet the specific following points:

- Walls to be 4" thick with CFC free urethane foam insulation, UL Class 1 rated
- Cam type locking devices
- 34" x 80" minimum door clearance
- Polished hardware (hinges and latch to match)
- Three hinges on doors (to include one Kason 1248 spring assist hinge per door)
- Leveraged pull handle (mechanical advantage type, Kason 1236 or equal)
- Quarter turn inside safety release lever handle mechanism (not screw type)
- Prewired door sections with heater wires and light fixtures and switches
- Kason 1806 LED light fixtures or Kason 1808 LED light fixtures
- Dial type thermometers at doors
- Model IC+ (with dry contacts) temperature and HACCP monitoring system at doors. Cooler and freezer alarms to interconnect with access control system for alert monitoring. Provide each system with a pair of 22 gauge low voltage wires. Wires shall be installed by the Controls Contractor. Wires shall run from the dry contacts to the access control panel. Kitchen Equipment Contractor to verify length prior to purchasing. To avoid false triggering, provide a shielded two-conductor cable with the shield connected to the receiving equipment.
- NSF construction throughout
- Interior and exterior faces of doors and exposed exterior walls shall be provided with aluminum diamond tread plate protective material to a height of 48" above finished floor. Hold diamond plating up 6" from the finish floor to accommodate the coved base.

Minimum materials - Interior and exterior wall surfaces shall be clad with .038" pebble finished aluminum. The ceiling shall be finished in white polyester over 24 gauge galvanized steel. Interior floor and ramp shall be 16 gauge diamond embossed aluminum over 3/4" thick marine plywood and insulation with a total thickness not to exceed 4".

Accessories - Freezer shall be provided with an electrically heated pressure relief port. Door shall be provided with a heated vision panel, 14-1/2" x 23" constructed of three panels of tempered unbreakable glass, electrically heated, with sealed air spaces between. Provide two total extra Kason 1806 LED OR Kason 1808 LED light fixtures for mounting in the rooms and deliver to Electrical Contractor for field installation.

Guarantee - The walk-in refrigerated room panels shall be guaranteed for a period of ten (10) years from the date of approved installation for defects in materials and workmanship when subjected to normal use and service; remainder of rooms for one year.

Item H03a
COOLER REMOTE CONDENSING UNIT
Make - Heatcraft, Bohn, Larkin, Climate Control, Chandler

Item H03b
COOLER EVAPORATOR COIL
Make - Heatcraft, Bohn, Larkin, Climate Control, Chandler

Item H03c
FREEZER REMOTE CONDENSING UNIT
Make - Heatcraft, Bohn, Larkin, Climate Control, Chandler

Item H03d
FREEZER EVAPORATOR COIL
Make - Heatcraft, Bohn, Larkin, Climate Control, Chandler

PART 3 - EXECUTION

3.1 SANITATION REQUIREMENTS

- A. Equipment specified herein shall be fabricated to conform to the "Food Service Equipment Standards" of the National Sanitation Foundation prepared by the Committee on Food Service Standards, and published by the National Sanitation Foundation, Ann Arbor, Michigan. Any differences of opinion on sanitation will be referred to the State Department of Health for a ruling.
- B. Equipment shall be installed in accordance with the manufacturer's instructions and the best practices of the food service industry, with careful attention to eliminating all cracks, crevices and concealed spaces in wet areas that would be difficult to clean or keep free of vermin and soil.

3.2 EXAMINATION AND ACCEPTANCE

- A. Determine whether the General Contractor will furnish and provide temporary power and light, openings and storage space to permit scheduled delivery of equipment. Verify water pressure and provide necessary reducing valves.
- B. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of specified work will be construed as acceptance of space conditions.
- C. Obtain and verify all measurements and conditions on the job, and assume responsibility in respect to same.
- D. Inspect flooring and raised concrete bases, wall finishes, painting, ceiling installation and all related work for readiness to commence installation of foodservice equipment. Verify the existence of required mechanical and electrical rough-ins.

3.3 CLEANING UP

- A. Debris and surplus materials resulting from installation work shall be removed promptly as work progresses, to a location indicated by the General Contractor.
- B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.

3.4 DEMONSTRATION AND OPERATING INSTRUCTIONS

- A. Before final acceptance, and by appointment with the Owner and his representatives, completely demonstrate with power, the correct operation of each new item of operating equipment.
- B. Prior to the demonstration, turn on all mechanical and electrical foodservice equipment. Test for leaks, poor connections, and inadequate or faulty performance and correct if necessary. Adjust for proper operation. Thermostatically controlled equipment and equipment with automatic features shall be operated for a sufficient length of time with proper testing equipment to prove controls are functioning as intended. Recalibrate thermostats if necessary.
- C. Provide Architect or Consultant with a loose leaf bound manual of operating data and maintenance instructions containing complete description, wiring diagrams, operating data, maintenance requirements and other information pertaining to the proper operation and upkeep of the various items of electrical or mechanical equipment. Include names, addresses and telephone numbers of authorized service agencies for all items. Arrange all material in alphabetical order by Manufacturer. Provide with a list of equipment to include make, model, and serial number where applicable. Book shall be turned over to Owner after review and approval.
- D. Submit guarantees and warranties to the Architect in the above specified manual with all warranty cards completed and becoming effective at the time the equipment was satisfactorily demonstrated.

3.5 PROTECTION OF WORK

- A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.
- B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.
- C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by the Architect.

3.6 EXISTING EQUIPMENT

- A. Foodservice equipment that is scheduled for reuse shall be removed and stored in a location provided by the General Contractor on site. This Contractor shall provide transportation of equipment.
- B. Verify and document the operating condition of all relocated equipment prior to its being disconnected. Document the condition of the equipment to note any dents, scratches, broken

components or other damage prior to placing it in storage. Protect equipment during transport and storage, and assume responsibility for its re-installation in the condition viewed prior to removal. Transport and install the equipment in accordance with Item Specifications.

- C. This Contractor is not responsible for refurbishing equipment noted as "Existing" on plans or specifications unless work is specifically called for in the Item Specifications.
- D. Disconnecting and reconnecting of services to "Existing" equipment shall be performed by related trades.
- E. This Contractor shall restart all existing equipment following its reconnection to building services and verify its correct operation as viewed prior to removal.
- F. This Contractor shall not provide a warranty or guarantee on "Existing" equipment. In the case of a new component being provided by this Contractor for an "Existing" piece of equipment, the component shall be warranted or guaranteed as specified hereinbefore.
- G. Foodservice equipment that is scheduled for reuse must be verified for NSF certification.
- H. Foodservice equipment that is scheduled for reuse and that requires plumbing and/or gas fitting work performed in the Commonwealth of Massachusetts, must be Board of State Examiners of Plumbers and Gas Fitters approved.

END OF SECTION

SECTION 114500
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. Related Sections:
 - 1. Section 123000 – Manufactured Casework
 - 2. Sections within Division 22 and 23 – Plumbing and HVAC for service fixtures, service waste lines, connections, and vents.
 - 3. Sections within Division 26 – Electrical

1.2 SUMMARY

- A. Section Includes:
 - 1. Cooking appliances.
 - 2. Refrigeration appliances.
 - 3. Clothes washers and dryers

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 - 3. Show left-handed and right-handed appliance door opening as indicated on drawings.
- B. LEED Submittals:
 - 1. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED V4 Green Building Rating System, of the US Green Building Council. Refer to 018113.23 SUSTAINABLE DESIGN REQUIREMENTS - LEED FOR SCHOOLS for certification level and certification requirements.
 - 2. Product Data for: For appliances indicated, documentation that products are ENERGY STAR rated.
- C. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Manufacturer.

- B. Product Certificates: For each type of appliance.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturers' special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintains, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- B. Certification Labels: Provide residential appliances which complies with standards and bears certification labels as follows:
 - 1. Energy ratings: Provide energy guide labels with energy cost analysis (annual operating costs) and energy information required by Federal Trade Commission.
 - 2. UL Standards: Provide residential equipment with UL labels.

1.7 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.2 COOKTOP

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. General Electric Company (GE Appliances).
 - 2. KitchenAid: a division of Whirlpool Corporation.
 - 3. Summit Appliance
 - 4. Bosch Appliances
 - 5. Samsung Appliances

B. Cooktop (CT-1): Basis of design, General Electric, "JP5030SJSS

1. Type: Four radiant smooth top
2. Dimensions:
 - a. Width: 30 inches
 - b. Depth: 21 inches
 - c. Height: 5-1/2 inches
3. Cook burner type: Four elements, (2) 7" elements, and (1) 6" elements, (1) 9"/6" Power Boil element.
4. Cooktop Surface: Black ceramic glass
5. Controls: Electronic touch, front center location.
6. Features:
 - a. ADA Compliant
 - b. Heating element "ON" indicator light
 - c. Control safety lock.
7. Appliance Color/Finish: Stainless steel on black.

2.3 EXHAUST HOOD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air King Ventilation Products
2. Broan-NuTone, LLC
3. KitchenAid: A division of Whirlpool Corporation

B. Ductless Exhaust Hood with Charcoal Filter (EH-1): Basis of design – Air King Ventilation Products, "ES368ADA"

1. Dimensions:
 - a. Width: 36 inches
 - b. Depth: 20 inches
 - c. Height: 7-1/2 inches
2. Motor/Blade: Fully enclosed PSC 4 pole motor. 2 Speed, thermally protected, permanently lubricated. Polymetric axial fan blade 9-1/8" diameter with 7 paddles.
3. Controls: Cabinet mounted dual rocker switch with plate, white finish.
4. Lighting: Include 8 Watt GU24 base LED lamp and 4 Watt night light with a bulb.
5. Ductless: Removable front vent.
6. Filters: Charcoal Filter; CF-01
7. Feature: ADA Compliant.
8. Appliance Finish: Stainless Steel.
9. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.

2.4 MICROWAVE OVENS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. General Electric Company (GE Appliances).
2. KitchenAid: a division of Whirlpool Corporation.
3. LG Electronics.
4. Samsung.

B. Microwave Oven (MW-1): Basis of design, GE Appliances, "PEM31SFSS"

1. Type: Conventional.
2. Dimensions:
 - a. Width: 24 inches.
 - b. Depth: 12-7/8 inches.
 - c. Height: 12-1/8 inches.
3. Capacity: 1.1 cu. ft.
4. Features:
 - a. ADA Compliant
 - b. Child safety lock
5. Controls: Electronic touch controls and timer display.
6. Material: Stainless steel.

2.5 REFRIGERATOR/FREEZERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. General Electric Company (GE Appliances).
2. Summit Appliance.
3. Samsung.

B. Refrigerator/Freezer (REF-1): Basis of design, GE Appliances model "GTE21GSHSS"

1. Type: Two door, with top freezer
2. Dimensions:
 - a. Width: 32-3/4 inches
 - b. Depth: 34-1/2 inches.
 - c. Height: 66-3/8 inches.
3. Storage Capacity:
 - a. Total capacity: 21.9 cu ft
 - b. Fresh food capacity: 15.25 cu ft
 - c. Freezer capacity: 6.68 cu ft
4. Features:
 - a. ADA Compliant
 - b. LED lighting
5. Freezer Features: freezer compartment(s) with door(s).
 - a. Defrost type: Frost free
 - b. Temperature management: Air tower in freezer
6. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
7. Appliance Color/Finish: Stainless Steel

- C. Refrigerator/Freezer (REF-1A): Basis of design, GE Appliances model "GIE21GSHSS"
1. Type: Two door, with top freezer
 2. Dimensions:
 - a. Width: 32-3/4 inches
 - b. Depth: 34-1/2 inches.
 - c. Height: 66-3/8 inches.
 3. Storage Capacity:
 - a. Total capacity: 21.9 cu ft
 - b. Fresh food capacity: 15.25 cu ft
 - c. Freezer capacity: 6.68 cu ft
 4. Features:
 - a. ADA Compliant
 - b. LED lighting
 - c. Factory installed ice maker
 5. Freezer Features: freezer compartment(s) with door(s).
 - a. Defrost type: Frost free
 - b. Temperature management: Air tower in freezer
 6. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
 7. Appliance Color/Finish: Up to two finishes shall be selected.
- D. Undercounter Refrigerator (REF-2): Basis of design, Summit Appliance model "CT66LWBISSHVADA"
1. Type: Single door with inner door for freezer
 2. Dimensions:
 - a. Width: 23.63 inches
 - b. Depth: 23.5 inches.
 - c. Height: 32 inches.
 3. Storage Capacity:
 - a. Total capacity: 5.1 cu ft
 4. Features:
 - a. ADA Compliant
 - b. Factory installed lock
 - c. Dual evaporator system
 5. Freezer Features: freezer compartment(s) with door(s).
 - a. Defrost type: Automatic for fresh food and manual defrost operation for freezer compartment.
 6. Appliance Color/Finish: Stainless steel.

2.6 ICE MACHINE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering product that may be incorporated into the Work include, but are not limited to, the following:
1. Summit Appliance
 2. Ice-O-Matic
 3. Manitowoc
 4. True
- B. Ice Maker (IM-1); Basis of design, Summit Appliances "BIM470SADA"
1. Type: Water cooled with built-in pump
 2. Dimensions: Ice Machine
 - a. Width: 14-1/2inches
 - b. Depth: 23-1/4inches.
 - c. Height: 32-3/8 inches.
 3. Features:
 - a. ADA compliant
 - b. Internal pump
 4. Ice Shape: Cube
 5. 24 Hour Ice Production: 50 lbs
 6. Ice Storage Capacity: 25 lbs
 7. Defrost Type: Automatic
 8. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
 9. Appliance Color/Finish: Stainless steel.

2.7 DISHWASHERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Electrolux Home Products (Frigidaire).
 2. General Electric Company (GE Appliances).
 3. KitchenAid; a division of Whirlpool Corporation.
 4. LG Electronics.
 5. Whirlpool Corporation.
- B. Dishwasher (DW-1); Basis of design, GE Appliance model "GDT225SSLSS"
1. Type: Built-in undercounter.
 2. Dimensions:
 - a. Width: 24 inches.
 - b. Depth: 24 inches.
 - c. Height: 32-11/32 inches.
 3. Sound Level: Maximum 57 dBA

4. Quiet Features: Door insulation, quiet power motor, tub collar trim and tub insulation.
5. Tub and Door Liner: Stainless Steel
6. Rack System: One piece molded silverware basket with 1 cell cover, 2 plastic utility shelves with stem safe ball tipped tines.
7. Controls: 3 touchpads, fully integrated electronic top controls
8. Features:
 - a. ADA Compliant.
 - b. "Sanitized" Light Cycle Progress and "Clean" indicators.
 - c. 5-Level, Towerless wash system
 - d. 2-Stage self-cleaning filtration with extra fine filter.
 - e. Delay-wash option.
9. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
10. Appliance Color/Finish: Stainless steel.

2.8 CLOTHES WASHERS AND DRYERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Bosch – BSH Home Appliances Corporation
 2. General Electric Company (GE Appliances).
 3. LG Electronics.
 4. Maytag; a division of Whirlpool Corporation.
- B. Clothes Washer (W-1): Complying with AHAM HLW-1. Basis of design, GE Appliance model, "GFW550SPNDG"
 1. Type: Freestanding, front-loading unit.
 2. Drum: Stainless steel
 3. Dimensions:
 - a. Width: 28 inches.
 - a. Depth: 32 inches.
 - b. Height: 40 inches.
 4. Capacity: 4.8 cu. ft.
 5. Include power cord.
 6. Controls: Electronic touch controls and rotary-dial controls with LEDs
 7. Motor: Manufacturer's standard with built-in overload protector.
 8. Wash Cycles: Bulky/bedding, cold wash, delicates, normal, quick-wash, rinse& spin, sanitize, self-clean and whites.
 9. Door Style: Reversible, Chrome outer ring with chrome vent, see-through glass with tinted door.
 10. Features:
 - a. ADA compliant. Requires bottom of basket opening between 15" – 36" above floor finish.
 - b. Control lock.
 - c. Antimicrobial technology
 11. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.

12. Appliance Finish: Diamond Gray

- C. Clothes Dryer (D-1): Complying with AHAM HLD-1. Basis of design, GE Appliance model "GFD55ESPNDG"
1. Type: Freestanding, frontloading unit.
 2. Drum: Aluminized Alloy
 3. Dimensions:
 - a. Width: 28 inches.
 - b. Depth: 32 inches.
 - c. Height: 40 inches.
 4. Controls: Electronic touch controls and rotary-dial controls with LEDs.
 5. Capacity: 7.8 cu. ft.
 6. Include power cord.
 7. Features:
 - a. ADA compliant. Requires bottom of basket opening between 15" – 36" above floor finish.
 - b. Anti-vibration circular side walls
 - c. Five temperature settings.
 - d. Sanitize cycle.
 - e. Dryer vent alert
 8. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
 9. Appliance Finish: Diamond Gray.

2.9 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Beginning of installation means acceptance of existing site conditions.

3.2 PHASED INSTALLATION

- A. The Contractor shall procure and install appliances noted as Cookstoves (CS-1), Freezers (FRE-1), two Refrigerators (REF-1A), one Washer (W-1), and one Dryer (D-1) at temporary Culinary Classrooms during Phase-1 in the rooms as indicated on the Drawings. The Contractor shall un-install these appliances and re-install them at their final location in the Culinary Classrooms in Phase 2.

3.3 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Refer to drawings for left or right hinged door opening installation.
- C. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- D. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- E. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
- F. After installation is completed, ensure that operating parts work freely. Adjust hardware and catches. Repair or replace damaged parts, dents, buckles, abrasions, or other damage affecting the appearance or serviceability.

3.4 FIELD QUALITY CONTROL

- A. An appliance will be considered defective if it does not pass tests and inspections.
- B. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean and polish glass, plastic, hardware and accessories, fixtures and fittings.
- B. Remove protective coverings from prefinished work just prior to Owner's acceptance of facility.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION

SECTION 115210

PROJECTION SCREENS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Electrically-operated projection screens.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 095100 - ACOUSTICAL CEILINGS for coordination with ceiling-recessed units.
 - 2. Division 26 - ELECTRICAL for electrical service and connections including metal device boxes for switches and conduit, where required, for low-voltage control wiring.

1.3 SUBMITTALS

- A. Product Data: For each type of screen indicated.
- B. Shop Drawings: Show layouts and types of projection screens. Include the following:
 - 1. Location of screen centerline relative to ends of screen case.
 - 2. Location of wiring connections.
 - 3. Location of seams in viewing surfaces.
 - 4. Drop length.
 - 5. Connections to supporting structure for pendant- and recess-mounted screens.
 - 6. Anchorage details.
 - 7. Details of juncture of exposed surfaces with adjacent finishes.
 - 8. Frame details.
 - 9. Accessories.
 - 10. Wiring Diagrams: For electrically operated units.
- C. Maintenance Data: For projection screens to include in maintenance manuals.

PROJECTION SCREENS

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver projection screens until building is enclosed and other construction within spaces where screens will be installed is substantially complete and ready for screen installation.
- B. Store rear-projection screens in manufacturer's protective packaging and according to manufacturer's written instructions.

1.6 COORDINATION

- A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling framing, light fixtures, HVAC equipment, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Bretford Manufacturing, Inc.
 - 2. Da-Lite Screen Co., Inc
 - 3. Draper Inc.
 - 4. Stewart Filmscreen.

2.2 FRONT-PROJECTION SCREENS

- A. Electrically Operated Screens: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Line Voltage Control: Remote, 3-position control switch installed in recessed metal device box with flush cover plate matching other electrical device cover plates in room where switch is installed.
 - 2. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
 - 3. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- diameter metal rod with ends of rod protected by plastic caps.

- a. Roller for end-mounted motor supported by self-aligning bearings in brackets.
 - b. Roller for motor in roller supported by vibration- and noise-absorbing supports.
- B. Recessed, Electrically Operated Screens with Automatic Ceiling Closure: Motor in roller units designed and fabricated for recessed installation in ceiling; with bottom of case composed of two panels fully enclosing screen, motor, and wiring, one panel hinged and designed to open and close automatically when screen is lowered and fully raised, the other removable or openable for access to interior of case.
 - 1. Provide screen case constructed to be installed with underside flush with ceiling.
 - 2. Prime paint surfaces of screen case that will be exposed to view in the finished work.
- C. Screen Material and Viewing Surface:
 - 1. Matte-White Viewing Surface: Peak gain of 0.9 to 1.0, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.
 - 2. Mildew Resistance: Rating of 0 or 1 when tested according to ASTM G 21.
 - 3. Flame Resistance: Passes NFPA 701.
 - 4. Seamless Construction: Provide screens, in sizes indicated, without seams.
 - 5. Edge Treatment: Black masking borders.
 - 6. Provide extra drop length of dimension indicated to comply with the following requirements for fabric color and location of drop length:
 - 7. Size of Viewing Surface: As indicated on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install projection screens at locations indicated to comply with screen manufacturer's written instructions.
- B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
 - 1. Install low-voltage controls according to NFPA 70 and manufacturer's written instructions.
 - a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
 - 2. Test electrically operated units to verify that screen controls, limit switches, closure, and other operating components are in optimum functioning condition.
 - 3. Test manually operated units to verify that screen operating components are in optimum functioning condition.

3.2 PROTECTING AND CLEANING

- A. After installation, protect projection screens from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION

SECTION 11 57 30

COSMETOLOGY EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. Furnish cosmetology equipment listed in this Specification and/or shown on the Equipment Drawing. Include delivery to the building, unpacking, setting in place and attachment to structure, as required for complete installation.
- B. Remove all debris, dirt and rubbish accumulated as a result of this installation and leave the premises clean and ready for use.
- C. Verify and confirm all building dimensions relative to equipment to be furnished and installed by taking actual field measurements at the job site prior to equipment fabrication.
- D. Become familiar with job conditions and building measurements to coordinate the planning, design, delivery, and installation of equipment furnished under these specifications, with all other related trades and associated work during the term of this contract.
- E. This Cosmetology Equipment Subcontractor shall supply an installation of equipment that is equal to or exceeding the quality and function described in this minimum requirement Specification and shown on the Drawing.

1.3 SUBMITTALS

- A. Prepare and submit Shop Drawings in accordance with requirements of Division 1 and in the manner described therein.
- B. The Drawings shall be 1/4" scale and shall show the layout of all equipment. 1/2" scale Drawings shall be submitted for all fabricated or shop-made equipment.
- C. The exact location of all connections shall be dimensioned for all equipment and labeled with the necessary information. This Cosmetology Equipment Subcontractor shall obtain and verify all dimensions, measurements and conditions, and shall assume all responsibility in respect to same.
- D. No fabrication, shipment, or installation shall take place until drawings and manufacturer's cuts have been approved and returned to the Cosmetology Equipment Subcontractor.

COSMETOLOGY EQUIPMENT

- D. LEED Submittal – refer to Division 01 Section “LEED v4 BD+C Requirements”
 - 1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
 - 2. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project.
 - 3. LEED Action Plans: Provide preliminary submittals indicating how the following requirements will be met:
 - a. Construction Waste Management in compliance with Division 01 Section “Construction Waste Management.”
 - b. List of proposed materials with recycled content: Manufacturers certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.
 - c. Local/Regional Materials:
 - 1.) Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2.) Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

1.4 SAMPLES

- A. Submit samples of all materials required by the Architect.
- B. Samples shall be prepared and submitted in accordance with requirements of Division 1.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 PERMIT, LAWS, ORDINANCES AND CODES

- A. Comply with laws, ordinances, rules and regulations of all local, state and federal authorities having jurisdiction, the rules and regulations of the National Board of Fire Underwriters and the local electric code.

1.6 OPERATING INSTRUCTIONS AND MAINTENANCE MANUAL

- A. Instruct to the Owner's satisfaction such persons as the Owner designates, in the proper operation and maintenance of the equipment and their parts.
- B. Furnish in accordance with Division 1, operating and maintenance manuals and forward same to the Architect for transmittal to the Owner.
- C. For maintenance purposes, provide shop Drawings, parts lists, Specifications and manufacturer's maintenance bulletins for each piece of equipment.
- D. Provide name, address, and telephone number of the manufacturer's representative and service company for each piece of equipment, so that service or spare parts can be readily obtained.

1.7 GUARANTEE

- A. Attention is directed to provisions of Division 1 regarding guarantees and warranties for work under this Contract.
- B. Manufacturers shall provide their standard guarantees for work under this Section. However, such guarantees shall be in addition to and not in lieu of all other liabilities which manufacturers and the Cosmetology Equipment Subcontractor may have by law or by other provisions of the Contract Documents.
- C. Upon receipt of notice from the Owner of failure of any part of the equipment during the guarantee period, the affected part or parts shall be replaced.
- D. Furnish, before the final payment is made, a written guarantee covering the above requirements.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Certified Wood: Provide a 100 percent of the wood-based materials and products certified in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria.
- B. Low-Emitting Materials, Adhesives and Sealants: Materials used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) must not exceed the following requirements.
 - 1. Adhesives, Sealants, and Sealant Primers: South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
 - 2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.
- C. Low-Emitting Materials, Field-Applied Paints and Coatings: Paints and coatings used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) must not exceed the VOC limits and must not include any of the chemical components limited or restricted by the following standards.
 - 1. Architectural Paints, Coatings and Primers: Green Seal GS-11, Paints, First Edition May 20, 1993. For applications on walls and ceilings.
 - 2. Clear Wood Finishes, Floor Coatings, Stains, and Shellacs: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings, rules in effect on January 1, 2004.
- D. Low-Emitting Materials, Composite Wood, and Agrifiber Products: Composite wood and agrifiber products used inside the exterior weatherproofing system shall contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

PART 2 - ITEMS TO BE FURNISHED AND INSTALLED

CM-03 DUAL SIDED STYLING STATION		TWENTY FOUR (4) REQUIRED
Location:	Cosmetology #B120 (12)	(EQ 2.12)
	Cosmetology #B121 (12)	
Make & Model Cabinet: Collins "MILAN ISLAND-CUSTOM, 2123-48" or equal.		
Dimensions: 48"L x 32"D x 66"H		

Description: Dual-sided salon shall be provided with standard laminate construction. The assembly shall include the following on both sides: A mirror, a 15" wide storage cabinet with drawer, quad electrical mounted on the inside of the storage cabinet, and counter mounted tool holders.

CM-04 SIDE WASH SHAMPOO STATION **TWELVE (12) REQUIRED**

Location: Cosmetology #B120 (6) (EQ 2.12)
Cosmetology #B121 (6)

Make & Model Cabinet: Collins "Cameo Bulkhead, 2201-45" or equal.

Make & Model Shampoo Bowl: Collins "CB80" or equal

Dimensions: 45"L x 10"D x 75"H

Description: Side wash shampoo cabinet configuration shall include 24" bowl mounting surface, Tilt-out clean towel storage, Tilt-out soiled towel hamper, Backsplash, upper storage cabinet with adjustable shelves. The ceramic shampoo bowl shall include 570 faucet, spray hose, vacuum breaker, drain assembly. Bowl dimension: 19"W x 20"D x 10"H

CM-05 DOUBLE MANICURE STATION **TEN (5) REQUIRED**

Location: Cosmetology #B120 (3) (EQ 2.12)
Cosmetology #B121 (2)

Make & Model Cabinet: Collins "Ducted Table for Two, 2265-78" or equal.

Dimensions: 78"L x 20"D x 32"H

Description: Manicure table shall be provided with two (2) knee spaces, built-in exhaust fan; (2) 4" diameter side connection; two padded rests, two slim line LED lights and connections, (2) grommets for lamp cords and (2) duplex outlets with dual USB charging ports. Table shall be provided with three drawers for storage. Top shall be provided with grommets to cover any holes.

Note: Vent shall be wall accessed.

CM-06 PEDICURE STATION **THREE (3) REQUIRED**

Location: Cosmetology #B120 (3) (EQ 2.12)

Make & Model Cabinet: Continuum "Echo LE Spa Edition" or equal.

Dimensions: 62"L x 34.5"D x 54"H (Chair 23", floor to seat)

Description: Pedicure station shall feature following:

Welded steel frame construction and pipe-less magnetic jet system

Fiberglass basin with textured bottom, basin capacity of 5.35 gallons

Commercial-grade massage mechanism, dual client/tech seat controls, USB port.

Compatibility with disposable tub liners.

Seat shall feature arm rests swing up for easy chair access, contoured foot rest, adjustable leg support, reclining back, full shiatsu back massage, and premium ultra-leather.

PART 3 - EXECUTION

3.1 EXAMINATION AND ACCEPTANCE

- A. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of work shall be construed as acceptance of space conditions.

- B. This Cosmetology Equipment Subcontractor shall obtain and verify all measurements and conditions on the job, and shall assume all responsibility in respect to same.

3.2 CLEAN UP

- A. All debris and surplus materials resulting from installation work shall be removed promptly as work progresses by this Cosmetology Equipment Subcontractor, to a location indicated by the General Contractor.
- B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.

3.3 PROTECTION OF WORK

- A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.
- B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the Contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.
- C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by and to the satisfaction of the Architect.

END OF SECTION

SECTION 11 61 00

AUTOMOTIVE EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. Furnish automotive equipment listed in this Specification and/or shown on the Equipment Drawing. Include delivery to the building, unpacking, setting in place and attachment to structure, as required for complete installation.
- B. Remove all debris, dirt and rubbish accumulated as a result of this installation, and leave the premises clean and ready for use.
- C. Verify and confirm all building dimensions relative to equipment to be furnished and installed by taking actual field measurements at the job site prior to equipment fabrication.
- D. Become familiar with job conditions and building measurements to coordinate the planning, design, delivery, and installation of equipment furnished under these specifications, with all other related trades and associated work during the term of this contract.
- E. This Automotive Equipment Subcontractor shall supply an installation of equipment that is equal to or exceeding the quality and function described in this minimum requirement Specification and shown on the Drawing.
- F. Bolt machines securely to floor or workbench where shown on the equipment drawings. Machines shall be properly leveled and provided with vibration pads prior to bolting to floor or workbench. All installation work shall be done in accordance with manufacturer's recommendations.

1.3 RELATED WORK UNDER OTHER SECTIONS

- A. The final electrical connections to machinery controls and plumbing complete with shut-offs and final connection shall be by the Electrical and Plumbing Subcontractors.
- B. Furnishing of all building plumbing, electrical and venting roughing-in within the area of the equipment to accommodate all services called for in the specification or shown on the drawings.

1.4 SUBMITTALS

- A. Prepare and submit Shop Drawings in accordance with requirements of Division 1 and in the manner described therein.
- B. The Drawings shall be 1/4" scale and shall show the layout of all equipment. 1/2" scale Drawings shall be submitted for all fabricated or shop-made equipment. Drawings shall be submitted in one (1) complete package.
- C. The exact location of all connections shall be dimensioned for all equipment and labeled with the necessary information. This Automotive Equipment Subcontractor shall obtain and verify all dimensions, measurements, and conditions, and shall assume all responsibility in respect to same.
- D. No fabrication, shipment, or installation shall take place until drawings and manufacturer's cuts have been approved and returned to the Automotive Equipment Subcontractor.
- E. LEED Submittal – refer to Division 01 Section "LEED v4 BD+C Requirements"
 - 1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
 - 2. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project.
 - 3. LEED Action Plans: Provide preliminary submittals indicating how the following requirements will be met:
 - a. Construction Waste Management in compliance with Division 01 Section "Construction Waste Management."
 - b. List of proposed materials with recycled content: Manufacturers certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.
 - c. Local/Regional Materials:
 - 1.) Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
 - 2.) Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

1.5 SAMPLES

- A. Submit samples of all materials requested by the Architect.
- B. Samples shall be prepared and submitted in accordance with requirements of Division 1.

1.6 PERMITS, LAWS, ORDINANCES AND CODES

- A. Comply with laws, ordinances, rules and regulations of all local, state and federal authorities having jurisdiction, the rules and regulations of the National Board of Fire Underwriters and the local electric code.

1.7 OPERATING INSTRUCTIONS AND MAINTENANCE MANUAL

- A. Instruct to the Owner's satisfaction such persons as the Owner designates, in the proper operation and maintenance of the equipment and their parts.
- B. Furnish in accordance with Division 1, operating and maintenance manuals and forward same to the Architect for transmittal to the Owner.
- C. For maintenance purposes, provide shop Drawings, parts lists, Specifications and manufacturer's maintenance bulletins for each piece of equipment.
- D. Provide name, address and telephone number of the manufacturer's representative and service company for each piece of equipment, so that service or spare parts can be readily obtained.

1.8 GUARANTEE

- A. Attention is directed to provisions of Division 1 regarding guarantees and warranties for work under this Contract.
- B. Manufacturers shall provide their standard guarantees for work under this Section. However, such guarantees shall be in addition to and not in lieu of all other liabilities which manufacturers and the Automotive Equipment Subcontractor may have by law or by other provisions of the Contract Documents.
- C. Upon receipt of notice from the Owner of failure of any part of the equipment during the guarantee period, the affected part or parts shall be replaced.
- D. Furnish, before the final payment is made, a written guarantee covering the above requirements.

PART 2 - PRODUCTS

2.1 SHOP MACHINERY

- A. All machines shall be delivered completely wired with starters having overload protection. Motors 1/2 H.P. or over as specified herein, shall have motor control which consists of low voltage, push-button magnetic control system with three-leg overload protection. All light accessories, where called for, shall be furnished complete with bulbs and wired through motor control to operate when machine is being used. Plugs, where called for, on 120V machines shall be three-prong type, and plugs for 208V, or greater shall be four-prong type. Motors shall be of same manufacturer as the machines or Westinghouse, General Electric, or equal
- B. For purposes of identification of style and level of quality of equipment desired, these specifications refer to Automotive Equipment as currently manufactured by companies listed

herein under Paragraph 2.2. These references are not intended to be restrictive or limiting to competitive makes and models of comparable quality and design. Bidders must submit sufficient illustrative material with their proposal to permit comparisons, for all items included in the proposal.

2.2 ITEMS TO BE FURNISHED AND INSTALLED

<u>AT-01 TWO-POST ABOVE GROUND ASYMMETRICAL LIFT (10,000 LBS.)</u>		<u>EIGHT (8) REQ.</u>
Location:	Auto Technology #D003 (8)	(EQ 2.3)

Make & Model: Rotary Lift #SPOA10; or equal.

Dimensions: 11'-5-1/2"W x 11'-8-1/2"H O.A.

Power: 2 H.P., 208V/60C/1 phase.

Description: Provide two-post above ground asymmetrical lift complete with standard construction, features and accessories, including 10,000 lbs. lifting capacity; electric-hydraulic operation; two (2) full stroke high-pressure cylinders, one (1) in each column; three-position flip-up adapters with built-in truck adapters; patented "Double S" single –piece construction column design that provides a channel for the bearings to travel that maximize the strength of the column; adjustable height options; slider block bearings; overhead padded switch bar; single point lock releases which release the locks at the same time; latches every 4"; arm restraints that allow for easy lift arm positioning; dual controls; third party tested by ETL and certified by ALI to meet strict ANSI standards. The three-stage arm shall increase overall arm sweep and minimum arm reach to precisely lift vehicles that have uni-body construction, visually marked pick-up points on the vehicle; wider vehicle tread width and lower profile; and a short or long wheelbase. The true asymmetrical design allows for easy vehicle entry with columns at rotated 30°. The factory rotated columns allow doors of vehicle to be fully opened while properly positioned on lift. This places the approximate center of gravity of the vehicle in line with the optimum load capability of the column. Lift shall be provided with conventional two-hand operating control, power unit down; and manual release locking system.

Rise:	78-1/4"
Drive-Thru Clearance:	95-1/4"
Floor to Overhead Switch:	11'-2-3/4"
Reach (Front Arm Min.):	20-1/2"
Reach (Front Arm Max.):	40-3/4"
Reach (Rear Arm Min.):	40-1/4"
Reach (Rear Arm Max.):	61"
Min. Adapter Height:	4-3/4"
Low Step Height:	7"
High Step Height:	10-1/4"
Inside Columns:	107-1/4"
Cylinder Height:	11'-10-3/4"
(Full Rise):	12'-4-3/4"
Lifting Capacity:	10,000 lbs.
Time of Full Rise:	45 seconds
Max. Load (Per Arm):	2,500 lbs.
Min. Bay Size:	12' x 24'
Ceiling Height Required:	12'

Note: Item shall be installed complete and ready for use. Electrical Subcontractor shall provide final connection, including safety wiring. Provide O&M Manuals for use by General Contractor and Owner.

AT-02 TWO-POST ABOVE GROUND SYMMETRICAL LIFT (16,000 LBS.)		THREE (3) REQ.
Location:	Auto Collison #C022 (1)	(EQ 2.2)
	Auto Technology #D003 (2)	(EQ 2.3)
Make & Model: Rotary Lift #SP016-CARGO; or equal.		
Dimensions: 11'-5/8"W x 14'-9"H O.A.		
Power: 2 H.P., 208V/60C/1 phase.		
Description: Provide two-post above ground symmetrical lift with standard construction, features and accessories, including 16,000 lbs. lift capacity; thread-up pad adapters; lifting pad 3" higher than standard model and top overhead beam height 2' taller than standard model; patented "Double S" single –piece construction column design that provides a channel for the bearings to travel that maximize the strength of the column; overhead equalization system; electric-hydraulic operation; slider block bearings; overhead padded switch bar; single point lock releases which release the locks at the same time; latches every 4"; arm restraints that allow for easy lift arm positioning; dual controls; third party tested by ETL and certified by ALI to meet strict ANSI standards. The three-stage arm shall increase overall arm sweep and minimum arm reach to precisely lift vehicles that have uni-body construction, visually marked pick-up points on the vehicle; wider vehicle tread width and lower profile; and a short or long wheelbase. Columns are not rotated on true symmetrical design lifts. The vehicle load shall be centered between the columns to maximize lifting capacity, with more width between columns to accommodate larger vehicles and improve vehicle access; and shall allow maximum door opening on trucks and vans for improved access to vehicle interior. Lift shall be provided with one touch control on each column, power unit down; and manual release locking system. Lifts shall be provided with polymer adapters that thread-up, and have stackable inserts.		
Rise:	78-23/32"	
Drive-Thru Clearance Standard:	13'-5"	
Overall Height:	15'-0" to 16'-6"	
Reach (Front and Rear Arm Min.):	34-13/16"	
Reach (Front and Rear Arm Max.):	64-13/16"	
Min. Adapter Height:	5-13/32"	
Max. Adapter Height:	8-1/32"	
Inside Columns:	126-15/32"	
Lifting Capacity:	16,000 lbs.	
Time of Full Rise:	81 seconds	
Max. Load (Per Arm):	4,000 lbs.	
Min. Bay Size:	15' x 30'	
Ceiling Height Required:	17'-9"	
Note: Item shall be installed complete and ready for use. Electrical Subcontractor shall provide final connection, including safety wiring. Provide O&M Manuals for use by General Contractor and Owner.		
AT-07 EXTENDED SCISSOR ALIGNMENT LIFT RACK (16,000 LBS.)		ONE (1) REQUIRED
Location:	Auto Technology #D003 (1)	(EQ 2.3)
Make & Model: Hunter #RX16; or equal.		
Power: 26 Amps., 208V/60C/1 phase.		
Air Pressure: 90-150 PSI.		

Description: Provide extended scissor alignment lift rack complete with standard construction, features and accessories, including 12,000 lbs. lift capacity; surface-mounted; long deck; clear access in front and rear with no cross members; for use in 24" wide runways; airline kit built into the rack that provides power for jacks and air tools at front and rear; gutters to guide water away from turn plates and rear slip plates; flush runways – front turn plates and rear slip plates shall be recessed at deck level; louvered approach ramps for drive on ease in slippery conditions; low voltage feedback system that keeps runways level and safely stops if obstruction is hit; 18-position air-operated safety locks level at all alignment heights; long-life chromed, hardened pins and Teflon coated bearings at all pin locations; separate operation console that may be mounted left, right, front, or rear; hydraulic velocity safety fuses that shut down lift operation in the event of pressure loss; two (2) wheel chocks; two (2) rolling swing air jacks; 184" general service maximum wheelbase; 179" two-wheel alignment maximum wheelbase; 158" four-wheel alignment maximum wheelbase; 10" lowered height; maximum lifting height – 71"; narrow 7'-4-1/2" overall width; minimum width of 40" between runways; FIA Fully Integrated PowerSlide System that locks and unlocks turntables and slip plates automatically at the appropriate points of the alignment process; FIA Fully Integrated Air Inflation System that automatically inflates or deflates tire pressure depending on preselected value.

Manuals for use by the General Contractor. Provide two (2) days of Staff Training, on-site, for the proper operation and use of items AT-01, AT-02 & AT-07.

AC-01 AUTOMOTIVE SPRAY BOOTH	(1)	ONE (1) REQUIRED
Location: Auto Collision #C022	(1)	(EQ 2.2)
Make & Model: Global Finishing Solutions Full Downdraft over concrete pit (by others).		
Spray Booth Dimensions: 27'-5"L x 20'-5-3/4"W x 14'-0"H;		
External Booth overall; 27'-0"L x 14'-0"W x 12'-0"H Working Height		
Dimensions of the Dual Row Pit to be coordinated with the requirement of this section as follows: 14'-0"W x 27'-0"L x 1'-9-3/4"		
Four-Slab Product Entry Door: 10'-8"W x 11'-10"H.		
Personnel Door: 2'-8"W x 6'-8-3/4"H.		
Power Requirements:		
In-Take Motor: 15 H.P., 208V/3 phase.,		
Exhaust Motor: 15 H.P., 208V/3 phase.		
Minimum Circuit Capacity: 113.8 Amp. Full Load Amps: 143.0Amp		
Lighting: 30.0 Amp. Circuit, 120V/1 phase.		
Air Flow Rate: 15,000 cfm		
Max Firing Rate: 1513000 BTU/hr;		
Min. Inlet Pressure (inwc): 13.0		
Max Inlet Pressure (psi): 5.0		
Inlet Pipe Size NPT: 1-1/4 inches		
Temperature Rise: 80 – 91 degrees Fahrenheit		

Description: Provide Automotive Spray Booth with all standard construction, features and accessories as described and outlined herein. The booth exhaust shall be located in the rear corners and shall be made of pre-painted white galvanized sheet metal. Air shall be drawn through the filters, filter support grids, and exhausted through the top of booth. Wave exhaust filter specifications: Removal Efficiency – 99.83%; Holding Capacity – 4.4 lbs.; Pressure Drop – 0.12 inwc (initial)/0.50 inwc (final); Flammability Rating – UL Class II;

and material shall comply with the requirements of UL900, NFPA-33, OSHA, and New York rule.

The booth walls shall be composed of self-supporting panels, 1-1/2' or 3' wide by 11' high.

Each insulated wall panel shall be an assembly composed of an inside and outside skin, internal support channels and insulation. The inside and outside skins and internal support channel shall be made of 20 gauge galvanized, then pre-painted white, and PVC film protected sheet metal. The thickness of the insulated wall panel shall be 2-1/2". Insulation material shall be thermo set resin bonded flexible roll; maximum operating temperature - 450°F; and initial thickness - 2-1/2". The wall panels shall be connected together by H-shaped profiles with hemmed edges made of 20 gauge galvanized, then pre-painted white, and PVC film protected sheet metal. Precision-fit booth construction shall require no screws for assembly.

Roof and Plenum: Single skin, insulated roof panels shall be made of 18 gauge galvanized steel. Panels shall be installed in a manner that provides adequate explosion venting area. The booth plenum shall be 2' high, and span the entire length and width of the booth. A perforated diffuser, made of galvanized sheet metal, shall be located in the plenum at the discharge of the air heater. The diffuser shall induce turbulence and slow the air in the plenum to provide even airflow through the filter ceiling. This diffuser contains two (2) vanes that shall be able to turn the air discharged from air heater.

Filter Ceiling: The filter ceiling shall be a high performance airflow ceiling (HPAC) assembly consisting of filter support members constructed of galvanized, then pre-painted white, sheet metal and eight (8) fully enclosed light fixtures. This filter ceiling shall be designed to provide a main airflow zone around the vehicle while providing exceptional lighting from the hip mounted lights. The filter support members and lights shall be bolted together, attached to the side wall panels and supported by the booth's structural members. The filtered ceiling shall provide filter openings that utilize roll media in the filter ceiling below the plenum. Plenum filter specifications: Removal Efficiency - 99.9% at removing particles larger than 10 microns; Pressure Drop - 0.38inwc (initial); Flammability Rating - UL Class II; and the filter material shall be a multi-layer design, 1" thick media of 6 and 15 denier fiber forming the air entering side, and 1/2" scrim backed diffusion media forming the air leaving side. The fibers in the media shall be coated with and non-drying, non-migrating adhesive assuring booth air cleanliness.

Doors: The booth shall be configured as a solid back with one (1) door, and a 4-wing frontal doors with windows. Each slab of the door shall be solid with one (1) having an observation window. The four (4) slab doors shall open outward. One (1) of the center slabs shall be a personnel door. Each door slab shall be an internal frame made of galvanized steel. External skins shall be constructed of 20 gauge galvanized, then pre-painted white, and PVC film protected sheet metal. Internal insulation in the door slab shall be the same as the booth panels. The observation window shall be made of tempered glass mounted in sheet metal frames. To prevent air leaks through the door a rubber seal shall be applied around the perimeter of each door slab. The rubber seal shall be mechanically fixed to facilitate easy replacement. Each door slab shall be supported by two (2) sturdy steel hinges that can be adjusted horizontally. Two (2) large door handles shall be located on the personnel slab; and shall be made of galvanized, pre-painted steel. The door closing shall be pre-painted tube steel held in place by fiberglass reinforced nylon supports. Spring roller latches provide smooth opening and closing of the personnel door slab. The personnel door shall have an observation window and open outwardly. The personnel door shall be the same construction as the product door slabs. Spring roller latches shall be provided for smooth opening and closing of the door. The light fixtures shall be mounted and serviced from inside the booth. Light fixtures shall be

installed in the sidewalls and plenum light housings of the booth. The booth shall be furnished with four (6) sidewall light fixtures and eight (8) plenum light fixtures. Air outlets shall be integrated into the interior side walls of the booth on two (2) long sides. Light fixture specifications shall be as follows: ETL listed for use in paint spray booth; be provided with energy efficient T8 lamps; and tempered glass light cover with proximity safety switch to ensure covers are correctly replaced after servicing.

The Advanced Cure Towers shall be located in engineered locations on the sidewall of the booth. The towers shall be attached to the side wall panels using tek screws, and sealed with the sealant provided insuring an air tight fit. Once installed the cure towers shall provide an adjustable, turbulent air flow from the sidewalls of the booth. Advanced cure tower specifications and features shall include: Intake filter; High-pressure, radial-blade, direct drive blower with aluminum impeller; Blower design to meet the AMCA Type B, Classification for Spark Resistant Construction; Class 1 Div. 2 motor sealed from the booth atmosphere and vented to an unclassified area outside the booth; Rotary shaft seal; Motor mounted vibration isolators; Blade plenum with diffuser to ensure even airflow through the Blades; Precision direction of air through small slits in the module; and Motor wire harnesses.

The direct-fired air heater shall be located above the booth. The air heater shall be supported by a steel support structure and integrated into the roof of the spray booth for optimal performance. The air heater shall be manufactured in two (2) pieces a burner section and a blower section. Each section shall consist of insulated sheet metal panels bolted together. In the burner section the insulated panels shall be lined with galvanized panels designed to resist the heat of the burner flame. The internal components, burner, blowers, and recirculating damper shall be then bolted to the insulated panels. Once these internal components are installed the control panel, gas train, and access doors shall be then added to the assembly. The intake motor, exhaust motor, gas train, pre-filter, exhaust filter, and control panel shall be assessed easily. The intake hood shall be made of galvanized sheet metal and shall be specifically designed to keep rain and snow from entering the stack while not impairing airflow.

The 34" round intake and exhaust duct shall be made from 18 gauge, G90 galvanized sheet metal. A section of stack with a clean outdoor shall be provided for the exhaust stack. A system of two (2) single blade dampers shall provide 100% fresh air to the booth during the spray cycle. During the cure cycle the two (2) dampers shall be rotated so that 80% of the air entering the cabinet shall be recirculated and 20% is fresh air. Two (2) intake bag filters shall trap airborne dirt before the dirt can impair the operation of the air heater or clog the plenum filters. Intake filter specifications: Average Arrestance – 95%; Pressure drop – 0.12 inwc (initial)/1.0 inwc (final) and Flammability Rating – UL Class II. An all- aluminum 2' long burner with an ETL approved gas train and UL approved components can operate with natural gas fuel. The burner shall be specifically designed to reduce NO₂ and CO emissions and provide a higher turn down for safer more efficient spray booth operation. Burner/Gas Train Specifications: Maximum Energy Production – 1,139,000 BTU (Natural Gas); Maximum Temperature Rise - 108°F (Natural Gas); Maximum Inlet Pressure – 14 inwc; and Maximum Manifold Pressure – 3.1 inwc (Natural Gas). Intake air shall be provided by a double width double wide fan wheel. The fan design shall meet the AMCA Type B, Classification for Spark Resistant Construction. The standard drive arrangement consist of 7.5 H.P. motor and fan wheel that provides 10,000 CFM of air to the booth. Air shall be exhausted from the booth by a tube axial fan. The fan design shall meet the AMCA

Type B, Classification for Spark Resistant Construction. The power of the exhaust motor and size of the fan wheel must match the intake motor and fan wheel.

The 3 Logic Control Panel Series shall be a UL listed, PLC based control panel designed to operate the spray booth safely and efficiently. The control panel shall guide the booth through the spray, flash, cure, and cool down cycles. The following list of components, of the main control panel, describes the operations each component performs relative to the safe and efficient operation of the spray booth. This control panel shall be accessible from the service platform located above the booth.

- Dual high temperature limit switches: Interrupt operation of the burner if the high temperature set point is exceeded.
- Airflow switch: Must prove airflow through the air heater before opening the gas valves and igniting the burner.
- Negative press switch: Monitors the booth pressure, and if the booth pressure drops below the set point the air heater is stopped.
- Filter monitoring: Provides real time filter loading data to optimize filter usage and spray booth efficiency.
- Auto Balance pressure transducer: Constantly monitors and adjusts the booth pressure to ensure uniform booth pressure as the air heater and booth filters load.
- Flash mode pneumatic palm switch: Provides a way to turn the Advance Cure towers on or off while inside the booth.
- Exhaust VFD: Controls the speed of the exhaust motor.
- Intake VFD: Controls the speed of the exhaust motor, required for the economy mode operation.
- Disconnect switch: Shall be integrated into the control panel door to ensure the power is disconnected whenever the control panel cabinet doors are open.
- Cooling fan: Maintains airflow through the control cabinet.
- Advance Cure contactors.
- Spray Gun solenoid valve: Must receive proof of air flow in the booth before supplying air to the spray gun.
- Proximity door switches: Detect whether the booth doors are open or closed. All booth doors must be closed for the auto balance to operate. If a door is open for more than 20 seconds during the spray mode the spray gun solenoid valve will shut the air to the spray gun off. If a booth door is open for more than 20 seconds during cure mood the booth set point temperature shall be reduced to 90°F.
- PLC, Coils, Flame safeguard, Transformers, Terminal Strips, Transducers, Fuses, and Contactors: As required for a safe and efficient control panel.

The following is a list of features of the remote Logic Panel. This Panel shall be located on the side of the booth more than 3 feet from a booth opening.

- Touch screen operator interface.
- Booth temperature display: Shows the current and set point temperatures in the booth.
- Booth pressure display.
- Start, stop, cure, and flash buttons: Allow the operator to manually change booth modes or power the booth on or off.
- Lighting switch.
- Emergency stop button: Stops all booth operations.
- Economy mode switch: When activated reduces the airflow through the booth, only available in spray mode.
- Burner indicator display: Informs the operator that the burner is running.

- Intake and exhaust motor indicator displays: Inform the operator that the monitors are running.

Note: Provide two (2) days of Staff Training, on-site, for the proper operation and use of Items AC-01, AC-02 and AC-03.

AC-02 PAINT MIX ROOM

ONE (1) REQUIRED

Location: Auto Collision #C022

(1)

(EQ 2.2)

Make & Model: Global Finishing Solutions "Ultra XD" Paint Mix Room; or equal.

Dimensions: 12'-4"L x 9'-1-1/2"W x 11'-0"H Exterior; and 12'-0"L x 9'-0"L x 9'-0"H Interior.

Power Requirements: 20.0 Amp., 120V/60C/1 phase.

Description: Provide Paint Mix Room with all standard construction, features and accessories as described and outlined herein. Room shall be three-sided and installed against rear wall of Automotive Spray Booth, Item AC-01. The mix room exhaust shall be located in the ceiling of the booth. Air shall be drawn through the filter, and exhausted through the top of the booth.

GFS Wave Exhaust Filter Specifications: Removal Efficiency – 99.83%; Holding Capacity – 4.4 lbs.; Pressure Drop – 0.12 inwc (initial)/0.50 inwc (final); Flammability

Rating – UL Class II; and Material shall comply with the requirements of UL900, NFPA-33,

OSHA, and New York rule. The paint mix room walls shall be composed of self-supporting panels, 1-1/2' or 3' wide by 9' high. Each insulated wall panel shall be an assembly composed of an inside and outside skin, internal support channels and insulation. The inside and outside skins and internal support channel shall be made of 20 gauge galvanized, then pre-painted white, and PVC film protected sheet metal. The thickness of the insulated wall panel shall be 2-1/2". Insulation Specifications:

- Material: Thermo set resin bonded flexible roll;
- Maximum operating temperature: 450° F; and
- Initial thickness – 2-1/2".

The wall panels shall be connected together by H-shaped profiles with hemmed edges made of 20 gauge galvanized, then pre-painted white, and PVC film protected sheet metal. Precision-lit booth construction shall require no screws for assembly. Single skin, insulated roof panels shall be made of 18 gauge galvanized steel. Panels shall be installed in a manner that provides adequate explosion venting area.

One of the mix room wall panels shall be provided with a personnel door. The personnel door slab shall be an internal frame made of galvanized steel. External skins shall be constructed of 20 gauge galvanized, then pre-painted white, and PVC film protected sheet metal. Internal insulation in the door slab shall be the same as the booth panels. The observation window shall be made of tempered glass mounted in a sheet metal frame. To prevent air leaks through the door a rubber seal shall be applied around the perimeter of the door slab. The rubber seal shall be mechanically fixed to facilitate easy replacement this door has an observation window and opens outwardly. Spring roller latches shall be provided for smooth opening and closing of the door.

The light fixtures shall be mounted and serviced from inside the paint mix room. Light fixtures shall be installed in the ceiling of the paint mix room. The 9' x 12' paint mix room shall be provided with two (2) ceiling mounted light fixtures. Light Fixture Specifications: ETL listed for use in paint spray booth; Energy efficient T8 lamps; four (4) tube light fixture requires 1.0FLA @ 120V; and Tempered glass light cover with proximity safety switch to ensure covers are correctly replaced after servicing.

Note: Provide two (2) days of Staff Training, on-site, for the proper operation and use of Items AC-01, AC-02, AC-03 and AC04

AC-03 NON-RECOVERY POWDER BOOTH STSTEM **ONE (1) REQUIRED**

Location: Auto Collision #C022 (1) (EQ 2.2)
Make & Model: Global Finishing Solutions PNRG-120818
Dimension: 12'-4"W x 22'-2"D x 8'-10"H, Exterior; 12'-0"W x 18'-0" D x 8'-0", Working dimension.
Power: 208V/3PH/4W/60Hz
Full Load Amps: 25
Largest Motor HP: 5; Total HP: 5
Lighting Voltage: 120 4W
Min. Service Required: 32 Amp.
Exhaust Fan: 30" diameter; 9,600 cfm; 1 ¾ Static Pressure, 3HP, 208/230/460V, Phase 3
Lights: (6) 48"W LED; 120/277V; Class 2, Division 2 rating.
3 Stage Filtration:
1st Stage: Type – (1) GFS Wave Roll Media
2nd Stage: Type - (18) 216-511
3rd Stage: Type – (6) 216-038

The booth shall feature 18-gauge galvanized steel panels with smooth interior equipped with following:

- Primary filtration system with full set of filters, grids and manometer for filter maintenance.
- Filter shall be rated MERV 14-rated redundant filters.
- High-performance, direct-drive plug fan with TEFC motor
- (6) Four-tube, T8 LED light fixtures

Designed to comply with tall federal, NFPA and OSHA regulations.

AC-04 BATCH OVEN **ONE (1) REQUIRED**

Location: Auto Collision #C022 (1) (EQ 2.2)
Make & model: Global Finishing Solutions, BPO-100810-TM-SB-SD-SP
Dimension: 15'-8-3/4"W x 25'-3/4"D x 14'-11"H, Exterior; 12'-0"W x 18'-8-3/4" D x 8'-0", Working dimension.
Power: 208V/3PH/4W/60Hz
Full Load Amps: 41
Largest Motor HP: 10; Total HP: 11
Lighting Voltage: 120 4W
Min. Service Required: 51 Amp
Oven Material Panel Thickness: 4"
Insulation Density: 4#
Structure Type: HSS Tube
Plug Fan: Make – Aerovent; Size: 221 CPG; CFM: 9,600; 3"SP; 10HP; 208/230/460V, Phase 3
Rotation: CW; Discharge: Horizontal
Burner: Make – MIDCO V2; 1,260,000 BTU/HR; Natural Fuel Type; Blower Voltage: 120V; Blower HP – 0.5
Exhaust Fan: Make – Aerovent; Size – 105 BIUB; 1,000 CFM; 1" Static Pressure; 0.5 HP; 208/230/460V; Phase 3; Rotation: CW; Discharge: UBD
Standard Temperature Range: 30 – 500 degrees Fahrenheit

Features:

- Four inch insulated panels made from 20-gauge aluminized steel with four-pound, heavy-duty mineral wood batt. Each oven panel shall feature tongue and groove edges with 20-gauge slotted channels for precise assembly.
- Built-in, adjustable uni-flow air distribution tabs allow for uniform assembly
- PLC control panel with touchscreen HMI.
- Equipped for electric, natural gas or propane
- Top mounted heat chamber
- Airflow switches and interlocks

- Meets the safety requirements of NFPA 86, Standard for Ovens and Furnaces.

AC-05 FRAME STRAIGHTENER **ONE (1) REQUIRED**

Location: Auto Collision #C022 (1) (EQ 2.2)
 Make & Model: Car-O-Liner, BenchRack 5000 (In Ground); or equal.
 Dimensions: 16'-0"L x 3'-10"W x 3'-10"H extended overall.
 Power: 220V/60Hz/Phase 1
 Rated Amperage for power unit T605: 16
 Description: Provide frame straightening machine with all standard construction, features and accessories to include three (3) towers, adapter with bushings, multipurpose clamp, chain holder, track plates and downpull and torque bar. Simultaneous multiple pulling; true 360° capability; all lift and pull functions operate from one, hand-held control; tapered/lubrication-free internal roller bearings; 1/2" and 3/8" high-strength steel tower material; in-ground capability, powder coated components; and availability of training, service and technical support; in accordance with the General Conditions.
 Max length with draw aligner: Bench length + 44"
 Max Width with draw aligner: 7'-6"
 Width with ramps attached: 6'-7-1/2" standard ramps; 7'-4" wide ramps
 Min Height: 1'-3-3/4"
 Max Height: 3'-10-3/4"
 Total Weight, lift and work platform: 1.4 tons
 Lift Capacity: 4.6 tons
 Hydraulics pulling force per draw aligner: 10 tons
 Hydraulics max. pressure: 1015.6 PSI
 Hydraulics pressure: 3045.79 PSI
 Air Connection pressure: Max 145 PSI
 Sound level: Below 70 dBA
 Electrical cable length: 13'-0"
 Hydraulic hose length: 23'-0"
 Cable to Control box: 33'-0"

AT-12 OVERHEAD SINGLE GIRDLE CRANE SYSTEM & CHAIN FALL **ONE (1) REQ.**

Location: Auto Technology, Small Engine #D003H (1) (EQ 2.3)
 Note: Crane system shall be coordinated with the entry door and steel.
 Description: Ceiling mounted workstation steel monorail crane system including hanger assemblies, enclosed track monorail, hoist trolley, festooning system, bumpers, and other accessories required for complete installation.
 Provide full set of shop drawings.
 Lift: 14' High
 Hoist: Manual
 Trolley: Manual
 Festooning: Spark resistant package with filter and lubricator
 Rails: As shown on drawing EQ 2.3

A. HANGER ASSEMBLIES:

- Includes hanger assemblies required for suspending monorail from overhead steel beam support structure.
- Two-piece hangers suspending monorails below support beams shall consist of upper hanger bracket with beam clips and lower runway bracket connected with threaded B7

- alloy steel rod. 12-inch (304 mm) drop rods are included. 12-inch drop rods are standard, but drop rods can be virtually any length.
- B. MONORAIL: Enclosed, cold formed, steel box track that permits hoist trolley and festoon carriers to ride along monorail.
 - 1. Fabricated lower running flanges with flat surfaces. Sloped flanges not permitted.
 - 2. Splice Joint: Includes channel-shaped track splice joint with bolts, lock washers, and nuts for joining monorail sections.
 - C. FESTOON STACK SECTION: Includes enclosed track extension to account for stacking festoon carriers at end of monorail.
 - D. HOIST TROLLEY: Rigid-body trolley designed to roll inside enclosed track of monorail and to carry hoist and load. Articulating trolleys are not acceptable.
 - 1. Construction: Two-piece stamped steel body with two wheels on each side and tapered clevis positioning hoist hook at center of trolley, so load weight is evenly distributed to all four trolley wheels. Includes removable clevis pin (type and size determined by manufacturer for specified capacity). Trolleys with non-removable clevis pins are not acceptable. Holes provided in body for mechanical connections.
 - 2. Wheels: Removable, self-centering steel wheels with sealed lifetime lubricated bearings. Vertical wheels shall be flat to match track profile. Non-removable or tapered wheels are not acceptable.
 - 3. Drop Lugs: Included on both sides of trolley to limit trolley in the event of wheel, axle, or load bar failure.
 - 4. Designed for hook attachment of hoist.
 - E. END STOPS: Molded composite, resilient bumper installed in monorail to prevent hoist trolley and festoon carriers from rolling out of track. Bolt stops without energy absorbing bumper are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION AND ACCEPTANCE

- A. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of work shall be construed as acceptance of space conditions.
- B. This Automotive Equipment Subcontractor shall obtain and verify all measurements and conditions on the job and shall assume all responsibility in respect to same.

3.2 CLEANING UP

- A. All debris and surplus materials resulting from installation work shall be removed promptly as work progresses by this Automotive Equipment Subcontractor, to a location indicated by the General Contractor.
- B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.

3.3 PROTECTION OF WORK

- A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.

- B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the Contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.
- C. Damaged work as determined by the Architect, shall be repaired, or replaced as determined by and to the satisfaction of the Architect.

END OF SECTION

SECTION 116133
STAGE RIGGING

PART 1- GENERAL

1.1 SUMMARY

- A. This specification covers the fabrication, furnishing, delivery, and installation of the stage rigging system. The form of contract, general conditions, and the project drawings are considered to be parts of these specifications.
- B. The Rigging Contractor shall provide all items necessary for a complete, safe, fully functional system as described herein, including all tools, scaffolding, labor, and supervision, even though they may not be specifically enumerated. Any errors, omissions or ambiguities do not relieve the Rigging Contractor of this responsibility but shall be brought to the attention of the Architect and Theatre Consultant for clarification.
- C. Base bid shall consist of, but not be limited to, the following:
 - 1. Dead hung battens supporting lighting, sound, drapery, and scenery.
 - 2. All drapery hardware, including motorized traveler tracks and control system for stage drapery.
 - 3. Install stage drapes provided by Theatre Drapery Contractor of Section 116143.

1.2 RELATED WORK

- A. Division 5 Structural Steel: Structural steel and miscellaneous metals not specifically called out as part of this section
- B. Section 116153 Stage Dimmers & Controls
- C. Division 26: Electrical connections, conduit, boxes and interconnecting wiring for stage rigging equipment as shown on the drawings.

1.3 DEFINITIONS

- A. "Owner" as used in this section shall mean the representative of Northeast Metropolitan Regional Vocational High School.
- B. "Theatre Consultant" as used in this section shall mean Studio T+L, LLC.
- C. "Rigging Contractor" OR "RC" as used in this section shall mean the contractor responsible to provide, furnish and/or install, as noted, the stage rigging system.
- D. "Architect" as used in this section shall mean Drummey Rosane Anderson., Inc.
- E. "Structural Engineer" as used in this section shall mean _____.
- F. "Electrical Contractor" as used in this section shall mean the contractor for Division 26.
- G. Wherever the words "Approved", "Approval", and "Approved equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Architect.
- H. "Provide", as used herein, shall mean that the RC is responsible for furnishing and installing said item or equipment.
- I. "Furnish", as used herein, shall mean that the RC shall acquire and make available said item or equipment and that the installation shall be under other sections of these specifications.

- J. "Contract Documents" as used in this section shall be deemed to include both the specification section and related bid drawings.
- K. "NIC" as used in the contract documents means, "Not Included in this Contract"
- L. "Or As Approved" as used in the contract documents means "substitution only after written approval by Consultant and as noted in section 1.11."

1.4 RIGGING REFERENCE STANDARDS

- A. Statically suspended rigging systems shall comply with ANSI E1.2-2 – 2021 Entertainment Technology – Statically Suspended Rigging Systems

1.1 RIGGING CONTRACTOR

A. General

1. The provider of the rigging system herein described shall be acknowledged in business as a Stage Rigging Contractor, hereafter referred to as RC. This company shall employ full time Systems Designers and Project Managers with experience in completing work of similar or greater size and scope. The role of the RC in this project shall be to provide and install all equipment listed in this section. The RC shall furnish a complete working system meeting the intent of this specification. The RC shall coordinate delivery schedules and installation of equipment with the CM. Additionally, the RC shall be responsible for all documentation for equipment in this section, system record drawings, final testing of the system and training of the Owner's personnel as required by this specification.

B. Qualifications

1. The RC shall have a minimum of 10 years experience in the operation and installation of similar equipment associated with the construction and/or renovation of facilities similar in scope to this project.
2. The RC shall have been in business for a minimum of 10 consecutive years and shall have no history of bankruptcy.
3. The RC shall be an authorized dealer for an adequate number of manufacturers of system products necessary to provide a complete working system meeting the intent of this specification.
4. The RC shall have on staff at least two full-time manufacturer-certified field service technicians and have technical support and assistance accessible 24 hours a day, seven days a week.
5. The RC shall offer a Maintenance and Service Contract.
6. The RC shall provide a one-year system warranty for the complete system, not including expendable supplies, effective from the date of system acceptance. Within this warranty period, the RC shall be responsible as the Owner's sole contact for the remedy, repair, or replacement of system deficiencies (through the manufacturer's warranty where applicable).
7. The RC shall employ an Entertainment Technician Certification Program (ETCP) Certified Theatre Rigger for this project. The Certified Rigger shall be the project manager and/or site foreman, and shall be responsible for the overall project including the layout, inspection, and training.

C. Project Management

1. The RC shall designate a dedicated Project Manager. The RC's Project Manager shall be the main contact between the RC, the manufacturers, the Architect, Theater Consultant, and the Contractors from contract award until final sign off.
 2. The RC's Project Manager will provide Project Status Reports. These status reports shall provide the basis for analysis of completion as well as for progress meetings between the RC and the Architect.
 3. The RC's Project Manager shall provide the Construction Manager or General Contractor with a two-week Look Ahead Schedule to help with the coordination of other trades, as needed.
- D. Approved rigging equipment manufacturers for this part of the work are as follows.
1. J.R. Clancy, Syracuse, NY – 800.836.1885
 2. I. Weiss, Long Island City, NY – 800.325.7192
 3. Thern Stage Equipment, Winona, MN – 800.553.2204
 4. Texas Scenic Studio, San Antonio, TX – 800.292.7490
 5. Automated Devices Company, Allentown, PA – 610.797.6000
- E. Approved rigging equipment Installers for this part of the work are as follows.
1. Pook Diemont and Ohl, Bronx, NY – 718.402.2677
 2. I. Weiss, Long Island City, NY – 800.325.7192
 3. Texas Scenic Studio, San Antonio, TX – 800.292.7490
 4. Syracuse Scenery & Stage Lighting Co, Inc., Liverpool, NY – 800.453.7775

1.2 RIGGING CONTRACTOR RESPONSIBILITIES

- A. All work of this section shall be the responsibility of the RC except where specifically assigned as work under other sections of these specifications
- B. The stage rigging systems are specified to a minimum performance standard. Do not interpret listing of standard products from acceptable RC's as specifying or accepting those products. Make any and all alterations to standard design and construction of any equipment necessary to meet any and all requirements of this section.
- C. This specification section, related sections and the contract drawings describe performance attributes of systems to be provided, including means of operation and control, dimensions and profiles and visual appearances. Assume all responsibility for engineering of systems described herein, including modification of and addition to any details required fulfilling the design intent of the specification section.
- D. Provide only those products listed herein. Provide products that are manufactured in accordance with the manufacturer's published specifications in effect on the date of this specification.
- E. The system(s) shall conform to all applicable code requirements and shall be in conformance with industry standards of operation and practices. All materials, arrangements, and procedures shall comply with applicable code requirements, allowing the users to arrange and operate a safe assembly and provide a safe working environment for audience and user personnel.
- F. All equipment shall be thoroughly tested in the RC's shop prior to shipment to ensure mechanical and electrical integrity.

- G. Omissions and/or errors within this specification section shall not relieve the RC of the responsibility for providing a properly functioning installation of the rigging system.
- H. Correct and replace, at no cost to the Owner, any system or part of the system that does not meet the requirements of this section at the time of Completion Check-out or any time during the warranty period.

1.3 REVIEW AND INTERPRETATION DURING BIDDING

- A. All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation shall be allowed for any labor or item the bidder could have been fully informed of prior to the bid date.
- B. Notify Architect and Theatre Consultant of any omissions, discrepancies or ambiguities in the specification section and the contract drawings so a clarification may be issued. Notify Architect and Theatre Consultant if exception is taken to any statement, indication or criterion in the contract documents.
- C. Obtain all other contract documents, including architectural, electrical, structural and mechanical to ensure there are no conflicts with the work of this section. Notify Architect and Theatre Consultant of all such conflicts and propose modifications to resolve the conflicts.
- D. Submit the notifications, A and B above, in writing to Architect and Consultant in a timely manner prior to bid opening date. Lack of notification shall be understood to indicate acceptance of all requirements of the contract documents and shall preclude any future claims.
- E. Interpretations or corrections to the contract documents shall be issued by Addendum. Interpretations or corrections given by any other method will not be binding.

1.4 SUBSTITUTIONS

- A. Substitutions in the contract documents will only be considered where noted "OR AS APPROVED." Submit requests for substitutions, in writing, to Consultant in a timely manner prior to bid opening. Consultant shall be the sole judge of acceptability of proposed substitutions.
- B. Approved substitutions will be listed by Addendum. Verbal or other written approvals will not be binding.

1.5 BID SUBMITTALS

- A. Provide a complete Bill-of-Materials as part of the bid proposal. Include a list of all equipment, systems, components, sub-assemblies, etc., proposed to fulfill the requirements of the contract documents.
- B. The Bill-of-Materials will be used to evaluate whether the proposal meets the letter and intent of the contract documents. Bids not meeting the specification, based upon a review of the Bill-of-Materials, may be rejected. The Bill-of-Materials will not, however, be the exclusive determinant of the equipment and services required for the work of this section.
- C. List any exceptions taken. Cite specific reference by page and section and briefly describe the nature of the exception. The absence of this list shall indicate acceptance of all terms of the contract documents. Exceptions taken after acceptance of bids shall only be considered at the discretion of the Theatre Consultant.
- D. Include standard catalog cut-sheets and specifications for all proposed equipment. Note all modifications or deviations from those standard sheets.
- E. The owner reserves the right to waive all formalities, to be sole judge of quality and equality of the several bid proposals, and reserves the right to reject any and all bids.

1.6 POST TENDER MEETING

- A. Meet with the Theatre Consultant prior to beginning work on the shop drawings. Project manager and project engineer must attend and be prepared to review the project schedule and to discuss concepts described in the contract documents and proposed methods and means of executing those concepts.
- B. Present a preliminary schedule of submittals, fabrication and installation work for review by Theatre Consultant.

1.7 SUBMITTALS

- A. Shop Drawings
 - 1. Submit complete sets of submittals to Theatre Consultant in quantities as noted in the General Conditions or as directed by Architect for approval prior to fabrication. Indication by arrow and boxed caption all deviations from contract drawings and specifications, beyond deviations discussed at the Post Tender Meeting, must be included.
 - 2. Prepare shop drawings under the supervision of a qualified project engineer. Include names and contact telephone numbers of project manager and project engineer with shop drawing package.
 - 3. All shop drawings shall be stamped and sealed by the project engineer, who shall be licensed by the State of Massachusetts.
 - 4. All shop drawings shall represent actual fabrication and details. Copies or tracing of contract documents are not acceptable.
 - 5. Shop drawings shall show material, finishes, metal gauges, overall and detail dimensions, sizes, electrical and mechanical connections, fasteners, welds, provisions for the work of others, and similar information. Shop drawings shall indicate complete details of equipment, including manufacturer's catalog numbers for components and shall include complete wiring diagrams (as required). The shop drawings shall be reviewed by the Theatre Consultant before the equipment is manufactured. The drawings will be used by the RC when installing the equipment.
 - 6. Shop drawings and related data must be submitted complete sets. Isolated items will not be considered for approval. Required re-submissions similarly must in complete sets unless exceptions are previously authorized in writing.
 - 7. Review of shop drawing by Theatre Consultant, Architect and Engineer is for conformance with the design concept and information provided in the contract documents. Non-conformities and errors detected during review shall be noted on shop drawings and returned to RC upon completion of review.
 - 8. Theatre Consultant, Architect and Engineer are not responsible for completeness or accuracy of RC's shop drawings. Review of shop drawings containing deviations and inconsistencies not detected does not relieve the RC from sole responsibility to provide materials and work conforming to the contract documents.
 - 9. No equipment shall be manufactured, fabricated, shipped or installed prior to review of shop drawings by Consultant, Architect and Engineer. Only shop drawings returned and marked APPROVED or APPROVED AS NOTED may be used by the RC. Correct and re-submit any shop drawings marked REVISE AND RE-SUBMIT or NOT APPROVED.

10. If field dimensions and/or other coordination information obtained after review of shop drawings requires changes in size, detail or similar considerations, notify Theatre Consultant and re-submit the relevant shop drawings.

11. All shop drawings shall identify Studio T+L, LLC as the Theatre Consultant.

1.8 SAMPLES AND MOCKUPS

- A. Provide samples and mock-ups identified in the contract documents or as requested by Consultant.

1.9 AS-BUILT DRAWINGS

- A. The RC shall submit to the Theatre Consultant a set of accurately marked-up plans indicating all changes encountered during the installation to reflect the "as built" installation.
- B. A Lineset Schedule shall be included in the as-built set of drawings. All dimensions shall be listed for each lineset from the plaster line to the position of the line set over the stage.
- C. The as-built drawings shall show all supplemental steel installed by the RC.

1.10 MAINTENANCE AND OPERATION MANUALS

- A. The RC shall furnish to the Owner four bound sets of maintenance and operating instructions for the rigging. Included in this document shall be recommendations for routine maintenance; the frequency of maintenance tasks; lists of lubricants and torques of nuts and bolts; recommendations for establishing safe operation procedures; and flame-proofing certificates.
- B. The Operation Manuals shall be subject to approval by the Theatre Consultant and must be submitted for review prior to instruction of staff.

1.11 PROJECT CONDITIONS

- A. All dimensions shall be verified in the field prior to fabrication by the RC, who shall make at least one (1) visit to the job site prior to preparation of shop drawings.
- B. No extras will be allowed for any misunderstanding by the RC as to the amount of work involved or his lack of knowledge about conditions pertaining to the work.
- C. The RC shall immediately notify the Architect and Theatre Consultant of any site conditions or variations which affect installation or completion of work and, when appropriate, shall indicate suggested remedial procedures by drawings and/or descriptions.
- D. Work not included:
 - 1. Structural steel for building structure.
 - 2. Electrical connections for motorized tracks.
 - 3. Primary and secondary wiring for any electrical equipment.
 - 4. Furnishing of stage lighting equipment.
- E. Substitutions, changes or deletions from these plans and specifications will not be allowed without prior approval, in writing, of the Architect.
- F. Substitutions for specified equipment or installation methods must be approved by the Consultant. Appropriate drawings or other significant data must be submitted proving the equivalence or superiority in quality and performance of the proposed substitution(s) to be considered. Any proposed substitution(s) must be submitted to the Theatre Consultant in a timely manner in order to be considered.

- G. All questions requiring clarification or interpretation of the specifications should be addressed to the Architect.

1.12 PRODUCT DELIVERY, HANDLING, AND STORAGE

- A. All material and equipment shall be delivered and unloaded by the RC within the project site and as directed by the CM.
- B. The RC shall protect all material and equipment from breakage, theft or weather damage. No material shall be stored directly on the ground.

1.13 COMPLETION DATE

- A. The work shall be complete in all respects during 2025. An exact date will be determined at the time the contract is awarded.
- B. A final check-out by the Architect and Theatre Consultant and a reasonable allowance of time to complete "punch-list" items must be included in the RC's planning and job schedule.

1.14 TESTS AND INSPECTIONS

- A. Upon completion of all work, the RC shall certify in writing that work is complete and ready for inspection for final approval. Upon receipt of written notice, final inspection shall be scheduled by the Architect, Theatre Consultant, and Owner's representative at their convenience and that of their representatives and consultants, within a period of 15 to 20 days following receipt of such notification.
- B. After the inspection, the RC shall make any adjustments or modifications necessary to bring the work into conformance with established contract requirements.
- C. Should deficiencies, due to faulty equipment or installation, require reinspection after corrective work, all expenses of such reinspection, including time and travel of the Architect, Theatre Consultant and Owner representatives, shall be the responsibility of the RC, without cost to the Owner, regardless of other contractor's negligence or failures.

1.15 STAFF INSTRUCTION

- A. RC's supervisor shall instruct designated staff members, or Owner's technical representatives, in safe operation, servicing, care and maintenance of all equipment. Instruction shall be for a minimum of eight (8) hours.
- B. The Architect and Theatre Consultant may be present or represented.
- C. Instruction is to be scheduled in conformance with test and inspection schedules, and availability of Owner representatives, Architects, Theatre Consultant and Staff.

1.16 TUNE UP

- A. RC's supervisor shall visit the theater six (6) months after acceptance by the Owner to make any required adjustments to the rigging system and to answer any questions posed by the staff.

1.17 WARRANTY

- A. The RC shall provide a written guarantee against defects in materials or workmanship for three years (one year for motorized equipment) starting from the date of acceptance of equipment by the Owner's representative. During the warranty period, repair or replacement of defective materials and/or repairs of faulty workmanship shall be provided, at no cost to the Owner, within thirty days written notification of defect(s).

- B. The guarantee shall not cover equipment that has become defective due to misuse, abuse, accident, act of God, alteration, vandalism, ordinary wear and tear, improper maintenance, or used not in a manner intended.

PART 2 – PRODUCTS

2.1 MINIMUM STANDARDS

- A. Materials shall conform to the edition of the following standards current on this document's bid date:
1. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 2. ASTM B210 Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
 3. ASME B18.2.1 Square, Hex, Heavy Hex, And Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, And Lag Screws (Inch Series)
 4. ASME B18.2.2 Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
- B. In order to establish minimum standards of safety, the following criteria shall be followed:
1. Cables and fittings: Safety Factor of 8
 2. Cable bending ratio: Sheave is 30 times diameter of cable
 3. Maximum tread pressures: 500 lbs. for cast iron; 900 lbs. for Nylatron; 1000 lbs. for steel
 4. Maximum cable fleet angle: 1-1/2°
 5. Steel: 1/5 of stress yield
 6. Bearings: Two times required load at full speed for 2,000 hours
 7. Bolts: Minimum SAE J429 Grade 5 (ISO R898 Class 8.8), zinc plated
 8. Motors: 1.0 Service Factor
 9. Gearboxes: 1.25 Mechanical Strength Service Factor
 10. A minimum of three (3) dead wraps shall be provided on any winch drum.
- C. All materials used in this project shall be new, unused and of the latest design. Re-furbished and obsolete materials are not permitted.
- D. WIRE ROPE AND FITTINGS
1. Lift Cables: All lift cables shall be 7 x 19 construction, galvanized aircraft cable, sized as required, and with a minimum breaking strengths as follows:
 - a. 1/8" diameter - 2,000 pounds
 - b. 3/16" diameter - 4,200 pounds
 - c. 1/4" diameter - 7,000 pounds
 - d. 5/16" diameter - 9,800 pounds

- e. 3/8" diameter - 14,400 pounds
 - 2. Cable fittings and clips shall conform to wire rope manufacturer's recommendations as to size, number and method of installation and shall be forged steel only, galvanized finish. Clips shall be drop forged "Crosby" or "Nicopress."
 - 3. Eyes at cable terminations shall be formed over thimbles of correct size.
 - 4. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building structure or other equipment. Pulleys and sheaves shall be aligned to provide fleet angles not exceeding one and one-half (1.5) degrees.
 - 5. Mule blocks, cable rollers and guides shall be installed as required to provide proper alignment.
 - 6. Turnbuckles shall be drop forged and galvanized. Turnbuckles shall be drilled and moused after adjustment to prevent loosening. Jam nuts are not acceptable.
- E. ALUMINUM MATERIALS AND ACCESSORIES
- 1. Thicknesses, gauges and tempers of aluminum products shall be as required for proper forming operations and to meet structural standards.
 - 2. Aluminum Extrusions, Structural Shapes, Anchors and Clip: 6061 alloy.
 - 3. Aluminum Castings: 214 or 356 alloy, per strength requirements.
 - 4. Fasteners: Includes bolts, nuts, washers, screws, nails, rivets and other fastenings necessary for proper erection and/or assembly of aluminum work.
- F. FINISHES FOR ITEMS WITHOUT FACTORY FINISH
- 1. Interior Ferrous Metal: Welds, burrs and rough surfaces shall be ground smooth and completed assembly cleaned and given one shop prime coat of paint. Two finished coats of paint shall be applied in field during, or at completion of erection.
 - 2. Aluminum: No painted finish required.
 - 3. All Exposed Fastenings: To match color and finish of adjacent material.
- G. RECOMMENDED WORKING LOADS
- 1. This specification calls for minimum recommended working loads for many hardware items. This is the maximum load which the manufacturer recommends be applied to properly installed, maintained, and operated new equipment. Manufacturer's recommended working loads shall be determined by calculations by a Licensed Professional Engineer and destructive testing by an independent testing laboratory. These calculations and reports shall be available for review.

2.2 PIPE GRID

A. General

- 1. Pipe grids shall be constructed from lengths of 1-1/2" nominal I.D. schedule 40 black iron pipe. All joints shall be sleeve spliced with 18" long sleeves with 9" extending into each pipe and held by two 3/8" hex bolts and lock nuts on each side of the joint. Grids shall be installed as indicated on the TR drawings.
- 2. Overlapping pipes shall be joined with a cross grid connector or by an approved equal. The cross grid connector shall have a recommended working load of at least 1,500 lbs.

3. Each pipe shall terminate just off the wall. Internally sleeved wall plates shall securely brace the grid against the wall once it is in place. Supply sufficient braces to prevent lateral movement of the pipe grid.
4. The grid shall be hung from the overhead steel structures on centers not exceeding 8 feet in either direction using approved beam clamps and forged turnbuckles attached to pipe clamps or connector strip hanging brackets.
5. Cross pipes shall be installed above supporting pipes when possible. If cross pipes must be installed below supporting pipes, appropriately rated hardware shall be used.

B. Components

1. All statically suspended rigging system components shall contain rated, traceable hardware throughout the load path of the system.
2. Fasteners
 - a. Unless otherwise specifically noted, fasteners shall have a minimum of SAE J429 Grade 5 or be appropriately rated for the intended application.
 - b. Fasteners shall be self-locking or secured by alternate means to prevent loosening.
 - c. Attachments made through slotted, elongated, or oversized holes (more than 1/16" over the fastener diameter), shall use appropriate flat washers.
3. Beam clamps with jaws attaching to both sides of a flange shall be used whenever possible and such clamps shall use either an adjustable or fixed locking mechanism.
4. Eye Bolts and Eye Nuts
 - a. Open hooks and bent eye bolts shall not be used.
 - b. Eyebolts and eye nuts shall incorporate a thread locking method (e.g. jamb nut, lock washer and nut, thread locking adhesive or peening).
 - c. Eyebolts without shoulders and eye nuts shall only be used for in-line loads and shall not be subjected to any side loads.
5. Shackles
 - a. All shackles shall be forged carbon or alloy steel permanently marked with the manufacturer's identification, size and load rating.
 - b. Screw pin shackles shall be provided with a redundant fixing means to prevent pin rotation.
6. Fasteners
 - a. All bolted connections shall be secured by through-bolting.
 - b. Building structure (beams, braces, purlins, angles, tube, et cetera) shall not be drilled for through-bolting unless reviewed and approved by a registered design professional.
 - c. Installation and use of concrete and masonry anchors shall be done in accordance with manufacturer's instructions and specification.

C. Suspension Media – Threaded Rod

1. Threaded rod shall only be used in straight tension.
2. Statically suspended rigging systems shall be stabilized to prevent the bending of threaded rod.

3. Bending or other deformation of threaded rod shall not be permitted.
4. Welding of threaded rod shall not be allowed as the primary method of attachment unless approved by a registered design professional.

D. Supplemental Structure

1. Components including but not limited to I-beams (e.g. Wide Flange or S), hollow structural section (HSS), or other structural shapes (e.g. angle, channel, bar stock) may be mounted to the building structure to accommodate suspension points.
2. The structural component(s) shall be rated with a minimum design factor of 3:1 based upon the design load against ultimate breaking strength and a design factor of 2:1 shall be used based upon the design load against yield, as applicable.
3. Bolts used for the attachment of load bearing components shall be a minimum grade 5 and incorporate a thread locking method (e.g. jamb nut, lock washer and nut, thread locking adhesive or peening) unless otherwise specified by the manufacturer.

E. Turnbuckles

1. All turnbuckles shall be forged carbon steel or alloy steel and permanently marked with the manufacturer's identification and size.
2. Turnbuckles shall only be used for in-line loads.
3. No part of the turnbuckle shall be replaced with common hardware regardless of grade.
4. Turnbuckles shall be provided with a redundant fixing means to ensure they hold position.

2.3 Pipe Battens

1. All battens shall be pipe battens of 1-1/2" nominal diameter schedule 40 steel pipe in lengths as shown on the drawings.
2. The battens shall be capable of supporting at minimum 30 lbs/ft of uniformly distributed load (UDL). Battens shall be capable of sustaining a point load of 100 pounds at mid-span between any two suspension points with a maximum span deflection of 1/180 of the span.
3. All joints shall be spliced with a .120 x 1 9/16 dia. DOM tube 18" long with 9" of tube inserted into each half of the splice. The tight fitting splice tube shall be held in place by a pair of 3/8 x 2 1/2" grade 5 hex bolts on each side of the joint. The bolts shall pass through the pipe at an angle of 90° to each other. There shall be two bolts on each side of the joint spaced 1" and 8" from the joint. Alternatively, one pair of bolts on one side of the joint may be replaced with either plug welds or tight fitting steel rivets. Pipes shall be straight and painted flat black.
4. Each off stage end of the batten shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4" in length. Write line set number on upstage and downstage of the cap.
5. Wire rope termination at pipe shall be accomplished through the use of trim chains or batten clamps as shown on the drawings.

B. Turnbuckles and Pipe Clamp.

1. Turnbuckles: Turnbuckles.
 - a. Turnbuckles shall be drop forged and galvanized, and conform to ASTM F-1145 Type 1, Grade 1 standard. Turnbuckles shall be moused after adjustment to prevent loosening.
2. Pipe Clamps: Pipe Clamps.
 - a. Full Pipe Clamps:

- b. Pipe clamps shall be made of two strips of 12 Ga. by 2 inch hot rolled steel formed to encompass and clamp the pipe batten to prevent its rotation. Corners shall be rounded.
- c. There shall be a 3/8 inch x 1 inch hex bolt with lock nut above and below the batten. A 5/8 inch hole in the top of each clamp half allows the attachment of cable, chain, or other fittings.
- d. Full pipe clamps shall have a manufacturer's recommended load rating of at least 750 lbs.

2.4 SIGNAGE

- A. Signage with basic operating instructions and warnings shall be posted in the area where the equipment will be operated. Furnish and install signs per the drawings, adjacent to the locking rail on the fly floor and on the loading bridge. Signage shall be in conformance with ANSI-Z535.

2.5 STAGE DRAPERY TRACKS

- A. Curtain tracks shall be of 14-gauge steel construction with a black finish, entirely enclosed except for slot in bottom, each half to be in one continuous piece except where splicing clamps are required.
- B. Each curtain carrier shall be spaced on 12" centers and shall be of steel construction with two neoprene-tired ball-bearing wheels held to steel body by rustproof nickel-plated rivet, such wheels rolling on two separate parallel treads.
- C. Each curtain carrier shall consist of a free-moving plated swivel and sufficient trim chain to accommodate curtain snap hook.
- D. Live-end pulley and Dead-end pulley blocks shall be adjustable and shall be equipped with 8" diameter ball-bearing wheels adequately guarded.
- E. A rubber bumper shall be attached to each curtain carrier to function as noise reducer.
- F. The manufacturer shall furnish two end stops for placement at each track end.
- G. Drapery track shall be ADC model noted on drawings, or approved equal.

2.6 DRAPERY TRACK MOTORS

- A. Large Draw Curtain Machine
 - 1. The large draw curtain machine shall be fully automatic type equipped with a 1-HP motor connected to gear unit, on the output drive shaft of which shall be mounted elevator-type grooved aluminum cable drum and outboard bearing to support and align extended shaft.
 - 2. A cable tension device shall be provided to help automatically remove slack from cable and retain cable within drum grooves.
 - 3. The drum shall deliver a cable speed of 72 feet per minute.
 - 4. The mechanism shall include a magnetic contactor to provide reversing action at any point along the travel and shall include three-button control switch mounted on the unit and one for remote control.
 - 5. Control shall be accomplished through a low voltage (24vac) system running from the control switch on the machine to the remote-control station.
 - 6. Integral rotary limit switches for the "open" and "close" directions shall be driven from the output drive shaft of gear reduction unit.

7. The machine shall be equipped with disconnect switch, overload protective breaker and emergency hand crank for conversion to hand operation.
8. The entire mechanism shall be mounted on heavy steel base.
9. Model 7005-TV as manufactured by Automatic Devices Company of Allentown, PA, or approved equal.

B. Small Draw Curtain Machine

1. The small draw curtain machine shall be fully automatic type equipped with a 1/2 HP fixed speed AC motor directly driving a right-angle gear reduction unit, on the output shaft of which shall be mounted a dual N-grooved drive wheel.
2. Cable tension shall be provided by an integral adjustable tension pulley.
3. The drive wheel shall deliver a fixed cable speed of 90 feet per minute.
4. The mechanism shall include magnetic contactor to provide reversing action at any point along the travel and shall include three-button control switches, one mounted on the machine's control box and one for use as a remote control.
5. Control switch wiring shall be accomplished through a low voltage system running from the machine control box to the remote-control switch station.
6. Track mounted limit switches shall provide stop signals to machine for full open and full close positions.
7. The machine shall be equipped with disconnect switch, overload protective circuit breaker and control protective circuit breaker.
8. The entire machine shall be mounted on a heavy steel base designed to be attached to end of curtain track and supported from the building structure.
9. Model 2928-S as manufactured by Automatic Devices Company of Allentown, PA., or approved equal.

PART 3 – EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

- A. The Rigging Contractor shall be responsible for storage of stage equipment, tools, and equipment during the period of the installation.
- B. Drapery shall be delivered to the site under other sections of these specifications and handed over to the RC on-site.

3.2 INSTALLATION

- A. All specified equipment shall be installed by fully trained superintendents and workmen who are fully responsible to, and fully represent the stage rigging company. Equipment shall be installed in a workman like manner, per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.
- B. Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes. All welding must be performed in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1).

3.3 FINISHES

- A. All welds must be touched up to match disturbed finishes.
- B. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

3.4 BUILDING INTERIOR PROTECTION

- A. The RC shall ensure the protection of the stage floor throughout each and every rigging phase of the project.
- B. The RC shall ensure the protection of the auditorium throughout each and every rigging phase of the project.

3.5 CLEAN UP

- A. The RTC shall be responsible for clean up, including removal of packing materials etc. and the protection of surfaces or equipment provided under other sections of these specifications.

3.6 INSPECTION

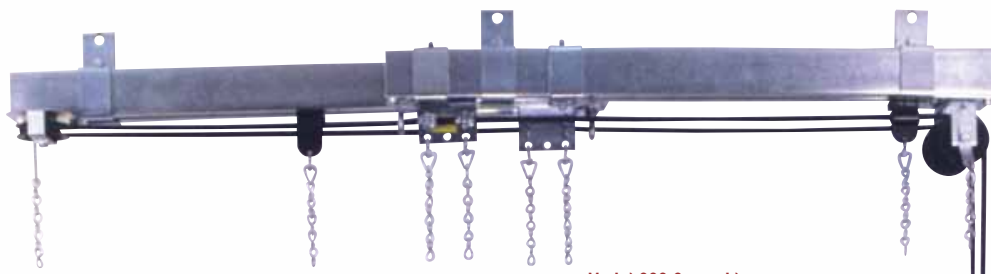
- A. During the installation of equipment, the RC shall arrange for access as necessary for inspection of equipment by the Owner's representatives.
- B. Special Testing: If specifications, the Architect's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Rigging Contractor shall give the Architect timely notice of its readiness for inspection, and of dates of inspections to be made by other authorities.
- C. Completion Testing: Upon completing the installation of all work specified under this section, the Contractor shall so notify the Architect, who will schedule an inspection. At the time of this inspection, the Rigging Contractor shall furnish sufficient workers to operate all equipment and to perform such adjustments and tests as may be required by the Owner's representative. Any equipment which fails to meet with the specifications shall be repaired or replaced with suitable equipment and the inspection shall be re-scheduled under the same conditions as previously specified. At the time of these inspections, no other work shall be performed in the auditorium and stage areas. All temporary bracing, scaffolding, etc. shall be removed to permit full operation of and access to all equipment. Final approval will be withheld until all systems have been thoroughly tested and found to be in first class operating condition in every particular.

END SECTION 116133



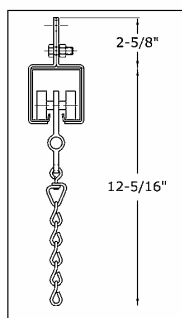
SILENT STEEL® 280 SERIES CURTAIN TRACKS

280

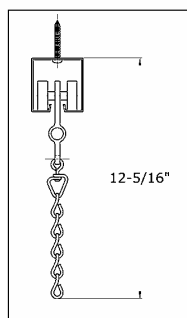


Model 280 Assembly

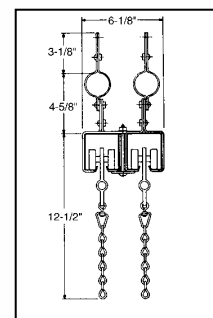
Cross Section of
280 Suspended



Cross Section of
280 Ceiling Mount



Cross Section
of 280 Track at
Center Overlap
Pipe Mounted
Min. pocket width: 7 in.



SILENT STEEL® MODEL 280 [380]

SILENT STEEL is the most famous name in heavy duty stage tracks. Model 280 steel (380 steel (aluminum available)) is used in the majority of stage installations with heavy weight curtains of almost any length and is particularly quiet in operation. Models 281(381) and 282(382) can be used for heavier curtains. They are essentially identical to Model 280(380) except Model 281(381) is equipped with neoprene-tired ball-bearing carriers and Model 282(382) is supplied with nylon tired ball-bearing carriers. Both systems are equipped with larger diameter floor and end pulleys.

MODEL 281 [381]

Model 281(381) features quiet and smooth operating No. 2849(BL) Neoprene Ball-Bearing Single Carriers and No. 2850(BL) Neoprene Ball-Bearing Master Carriers. No.2827 Rubber Spacers are used to reduce noise even further. With Model 281(381) Back Pack® tracks No. 2826 and No. 2827 Rubber Spacers are used.

MODEL 282 [382]

Model 282(382) features No. 2851(BL) Nylon Ball-Bearing Single Carriers and No. 2852(BL) Nylon Ball-Bearing Master Carriers. No. 2827 Rubber Spacer is used in place of No. 2825. No. 2863(BL) 5" Live End Pulley, No. 2864(BL) 5" Dead End Pulley and No. 2866(BL) 5" Adjustable Floor Pulley help in easing the operation of heavy curtains. With Model 282(382) Back Pack® tracks No.2826 and No. 2827 Rubber Spacers are used.

**280(380) Series tracks
cannot be curved.**

MODEL 280-A [380-A]

Model 280-A(380-A) is identical to Model 280(380) except No. 2801-B(BL) Single Carriers (with plated steel block) are used instead of the nylon blocked No. 2801(BL).

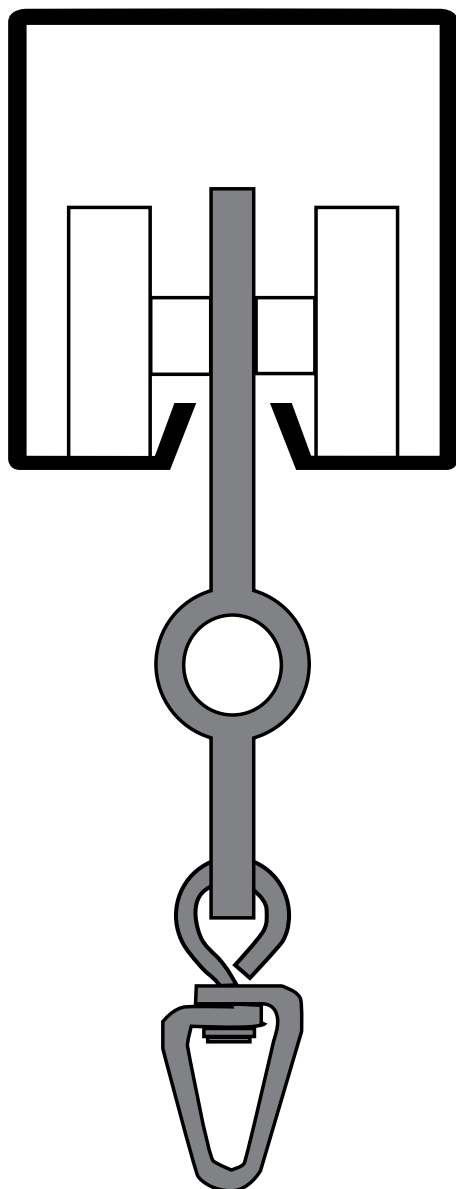
MODELS 283-N [383-N] and 283-R [383-R]

Model 283-N(383-N) and Model 283-R(383-R) employ No. 2863-A(BL) 8" Live End Pulleys, No. 2864-A(BL) 8" Dead End Pulleys and No. 2866-A 8" Adjustable Floor Pulleys which combined with the No. 2830 1/2" Sash Cord reduce operating effort on systems with heavy curtains. The difference between Model 283-N(383-N) and 283-R(383-R) is as follows: Model 283-N(383-N) uses No. 2851(BL) Nylon Ball-Bearing Single Carriers and No. 2852(BL) Nylon Ball-Bearing Master Carriers while Model 283-R(383-R) uses No. 2849(BL) Neoprene Ball-Bearing Single Carriers and No. 2850(BL) Neoprene Ball-Bearing Master Carriers. Not recommended for light duty applications.

Model 284 [384], 284-N [284-N], and 284-R [284-R]

Model 284(384), 284-N(384-N), and 284-R(284-R) are for walk-along operation only and are provided with no pulleys or operating cord. The difference between Model 284-N(384-N) and 284-R(384-R) is as follows: Model 284(384) employs 2801(BL) single and 2802(BL) master carriers. Model 284-N(384-N): No. 2851(BL) Nylon Ball-Bearing Single Carriers and No. 2852(BL) Nylon Ball-Bearing Master Carriers are used. Model 284-R(384-R): No. 2849(BL) Neoprene Ball-Bearing Single Carriers and No. 2850(BL) Neoprene Ball-Bearing Master Carriers are used. Not recommended for light duty applications.

NOTE: Component parts also available in black. Designated by [BL] after part number.



Full Size End View
(NOTE: TRIM CHAIN NOT SHOWN)



No. 2800 Channel [2800 BL]

1' - 2 lbs. 12 oz.

No. 2800-ABL Channel

1' - 15 oz.

14 gauge galvanized steel. 2800 BL powder coated black finish. (No. 2800-ABL supplied in 12 gauge aluminum with a black finish) Obtainable in unspliced lengths up to 26'. Holes can be drilled for direct ceiling attachment. Approximately: 2-5/8" wide x 2-3/4" high.



No. 2801 (BL) Single Carrier

1 - 3-1/4 oz.

Carrier spacing: 12". Block constructed of nylon material supported from ball-bearing with 2 heavy duty polyethylene wheels. Plated swivel for free, effortless curtain movement. Trim chain supplied for curtain trimming. Combined carrier and bumper width: Approximately 2". Length from bottom of track to bottom of 5 chain links: Approximately 9-1/4" from bottom of track to bottom of trim chain.



SILENT STEEL® 280 SERIES CURTAIN TRACKS

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No. 2801-A (BL) Single Carrier

1 - 7 1/4 oz.

Carrier spacing: 12". Block constructed of plated steel supported from ball-bearing with 2 heavy duty polyethylene wheels. Plated swivel for free, effortless curtain movement. Trim chain supplied for curtain trimming. Gate precludes need for removing and rethreading operating cord. Combined carrier and bumper width: Approximately 2". Length from bottom of track to bottom of 5 chain links: Approximately 9-1/4" from bottom of track to bottom of trim chain.



No. 2801-B (BL) Single Carrier

1 - 6.4 oz.

Carrier spacing: 12". Block constructed of plated steel supported from ball-bearing with 2 heavy duty polyethylene wheels. Plated swivel for free, effortless curtain movement. Trim chain supplied for curtain trimming. Combined carrier and bumper width: Approximately 2". Length from bottom of track to bottom of 5 chain links: Approximately 9-1/4" high from bottom of track to bottom of trim chain.



No. 2802 (BL) Master Carrier

1 - 9 oz.

Block constructed of plated steel supported from 2 ball-bearings with 4 heavy duty polyethylene wheels and 2 cable clips which clamp cord to carrier.

Carrier width: Approximately 3-1/2". Length from bottom of track to bottom of 5 chain links: Approximately 9-1/4" high from bottom of track to bottom of trim chain.



No. 2802B Master Carrier with brake

1 - 1 lb. 12 oz.

One foot in length and features nylon-tired, ball-bearing wheels. The spring-loaded brake is released by pulling down on an operating line when positioning the carrier. For walk-draw applications only.

No. 2802B4 Master Carrier with brake

1 - 2 lbs. 3 oz.

This custom unit is similar to the 2802B but is 4 feet in length and features nylon-tired, ball-bearing wheels. The spring-loaded brake is released by pulling down on an operating line when positioning the carrier. For walk-draw applications only.



No. 2849 (BL) Neoprene Ball-Bearing Single Carrier

1 - 12 oz.

Block constructed of plated steel supported from 2 sealed and greased neo-prene-tired ball-bearing wheels. Provides quieter operation. No. 2827 Rubber Spacer must be inserted between each carrier. Used with Model 281 & 283-R.

Approximately: 9-1/4" from bottom of track to bottom of trim chain.



No. 2850 (BL) Neoprene Ball-Bearing Master Carrier

1 - 1 lb. 12 oz.

Block constructed of plated steel supported from 4 sealed and greased neo-prene-tired ball-bearing wheels. Used with Model 281 & 283-R.

Approximately: 9-1/4" high from bottom of track to bottom of trim chain.



No. 2851 (BL) Nylon Ball-Bearing Single Carrier

1 - 9 oz.

Block constructed of plated steel supported from 2 nylon-tired ball-bearing wheels. Provides longer service life and easier operation. Used with Model 282 & 283-N.

Approximately: 9-1/4" high from bottom of track to bottom of trim chain.

SILENT STEEL® 280 SERIES CURTAIN TRACKS



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No. 2852 (BL) Nylon Ball-Bearing Master Carrier

1 - 1 lb. 8 oz.

Block constructed of plated steel supported from 4 sealed and greased nylon-tired ball-bearing wheels. Used with Model 282 & 283-N.

Approximately: 9-1/4" high from bottom of track to bottom of trim chain.



No. 2839 Overlapping Master Carrier

1 - 2 lbs. 13 oz.

Used with single section tracks to create a fixed 12" center overlap. Approximately: 15-1/2" long x 2" wide x 9-1/4" high from bottom of track to bottom of trim chain.



No. 2840 Masking/Panel Master Carrier

1 - 2 lbs. 9 oz.

For moving panels or side masking curtains. Steel plate is attached to masking or panel frame. Constructed of painted steel and equipped with 4 nylon-tired ball-bearing wheels and 2 cord/cable connectors (Model C098) to clamp.

Carrier width: Approximately 4"



No. 2861 Door Carrier

1 - 28 oz.

Constructed of 4 nylon-tired ball-bearing wheels mounted to plated steel body. Adjustable design permits leveling of door height without removing door from carrier. Rated for 100 pound load on properly supported track. Approximately 4" long x 1-3/4" wide x 6-3/8" high (to base of plate).



No. 2861A Basic Scenery Carrier

1-16 oz.

Rated for 150 pound load on properly supported track. Approximately 4-1/2" long x 3-1/4" high, 3/8" thread



No. 2848 Space Saver

1 - 1 oz.

For reducing curtain stacking area. Used in place of carrier. Recommended spacing: no more than 1 between two carriers at end pulley area only. 3/16" thickness. Not used with Model 283-N and Model 283-R manually operated tracks. Total quantity should not exceed 10% of curtain width. (Example: 40' curtain would use 2 per side).



No. 2833(BL) Back Pack Guide® (Optional)

1 - 1 oz.

Provides sliding door effect. Prevents curtain from accumulating until track ends are reached. Thickness 1/8"



No. 2834 (BL) Back Pack Guide® (Optional)

1 - 1 oz.

For machine operated tracks. Prevents curtain from accumulating until track ends are reached. Thickness 1/8"



No. 2833-A(BL) Back Pack Guide® (Optional)

Used with Model 283-N and Model 283-R manually operated tracks. Sized for No. 2830 Cord. Thickness 1/8"

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Curtain Track
Accessories



SILENT STEEL® 280 SERIES CURTAIN TRACKS

280



No. 2803 (BL) Live End Pulley

1 - 2 lbs. 5 oz.

Equipped with 2 oil-impregnated sleeve-bearing nylon wheels. Steel block anchorable to any position under track without drilling.

Pulley width: Approximately 4".



No. 2804 (BL) Dead End Pulley

1 - 1 lb. 8 oz.

Equipped with 1 oil-impregnated sleeve-bearing nylon wheel. Same type adjustment block as Live End.

Pulley width: Approximately 4".



No. 2803-F Flying Live End Pulley

1 - 4 lbs. 13 oz.

Used with flying type curtain machines to route the cable 180 degrees, back over the track to the track-mounted machine. Extends beyond track approximately 4".



2803H Horizontal Live End Pulley

1 - 3 lbs 12 oz.

Used in place of the standard Model 2803 Live End Pulley. The pulley routes the operating lines horizontally and at a 90 degree angle relative to the track. A mule sheave (Model MB-2) can be used at the back wall to route the cables to a floor mounted machine or tension pulley. Dimensions: 7-1/4"L x 4" W



No. 2803-B Center Take Off Pulley

1 - 5 lbs. 12 oz.

Used to route the operating cables perpendicular to the track. Must be located a minimum of 4' from the end of the track. Add 1 each 2804 Dead End Pulley to system when this device is used. Extends 5" from side of track.

NOTE: Additional pulleys may be required to mule operating lines to machine or floor pulley.



No. 2863 (BL) 5" Live End Pulley

1 - 4 lbs.

Painted steel construction equipped with two 5" diameter glass filled nylon ball-bearing wheels. Used with Model 282. Pulley width: 5-1/2".



No. 2864 (BL) 5" Dead End Pulley

1 - 4 lbs. 12 oz.

Painted steel construction equipped with one 5" diameter glass filled nylon ball-bearing wheel. Used with Model 282. Pulley width: 10".



No. 2863-A 8" Live End Pulley

1 - 6 lbs.

Painted steel construction equipped with two ball-bearing equipped 8" diameter nylon wheels. Used with Model 283-N and Model 283-R. Pulley width: 7".



No. 2864-A 8" Dead End Pulley

1-5 lbs.

Painted steel construction with single 8" diameter ball-bearing equipped nylon wheel. Used with Model 283-N and Model 283-R. Pulley width: 10".

SILENT STEEL® 280 SERIES CURTAIN TRACKS



280

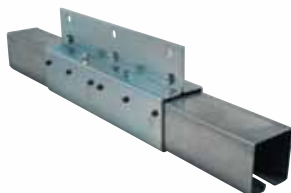


No. 2864R45 Dead End Pulley 45 Degree Angle

1-6 lbs.

Used when track systems need to fit in narrow ceiling pockets or when 2 track systems need to be placed closely side by side. Used with Model 2863A Live End Pulley. Painted steel construction with single 8" diameter ball-bearing nylon wheel. Can be used with any Model 280 track system.

10"W x 11"L



No. 2824 (BL) Suspended Splicing Clamp

1 pr. - 6 lbs. 6 oz.

Two piece 11 gauge steel clamp for joining track sections assuring proper alignment of track channels. Approximately 12" long x 2-3/4" wide x 5-1/2" high.

NOTE: For suspended tracks only.



No. 2824-A (BL) Ceiling Splicing Clamp

1 pr. - 2 lbs. 14 oz.

Two piece 11 gauge steel clamp for joining track sections assuring proper alignment of track channels.

Approximately: 12" long x 7/8" wide x 2-13/16" high.

NOTE: For ceiling mounted tracks only.



No. 28081D Hanging Clamp with Cord Support

Idle pulley device. Used to support and help prevent the cord or cable from sagging below the track sightline. Suggested spacing 6'. Pulley width approximately 4". Available for bi-part and one-way applications.



No. 2808 (BL) Hanging Clamp

1 pr. - 16 oz.

Recommended spacing: 7 ft. Steel, chain or cable suggested for track suspension. Adjustable to any location on the track. Pipe battens recommended for long and heavy curtain installations.



No. 2809 (BL) End Stop

1 - 6.4 oz.

Prevents carriers from moving beyond selected position in track.

Cannot be used with Rotodrapers®. Correct hardware supplied with Rotodrapers®.



No. 2807 (BL) Lap Clamp

1 - 1 lb. 8 oz.

For securing bi-parting tracks at the center overlap.

NOTE: For use with suspended track systems only.

Sold individually.



No. CPS-1 Center Pipe Support

1 pr - 15.2 oz.

To facilitate the clamping of steel track channel to a single pipe batten. The Center Pipe Support is placed at the overlap and the two lap clamps are used in the normal manner.

(Lap and pipe clamps sold separately.)



No. 2821 Pocket Mounting Bracket for Model

2800 Track

1 - 1 lb.

Steel offset bracket for mounting Model 2800 track to side of ceiling pocket. Projects track approximately 4 1/2" from side of pocket. Must be used with Model 2808 Hanging Clamp (not included). Plated steel construction.

4-1/2" L x 2" W

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Curtain Track
Accessories



SILENT STEEL® 280 SERIES CURTAIN TRACKS

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No. 2822 Pocket Mounting Bracket for Model 2800 Track

1 - 12 oz.

Steel offset bracket for mounting Model 2800 track to side of ceiling pocket. Projects track approximately 2" from side of pocket. Must be used with Model 2808 Hanging Clamp (not included). Plated steel construction. 4-1/2"L x 2"W

NOTE: If using pocket mounting brackets with bi-parting track system, both 2821 & 2822 pocket brackets must be used.

NOTE: These brackets are not designed for wall mounted track systems. They do not project enough to allow the curtain to stack without rubbing against the wall.



No. 2823 Ceiling Bracket

1 - 13 oz.

Ceiling Bracket used when it is not possible to drill through track and attach directly to ceiling.

Approximately: 5-1/4" long x 2" wide x 2-3/4" high.



THREADER

1 - 1 lb

Designed to allow suspension of our various track models from tensile rated threaded rod. The bracket is fabricated from hardened steel and has centered hole designed to accept 1/2" threaded rod. Track hanging clamps not included. Dimensions: 3-7/8"H x 1-1/2"W x 3-1/4"L



No. 2814 [BL] Pipe Clamp

1 pr. - 13 oz.

For 1-1/4" I.D. Schedule 40 pipe



No. 2815 [BL] Pipe Clamp

1 pr. - 16 oz.

For 1-1/2" I.D. Schedule 40 pipe



No. 2816 [BL] Pipe Clamp

1 pr. - 18 oz.

For 2" I.D. Schedule 40 pipe



No. 2865 [BL] Tension Floor Pulley

1 - 1 lb. 12 oz.

Equipped with 1 oil-impregnated sleeve bearing nylon wheel. Tension spring provides continuous cord tension. Can be either wall or floor mounted. Spring-loaded latch maintains wheel in uppermost position during installation. Approximately: 1-1/2" long x 3-1/2" wide x 13" high.



Multi-Purpose Carrier

6" wide x 8-1/4" high

1 - 4 lbs.

Nylon-tired ball-bearing wheels. Rated capacity 225 lbs.

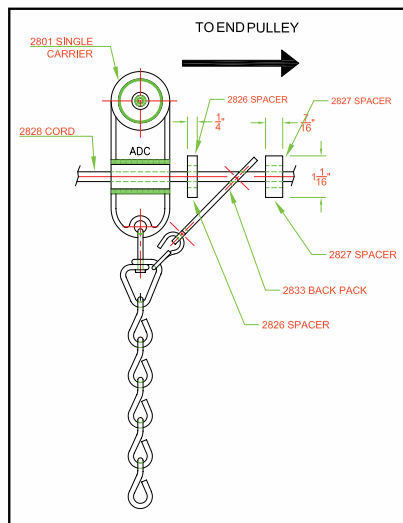


SILENT STEEL® 280 SERIES CURTAIN TRACKS

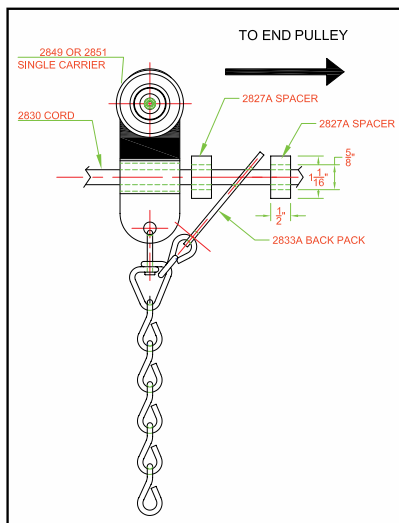
280

Back Pack Drawings

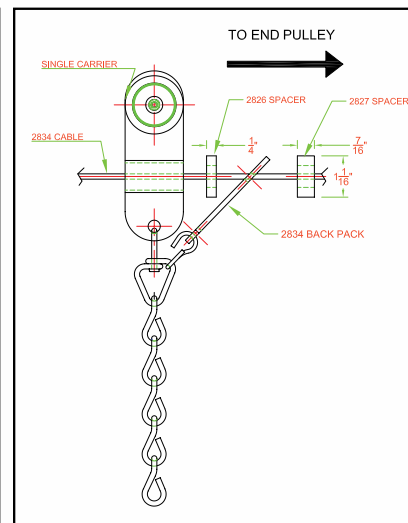
2833 Back Pack



2833A Back Pack



2834 Back Pack



Note: Do not use back-pack guides on master carriers or the last single carrier of any system.



No. 2828 Cord

100' - 5 lbs. 7 oz.
Synthetic center and stretch-resistant.
For manually-operated 280, 281, 282 tracks. 3/8" (No. 12)



No. 3529 Cable

100' - 2 lbs. 7 oz.
Wire center with woven polyester cover.
Used with drum-drive machines. 3/16" (No. 6)



No. 2829 Cable

100' - 2 lbs. 15 oz.
Wire center. Used with machine operated track systems. 1/4" (No. 8)



No. 2830 Cord

100' - 6 lbs. 2 oz.
Synthetic center and stretch resistant.
For manually operated Model 283-N and Model 283-R tracks. 1/2" (No. 14)



Model 2928



Consider using a 2928 Inline Machine with your 280 Track System.

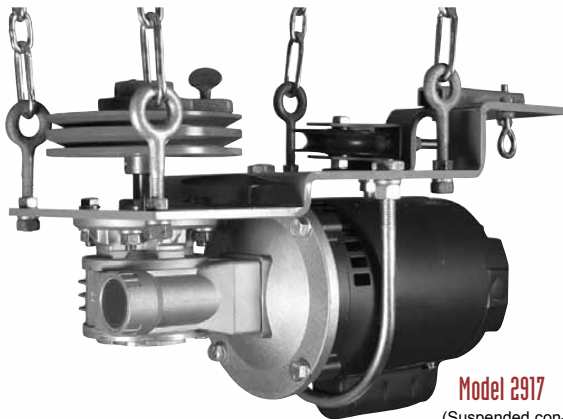


DRAW CURTAIN MACHINES: VERSATILE

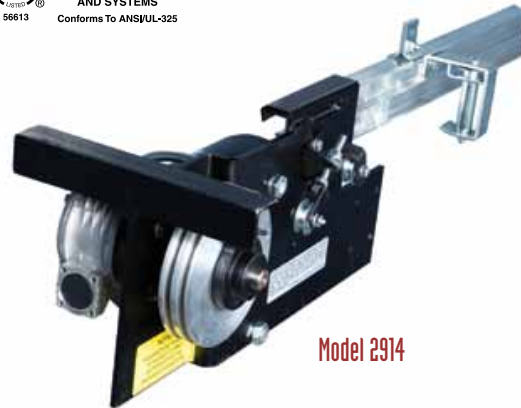
MODEL 2928, 2917, 2950 AND 2914 SILVER SERVICE® MACHINES



ETL LISTED
DOOR, DRAPERY,
GATE, LOUVER AND
WINDOW OPERATORS
AND SYSTEMS
56613
Conforms To ANSI/UL-325



Model 2917
(Suspended configuration show)



Model 2914



TMLS



TMLS



Model 2928
(Ceiling mounted configuration show)



Model 2950



TMLS



TMLS



DRAW CURTAIN MACHINES: VARIABLE

SILVER SERVICE® Model 2905-TV HERCULES® Models 6505-TV and 7005-TV

Model 2905-TV



Close-up of RCS-TV
(wall [standard] and flush mount
[optional] units shown)

NOTE: Guard not shown. Required for ETL compliance.

Models 2905-TV, 6505-TV and 7005-TV combine versatility with the power and drum capacity needed to operate large draw curtains. Equipped with electronic frequency drives, the TV series machines are the most versatile in the ADC line. Designed for draw applications, these machines offer a multitude of parameters that can be programmed in the field to meet a variety of applications. Parameters such as run speed, maximum obtainable speed, minimum obtainable speed, acceleration ramp time and deceleration ramp time are easily changed at the drive. Each machine is provided with deceleration limit switches which allow the machine to decelerate to a stop rather than abruptly stop at the end of its travel. These machines also feature emergency overtravel limit switches and push buttons which bypass the deceleration ramp time and shut the machine off immediately. The operation of these machines is Start/Stop/Reverse from any point of travel and low voltage control is standard. If versatility is a project requirement, this series of machines is the best option.

A Cable Tension Device is included as standard equipment. A magnetic brake, for precise stopping, is available as an option.

OUTSTANDING FEATURES:

GROOVED CABLE DRUM

Assures positive drive without cable slippage. Aluminum construction 8" diameter x 12" long. Coated wire-center cable must be used. Drum must be at least 14' from track live end pulley, or last pulley in system to allow cable to wind properly on drum.

VARIABLE SPEED (0-72 RPM) Speed cannot be adjusted while machine is operating without effecting limit positions.

	Model No.		
	2905TV	6505TV	7005TV
Horsepower	1/2	3/4	1
Input Voltage/Phase	120/220 1 208/230 3	120/220 1 208/230 3	120/220 1 208/230 3
Cable Speed (fpm)	0-72	0-72	0-72
Number of Remote Wires	6	6	6
Control Voltage (Plus Ground)	24 VAC	24 VAC	24VAC
Length With Guard	42	42	42
Width With Guard	30	30	30
Height With Guard	18	18	18
Shipping Weight Without Guard	230	235	245

Frequency drive machines must be used for any motorized system over 100 feet wide. Failure to do so would void the factory warranty.

CABLE TENSION DEVICE

Helps eliminate cable slack automatically. Also helps retain cable within drum grooves.

EMERGENCY HAND CRANK

Facilitates hand operation of curtain in case of mechanical or power failure.

ROTARY LIMIT SWITCH

Allows for user defined decelerated pre-set stops for the "Full Open" and "Full Close" positions. The limit assembly is also supplied with emergency overtravel limit switches which bypass the deceleration ramps and shut the machine off immediately.

DISCONNECT SWITCH

Toggle switch which removes power to machine's internal circuitry.

Power will still be active at the machine terminal strip and on one side of the disconnect switch. To completely remove power from the machine for servicing, power must be shut off at its source and locked out according to OSHA regulations.

OVERLOAD PROTECTIVE BREAKER

Automatic type help protect machine, track and curtain against effects of accidental overload. Must be manually reset.

FREQUENCY CONTROL DRIVE

Provides user definable parameters of operation. Examples are: run speed, maximum obtainable speed, minimum obtainable speed, acceleration ramp time and deceleration ramp time.

SUGGESTED SPECIFICATIONS FOR MODELS 2905-TV, 6505-TV OR 7005-TV

Curtain machines shall be fully automatic type equipped with ... HP motor connected to gear unit, on the output drive shaft of which shall be mounted elevator-type grooved aluminum cable drum and outboard bearing to support and align extended shaft. Cable tension device shall be provided to help automatically remove slack from cable and retain cable within drum grooves. Drum shall deliver a variable cable speed of 0-72 feet per minute. Mechanism shall include electronic frequency drive to provide variable speed, accelerated starts, decelerated stops and reversing action at any point along the travel and shall include three-button control switch mounted on unit and one for remote control. Control switch wiring shall be accomplished through low voltage system running from control box on the machine to the remote control station. Special limit switch shall be driven from output drive shaft of gear reduction unit. Machine shall be equipped with disconnect switch, overload protective breaker and emergency hand crank for conversion to hand operation. The entire mechanism shall be mounted on heavy steel base. Model ... as manufactured by Automatic Devices Company of Allentown, PA.

DRAW CURTAIN MACHINES: VERSATILE



MODEL 2928, 2917, 2950 AND 2914 SILVER SERVICE® MACHINES



Close-up
of RCS-1
(standard)



Close-up
of RCS-2
(optional)



Electrical
Control
Box

	Model No.			
	2914	2928	2917	2950
Track series to use	140	280	170	500
Horsepower	1/2	1/2	1/2	1/2
Volts	120	120	120	120
Control voltage	24 VAC	24 VAC	24 VAC	24 VAC
Num. of Wires to Remote (Plus Ground)	4	4	4	4
Cable speed	90/45 fpm	90/45 fpm	90/45 fpm	90/45 fpm
Length	18"	16"	16"	16"
Width	11"	12"	12"	12"
Height	9"	10"	10"	10"
Weight	45 lbs	45 lbs	45 lbs	45 lbs

These machines are not to be used for the lifting, supporting, or transporting of people. These machines should not be used to move objects over areas where people are present unless suitable safety devices are installed. Other data will be found in the Curtain Machine Selector Guide (page 86).

Specifically designed for projects requiring the curtain machine to be located off of the finished floor. This model machine is designed to attach to, and align with, the curtain track and be supported by an overhead structure via eye-bolts mounted to the machine's base. The machine eliminates the vertical operating cables that normally run from a floor mounted machine to the track live-end pulley. The control box for this model machine is connected by 6' of BX cable to the machine. Control is stop/start/reverse from any point of travel.

OUTSTANDING FEATURES:

N-GROOVE WHEEL DRIVE

Double machined N-grooves in conjunction with an adjustable tension idler provide maximum friction for a near slip free operation.

REMOTE CONTROL STATION

Three-button type and marked Open, Close and Stop. Any number of remote control stations can be used with this model machine. Machine is supplied with remote control station which can be mounted up to 2000 feet away from control box.

CONTROL BOX

Supplied attached to but separate from the machine for placement on an adjacent wall. Control box is supplied pre-wired and to machine with 6' of BX cable.

LIMIT SWITCHES

Track mounted limit switches are used to provide positive stops for the curtain. Two limits are provided with the machine - one for the open direction and one for the close direction. Limit switch voltage is 24 VAC. Master carrier with tripping dog included.

OVERLOAD PROTECTIVE BREAKER

Automatic type which helps to protect the machine, track and curtain from the effects of accidental overload. Must be manually reset.

SAFETY RELAY

Prevents single phase motor from continuing to run in the same direction when a push-button is pressed at the same instant a limit switch is tripped.

OPTIONAL EQUIPMENT

Wireless remote control (Model WRC-1)
Key operated remote control (Model KOS-1)

Specifications for Models 2928, 2950, 2917 & 2914 Silver Service Machine

Curtain machine shall be fully automatic type equipped with a 1/2 HP fixed speed AC motor directly driving a right-angle gear reduction unit, on the output shaft of which shall be mounted a dual N-grooved drive wheel. Cable tension shall be provided by an integral adjustable tension pulley. Drive wheel shall deliver a fixed cable speed of 90 feet per minute. Mechanism shall include magnetic contactor to provide reversing action at any point along the travel and shall include three-button control switches, one mounted on the machine's control box and one for use as a remote control. Control switch wiring shall be accomplished through a low voltage system running from the machine control box to the remote control switch station. Track mounted limit switches shall provide stop signals to machine for full open and full close positions. Machine shall be equipped with disconnect switch, overload protective circuit breaker and control protective circuit breaker. The entire machine shall be mounted on a heavy steel base designed to be attached to end of curtain track and supported from the building structure. Model 2928, 2950, 2917 & 2914 as manufactured by Automatic Devices Company of Allentown, PA.

Machines

Remote
Control
Station

SECTION 116143
STAGE DRAPERY

PART 1- GENERAL

1.1 SUMMARY

- A. The Theatre Drapery Contractor (TDC) shall furnish materials and labor for draperies specified herein and on the drawings including;
 - 1. Traveler curtains
 - 2. Valence curtain

1.2 RELATED WORK

- A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 01 specification sections apply to this section.
- B. Section 116133 Stage Rigging

1.3 DEFINITIONS

- A. "Owner" as used in this section shall mean the representative of Northeast Metropolitan Regional Vocational High School.
- B. "Consultant" as used in this section shall mean Studio T+L, LLC.
- C. "Theatre Drapery Contractor" or "TDC" as used in this section shall mean the contractor responsible to provide, furnish and/or install, as noted, the stage draperies and related fabric under Section 116143.
- D. "Architect" as used in this section shall mean Drummey Rosane Anderson, Inc.
- E. Rigging Trade Contractor, Rigger or RC shall mean the contractor for Section 116133.
- F. "IFR" as used in this section shall mean Inherently Fire Retardant as defined by NFPA 701.
- G. "FR" as used in this section shall mean Fire Retardant as defined by NFPA 701.
- H. Wherever the words "Approved", "Approval", and "Approved equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Architect.
- I. "Provide", as used herein, shall mean that the TDC is responsible for furnishing and installing said item or equipment.
- J. "Furnish", as used herein, shall mean that the Theatre Drapery Contractor shall acquire and make available said item or equipment and that the installation shall be under other sections of these specifications.
- K. "Contract Documents" as used in this section shall be deemed to include both the specification section and related bid drawings.
- L. "NIC" as used in the contract documents means, "Not Included in this Sub-Contract"
- M. "Or As Approved" as used in the contract documents means "substitution only after written approval by Consultant.

1.4 SUBMITTALS

- A. Samples for verification purposes: physical 12-inch square or complete pattern repeat (whichever is smaller), of each fabric in color specified herein.
- B. Provide draperies that are certified to be FR or IFR in accordance with requirements of the most current version of NFPA 701, and with any additional state or local codes.
- C. With each FR fabric sample, provide the name of the flame-retardant chemical used (if any), the treatment method, the application date, the allowable life span of the treatment, and details of any restrictions or limitations.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm with not less than five years of successful experience in fabrication and installation of Stage Draperies similar to those required for this project.
- B. Pre-qualified drapery firms include:
 - 1. I. Weiss, Fairview, NJ – 888-325-7192
 - 2. Pook, Diemont, and Ohl, Bronx, NY – 718.402.2677
 - 3. Rose Brand, Secaucus, NJ – 800.223.1624
 - 4. Syracuse Scenery & Stage Lighting, Liverpool NY – 800.453.7775

1.6 DELIVERY

- A. Bid price shall include full freight charges for the delivery of all Drapery items to the job site.
- B. Delivery will be required during 2025 and shall be coordinated with the Construction Manager.
- C. Each drapery item must be carefully wrapped and sealed tight for shipment in rigid and completely water-proof wrapping material to insure against impact and water damage during shipment. Shipping date shall be coordinated with the Contractor to ensure the shortest length of time between packing and hanging in order to prevent permanent wrinkling.

1.7 WARRANTY

- A. Theatre Drapery Contractor agrees to make all repairs, including replacement of materials, made necessary due to defects in workmanship and materials without additional cost to the Owner for a period of 12 months from the date of Owner acceptance.

1.8 PROJECT CONDITIONS

- A. Substitutions, changes or deletions of specified equipment must be approved by the Architect and Theater Consultant. Appropriate drawings or other significant data must be submitted no later than ten (10) days prior to the bid opening date proving the equivalence or superiority of the proposed substitutions to be considered.
- B. All questions requiring clarification or interpretation of the Drawings and/or Specifications should be addressed in writing to the Architect.
- C. Field Measurements: Check actual stage curtain and window curtain openings by accurate field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying work.

PART 2 – PRODUCTS

- 2.1 GENERAL: Provide fabrics inherently and permanently flame resistant or chemically flame resistant by immersion treatment according to performance requirements indicated. Provide fabrics of each type and color from same dye lot.

2.2 FABRIC #1

- A. Heavy Weight Synthetic Velvet: Synthetic napped, FR, velour fabric weighing not less than 24 ounces per linear yard, with pile height of approximately 2 mm with a minimum width of 54 inches.
- B. Products: Subject to compliance with requirements, provide the following from manufacturers' standard color line:
 - 1. Dazians "Angelo" 24 oz./yd.
 - 2. JB Martin "Dante" 25 oz./yd.
 - 3. KM Fabrics "Charisma" 24 oz./yd.

2.3 FABRIC #2

- A. Ranger Lining, 100% cotton weighing not less than 13 ounces per linear yard, black, 68" minimum width, FR.

PART 3 – FABRICATION

3.1 GENERAL

- A. Seams and Sewing: Conform to the best trade practices. All seams and hems shall be flat and true without any puckers or pulls. Where widths of fabric are joined together, provide three-layer flat finished seams, sewn in such a manner that all raw edges of the fabric are concealed. No over-locking stitching permitted. All fabric panels or widths shall run the full height of the finished curtains without any horizontal seams, and all seams shall be vertical. All curtains shall be table-square. Horizontal seams and fabric less than half-width are not permitted.
- B. Lining: Provide lining for each curtain so specified in the same fullness and finished 2 inches shorter than face fabric with no less than 2" hem. Attach lining to face fabric along bottom line at seams with 4" long strips of heavy woven cotton tape at 24" intervals.
- C. Tie Line: For draperies specified with grommets and tie lines the tie lines shall be 36" long black #4 braided line. Provide alternate colored tie line at the center grommet.
- D. Turnbacks: Where specified, provide turnbacks, formed by folding designated number of inches of face fabric back at each end of panels and securing by sewing through both layers of fabric. Capture vertical edge with continuous stitching.
- E. Webbing: Webbing shall be 12 lb., 3-1/2" wide jute webbing, or approved equal, unless otherwise specified.
- F. Labeling
 - 1. The top off-stage corner of each finished stage Drapery item shall each have a rectangular piece of white synthetic material sewed securely to the back side of the Drapery. Write onto the label the appropriate information in the manner indicated below using indelible black marking inks:
 - a. Manufacturer's name
 - b. Type of drape (i.e.: S.L. Traveler Panel)
 - c. Dimensions (W x H)
 - d. "I.F.R" or "Flame proof after dry cleaning or after X months/years"
 - e. Material

G. Flame-Resistance Testing: In order to provide fabric for periodic testing of the flame-resistance of the stage drapery, a 4" wide strip of fabric shall be separately sewn to one of the off-stage vertical side hems of that curtain, so that any part of the strip can be removed without affecting the stitches of the side hem.

1. For drapery provided in multiples, such as legs, provide a testing strip on one only one piece.
2. For full-height drapery, such as legs and cyclorama, the strip of fabric shall extend from the top of the bottom hem to a minimum height of 6'-0".
3. For partial-height drapery, such as borders, the strip of fabric shall extend from the top of the bottom hem to the bottom of the top hem.

3.2 BOX PLEATED DRAPERY

- A. Top Hems: Reinforce top hems by double-stitching 3-1/2 inches wide heavy jute or polypropylene webbing to top edge with minimum 1" of face fabric turned under. Provide not less than #3 grommets spaced at 12 inches on center at 1 1/2" from edge.
- B. Bottom Hems: Provide bottom hems not less than 5 inches deep with separate interior heavy canvas chain pockets equipped with No. 8 cadmium-plated jack chain or 1-inch tape weight. Stitch chain pocket so chain rides 2 inches above bottom edge of curtain. Stitch pocket closed at both ends.
- C. Fullness
 1. 100 percent fullness: Provide fullness, exclusive of turnbacks and hems, by showing additional material into 6 inch double-stitched, flat, box pleats spaced 12 inches on center.
 2. 75 percent fullness: Provide fullness, exclusive of turnbacks and hems, by showing additional material into 4-1/2 inch double-stitched, flat, box pleats spaced 12 inches on center.
 3. 50 percent fullness: Provide fullness, exclusive of turnbacks and hems, by showing additional material into 3 inch double-stitched, flat, box pleats spaced 12 inches on center.
 4. Arrange all vertical seams so that they fall within pleats.
- D. Provide not less than #3 brass grommets spaced at 12 inches and centered on box pleats, for tie lines (drops, legs, borders) or snap hooks (travelers).

3.3 FABRICATION DETAILS

- A. Traveler Curtains
 1. Fabricate traveler curtains with fabric and fullness as shown in the drapery schedule, with 1/2 full width turnbacks at on stage edges and 6" turn backs on off-stage edges of both panels, lined as specified above and hung with a 36-inch overlap at the centerline.
- B. Valence Curtain
 1. Fabricate valence curtain with fabric and fullness as shown in the drapery schedule, with 6" turn back on off-stage edges and lined as specified above.

PART 4 – EXECUTION

- 4.1 Installation shall be by the Theatre Drapery Contractor and shall be coordinated with the contractor for Section 116133 Stage Rigging.

END SECTION 116143

SECTION 116153
STAGE LIGHTING POWER AND CONTROL

PART 1- GENERAL

1.1 SUMMARY

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications, apply to the work in this Section.
- B. All work of this section shall be furnished under a single subcontract and shall be the responsibility of the Lighting System Integrator (LSI) except where specifically assigned to the general contractor or electrical contractor.
- C. Work of this Section includes, but is not limited to, the following:
 - 1. Furnish wiring devices, back boxes, panels, relay panels, lighting control racks, as described herein and on the drawings.
 - 2. Coordination with the Electrical Contractor (EC) for a complete and working theatrical dimming and control system.
 - 3. Engineering as required by the Contract Documents.
 - 4. Provide continuous liaison with the Construction Manager (CM) and other trades during construction, and coordinate delivery schedules and installation of equipment.
- D. This specification shall be considered as an outline form and other appurtenances that may be required for the efficient and safe operation of the dimming and control systems specified in this section shall be furnished by the LSI, the same as if specified herein.
- E. Any quantities, measurements or dimensions listed or shown are for the convenience of the Lighting System Integrator in the preparation of his estimate but will not relieve the SI of his responsibility for the determination of the exact quantities, measurements, and dimensions required for a complete job.

1.2 RELATED WORK

- A. Receipt and installation of stage lighting and architectural lighting system as per Division 26.
- B. Electrical service from power mains through fused safety switches to primary terminals of dimmer racks.
- C. Emergency power supply, distribution and protection, except as noted.
- D. Placement and installation of equipment, except as noted.
- E. All conduit, junction boxes, wire and wire pulling.
- F. Back boxes as shown on the drawings.
- G. All wire terminations.
- H. Architectural lighting fixtures.
- I. Interior work as specified in Division 9.
- J. Rigging work as specified in Section 116133.
- K. Dimmer room and control room finishes and glazing.

- L. Equipment painting and finishing, except as noted.

1.3 DEFINITIONS

- A. "Owner" as used in this section shall mean the representative of Northeast Metropolitan Regional Vocational High School.
- B. "Theatre Consultant" as used in this section shall mean Studio T+L, LLC.
- C. "Lighting System Integrator" (LSI) as used in this section shall mean the contractor responsible to provide, furnish and/or install, as noted, the stage lighting and architectural lighting dimming and control system as defined by Section 116153.
- D. "Architect" as used in this section shall mean Drummey Rosane Anderson, Inc.
- E. "Electrical Engineer" (EE) as used in this section shall mean ____.
- F. "Electrical Contractor" (EC) as used in this section shall mean the contractor for Division 26.
- G. Wherever the words "Approved", "Approval" and "Approved equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Architect and Theatre Consultant.
- H. "Provide", as used herein, shall mean that the LSI is responsible for furnishing and installing said item or equipment.
- I. "Furnish", as used herein, shall mean that the LSI shall acquire and make available said item or equipment and that the installation shall be by others.
- J. "Install", as used herein, shall mean that the LSI shall make installation of items or equipment furnished by others.
- K. "Contract Documents", as used herein, shall be deemed to include both the specification section and related bid drawings.
- L. "NIC" as used in the contract documents means, "Not Included in this Contract".
- M. "By Others" as used in the contract documents means "Provided by Another Subcontractor".
- N. "Or As Approved" as used in the contract documents means "Substitution only after written approval by Consultant".

1.4 SCOPE OF WORK

- A. Provide and/or Furnish and/or Install, as noted herein, new and unused equipment and materials to create a complete and functional dimming and control system for the stage lighting and architectural lighting as specified herein and in the contract drawings
- B. The LSI shall provide all materials, labor and engineering to manufacture and deliver all equipment including but not limited to, items shown on the drawings and specified herein:
 - 1. Furnish all relay racks, as may be required.
 - 2. Furnish all stage lighting control systems including: control console(s), control console accessories and video accessories; house lighting control systems; work lighting control system and all panels and pendants as specified herein for Architectural, DMX512 and Ethernet control networks.
 - 3. Furnish all stage lighting power and data distribution devices including: plugging strips, plugging box face panels, multi-cables, multi-cable connectors and junction boxes as specified herein.

4. Furnish all back boxes for stage lighting and architectural panels and devices except as noted.
 5. Site inspection reports and installation instructions.
 6. Factory testing, engineering check-out, field testing and completion check-out as noted herein.
 7. Program all architectural lighting and stage lighting control stations. The Theatre Consultant will provide the LSI with a complete list of dimmer and channel assignments for each button and slider on each architectural lighting control station. The LSI shall provide a minimum of two (2) weeks notice to the Theatre Consultant when such information is required.
 8. Provide "as built" drawings, guarantee and warranty, operation manuals, staff instruction and software updates as noted herein.
- C. All equipment and systems specified herein shall perform as specified when installed on site. Examine all sections of Division 26 and determine their relationship to the work of this section. Perform all work of this section in accordance with the applicable requirements of Division 16 to provide an interrelated electrical system.

1.5 CONTROL PROTOCOL REFERENCE STANDARDS

- A. Products utilizing the "DMX" or "DMX512" control protocol shall comply with ANSI E1.11 – 2008 (R2018), Entertainment Technology - USITT DMX512-A, Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories.
- B. Products utilizing the "ACN" control protocol shall comply with ANSI E1.17 – 2015, Entertainment Technology - Architecture for Control Networks (ACN).
- C. Products utilizing the "RDM" control protocol shall comply with the following standards:
 1. ANSI E1.20 – 2010, Entertainment Technology - RDM - Remote Device Management over USITT DMX512 Networks
 2. ANSI E1.37 - 1 – 2012 (R2017) – Entertainment Technology – Additional Message Sets for ANSI E1.20 (RDM) Part 1
 3. ANSI E1.37 - 2 (RDM) – Part 2 – 2015, Entertainment Technology, Additional Message Sets for ANSI E1.20 (RDM) – Part 2, IPv4 & DNS Configuration Messages
- D. Products utilizing the "RDMnet" control protocol shall comply with ANSI E1.33 - 2019, Entertainment Technology -- (RDMnet) -- Message Transport and Device Management of ANSI E1.20 (RDM) Compatible and Similar Devices Over IP Networks.
- E. Products utilizing "Lightweight/Streaming ACN" control protocol shall comply with ANSI E1.31 – 2018, Entertainment Technology – Lightweight streaming protocol for transport of DMX512 Using ACN.
- F. Products utilizing a "0 – 10V" control protocol shall comply with ANSI E1.3 - 2001 (R2016), Entertainment Technology - Lighting Control Systems - 0 to 10V Analog Control Specification.
- G. Portable data cables used to transmit "DMX" or "DMX512" data shall comply with ANSI E1.27-1-2006 (R2014), Entertainment Technology-Standard for Portable Control Cables for Use with USITT DMX512/1990 and E1.11 (DMX512-A) Products.
- H. Permanently installed data cables used to transmit "DMX" or "DMX512" data shall comply with ANSI E1.27-2 – 2009 (R2019), Entertainment Technology - Recommended Practice for Permanently Installed Control Cables for Use with ANSI E1.11 (DMX512-A) and USITT DMX512/1990 Products.

1.6 SYSTEM INTEGRATOR

A. General

1. The supplier of the system herein described shall be acknowledged in business as a Theatre Lighting Systems Integration Company, hereafter referred to as LSI. This company shall employ full time Systems Integrators and Project Managers with experience in completing work of similar or greater size and scope. The role of the LSI in this project shall be to provide all equipment listed in this section to the Electrical Installer for installation. The LSI shall furnish a complete working system to the Electrical Contractor, meeting the intent of this specification. The LSI shall coordinate delivery schedules and installation of equipment with Electrical Contractor. Additionally, the LSI shall be responsible for all documentation for equipment in this section, system record drawings, final testing of the system and training of the Owner's personnel as required by this specification.

B. Qualifications

1. LSIs that are not pre-approved shall provide with their bid the following information or statements.
 - a. The LSI shall have a minimum of 10 years experience in the installation and operation of similar equipment associated with the construction and/or renovation of facilities similar in scope to this project.
 - b. The LSI shall have been in business for a minimum of 10 consecutive years and shall have no history of bankruptcy.
 - c. The LSI shall be an authorized dealer for an adequate number of manufacturers of system products necessary to provide a complete working system meeting the intent of this specification. System products shall include but are not limited to the following:
 - 1) Dimming Equipment
 - 2) Control Systems
 - 3) Stage Lighting Fixtures
 - 4) Power Distribution Devices and Faceplates
 - 5) Stage Lighting Accessories
 - a. The LSI shall have on staff at least two full-time manufacturer-certified field service technicians and have technical support and assistance accessible 24 hours a day, seven days a week.
 - b. The LSI shall offer a Maintenance and Service Contract.
 - c. The LSI shall provide a one-year system warranty for the complete system, not including expendable supplies, effective from the date of system acceptance. Within this warranty period, the LSI shall be responsible as the Owner's sole contact for the remedy, repair, or replacement of system deficiencies (through the manufacturer's warranty where applicable).

C. Project Management

1. The LSI shall designate a dedicated Project Manager. The LSI's Project Manager shall be the main contact between the LSI, the manufacturers, the Architect, the Theatre Consultant and the Contractors from contract award until final sign off. The LSI's Project Manager shall be the same person throughout the entire course of the project, unless otherwise approved by the Architect.

2. The LSI's Project Manager will provide Project Status Reports. These status reports shall provide the basis for analysis of completion as well as for progress meetings between the LSI and the Architect.
3. The LSI's Project Manager shall provide the Construction Manager or General Contractor with a two-week Look Ahead Schedule to help with the coordination of other trades, as needed.

1.2 SYSTEM INTEGRATOR RESPONSIBILITIES

- A. This specification section, related sections and the contract drawings describe performance attributes of systems to be provided, including means of operation and control, dimensions and profiles and visual appearances. Assume all responsibility for engineering of systems described herein, including modification of and addition to any details as required fulfilling the design intent of the specification section.
- B. All work shall be manufactured in accordance with the latest editions of applicable publications and standards of the following organizations:
 1. National Electric Code (NEC) and all prevailing local regulations.
 2. Underwriter's Laboratories, Inc.(UL)
 3. National Electrical Manufacturers Association (NEMA)
- C. All equipment, systems, components and assemblies shall be UL and/or CSA listed and meet all applicable local codes, standards and customary practice applying to the work of this section.
- D. All equipment shall be thoroughly tested in the LSI's shop prior to shipment to ensure mechanical and electrical integrity.
- E. Provide timely inspection and instruction to EC to ensure proper installation of the dimming system.
- F. Omissions and/or errors within this specification section shall not relieve the LSI and the EC of the responsibility for providing a properly functioning installation of the dimmer system.
- G. Correct and replace, at no cost to the Owner, any system or part of the system that does not meet the requirements of this section at the time of Completion Check-out or any time during the warranty period.

1.3 QUALITY ASSURANCE

- A. The manufacturer of the dimming and control equipment (both theatrical control and architectural control) shall be:
 1. Electronic Theatre Controls, Middleton, WI – 608.831.4116
 2. Strand Lighting, Dallas, TX – 214.647.7880
- B. Approved manufacturers of the wiring devices shall be:
 1. Union Connector, Jacksonville, FL – 631.753.9550
 2. SSRC, Duncan, SC - 864.848.9770
 3. Lex Products, Shelton, CT – 800.643.4460
 4. Electronic Theatre Controls, Middleton, WI – 608.831.4116
 5. Strand Lighting, Dallas, TX – 214.647.7880

1.4 REVIEW AND INTERPRETATION DURING BIDDING

- A. Notify Architect and Consultant of any omissions, discrepancies or ambiguities in the specification section and the contract drawings so that a clarification may be issued. Notify Architect and Theatre Consultant if exception is taken to any statement, indication or criterion in the contract documents.
- B. Obtain all other contract documents, including architectural, electrical, structural and mechanical to ensure there are no conflicts with the work of this section. Notify Architect and Theatre Consultant of all such conflicts and propose modifications to resolve the conflicts.
- C. Submit the notifications, A and B above, in writing to Architect and Theatre Consultant at least fourteen (14) days prior to bid opening date. Lack of notification shall be understood to indicate acceptance of all requirements of the contract documents and shall preclude any future claims.
- D. Interpretations or corrections to the contract documents shall be issued by Addendum. Interpretations or corrections given by any other method will not be binding.

1.5 SUBSTITUTIONS

- A. Substitutions in the contract documents will only be considered where noted "OR AS APPROVED". Submit requests for substitutions, in writing, to Theatre Consultant no less than fourteen (14) days prior to bid opening. Theatre Consultant shall be the sole judge of acceptability of proposed substitutions.
- B. Approved substitutions will be listed by Addendum. Verbal or other written approvals will not be binding.

1.6 BID SUBMITTALS

- A. The LSI shall provide the following information as part of their bid package:
 - 1. The LSI shall submit a list of at least five systems of similar scope and size which have been in service for at least six months. Include name, address and telephone number of owner, architect and theater consultant.
 - 2. List of staff to be assigned to this project.
- B. Provide a complete Bill-of-Material sets as part of the bid proposal. Include a list of all equipment, systems, components, sub-assemblies, etc., proposed to fulfill the requirements of the contract documents.
- C. The Bill-of-Materials will be used to evaluate whether the proposal meets the letter and intent of the contract documents. Bids not meeting the specification, based upon a review of the Bill-of-Materials, will be rejected. The Bill-of-Material will not, however, be the exclusive determinant of the equipment and services required for the work of this section.
- D. List any exceptions taken. Cite specific reference by page and section and briefly describe the nature of the exception. The absence of this list shall indicate acceptance of all terms of the contract documents. Exceptions taken after acceptance of bids shall only be considered at the discretion of the Theatre Consultant.
- E. Include standard catalog cut-sheets and specifications for all proposed equipment. Note all modifications or deviations from those standard sheets.
- F. The owner reserves the right to waive all formalities, to be sole judge of quality and equality of the several bid proposals, and reserves the right to reject any and all bids.

1.7 SHOP DRAWINGS

- A. Submit complete sets of submittals to the Theatre Consultant in quantities as noted in the General Conditions or as directed by the Architect for approval prior to fabrication. Indication by

arrow and boxed caption of all deviations from contract drawings and specifications beyond deviations discussed at the Post Tender Meeting must be included.

- B. Prepare shop drawings under the supervision of a qualified project engineer. Include names and contact telephone numbers of project manager and project engineer with shop drawing package.
- C. All shop drawings shall represent actual fabrication and details. Copies or tracing of contract documents are not acceptable.
- D. Shop drawings shall show material, finishes, metal gauges, overall and detail dimensions, sizes, electrical and mechanical connections, fasteners, welds, provisions for the work of others, and similar information. Shop drawings shall indicate complete details of equipment, including manufacturer's catalog numbers for components and shall include complete wiring diagrams. The shop drawings shall be reviewed by the Consultant before the equipment is manufactured. The drawings will be used by the LSI and Electrical Contractor when installing the equipment.
- E. Shop drawings for wiring devices shall utilize the exact circuit numbering system as detailed on the contract drawings. Furnish catalog cuts, drawings and/or descriptive material of catalog items as requested by the Architect.
- F. Shop drawings and related data must be submitted complete and at one time. Isolated items will not be considered for approval. Required re-submissions similarly must include all items at one time unless exceptions are previously authorized in writing.
- G. Review of shop drawing by the Theatre Consultant, Architect and Engineer is for conformance with the design concept and information provided in the contract documents. Non-conformities and errors detected during review shall be noted on shop drawings and returned to LSI upon completion of the review. The Theatre Consultant, Architect and Engineer are not responsible for completeness or accuracy of LSI's shop drawings. Review of shop drawings containing deviations and inconsistencies not detected does not relieve the LSI from sole responsibility to provide materials and work conforming to the contract documents.
- H. No equipment shall be manufactured, fabricated, shipped or installed prior to review of shop drawings by the Theatre Consultant, Architect and Engineer. Only shop drawings returned and marked APPROVED or APPROVED AS NOTED may be used by the LSI. Correct and re-submit any shop drawings marked REVISE AND RE-SUBMIT or NOT APPROVED.
- I. If field dimensions and/or other coordination information obtained after review of shop drawings requires changes in size, detail or similar considerations, notify the Consultant and re-submit the relevant shop drawings.
- J. All shop drawings shall identify Studio T+L, LLC. as the Theater Consultant.

1.8 SAMPLES AND MOCKUPS

- A. Provide samples and mock-ups identified in the contract documents or as requested by the Theatre Consultant.

1.9 MAINTENANCE AND OPERATION MANUALS

- A. After the installation is complete, the LSI shall provide four copies of an Operations Manual which shall include:
 - 1. Catalog cuts of all equipment.
 - 2. Operation manual for control console.
 - 3. Recommendations for periodic maintenance.

4. Catalog numbers and manufacturer's names and addresses for perishable items such as pilot lamps and fuses.
 5. Diagnostic procedures.
 6. Emergency and normal repair telephone contact sheet for 24-hour service.
 7. As built drawings showing all changes encountered during the installation.
 - B. The Operation Manuals shall be subject to approval by the Theatre Consultant and must be submitted for review prior to instruction of staff.
- 1.10 COMPLETION DATE
- A. Completion of the entire dimming system shall be according to the Construction Manager's schedule sometime in 2025. An exact date will be set at contract award.
 - B. A final check-out by the Theatre Consultant and a reasonable allowance of time to complete "punch-list" items must be included in the LSI's planning and job schedule.
- 1.11 TESTS AND INSPECTIONS
- A. Upon completion of all work, the LSI shall certify in writing that work is complete and ready for inspection for final approval. Final inspection shall be scheduled by the Architect and Theatre Consultant at their convenience and that of their representatives and consultants, within a period of 15 to 20 days following receipt of such notification.
 - B. After the inspection, the LSI shall make any adjustments or modifications necessary to bring the work into conformance with established contract requirements.
 - C. Should deficiencies, due to faulty equipment or installation, require re-inspection after corrective work, all expenses of such re-inspection, including time and travel of the Consultants, the Architect and Owner representatives, shall be the responsibility of the LSI, without cost to the Owner.
- 1.12 STAFF INSTRUCTION
- A. The LSI shall instruct designated staff members, or the Owner's technical representatives, in the safe operation, servicing, care and maintenance of all equipment.
 - B. The Architect and Theatre Consultant may be present or represented.
 - C. Instruction is to be scheduled in conformance with test and inspection schedules, and availability of Owner's representatives, Architect, Theatre Consultant and staff.
 - D. Instruction period shall be no less than two 4-hour days, subject to the discretion of Owner's representatives, Architect, Theatre Consultant and staff.
 - E. LSI shall include and overview of the operation manual during this period.
- 1.13 MAINTENANCE PERIOD
- A. The LSI shall assure that the dimming system is properly installed, free of defects in materials and workmanship, and shall provide a warranty on all equipment and workmanship provided under this contract for a period of one year from the date of owner acceptance.
 - B. During the maintenance period, repair or replacement of defective materials and/or repairs of faulty workmanship shall be provided, at no cost to the Owner, within two days written notification of defect(s).
 - C. Three copies of the above warranty are required as a condition for final approval of the work.

- D. Submit with the warranty a yearly cost for dimming system maintenance contract covering three years subsequent to expiration of initial period. System is to be maintained at no less a level than when system was accepted upon completion.

PART 2 – PRODUCTS

2.1 LIGHTING CONTROL NETWORK

A. General

1. The lighting control network shall provide data distribution over TCP/IP Ethernet networks. Data shall be layer 3 routable. Systems using proprietary formats or formats other than 10/100/100Mbit wired Ethernet or non-layer 3 routable networks shall not be accepted.
2. Connections shall be made between consoles, face panels, architectural processors, dimmers, Net3 Gateways, and computers over standard Ethernet distribution systems using 100BaseT, 100BaseFL, or greater wiring. All installations shall conform to established Ethernet wiring practice, and installation shall be performed by contractors qualified to do this type of work. All wiring shall be tested at Category 5e or higher for full bandwidth operation to the appropriate IEEE standard.
3. The Lighting Control system must be supplied by a single manufacturer and must have seamless integration over Ethernet between the Entertainment and Architectural lighting control.

B. Capacities

1. The network shall support DMX routing, patching, and prioritization for up to 63,399 universes (32,767,488 DMX addresses). Each address may be input or output from any port on any DMX gateway in the system. DMX input, routing and output shall be specifically supported on the system from multiple sources and locations up to the maximum number of gateways supported by the Ethernet topology.
2. The network shall support multiple network hosts including consoles, gateways, dimming racks, computers, file servers, printers, and architectural control processors with discrete command lines and control. The lighting network shall support multiple venues within a system and discrete systems on the same network.

C. System Configuration and Monitoring

1. Network device configuration shall be via Net3 Gateway Configuration Editor (GCE) software, network PC, and/or ANSI E1.17 Architecture for Control Networks (ACN).
2. Patch addresses shall support viewing and manipulation via ANSI E1.17 ACN.
 - a. The system shall permit complete user flexibility allowing the system operator to patch each DMX input address to any ANSI E1.31 streaming ACN address, and DMX output to span streaming ACN universes.
 - b. The lighting system shall support assignment of DMX offsets, truncation of DMX universes, and provide choice of DMX port prioritization.
 - c. The lighting system shall support the DD start code extension to ANSI E1.31 which provides priority per address such that multiple control sources can share universes with discrete control per address.
 - d. Lighting systems that do not support the above mentioned address patching capabilities shall not be suitable.

3. The system shall allow assignable labels for all network devices to allow easy identification by system users.
4. Each network device shall have a discrete and unique IP address provided automatically by the software. The user may edit this IP address. Systems that do not support automated IP allocation with IP collision avoidance, and systems that do not allow complete reconfiguration of the above mentioned features over ANSI E1.17 ACN shall not be acceptable.
5. All configuration data for each network device shall be held at the device and system operation shall not require continuous on-line operation of the network configuration software.
6. Lighting console operators shall be able to backup the network configurations in the lighting control console. In the event of a network device failure, the operator shall be able to apply the configuration of the failed device to a replacement device of the same type without manually reentering settings. Systems that do not support configuration backup as described above shall not be accepted.
7. Architectural and Entertainment systems connected to the same network shall be capable of arbitrating control over E1.31 Streaming ACN (sACN) level data. The system shall be capable of alternating control of individual address data between architectural and entertainment systems without intervention by the user. The user shall dictate the conditions under which system shall automatically take control. The network shall allow user override of the selected defaults. Systems which require direct user intervention to allocate control of dimmers between architectural and entertainment lighting systems shall not be accepted.
8. The lighting control network shall allow multiple DMX input sources to be prioritized on the same universe as network native sources using E1.31 Streaming ACN prioritization. Multiple DMX inputs may be assigned to the same streaming ACN address (this provides multi-source control for a particular address). Likewise, the system shall support E1.31 prioritization of multiple simultaneous network sources. Systems that cannot prioritize multiple DMX inputs and multiple native network sources on a network shall not be deemed suitable.
9. The lighting network shall allow each DMX input address to be assigned a priority on the network allowing each DMX control level coming into the system to participate in full arbitration. Addresses with the highest priority shall have control, with lower priority addresses being ignored. Addresses assigned the same numeric priority, between 1 and 200, shall respond in highest level takes precedence (HTP) manner. The network shall require a valid DMX signal present at the input to initiate prioritization. Systems that do not allow for prioritized HTP for DMX inputs to the network shall not be allowed.

D. Operational Features

1. Each DMX gateway shall control up to 512 DMX addresses per port, within the confines of up to 63,999 DMX universes (32,747,488 address). The specific DMX data input or output by the gateway shall be configurable by the user.
2. Duplicate outputs of DMX data (DMX splitter) and discrete outputs shall be fully supported.
3. Merging of multiple DMX input sources on a single gateway without gateway with DMX output on the same gateway shall be supported without connection to the network. The gateway shall support assignment of priority to each input source independently
4. File transmission, synchronization and access to software shall be supported.

2.2 DMX/RDM ETHERNET GATEWAYS

A. General

1. The lighting control gateway shall be a microprocessor-based unit specifically designed to provide DMX-512 control of lighting systems and transport of RDM configuration and status messages. The gateway shall permit DMX-512 data to be encoded, routed over an Ethernet network and decoded back to DMX-512.
2. Gateways shall communicate over Ethernet directly with at least ETC, Inc.'s entertainment and architectural lighting control products and other Ethernet interfaces.
3. Connections shall be made between gateways, consoles, architectural systems, and PCs over standard Ethernet distribution systems using 10/100BaseT.
4. The gateway shall support multiple protocols including:
 - a. ANSI E1.17 Architecture for Control Networks (ACN)
 - b. ANSI E1.31 Streaming ACN (sACN)
 - c. ANSI E1.11 USITT DMX512-A
 - d. ANSI E1.20 Remote Device Management (RDM)
5. The gateway shall be tested to UL standards and labeled ETL Listed.
6. The gateway shall be RoHS Compliant (lead-free).
7. The gateway shall be CE compliant.

B. DMX Ports

1. DMX Ports shall comply with the requirements of ANSI E1.11 USITT DMX512-A standards.
2. Each DMX port shall be software-configurable for either input or output functionality.
3. DMX input shall be optically-isolated from the gateway electronics.
4. DMX output shall be earth-ground referenced.
5. DMX Port shall be capable of withstanding fault voltages of up to 250vAC without damage.
6. Each port shall incorporate one DMX512-A Connection
 - a. Each DMX port of the portable unit shall be modular and hot swappable
 - b. Each DMX port location shall support a single 5-pin male XLR, 5-pin female XLR, Ethercon RJ-45, or terminal strip module for DMX wiring.
7. Network gateways that do not indicate input/ output port configuration or presence of valid data shall not be accepted

C. Processor

1. Each gateway shall have sufficient processing power to manage up to 63,999 universes (32,767,488 addresses).
2. Maximum delay time from input to output shall not be greater than one packet time (approximately 22 mSec.).
3. A minimum DMX update rate of 40Hz shall be sustained under all conditions unless specifically configured for a slower rate for the sake of compatibility with 3rd party DMX devices.

D. Mechanical

1. The gateway shall be available in three versions

a. Rack-Mount

- 1) The Gateway shall be fabricated of 16-gauge steel, finished in fine-texture, scratch-resistant, black powder coat (RAL 9004).
- 2) Dimensions shall be 8.5" (22 cm) wide x 8.0" (20 cm) deep x 1.75" (5 cm) high.
- 3) The weight of the gateway shall be 3.5 lbs. (1.6 kg) with four DMX modules. An individual module shall weight no more than .25 lbs. (.1 kg).
- 4) The gateway shall support table top use

b. Portable gateway

- 1) The portable gateway shall include a complete enclosure finished in a black fine texture powder coat paint
- 2) Two wiring connections shall be required for connection to the lighting system
 - a) Ethernet connection that supports standard Cat5 patch cables or Ethercon cables. Gateways that do not support the use of Ethercon cables shall not be accepted
 - b) DMX input or output connection using is 5-pin XLR style connector
- 3) Dimensions shall not be more than 4.5" wide (115mm) x 3.5" (89mm) deep x 6.34" (161mm) high (not including mounting hardware)

c. DIN Rail Mount

- 1) The DIN Rail mounted gateway shall be included in an extruded aluminum enclosure.
- 2) Two wiring connections shall be required for connection to the lighting system
 - a) Ethernet connection that supports standard Cat5 patch cables
 - b) DMX input or output connection using is terminal strip style connector
- 3) Dimensions shall not be more than 8.03" wide (204mm) x 4.13" (105mm) deep x 1.22" (31mm) high (not including mounting hardware)

E. Power

1. Power for the gateway shall be provided over the Category 5 (or better) cable, utilizing IEEE 802.3af compliant Power over Ethernet (PoE). Power consumption using shall not be greater than 5 watts.
2. An optional low-voltage DC power input shall be available utilizing an isolated in-line power supply capable of an operating range of 8-28vDC. The Power supply shall be provided by the gateway manufacturer.
3. The gateway electronics shall be electrically isolated from the power supplied over the Catagory5 (or better) cable.

F. Configuration

1. Each gateway on the network shall be individually configurable using freely available software configuration tools. The primary configuration tool shall be Net3 Concert configuration software running on a network connected PC. The PC shall only be required for configuration, and shall not be required for normal operation of the system.
2. Each DMX gateway shall control up to 512 DMX addresses, within the confines of 63,999 universes.

3. The specific DMX data input or output by the gateway shall be freely configurable by the user.
4. Duplicate outputs of DMX lines (DMX splitter) and discrete outputs shall be fully supported.
5. Multiple DMX universes may be configured with any length up to 512 total addresses. Any range of DMX input addresses shall support selection and routing to the specified sACN output.
6. Multiple sACN sources may be combined with a priority may be assigned to each source sending data to the gateway
7. All relevant routing information shall be stored in non-volatile memory at each gateway. The system shall recover from a power outage without requiring the PC to be online. Gateways that do not support non-volatile storage of data routing shall not be accepted.

G. Network

1. Communications physical layer shall comply with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet specifications.
2. All network cabling shall be Category 5 (or better), conforming to TIA-568A/B, and shall be installed by a qualified network installer.
3. Data transport shall utilize the TCP/IP suite of protocols to transfer the DMX data.
4. ANSI E1.17 Architecture for Control Networks (ACN) and streaming ACN (sACN) shall be supported. Gateways that do not support ANSI E1.17 shall not be acceptable.
5. Switches shall comply with power-over-Ethernet IEEE802.3af, unless a separate in-line power supply is provided.
6. Multiple DMX signal routing patches and multiple facilities shall be supported and limited only by the file storage capacity of the computer with ETC Gateway Configuration Editor (GCE) Software installed.
7. Each DMX gateway shall control up to 512 DMX addresses, per DMX port within the confines of up to 64,399 universes (32,767,488 addresses) using Streaming ACN (sACN).
 - a. Any range of DMX addresses may be selected for each universe.
 - b. Multiple sources shall be supported by prioritized Highest Takes Precedence (HTP with priority). Each source shall support assignment of priority to allow override of default HTP behavior.
 - c. Each DMX port shall support its own universe and start address.
8. Gateways shall have built in DMX merger capability on a universe or channel-by-channel basis.
9. Gateways shall support have built in priority on a per-universe or channel-by-channel basis. Gateways that do not support prioritized merging of multiple network sources at independent priorities shall not be accepted.

H. DMX Connector modules

1. Each gateway shall support up to four connector modules containing a single DMX connector and its associated electronics
2. Connector module options shall include
 - a. 5-pin Male DMX connector for DMX Input

- b. 5-pin female DMX connector for DMX output
 - c. RJ-45 Ethercon connector for DMX input or output
 - d. Eight position terminal connector for DMX input or output. Terminal connections shall support screw terminals or Insulation displacement (IDC) wire terminations.
- 3. Each connector module shall be optically-isolated from the gateway electronics and from other DMX modules in the same gateway.
- 4. DMX connector modules shall be capable of withstanding fault voltages of up to 250vAC without damage.
- I. Environmental
 - 1. The ambient operating temperature shall be 0° to 40°C (32° to 104°F).
 - 2. The storage temperature shall be -40° to 70°C (-40° to 158°F).
 - 3. The operating humidity shall be 5% - 95% non-condensing.
- J. Accessories
 - 1. Hanging bracket kit shall allow unit to be mounted in three orientations.
 - a. U-Bolt or C-Clamp mounting hardware shall be available
 - 2. One E.I.A. rack space mounting bracket kit shall support either one or two complete units and allow for up to eight ports of DMX
 - 3. Front Access Panel kit shall allow the connectors on the rear of the gateway to be accessed from the front of an equipment rack. Options for 5-pin XLR style connectors that support DMX input or output shall be available
 - 4. A Universal Power Supply with international plug-set shall be available. Multiple power supplies shall be able to fit in a vertically stacked power strip.
 - 5. ETC Net3 Concert Configuration and monitoring Software
- K. System Requirements
 - 1. Provide the quantity and type of gateways required, as scheduled. Gateways and software shall be as manufactured by Electronic Theatre Controls Inc. of Middleton, WI.
 - 2. Provide Ethernet switches and power supplies as scheduled and as shown on drawings.
 - 3. Provide a current generation PC with Windows7 operating system equipped with a 10/100 Ethernet card.
 - 4. Systems that do not provide the above capabilities shall not be acceptable

2.3 DMX/RDM REPEATER

- A. General
 - 1. The DMX/RDM Repeater shall permit star-wiring and repeating of DMX512 and RDM signals over the connected DMX cabling.
 - 2. The DMX/RDM Repeater shall fully isolate and protect DMX transmitters and receivers, and RDM controllers and responders, from high common mode voltages, ground loop currents and other potentially damaging or disrupting electrical faults.
 - 3. The DMX/RDM Repeater shall have one primary bi-directional input port and eight bi-directional input/output (I/O) ports.

4. The DMX/RDM Repeater shall be capable of repeating and distributing simplex protocols other than DMX512, provided the protocol meets the electrical requirements of EIA RS422 or RS485.
5. It shall be possible to configure the unit such that there is no in-line processing of the input signal, to ensure that the output signal is an exact duplicate of the input signal with no processing delays.

B. Physical

1. The enclosure shall be constructed of formed or cast aluminum and steel.
2. The DMX/RDM Repeater shall be designed to mount in a single rack unit of height and shall include all necessary mounting hardware for this purpose
3. The housing shall be provided in satin black textured powder-coat finish. The front and rear panels will clearly identify ports and connectors with black print on a white background for legibility
4. An LCD screen with switchable backlight and six context-sensitive pushbuttons shall be on the front face, for configuration and status reporting.

C. Connectors

1. Input and bi-directional connections shall be any combination of:
 - a. 5-pin XLR-type
 - b. Two-part Phoenix-type screw terminal strips
 - c. RJ45 Etherncon®

D. Electrical

1. The power supply shall be a field-replaceable, wide-range input (85-264VAC, 50/60Hz) switching power supply. There shall be no power switch to reduce chances of being shut off in error.
2. There shall be 4000-volt electrical isolation between mains power supply and low voltage circuits.
3. There shall be 2500-volt electrical isolation between all input and I/O sections and between adjacent I/O sections.
4. The input port and each I/O port shall be capable of withstanding the continuous application of up to 250V without damage to internal components. Protection shall be of a self-resetting type, rated for 250V. Replaceable fuses are not acceptable.

E. Features

1. Three user-selectable operating modes shall be available.
 - a. In RDM splitter mode, the unit shall function as a 1-in, 8-out DMX opto-splitter. This mode shall also provide full compliance with the ANSI E1.20 Remote Device Management protocol standard. It shall be possible for the user to disable RDM functionality on a port-by-port basis to ensure correct operation of legacy, DMX-only equipment.
 - b. DMX Merger mode shall provide an HTP merge of the DMX input signal from the primary input and one other I/O port, on a first-discovered basis. The merged signal shall be output to the other I/O ports.

- c. DMX Hub mode shall allow one active DMX input to be applied to any I/O port and that signal shall be output from all remaining I/O ports. This “repatching” feature shall be automatic and transparent to the user.
 2. The DMX/RDM Repeater shall act as an RDM Controller while in RDM splitter mode and, upon user command, shall discover all RDM-enabled devices connected to its bi-directional ports and report their presence.
 3. The DMX/RDM Repeater shall provide trouble shooting tools that allow a user to monitor incoming DMX levels and to send valid DMX to specific output channels. These tools shall report DMX levels both graphically and numerically on the LCD display.
 4. Signal loss behavior, DMX output speed and LCD backlight shall be user determined. A keypad lockout function shall provide basic security.
 5. In normal operation, DMX status, RDM status and operating status shall be reported on the LCD screen without requiring user intervention.
 6. All features shall be accessed from the front panel, using the six pushbuttons and a menu system displayed on the LCD screen. The pushbuttons shall be selectively back-lit according to context and function.
 7. It shall be possible to field-update the module firmware via the DMX/RDM input port.
- F. Compliance
1. The DMX/RDM Repeater shall be compliant with ANSI E1.11 DMX512-A, USITT DMX512 or any EIA 422/485-based protocol.
 2. The DMX/RDM Repeater shall be compliant with ANSI E1.20 RDM Remote Device Management protocol.
 3. The DMX/RDM Repeater shall be compliant with the RoHS 2002/95/EC directive.

2.4 INTELLIGENT BREAKER SYSTEM

A. General

1. Intelligent breaker system shall be 120V Sensor IQ as manufactured by ETC, Inc., or equal as determined by the Theatre Consultant.
2. Breaker Panels shall be UL508, UL67, and UL924 Listed, and shall be so labeled when delivered
3. Breakers shall be UL489 listed and shall be labeled when delivered
4. Breaker Panels shall consist of a main enclosure with 12, 24, or 48 pole breaker subpanels, integral control electronics for low voltage terminations and provision for accessory cards
 - a. Up to two accessory cards shall be supported per breaker panel

B. Mechanical

1. The panel shall be constructed of 16-gauge galvanized steel. All panel components shall be properly treated or finished in fine-textured, scratch resistant paint
2. Breaker panels shall be capable of being mounted on the surface of a wall or recessed mounted
3. Breaker panels shall be available in 12, 24, and 48 pole configurations
 - a. 12 pole MLO (No provision for main Breaker)

- 1) 31 inches high, 14.25" wide and 4" deep (with front panel attached)
- b. 12 pole (with provision to add main breaker)
 - 1) 40.25 inches high, 14.25" wide and 4" deep (with front panel attached)
- c. 24 pole (with provision to add main breaker)
 - 1) 50.25 inches high, 14.25" wide and 4" deep (with front panel attached)
- d. 48 pole (with provision to add main breaker)
 - 1) 64 inches high, 20" wide and 5.25" deep (with front panel attached)
- 4. Choice of panel covers shall be available for surface or recess mount applications. This outer panel shall ship complete with a locking door to limit access to electronics and breakers
 - a. Optional center-pin reject security screws shall be available for all accessible screws
 - b. Optional recess mount doors shall extend 1" beyond all panel edges to hide wall cut-out
- 5. The unit shall provide interior cover over the control electronics and accessory cards to allow access only to class 2 wiring and prevent direct access to class 1 line voltage components
- 6. The panel shall support up to twelve, twenty-four, or 48 single pole branch circuits
 - a. Branch circuits shall range from 15A to 30A capable of holding full rated load for minimum of three hours continuously
 - b. Two and three-pole circuits shall be supported at decreased density where each pole constitutes one of the available single-pole circuits. Mixing of circuits in any combination shall be supported
- 7. Breakers shall provide manual switching control while power is unavailable to the panel such that critical lighting can be set to an on state, without the need for power to the panel
- 8. Breaker output lugs shall accept 10-14 AWG dual conductor wire
- 9. Breaker output lug shall support solid or stranded 6-14 AWG class B, C, or K copper wire
- 10. Control wiring for DMX, station bus, and Emergency input terminations shall land on a removable headers for contractor installation

C. User Interface

- 1. The user interface shall contain an LCD display with button pad to include 0-9 number entry, up, down back arrow navigation and enter
- 2. Test shortcut button shall be available for local activation of preset, sequence and set level overrides
- 3. The user interface shall have a power status LED indicator (Blue), a DMX status LED indicator (Green), a network status LED indicator (Green) and an LED indicator (red) for errors
- 4. Interface shall allow the backlight to timeout and shall provide user editable options to shut off backlight completely as well as adjust screen contrast
- 5. Ethernet interface shall default to automatic IP through link local and DHCP. Upon receiving IP address, the address of the Network Interface Card (NIC) shall display in the about menu. Static address and settings shall also be possible
- 6. The control interface shall support a USB memory stick interface for uploads of configurations and software updates

7. The user interface shall support power input from an external Uninterruptible Power Supply (UPS) supplying 800W-2400W AC power

D. Functional

1. Panel setup shall be user programmable. The control interface shall provide the following breaker setup features (per circuit):
 - a. Type (1 pole, 2 pole, or 3 pole)
 - b. Name
 - c. Circuit Number
 - d. DMX address
 - e. sACN address
 - f. Space Number
 - g. Circuit Modes
 - 1) Normal (priority and HTP based activation and dimming)
 - 2) Latch-lock
 - 3) Fluorescent
 - 4) DALI
 - h. On threshold level
 - i. Off threshold level
 - j. Include in UL924 emergency activation
 - k. Allow Manual
2. Breaker panels shall support discrete addressing of each breaker. Panels that are restricted to use of start address with sequential addressing, and cannot assign each 0-10V output control to any internal circuit shall not be acceptable
3. The panel shall be capable of switching 6 poles on or off at once, or in a user-selectable delay per breaker using a period of 0.1 to 60 seconds, in 0.1 second increments
4. An Ethernet connection shall provide advanced control of relays over streaming ACN (sACN) and transmit status, control override, and measured energy usage per branch circuit via an internal Web UI or central monitoring interface
 - a. Control electronics shall report the following information per branch circuit.
 - 1) Breaker state (On/Off)
 - 2) Breaker state (Open/Closed)
 - 3) Current draw (In Amps)
 - 4) Voltage
 - 5) Energy usage
 - 6) Panels that do not report this information shall not be acceptable.
5. Built-in Control shall include:

- a. Ability to record up to 16 presets in each space from the control panel, connected control stations, or timed events
 - b. Presets shall be programmable by recording current levels (as set by DMX or connected control stations), by entering levels on the control panel directly, manually selecting breaker state on each breaker, or a combination of these methods. From the control panel, stations, or timed events it shall be possible to record values for up to 16 zones per space
 - c. Up to 8 spaces in a single rack for total of up to 16 spaces shall be supported per system or system subnet
 - d. Indication of an active preset shall be visible on the control panel display
 - e. One 16-step sequence per space for power up and power down routines
 - f. The panel shall have a UL924-listed contact input for use in Emergency Lighting systems. The panel shall respond to the contact input by setting included breakers to "on", while setting non-emergency breakers "off". Each breaker can be selected for activation upon contact input
 - g. Upon Data loss the system shall provide options to hold last look infinitely or hold for a configured time period set by the installing technician then fade/switch to the input of the next available priority
 - h. Control electronics shall respond directly to control stations for zone, preset, and sequence control. Systems that require secondary control systems for this functionality are not acceptable
 - i. After power loss, electronics shall be capable of holding the system in its previous state until new level data (DMX, architectural presets, sequences and zones, or local overrides) is received to make each breaker change state
6. The control of lighting and associated systems via timed and Astronomical clock controls
- a. The breaker panel shall allow the activation of presets, sequence, and zone programming of up to 50 time clock events via a built in real and astronomical time clock
 - b. System time events shall be programmable via the control panel
 - 1) Time clock events shall be assigned to system day types. Standard day types include: everyday, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday
 - 2) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event
 - 3) System shall automatically compensate for regions using a fully configurable daylight saving time
 - 4) Presets shall be assigned to events at the time clock
 - c. The time clock shall support event override
 - 1) It shall be possible to override the timed event schedule from the face panel of the time clock
 - d. The time clock shall support timed event hold
 - 1) It shall be possible to hold a timed event from the face panel of the processor
 - e. Timed event hold shall meet California Title 24 requirements

7. The panel shall receive ESTA DMX512-A control protocol. Addressing shall be set via the user interface button keypad with any circuit patched to any DMX control address
 - a. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components
 - b. The breakers shall respond to control changes (DMX or Stations) in less than 25 milliseconds. DMX512 update speed shall be 40Hz
 - c. Setting changes shall be able to be made across all, some, or just one selected breaker in a single action from the face panel
 - d. DMX data loss shall allow for levels/breakers to be held for ever or for a specified time before switching to a lower priority source
 - e. Initial Panel setup
 - 1) The breaker panel shall automatically detect the type of breaker or dimmer installed in each location without need for manual configuration of the physical arrangement
 - 2) Quick rack setup shall be available to apply address settings across all circuits for rack number, DMX Start Address, sACN universe, and sACN start address
 - 3) Emergency Setup Menu shall provide optional delays when emergency is activated or deactivated, and option to turn off non-emergency circuits shall be available. Record function shall allow circuits that are turned on to be added to the emergency setting

E. Electrical

1. Breaker Panels shall be available to support power input from:
 - a. 120/208V three phase 4-wire plus ground
 - b. 120/240V single phase 3-wire plus ground
2. Conduit Entry:
 - a. Feeders:
 - 1) Top or upper 6" of either side
 - 2) Bottom or lower 6" of either side
 - 3) Feeders shall enter through the top or bottom according to the orientation of the enclosure.
 - 4) Feeder entry shall be nearest to the location of the feeder lugs or main breaker.
 - b. Load:
 - 1) Load wiring shall enter through the top or bottom of the enclosure through the surface nearest to the breaker sub panel
 - 2) Load wiring may also enter through left and/or right side provided a low voltage chase is not required through the same area. If class 2 chase is required, a field installable barrier panel shall be provided upon request. The side of the panel where the barrier has been installed shall not permit load wiring
 - c. Low Voltage:
 - 1) Top or upper 6" of either side
 - 2) Bottom or lower 6" of either side

- 3) For low voltage conduit entry at the breaker end of the cabinet, conduits shall be located at the outer 3" of the top/bottom panel
3. Breaker
 - a. Bus connection type: Stab on
 - b. 1, 2, or three poles
 - c. UL489 listed
 - d. 15 amp, 20 amp, or 30 amp
 - e. 22,000 SCCR; 65,000A series rated with main breaker
 - f. High inrush trip curve (matches all Sensor breakers)
 - g. Maintains trip curve through entire thermal range
 - h. Guaranteed not to trip at full load
 - i. Load lugs accept 6-14awg load wiring
 - j. Multi-conductor listed output terminal
 - k. Integral mechanically held air gap relay
 - l. Manual control of relay state using breaker handle w/o power
 - m. Integral current sensing
 - n. Integral position and trip sensing
 - o. Control and status provided by contact pads directly at bottom of the breaker case
 - p. No external wires or connections required for control or feedback
 - q. The breaker shall be capable of switching up to 30A
4. The breaker panel shall support a maximum feed size
 - 1) 100 Amps at 12 circuits
 - 2) 200 Amps at 24 circuits
 - 3) 400 Amps at 48 circuits
 - b. Breaker panels shall support main circuit breaker options:
 - c. Main breaker options shall be optional and available for purchase upon request
 - d. Main breakers shall be field installable
 - e. Main breakers shall be available in up to 100 Amps for 12 circuit panels, up to 200 Amps for 24 circuit panels, and up to 400A for 48 circuit panels at 120V
 - f. Series SCCR ratings apply as follows with appropriate main breaker:
 - 1) 22,000A or 64,000 at 120/208V
 - g. Main breakers shall allow the following range of wire sizes:
 - 1) Up to 300kcmil at 100A and 200A
 - 2) Up to 2x250kcmil at 400A
 - h. Main Lug input shall support up to 2x250kcmil

- i. Breaker panel shall support a 500kcmil main lug option for 48-circuit panels
- F. Breaker remote switching ratings
 - 1. Mechanical 1,000,000 cycles
 - 2. 24A Resistive 100,000 cycles
 - 3. 16A Ballast (HID) 75,000 cycles
 - 4. 15A Electronic (LED) 100,000 cycles
 - 5. 15A Tungsten 45,000 cycles
 - 6. 30FLA; 180 LRA Motor Load 50,000 cycles
 - 7. Tested duty cycle: 12 operations (6 cycles) per minute
 - 8. Decreasing duty cycle significantly increases switch life
 - 9. Isolation: 4000V RMS
 - 10. Current reporting accuracy: 5%
 - 11. Latching state mechanical relay
- G. Breaker Panel Accessories
 - 1. A low voltage 0-10V dimming option shall provide up to 24 0-10v control outputs that are linked to relay circuits within the panel. Each output shall support up to 400mA of current sink per output
 - 2. A contact input option shall provide 24 dry contact inputs to be linked for direct or group relay control, to activate a preset, or to activate a sequence. Controller software shall allow for normally open maintained, normally closed maintained, or momentary toggle
 - 3. A DALI control option shall provide 24 control loops of broadcast DALI control, with each loop controlling up to 64 DALI devices
 - 4. A RideThru option shall provide short-term power backup of control electronics by automatically engaging when power is lost, and recharging when normal power is present
 - 5. An Isolated Ground option shall provide each circuit in the panel with a ground terminal that is electrically isolated from the equipment ground
 - 6. Main Breaker options shall be available as shown in Section E.4
- H. Thermal
 - 1. The panel shall be convection cooled. Panels that require the use of cooling fans shall not be acceptable
 - 2. The panel shall operate safely in an environment having an ambient temperature between 32°F (0°C) and 104°F (40°C), and humidity between 5-95% (non-condensing)

2.5 COMPANY SWITCH

- A. General
 - 1. The Company Switch shall be available in 2 models: PowerSafe Pro, and PowerSafe Compact; as designed by Electronic Theatre Controls or equal as determined by the Theatre Consultant.
 - 2. Compact Models shall be available at 120/208V: 100A, or 200A; 3-phase, 4-wire plus ground.

3. Pro Models shall be available at 120/208V: 100A, 200A or 400A; 3-phase, 5-wire (double neutral) plus ground.
4. The Company Switch shall be UL and cUL listed and shall meet all applicable NEC standards.
5. The enclosure shall be NEMA 1 rated.

B. Mechanical

1. The Company Switch shall be fabricated of 16 gauge steel and finished using ETC styling with fine-textured scratch resistant epoxy paint.
2. The door which provides access to output connections shall be lockable with shunt trip interlock.
3. The "Compact" Enclosure size shall not exceed 25" high by 15.5" wide and 6" deep. The "Pro" Enclosure size shall not exceed 43.8" high by 18" wide and 6" deep.
4. Company Switch shall protect against access to power connections while the cabinet is energized so it can be guaranteed that output is in a "power off" state while connecting or disconnecting portable output cabling.
5. The company switch shall protect the user from unsecured access to output terminals and connectors in the following methods:
 - a. PowerSafe Compact: Door brackets shall lock swing hinged covers in place until the front door is opened. These brackets shall prevent insertion of connections under power.
 - b. PowerSafe Pro: Front access connector compartment shall protect against access to output connections behind a locked door while the cabinet is energized
6. The "Pro" Enclosure size shall not exceed 43.8" high by 18" wide and 6" deep.
7. Conduit entry shall be made via top, or side. Top and side panel shall free of conduit knockouts to allow for greater flexibility in contractor conduit entry.
8. A method of field isolating company switch chassis ground and connected equipment ground ("ISO ground") shall be supported without installation of additional kits or parts. Company Switch products that require additional parts to be shipped or factory configuration of "ISO ground" shall not be deemed acceptable.
9. Company switch shall accept 3rd party locks on built- in bracket for support of NFPA 70E safety lockout/tagout procedures.
10. 1The unit shall be capable of mounting on a wall with integral keyhole fixing points.
11. LED power indicators shall be provided to show that power is on/available between each phase and neutral.
12. PowerSafe "Pro" shall provide an LED Work Light which shall automatically illuminate the output connectors and lugs during "hook up" of portable equipment cabling.
13. Lugs shall support up to 4/0 class K cable for bare end tie-in through 500kcmil screw terminals.

C. C.Electrical

1. PowerSafe Pro shall include six CAM style connectors for each phase, dual neutral, and ground. Standard order connector genders shall be females for each phase, with male ground and neutral connectors. Other connector gender combinations shall be available on request.
2. PowerSafe Compact shall include five CAM style connectors for each phase, neutral, and ground. Standard order connector genders shall be females for each phase, with male ground and neutral connectors. Other connector gender combinations shall be available on request.

3. PowerSafe Pro shall include dual neutral output connections for support of 200% rated neutral.
4. The enclosure shall accept up to 200A or 400A copper or aluminum to the full name plate rating of the enclosure at 100% of the rated main breaker with a minimum AIC rating of 65,000A.
5. System rating of Company Switch shall be 65,000 amps symmetrical Short Circuit Current Rating (SCCR). Company Switch products that rely only on breaker AIC rating as a short circuit safety factor shall be deemed unacceptable. Company Switch products that have not proven this safety rating through high current short circuit testing with UL shall not be deemed safe for use under UL SCCR requirements and therefore are not acceptable.

D. Available Accessories

1. An option shall be provided and approved by UL for connection of field installed current transformers around incoming power conductors for connection to external 3rd party power meters.
2. An option shall be available in the PowerSafe Pro for strain relief.

2.6 LIGHTING CONTROL CONSOLE AND ACCESSORIES

A. Ion XE 20

1. General

- a. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The console shall be the Ion Xe 20 as manufactured by Electronic Theatre Controls, Inc., or equal as determined by the Theatre Consultant.
- b. The system shall provide control of either 2,048 or 12,288 outputs on a maximum of 32,768 control channels, which may be any number from 1 to 99,999. Systems that require external co-processing to control 12,288 outputs shall not be acceptable. Output shall be distributed over a 10/100 MB Ethernet network using Net3/ACN, ETCNet2, Avab and/or Artnet (multi-cast) protocols. The user shall be able to control the application of protocols at an individual address level.
- c. The system shall support full bi-directional RDM communication with compatible devices via DMX/RDM Gateways. RDM communication shall adhere to ANSI standard E1.20-2006 Entertainment Technology – RDM – Remote Device Management Over DMX512 Networks. Supported RDM features shall include:
 - 1) Discovery and Identification of RDM capable devices
 - 2) Setting of start addresses, operating modes and additional settings as exposed by connected devices and controllable via RDM
 - 3) Viewing of Sensor data as provided by connected devices
 - 4) Error reporting as provided by connected device
- d. A maximum of 10,000 cues, 1000 groups, 1000 presets, 4 x 1000 palettes (Intensity, Focus, Color and Beam), 99,999 macros, 1000 effects, 1000 curves, 1000 Color Paths and 1000 snapshots may be contained in non-volatile electronic memory and stored to an onboard solid-state hard drive or to any USB storage device.
- e. Recorded cue lists may be played back simultaneously on a maximum of 200 faders. Channels shall respond to cue information by last instruction with discrete rate control provided for all cues. The console may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required. HTP/LTP intensity flags, assert, proportional, intensity master or manual master fade

control. Priority and Background Priority may be placed on each cue list. It shall also be possible for a cue list to contribute to playback background states or to withhold such contributions.

- f. A Master Playback fader pair shall be provided. The 100mm fader pair may execute crossfades or all-fades, with IFCB cue level timing,
- g. 20 45mm faders shall be user configurable across 100 pages and provide additional playback faders (up to 200), additive or inhibitive submasters (up to 999), and grand master control. Associated displays provide content identification. Presets and IFCB palettes may be loaded to faders for playback control, either individually or in user-defined lists. Virtual fader control is also provided.
- h. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. Four pageable encoders shall be provided for control of non-intensity parameters. Non-intensity encoders toggle between coarse and fine control. The expand function for frame table devices shall provide a graphic representation of all images and colors in the associated device for instant selection. A graphic shutter representation shall provide additional control of shutter parameters. The display shall also provide an indication of the current value for the associated parameter, based on channel selection. A high-resolution rate wheel, which may also be used for fader paging shall be provided.
- i. Control surface buttons shall be backlit. This backlighting provides indication of functional states. Backlight intensity shall be user controllable, and shall automatically dim after a defined period of inactivity.
- j. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing in up to six different color spaces.
- k. System information, including playback status, live output and blind values for all record targets shall be displayed on a maximum of two external high resolution monitors, which may also be multi-touch touch-screens. Every display shall support three user-definable workspaces. Each of these workspaces shall provide individually configured frames, with size/scaling controls. Any Windows 7 compatible display may be used.
- l. A context sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system. This help system shall be integrated into the on-board user manual via hyperlinks.
- m. A fully integrated Virtual Media Server feature shall allow user to map images and animations to a rig array. 40 such maps may be created, each with 12 layers. System that rely on external hardware or software for this functionality shall not be acceptable.
- n. User-definable, interactive displays may be created. These displays, which can be used in live and blind operating modes, allow graphical layout of channels, desk buttons and programming tools. Standard symbols are provided, and the user may import their own symbols or graphics. Each symbol may be individually defined with data feedback characteristics. Non-interactive status information, such as a mirror of other user's command lines, may also be included in the display. A graphical browser is provided for fast selection of these views. Multiple zoom factors and placements may be stored and recalled for each display.

- o. A detachable alphanumeric keyboard shall be provided. The keyboard shall allow labeling of all show content. An integrated virtual alphanumeric keyboard shall also be provided.
 - p. Console software upgrades shall be made by the user via flash drive. It shall be possible to install software updates in all consoles, processor units and remotes from one device over the network.
 - q. The console operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the console shall return to its last output state when power is restored. Devices requiring a UPS to provide such protections shall not be acceptable.
 - r. Integrated dimmer monitoring features shall be provided to allow indication of dimming system status, error states and dimmer load monitoring. Adjustment of dimmer configuration from the console shall also be supported. Communications with the dimming system shall utilize ANSI E1.17 2006 - Entertainment Technology - Architecture for Control Networks.
 - s. Integrated RDM device features shall be provided. The console shall discover and patch RDM devices. The console shall monitor RDM devices to allow indication of RDM device online/offline status error states. The console shall be capable of changing settings of RDM devices such as the DMX start address. Communications with the RDM devices shall utilize ANSI E1.20 2006 – Remote Device Management.
 - t. Network configuration tools shall be provided from within the desk.
 - u. Show data may be created and modified on a personal computer, using either Windows 7 or higher or a Macintosh platform running OS 10.11 or later via a free offline editing application. The program shall run natively on Apple operating systems. Applications requiring PC emulation programs shall not be acceptable.
 - v. A PC, using either Windows 7 (or higher), or a Macintosh running OS 10.11 (or later) using the offline software application shall be able to connect to a control system via the network and view or modify current show data in an independent display environment, using an ETCnomad key. When connected without the key, the computer shall operate in Mirror Mode, with the device to be mirrored selectable by the user.
 - w. Synchronized backup shall be provided via another full console on the network, an ETCnomad/Puck, or by use of a remote processor unit. The backup console/RPU shall maintain synchronized playback with the master and shall take over control of the lighting system upon loss of communication with the master. Use of two RPUs to service and backup system output is also supported.
 - x. A maximum of 99 users may access and interact with show data simultaneously. Each user shall have an individual workspace. User identification may be assigned to more than one control device, allowing users to work in tandem, or allowing a designer/ALD to mirror the current display format, mode and command line of the associated programmer. Partitioned control allows discrete control of channel/parameter groupings by user. Partitioned control may be easily enabled and disabled with no need to merge show data from multiple users.
 - y. The system shall support up to 32 individual simultaneous Time Code inputs or Event lists using Show Control Gateways.
 - z. Systems that do not provide the above capabilities shall not be acceptable.
2. Controls and Playback

a. Manual Control and Programming Section

- 1) The console keyboard shall be grouped by function. Major groupings shall be record target functions, numeric keys, level assignment functions, display navigation functions and controls, as well as non-intensity parameter controls.
- 2) The command keypad shall be fully interactive with direct selects and other virtual controls, which provide “one touch” selection of channels, groups, palettes, presets, effects, snapshots and macros.
- 3) Non-intensity parameters may be set numerically via an extensible keypad. This control shall be fully interactive with the moving light encoder controls and the virtual controls. The controls shall also access available modes for each parameter type, min and max values for each parameter as applicable, as well as home position on a parameter basis. Each encoder shall support shift functions for fine control. The range of motion of coarse control may be set by the user. Tactile feedback shall indicate full and half frame positioning of certain controls.
- 4) Only those parameters available for control in the active lighting system shall be displayed for control. Displays shall condense or lowlight parameters not available to selected channels. Alternatively, the encoders may be placed in a state allowing parameters not applicable to the current selection to be suppressed.
- 5) Lamp controls provide direct access to luminaire functions such as striking and dousing arc lamps and calibrating entire fixtures or individual mechanisms of fixtures, as provided by the luminaire manufacturer. User access to these features is normalized across all manufacturers for ease of use. Use of a “control channel” for accessing these functions shall not be required and systems requiring use of control channels for these functions shall not be acceptable.
- 6) Fan functions shall be provided both via command line operation and through encoder controls.
- 7) Highlight shall be supported, with user definable highlight values. Lowlight conditions may be defined for selected, but not specified channels. Rem Dim commands, at specific levels by channel, may be optionally and automatically called with the highlight command.
- 8) Advanced color control functions provide color mixing in any of six different color spaces. Gel matches are provided via gel picker or by command line control. Tinting tools allow adjusting the color mix irrespective of the native mixing system. Spectrum tools support adjusting the output of additive color systems with more than three emitter types, allowing the X/Y coordinate to be held while adjusting the recipe that achieves that mix. Color Path tools allow the user to control the live fade of fixtures through the color space.
- 9) The Virtual Media Server function shall allow the user to create layouts of devices, identified as pixel maps. Media content (images, movies, text and procedurally generated effects) may then be applied, manipulated and stored. Stock content is provided and the user may import his own imagery and animations.
- 10) Macros may be set to run as default. Default macros called manually shall post to the command line, but executed via cue lists shall run in the background. The user may override this behavior by defining the macro to always execute in the foreground or background, regardless of the recall method. Startup, Shutdown and Disconnect macros may also be defined.

b. Playback Section

- 1) The playback faders shall consist of a 100mm Master Fader pair and 20 45mm additional pageable playbacks. Additional playbacks may be defined via external wings and/or virtual controls.
- 2) Up to 200 cue playback faders may be defined on the fader array. Each playback shall have an associated potentiometer and definable buttons.
- 3) Faders may be grouped for playback, with sliders and button action defined by the user.
- 4) It shall be possible to instantaneously halt an active cue, back to the previous cue, manually override the intensity fade or manually override the entire fade.
- 5) It shall be possible for a cue list to contribute to the background state or for the contents of each cue list to be withheld from such. Background and background priority states may be established.
- 6) Playback faders shall have the following associated controls:
 - a) Freeze, which halts the output of the fader
 - b) Stop Effect, which stops the action of an effect
 - c) Filter, to assign filter states to a fader
 - d) Go To Cue 0, to reset a cue list
 - e) Off, to turn off the contents of a playback, releasing control to the background state or to set to null.
 - f) Assert, to replay an active cue
 - g) Release, to release control to the background and reset the cue list.
 - h) Timing disable, channel filters, parameter filters, priority and background priority status may also be defined.
 - i) The potentiometer shall be configurable as a proportional master, an intensity master, or manual master. Support for rate, effect rate, effect size and Master Only controls is also provided. Filtered manual timing masters may be configured.
 - j) Rate override and fader paging are supported with a wheel encoder and associated controls.

3. Submasters

- a. Up to 999 proportional, fully overlapping additive or inhibitive submasters may be defined. Submasters shall have colored LEDs to indicate submaster status. Each submaster may have fade up, dwell and down fade times. Submasters may be set to priority and background priority status.
- b. Submasters may be set to HTP or LTP intensity. Non-intensity parameters on submasters shall be LTP only.
- c. Exclusive mode for a submaster shall prohibit the live contribution of that submaster from storing to cues or other submasters. Shield mode prohibits access of associated channels from any other playback or manual control operations.

- d. A submaster potentiometer may be defined as proportional, master only or intensity master. When set as an intensity master, a mark and unmark feature is supplied.
 - e. The submaster blind buffer shall be linked directly to live playback.
 - f. It shall be possible to set submaster values directly from the command line.
 - g. Submasters may be set to fade to background or to minimum value when the fader is returned toward zero.
 - h. Submaster values may contribute to the background state or withheld from such.
4. Grand Master Faders
- a. The location of the Grand Master shall be user definable. The grand master shall have associated blackout and blackout enable buttons.
 - b. Blackout shall send all associated intensity outputs to zero. Non-intensity outputs shall not be affected. It shall be possible to exclude channels from Grand Master control.
5. Display Controls
- a. Format shall change the view of selected displays.
 - b. It shall be possible for the user to choose which parameter categories or parameters (s)he wishes to display.
 - c. Flexichannel modes shall change which channels are viewed in selected displays, as follows:
 - 1) No modes
 - 2) Masters only/cells only
 - 3) Use Partitions
 - d. Flexichannel states shall change which channels are viewed in selected displays, modified by the modes, as follows:
 - 1) All channels
 - 2) Patched channels
 - 3) Show channels
 - 4) Active/Moved channels
 - 5) Selected channels
 - 6) Manual Channels
 - 7) View channels (user identified list)
 - 8) Channels with discrete timing
 - e. Expand shall extend the selected view sequentially across connected displays.
 - f. [Time] depressed shall display discrete timing data. [Data] suppressed shall display absolute values of referenced data. These functions may be latched.
 - g. Displays may also be toggled to show stored data currently manually overridden, the source of the current parameter data, output level, patch assignment, part structure and referenced marking data.

- h. Playback status displays are provided with a variety of different formats. Indications are provided per cue for live moves (lights fading from zero and also moving non-intensity parameters) and dark moves (inactive lights which have stored non-intensity parameter moves).
 - i. Display content including which of the workspaces is in focus on any of the two monitors and what views are docked in those workspaces may be instantly recalled using snapshots.
6. Operating Modes
- a. Live Mode
 - 1) Channel lists may be constructed using the +, -, and Thru keys as well as the direct selects. Channel selection and deselection is fully interactive, regardless of the method used.
 - 2) Levels may also be set with the keypad, level wheel and non-intensity encoders. "Selected" channels shall be those last addressed and under keypad control. Controls are provided for single button access to the last selected channel list, all channels with manual levels and all active channels.
 - 3) Channels may be set at a user defined default level using the Level key. +% and -% keys adjust channels quickly by user definable values.
 - 4) Channels and/or channel parameters may be captured. Capture mode shall allow the user to selectively capture channel data at specific levels. Captured data shall be indicated on the Live display.
 - 5) Sneak shall be used to restore specified channels to background states, default values, or to send them to specified values, in user specified times.
 - 6) Selected channels may be set at a level or held to current values while all other channels are set to zero using Rem Dim. Toggling Rem Dim shall restore all unselected channels to original levels. The Rem Dim level shall be user definable via the command line or with a default setup value.
 - 7) Channels may be recorded into groups for fast recall of commonly used channels. 1000 groups shall be available. Groups shall store selection order. The Offset function supports rapid creation of ordered groups, including reverse and random order.
 - 8) Parameter settings may be stored to Intensity, Focus, Color and Beam Palettes and to Presets. All referenced data may be stored to whole numbers or to up to 99 decimal places between each whole number.
 - 9) The following conditions may be placed on a channel or channel parameter to be included with a cue record action.
 - a) Discrete fade time and/or delay
 - b) Block flag
 - c) Assert flag
 - d) IFCB Filters, which may be set at a parameter level.
 - e) Release and Restore

- 10) 999 cue lists may be stored. Cues may be recorded in any order. Up to 99 decimal cues may be inserted between any two whole number cues. Each cue may contain a maximum of twenty parts.
- 11) It shall be possible to record cues and cue parts with the following information:
 - a) Any collection of channel data, as determined by the use of "Record", "Record Only" or selective store commands, combined with parameter filters.
 - b) Cue Level timing and delays for Intensity Up, Intensity Down, Focus, Color and Beam.
 - c) Follow or hang time
 - d) Link instruction
 - e) Loop value
 - f) Block, Assert, Preheat, and/or Mark Flag
 - g) Curve
 - h) Allfade
 - i) Label and note
 - j) Execute list to trigger other activity
- 12) Non-intensity channel parameters may be marked (preset), in two ways. Automark presets any parameters transitions in the cue just prior to intensity becoming active. Automark may be disabled on a cue or cue part basis, enabling a "live" move. Alternatively, non-intensity parameters may be marked to a specific cue with a single command instruction. It shall not be necessary to store these parameters directly into the cue in which the movement is to occur.
- 13) Any channel parameter may be stored with an effect instruction. These effects may contain relative offsets from current value, or absolute instructions. Effects may be progressive action or on/off states. Entry and exit behaviors shall modify the channel parameters activity when beginning and ending the effect.
- 14) Update may be used to selectively add modified parameter data quickly to that parameter's current source. Update may be specified to modify referenced data content or break the link to that content. A dialogue informs the user of the content that will be updated. A trace command may be used to modify the data to the original source of its move instruction. It shall be possible to update inactive record targets.
- 15) Recall From quickly pulls specified data from record targets or other channels into the current view.
- 16) Copy To quickly copies selected data to specified channels or other record targets.
- 17) Address and channel check functions shall be provided.
- 18) Channel parameters may be "parked" at levels. Those levels are not added to any live record operations, nor may they be changed until the parked element is "unparked". Scaled park provides real time proportional adjustment of stored intensity values. Address Park shall also be provided.
- 19) About shall provide detailed status of selected channels or specified record targets. This shall include current source, current value, discrete timing, parked value, marked to and for indications. Background levels and current DMX output are also

displayed. Channel usage indicates submaster and cue information and also provide a "dark moves" report on a per channel basis.

- 20) 1000 snapshots may be stored which instantly recall specified front panel and display configurations.
- 21) Live data may be displayed in a summary view or detailed table orientation.
- 22) Query shall allow selection of channels by their current or possible state. Keywords and fixture types shall allow quick access to fixtures.
- 23) User definable home positions, on a per channel basis, may be defined.
- 24) Channel level offset commands provide channel ordering and sub-grouping functions.
- 25) Undo shall be used to sequentially step back through manual operations or to undo record and delete actions. It shall be possible to undo multiple commands in one action.

b. Blind

- 1) The Blind display allows viewing and modification of all record targets without affecting stage levels.
- 2) Record target data may be displayed in a summary view, a detailed table orientation or a spreadsheet view, which allows quick data comparisons, move and replace functions.
- 3) Changes to blind data shall be automatically stored. Range selection of both record targets and channels shall be supported.

c. Patch Display

- 1) Patch shall be used to display and modify the system control channels with their associated library data.
- 2) Each channel may be provided with a proportional patch level, curve, label, swap and invert functions, as well as keywords to service Query.
- 3) Offset functions in patch shall allow selection of channel ranges and shall allow the user to establish a "custom" footprint for any device output.
- 4) Custom color wheels, color scrolls and gobo wheels shall be defined in patch. These devices shall be created with a simple table and graphical user interface supported by images of major manufacturers.
- 5) RDM discovery and device monitoring shall be supported.
- 6) Copy to and Move functions shall be supported in patch.

d. Setup/Browser

- 1) Setup shall access system, user and device configurations.
- 2) It shall be possible to partially import Eos show files. Users shall be able to select as much or as little of the show file as required, with renumber tools.
- 3) It shall be possible to import ASCII and Lightwright data files. It shall be possible to export as ASCII or .csv.
- 4) Setup shall also access show data storage, import, export, print to .pdf and clear functions, as well as show data utilities.

- 5) The system shall support programming and playback of real time clock events, including cue, submaster and macro execution at specific times of specified days or at a time based on astronomical events.
 - 6) A control screen shall be provided for network configuration, selecting date/time, software update controls, selecting functional language and/or keyboard for labeling option, as well as other system level tools.
 - 7) Available languages for prompts, advisories and help messages shall include English, Bulgarian, German, Spanish, French, Italian, Japanese, Korean, Russian, Chinese, simplified and Chinese, traditional.
 - 8) Supported keyboards shall include American, United Kingdom, French, German, Italian, Korean, Norwegian, Russian, Slovakian, Turkish, Swiss, Swedish, Finnish and Bulgarian.
7. Dimmer Monitoring and Configuration
- a. The lighting control system shall provide communication with an ETC Sensor+, Sensor3 or FDX dimming system for remote monitoring and configuration of show specific functions from within the software application.
 - b. Circuit level configuration and monitoring functions shall include but not be limited to:
 - 1) Control mode (dimnable, switched, latch-lock, always on, off or fluorescent).
 - 2) Curves
 - 3) Control threshold
 - 4) Min and Max Scale Voltage
 - 5) Preheat
 - 6) Scale load
 - c. Rack status messages shall include but not be limited to:
 - 1) State of UL924 panic closure
 - 2) DMX port error/failure
 - 3) Network error/failure
 - 4) A, B, C Phase below 90 or above 139 volts and headroom warning
 - 5) Ambient temperatures out of range
 - d. Circuit status shall include but not be limited to:
 - 1) Module type and location
 - 2) Output level
 - 3) Control Source
 - 4) Overtemp
 - e. Advanced circuit feedback shall include but not be limited to:
 - 1) Load higher or lower than recorded value
 - 2) DC detected on output
 - 3) SCR failed on/off

- 4) Breaker trip
- 5) Module has been removed
- 6) Load failure
- 7) Shutdown due to Overtemp
- 8. Interface Options
 - a. The console shall support a variety of local interfaces.
 - 1) AC input
 - 2) USB (five ports for items such as alpha-numeric keyboard, mouse, touch screens, USB Flash drive)
 - 3) Ethernet (two ports)
 - 4) Two Display Port output connectors, supporting Windows 7 compliant monitors as 1280x1024 resolution minimum. Touchscreen/multi-touch support of any/all of these monitors is provided.
 - 5) Contact Closure trigger via D-Sub connector
 - 6) 4 DMX/RDM ports
 - 7) Alternative Contact Closure trigger through Gateway
 - 8) OSC Transmit/Receive
 - 9) MIDI In/Out, MSC and MIDI Notes through Gateway
 - 10) SMPTE Timecode through Gateway
- 9. Accessories
 - a. ETCpad (ETC Portable Access Device)
 - b. iRFR and iRFR Preview (applications for iPhone, iPod Touch and iPad units)
 - c. aRFR (application for Android devices)
 - d. Net3 Remote Video Interface 3
 - e. 20 Fader or 40 Fader non-motorized fader wings
 - f. 10 Fader or 20 Fader motorized fader wings
 - g. Gateways
 - 1) Net3/ETCNet 2 to DMX/RDM Gateways (one to four ports)
 - 2) MIDI/SMPTE Gateway
 - 3) I/O Gateway with 12 analog inputs, 12 SPDT contact outputs, RS-232 interface
 - h. Synchronized Backup
 - i. An optional Backup system shall consist of one of the following combinations of devices:
 - 1) Two networked Consoles.
 - 2) One (or more) Console with one Remote Processor Unit (RPU)
 - 3) One (or more) Consoles with two Remote Processor Units (RPUs)
 - 4) ETCnomad/Puck

10. Physical

- a. All operator controls and console electronics for a standard system shall be housed in a single desktop console, not to exceed 30" wide, 15" deep, 4.5" high, weighing 16.6 pounds. Console power shall be 90 – 240V AC at 50 or 60Hz, supplied via a detachable locking power cord.

2.7 ETCnomad Puck

A. General

1. The dongle-protected mini-computer shall allow the user to connect to any Eos family control network and view, create, modify and control playback in a primary/backup or client role. The product shall also function as a stand-alone controller. The product shall be the ETCnomad Puck as manufactured by Electronic Theatre Controls, Inc., or equal.
2. The product shall provide control of either 512 or 6,144 outputs.
3. The device shall allow a user with the aid of a mouse, alphanumeric keyboard, customized USB control devices, ETC produced programming and fader wings or other external devices to perform operations used in Eos family of consoles.
4. The device shall be Windows 7 based, supporting up to two external displays (which may be multi-touch). I/O shall include power, four USB ports, 1 network port and one HDMI video port and 1 Mini Display Port as well as audio in/out.
5. The product shall support sACN and Artnet (multi-cast) output protocols.
6. ETCnomad Puck shall support all accessories available for the Eos family of software and shall also function with the Cobalt application.

2.8 FADER WING

A. General

1. The fader wings shall provide extended playback control for the lighting control system.
2. The fader wings shall be compatible with the lighting control console.
3. Up to three wings may be connected to any host hardware. These may be combined with the motorized fader wings.
4. The fader wings shall be available in two configurations:
 - a. The 20 fader wing shall have 20 45mm faders, 40 keys with LEDs and integral LCD displays.
 - b. The 40 fader wing shall have 40 45mm faders, 80 keys with LEDs and integral LCD displays.

B. Mechanical and Electrical

1. The fader wings shall connect to Eos family products via external USB cables and power.
2. The Eos FW 20 shall be 12.10" (307mm) wide, 3.93" (100mm) high and 14.24" (362mm) deep, weighing 5 pounds (2.27 kgs).

3. The Eos FW 40 shall be 22.30" (566mm) wide, 3.93" (100mm) high and 14.24" (362mm) deep, weighing 8.5 pounds (3.86 kgs).

2.9 REMOTE VIDEO INTERFACE

A. General

1. The Remote Video Interface (RVI) shall be a microprocessor-based device specifically designed to provide display of system data for the lighting control console.
2. The RVI shall contain the operating software for all supported products and may be changed easily from one operating mode to another.
3. Software updates shall be installed via USB flash drives.
4. 20 pre-programmed buttons shall be provided on the front panel of RVI.
5. The unit shall support three external Display Port monitors, which may also be single or multi-touch displays.
6. Four front panel LEDs provide operating status indication.
7. A variety of different controls may be attached to the RVI via the USB ports on the back or front of the unit.

B. Operation

1. The RVI3 shall provide both remote viewing and remote programming of all show data.
2. The RVI shall provide discrete local control, or may mirror other control device operations.
3. The 20 buttons shall be remapped to provide access to any control keys.
4. It shall be possible to connect the Net3 RFR, Eos Programming Wing and Motorized/Non-motorized wings.
5. Monitor resolution shall be 1280x1024 minimum. The monitors may also be touchscreens or multi-touch displays.

C. Interfaces

1. AC Input
2. USB (seven ports for items such as alphanumeric keyboard, pointing devices, touch screens, USB flash drive, etc.)
3. Ethernet (two discrete posts) 802.3af compliant PSE
4. Three Display Port connectors at 1280x1024 resolution minimum, supporting standard, single or multi-touch displays

D. Accessories

1. Rack Mount Kit
2. ETCpad (ETC Portable Access Device)
3. 20 Fader or 40 Fader non-motorized wings
4. 10 Fader or 20 Fader motorized wings
5. Eos Programming Wing
6. iRFR and iRFR Preview (application for Apple devices)
7. aRFR (application for Android devices)

E. Physical and Acoustical

1. All controls and electronics shall be in a single enclosure, not to exceed 17.13" (435mm) wide, 15.88" (403mm) deep, 3.52" (89 mm) high, weighing 22.5 pounds (10.21 kgs). Device power shall be 90 – 240V AC at 50 or 60Hz, supplied via a detachable power cord.
2. At typical CPU utilization, the unit shall operate at ≤ 30 dBA.

2.10 POWER AND DATA DISTRIBUTION

A. OUTLET AND PIGTAIL BOXES

1. General

- a. Connectors shall be available as 20A, 50A and 100A grounded stage pin, 20A twist lock and 20A "U" ground (dual rated "T-slot"); other connectors shall be available as specified
- b. Pigtails shall be three-wire type "S" jacketed cable sized for the maximum circuit ampacity
- c. Pigtails with 20 amp stage pin connectors shall be terminated using 12 gauge 4 way indent crimp (with inspection window) type where the wire is inserted and crimped directly in the socket
- d. Terminations for pigtail connectors shall utilize feed- through terminals individually labeled with corresponding circuit numbers
 - 1) 20 amp circuits shall use screwless tension clamp terminals listed for 20 – 8 gauge wire
 - 2) 50 amp circuits shall use compression terminals listed for 10 – 1 gauge wire
 - 3) 100 amp circuits shall use compression terminals listed for 8 – 2/0 gauge wire
 - 4) Terminals that place a screw directly on the wire are not acceptable
- e. Outlet and pigtail boxes shall be supplied with appropriate brackets and hardware for mounting as shown on the drawings
 - 1) Standard mounting options shall include pipe or wall mounting
 - 2) Brackets shall be made from ASTM A36 steel
 - 3) Hardware shall be ASTM A307 grade 5
- f. A low voltage distribution system shall be available to incorporate DMX, Ethernet or other protocols as specified in the power distribution box
 - 1) A voltage barrier shall be used to separate the low voltage wiring for the electrical circuits
- g. Power distribution equipment shall be listed by a nationally recognized test lab (NRTL)

2. Physical

- a. Outlet and pigtail boxes shall be 6.25" H x 3.3" D and fabricated from 18 gauge galvanized steel and finished in black fine-texture powder coat paint
 - 1) Covers shall be fabricated from 16-gauge galvanized steel
- b. Outlet and pigtail boxes shall be available in any length specified in increments of 3-inches with a maximum length of up to 3-feet
- c. Pigtails and outlets shall be spaced on 18" centers or as otherwise specified
- d. Outlets shall be mounted on individual 3" panels
- e. Circuits shall be labeled with 1.25" lettering
 - 1) Circuit labeling options shall include:

- a) Circuits shall be labeled on the front side of the connector strip with white lettering on black background labels
 - b) Circuits shall be labeled on front and back sides of the connector strip with white lettering on black background labels
 - c) Circuits shall be labeled on the front side of the connector strip with engraved lamacoid labels utilizing white lettering on black background labels
 - d) Circuits shall be labeled on the front and rear sides of the connector strip with engraved lamacoid labels utilizing white lettering on black background labels
 - e) Circuits shall be labeled on one side of the connector strip using individual circuit cover plates with lettering engraved in the cover and filled with the specified color
 - f) Circuits shall be labeled using specified labeling per plans and drawings
- f. Outlet and pigtail boxes shall support optional LED indicators to indicate the presence of power at each local circuit. The indicator shall be red in color and mounted in outlet or pigtail box
- 1) The LED indicator shall be mounted in the lower right corner of the outlet panel
 - 2) The LED indicator shall be mounted in the bottom of the outlet or pigtail box directly below the outlet panel
 - 3) The LED indicator shall be mounted in the cover plate directly below the circuit label for pigtail circuits

2.11 EQUIPMENT RACK

- A. The Lighting Equipment Rack shall be constructed of the following materials:
- 1. Top and base shall be 14-gauge steel
 - 2. Center section shall be 16-gauge steel
 - 3. Back pan shall be 16-gauge steel
 - 4. Rack rail shall be 11-gauge steel, with tapped 10-32 holes in universal E.I.A spacing
 - 5. The center section shall key lock close, key lock and padlock draw latch shall be provided.
 - 6. The rack shall be phosphate pre-treated and finished in a durable black powder coat.
 - 7. The rack shall be of welded construction.
- B. The front door shall be of steel framing with a solid steel door. It shall be hinged on the right side as you face the rack. It shall be provided with a key lock.
- C. The same key shall operate all locks on the Lighting Equipment Rack.
- D. Provide tubs, lacing bars, punch down blocks, and terminal strips as required.
- E. Provide adjustable leveling feet
- F. 115 volt vertical power strip with minimum 12 - 20A outlets.

2.2 SUNDRIES

- A. Furnish 6 extra low voltage fuses and other perishables which may be required.
- B. Furnish framed schedules (for house/work light dimming racks and lighting)

PART 3 – EXECUTION

3.1 COORDINATION

- A. The LSI shall coordinate delivery shop drawings, samples and equipment as specified herein with the CM, EC and Consultant.
- B. The LSI shall furnish scheduling information based on the product manufacturers lead time at time of contract award.

3.2 SYSTEM COMMISSIONING

- A. LSI shall provide system commissioning when notified by the EC that installation is complete.
- B. A 14 day lead time from notification to arrival on site shall be satisfactory for scheduling a factory licensed field service technician.
- C. System Commissioning shall consist of, but not be limited to, the following:
 - 1. System testing as specified herein.
 - 2. Low voltage device terminations.
 - 3. Console, dimmer and device activation and initialization.
 - 4. Stage Lighting and Architectural Systems Programming.
 - 5. Software installation, configuring and networking of rack mounted PC.
 - 6. Programming of architectural lighting presets.

3.3 SYSTEM TESTING, COMMISSIONING AND PROGRAMMING

- A. Field Check-Out by EC
 - 1. The EC shall furnish all equipment and instruments necessary for testing the complete wiring system during the progress of the work as well as after installation. Tests shall be demonstrated to the satisfaction of the architect, theatre consultant and/or owner. Test the following:
 - a. All circuits are continuous and free from short circuits.
 - b. All circuits are free from unspecified grounds.
 - c. All circuits are properly connected in accordance with the applicable wiring diagram.
 - d. Voltage drop at each end of the circuit with a 2000-watt load is within 2% tolerance.
 - e. All low voltage circuits comply with industry standards.
 - f. All DMX controlled architectural luminaires are addressed according to the contract drawings or shop drawings.
 - 2. Any defects shall be repaired at once and the tests re-conducted.
- B. Final Check-Out and System Commissioning by LSI
 - 1. Final check-out and system commissioning by the LSI shall occur after the EC's check-out as noted above, and after all defects have been remedied. The EC shall give adequate notice to the LSI that the system is ready for commissioning by the LSI
 - 2. The LSI shall furnish all equipment and instruments necessary for testing the complete system at the conclusion of installation. Tests shall be demonstrated to the satisfaction of the architect, theatre consultant and/or owner. Test the following:
 - a. All dimmers and relays are fully functioning.

- b. All equipment in the lighting control rack is fully functioning.
 - c. The emergency transfer switch and DMX emergency transfer are fully functioning.
 - d. All dimmers and relays respond to commands from the stage lighting console and the architectural lighting processor and control stations.
 - e. All numbered outlets are connected to the correspondingly numbered dimmer or relay.
 - f. All numbered RJ45 ports are connected to the correspondingly numbered port in the patch panel and are exchanging data with the stage lighting console and/or the architectural lighting processor and control stations as designed.
 - g. All DMX port numbers are connected to the correspondingly numbered DMX repeater and are exchanging DMX/RDM data with the stage lighting console and/or the architectural lighting processor and control stations as designed.
 - h. All architectural luminaires are correctly connected to the system and are responding in accordance with the zones shown on the RCPs
 - 3. Any defects shall be repaired at once and the tests re-conducted.
- C. Final Check-out by the Theatre Consultant
- 1. When the work on the entire structure has been completed and is ready for final review, a visit will be made by the Theatre Consultant or his duly authorized representative, at which time the LSI shall demonstrate that the requirements of the contract as it applies to his work have been carried out and that the system has been adjusted and operates as designed. Demonstrate the following:
 - a. The emergency transfer switch and DMX emergency transfer are fully functioning.
 - b. Spot demonstrate, at circuits outlets selected by the theatre consultant, that dimmers and relays respond to commands from the stage lighting console and the architectural lighting processor and control stations.
 - c. Spot demonstrate, at ports selected by the theatre consultant, that RJ45 ports are exchanging data with the stage lighting console and/or the architectural lighting processor and control stations as designed.
 - d. Spot demonstrate, at ports selected by the theatre consultant, that DMX port numbers are connected to the correspondingly numbered DMX repeater and are exchanging DMX/RDM data with the stage lighting console and/or the architectural lighting processor and control stations as designed.
 - e. Demonstrate that the architectural luminaires correctly connected to the system and are responding in accordance with the zones shown on the RCPs
 - 2. With the theatre consultant, architectural lighting designer, architect and/or owner, assign zones to all faders, set and record presets in all buttons, and map zones and presets to the touchscreen(s) as directed.
 - 3. Any defects shall be repaired at once and the tests re-conducted
- 3.4 CLEAN UP
- A. Upon completion inspect entire lighting equipment installation and clean all surfaces, make all necessary adjustments, remove all protective coverings, dirt, dust, finger marks, smears, contamination, extraneous materials and foreign matter and leave entire installation in clean and properly serviced, finished and operating condition.

3.5 OWNERS STAFF TRAINING AND SYSTEM ACCEPTANCE

- A. The LSI shall gather in one place and at one time all loose equipment, keys and as-built drawings which shall be turned over to the Owner. He shall have all items typed on a sheet of paper ready to be signed by an authorized representative of the Owner.
- B. The LSI shall provide a competent instructor to familiarize Owner's staff with the operation and maintenance of the system.
- C. The instructor shall provide a minimum instruction period of two full days. Instruction shall include but not be limited to familiarization with all software, network protocols and systems configuration, console operations and dimmer rack configuration.
- D. The LSI shall provide three (3) copies of black and white prints on the system corrected in red to indicate all changes made during construction and turned over to the Theatre Consultant upon completion and acceptance of the electrical work.

3.6 GUARANTEE

- A. Guarantee in writing that all material and workmanship to the apparatus installed under this contract are first class in every respect and conform to operating design criteria specified. Make good any defects, mechanical or electrical, not due to ordinary wear and tear or improper use or care, which may develop within a period of one (1) year, beginning from the day of final acceptance of the work by the Owner.
- B. The LSI shall also, during this one (1) year guarantee period, be responsible for the proper adjustments of all systems, equipment and apparatus furnished by him and do all work necessary to insure efficient and proper functioning of the systems and equipment.
- C. Any equipment malfunctions due to equipment failure or poor installation, shall be made good or be replaced as directed by the Architect or the Owner, at no cost to the Owner and at such times as designated by the Owner.

END SECTION 116153



100V 115/120V 230/240V

Eos Series



GENERAL INFORMATION

Ion Xe 20 provides complete control of conventional and moving lights, LEDs and media servers. It supports multiple users with partitioned parameter control and full backup, multiple playback faders and cue lists in a tracking, move-fade environment. The desk includes backlit buttons and 20 45mm non-motorized faders with associated displays.

FEATURES

- 2,048 or 12,288 outputs
- 32,768 control channels (any number from 1 - 99,999)
- Up to 99 discrete users
- Partitioned control
- Master playback pair with 100mm faders
- 20 45mm faders x 100 pages for configurable faders, submasters, masters and grandmaster control with two associated high-contrast monochrome LCD displays
- User-definable direct selects
- Four discrete palette types (IFCB)
- Presets function as "all palette"
- Effects provide dynamic relational and absolute progressive behavior
- Central information area (CIA) accesses the browser and other controls
- Four pageable encoders for non-intensity parameter control
- Configurable high-density channel display, with format and flexi-channel modes
- Up to six abstract color spaces, tinting, spectrum and fade path tools.
- User configurable, interactive Magic Sheets
- ETCNet2™ and Net3™ (powered by ACN), ArtNet and Avab® UDP network output protocols
- Show import from Obsession, Express™, Expression®, Emphasis®, Congo®, Cobalt®, Grand MA1, Grand MA2, Safari and Strand 500/300 Series
- Two individually configurable Ethernet ports
- Multiple MIDI and/or SMPTE TimeCode Inputs, Analog/Serial Inputs, OSC transmit/recieve
- Virtual Media Server function for pixel mapped effects, images, animations
- Support for multiple languages, including English, German,

ORDERING INFORMATION

Ion Xe 20

MODEL	DESCRIPTION
Ion Xe 20 - 2K	Ion Xe 20, 2,048 outputs (minimum)
Ion Xe 20 - 12K	Ion Xe 20, 12,288 outputs (maximum)
Ion Xe RPU - 2K	Ion Xe Remote Processor, 2,048 outputs
Ion Xe RPU - 12K	Ion Xe Remote Processor, 12,288 outputs
Ion Xe 10K	After-sale 10K upgrade
ETCnomad 512	Client for Mac/PC

Output protocols are distributed using ETCNet2 DMX Nodes or Net3 DMX/RDM Gateways. I/O Gateways and Show Control Gateways provide switch closure functionality, MIDI and SMPTE TimeCode.

Ion Xe 20 Accessories

MODEL	DESCRIPTION
Eos MFW 10	Eos Motorized Fader Wing 10
Eos MFW 20	Eos Motorized Fader Wing 20
Eos FW 20	Eos Standard Fader Wing 20
Eos FW 40	Eos Standard Fader Wing 40
Net3 RV13	Net3 Remote Video Interface
ETCpad	ETC Portable Access Device
Ion Xe - FC	Ion Xe Flightcase

Eos Family Offline Editor software for Mac and PC platforms is called ETCnomad and is available for download from www.etcconnect.com

Ion Xe 20 requires Windows 7 compatible external monitors, 1280x1024 minimum resolution, standard, touch or multi-touch

SHIPS WITH:

- Dust cover
- One Littlite
- Mouse and mousepad
- External alphanumeric keyboard
- Two active display-port to DVI adapters
- One locking IEC power cord



Lighting
Controller

SPECIFICATIONS

SYSTEM CAPACITY

- 2,048 or 12,288 Outputs
- 32,768 Control Channels (devices)
- 10,000 Cues
- 999 Cue Lists
- 200 Active Playbacks
- 999 Submasters
- 100 Fader Pages
- 4 x 1,000 Palettes (Intensity, Focus, Color, Beam)
- 1,000 Presets (all palette)
- 1,000 Groups
- 1,000 Effects (relative, absolute or step)
- 99,999 Macros
- 1,000 Snapshots
- 1,000 Curves
- 1,000 Color Paths
- Supports two external display-port monitors at 1280x1024 minimum resolution, with optional touch or multi-touch control
- Solid-state hard drive
- Five USB ports for flashdrives, pointing devices, keyboards

DISPLAY FUNCTIONS

- All show data may be viewed on a single external monitor. External views may be posted separately or expanded across a maximum of two monitors. Three user-configurable workspaces per display, with split-screen/sizing controls.
- The Central Information Area accesses:
 - Browser
 - File Management
 - System Defaults
 - Show Defaults
 - Desk Defaults
 - Partition Definitions
 - Network Configuration
 - Show Data Utilities
 - Print to PDF
 - Record Target Lists
 - Patch functions
 - Help
 - Electronic alpha-numeric keyboard
 - Command Line
 - Selected Cue
 - Error messages
 - Context-Sensitive Control
 - Parameter Categories and individual parameters
 - Filters
- Channel Displays
 - Live channel or table view
 - Blind cue, palette, preset and group views, in list, channel, table and spreadsheet formats
 - User-configurable to show required parameters and/or parameter categories (IFCB)
 - Flexi-channel to determine which channels to display
 - Zoom allows user to define how many channels are viewed
 - Color-coded intensity levels indicate direction of move

SPECIFICATIONS

- Color-coded non-intensity levels indicate change from previous state
- Graphic differentiation of moving lights, single parameter devices and unpatched channels
- Magic Sheets
 - User-defined interactive display layouts
 - Objects and images may be imported
- Patch Views
 - Patch by channel
 - Patch by address
 - Patch by Device List (RDM)
 - Assign proportional patch value, curve and, preheat value for intensity
 - Swap pan and tilt
 - Invert pan and tilt
 - Custom fixture editor
 - User configurable shutter order
- Playback Status Display
 - Accesses status of 100 fader pages
 - Expanded cue list for selected cue, optional dynamic countdown of active cues
- Cue List Index
- Effect Editor
- Group Editor
- Park Display
- Dimmer Monitoring
- Submaster List
- Fader Config Display

PLAYBACK CONTROLS

- Master Playback crossfade pair with two 100mm potentiometers, Go, Stop/Back and Load
- 50 pages of 20 45mm faders, each configurable as:
 - IFCB Palette/Preset Lists or single instances
 - Cue Playback, with user-configurable button/slider behavior
 - Grand Master with Blackout
 - Additive or Inhibitive Submaster, with user-configurable button/slider behavior
 - Filtered Manual Timing Master
- Rate Controller
- Playback fader controls include:
 - Load to assign cue lists
 - Timing Disable
 - Off/On
 - Release
 - Freeze
 - Assert
 - Manual Override
 - Rate
 - Go To Cue 0
 - Spread
 - Background Enable/Disable
 - 10 Priority States
 - 10 Background Priority States
 - Parameter and channel filters
- Macros
 - May be set to play background or foreground
 - Startup and Shutdown Macros
 - Disconnect Macros

SPECIFICATIONS

MANUAL CONTROL

- Channel selection from keypad and/or multi-touch direct selects
- Lists constructed with +, -, thru
- Intensity set with level wheel, keypad, level button, full and out
- Select Last recalls last sequential channel selection set
- Select Manual selects all channels with manual values
- Select Active selects all channels with intensity above zero
- Ordered groups
- Offset; including even, odd, random and reverse
- Fan
- Sneak
- User-definable home
- Home by parameter, parameter category or all non-intensity parameters
- Capture
- Park at level
- Scaled park for temporary percentage adjustment
- Recall-from and Copy-to commands
- About provides detailed view of selected channels or record targets
- Undo
- Highlight and Lowlight, with optional user-definable Rem Dim
- Lamp controls to strike and douse arc sources, calibrate devices

PROGRAMMING FEATURES

- Channel Functions
 - Non-intensity parameters set via numeric entry or pageable encoders
 - Encoders support software-controlled tactile response
 - Local display of color and gobo images
 - Color matching to gel selector
 - Color Path, color tinting and color spectrum tools.
 - Apply discrete time and delay per channel parameter
- Palette and Preset Functions
 - Record and Update
 - Toggle display to absolute data
 - Up to 999 decimal values may be inserted between any two whole numbers
- Effects
 - Create live or blind
 - Pattern-based relative dynamic effects
 - Absolute effects
 - Step effects
 - Channel level overrides
 - Cue level overrides
 - Entry mode determines how parameters enter effects
 - Exit mode determines how parameters depart effects
- Cue Recording
 - Cue List HTP/LTP Intensity
 - Cue List Priority and Background Priority
 - Cue List Assert
 - Fader as progress controller, manual or intensity master
 - Record manual values or channels in use
 - Auto playback of recorded cues
 - Referenced or auto-mark instructions
 - Block at cue or parameter level
 - Assert at cue or parameter level
 - All-fade flag

SPECIFICATIONS

- Follow or hang times
- Out of sequence link
- Loop functions
- Cue level parameter category timing
- 20-part multi-part cues
- Cue-level rate override
- Mark flags for Auto or Referenced and Referenced Priority Marks
- Up to 999 decimal cues between each two whole-numbered cues
- Execute List
 - Triggers snapshot
 - Triggers macros
 - Triggers go of other cues
 - Syncs go to multiple cue lists
 - Show-control triggers
 - Analog triggers
- Update and Update Trace functions
- Undo record and delete
- Submaster Recording and Playback
 - 999 additive or inhibitive submasters
 - Bump button timing for fade up/dwell/fade out
 - Assert/Channel select button
 - Exclusive or Shielded Mode
 - Background enable/disable
 - Restore to background or minimum value
 - LTP/HTP intensity
 - Fader as progress controller or intensity master
 - Bump button to mark NPs
 - Priority and Background Priority status
 - Motorized faders match level across all devices and when paging
 - Submaster mapping on the fly
- Curves
 - Assignable in patch to modify dimmer output ramp
 - Assignable at cue or cue part level to modify intensity crossfade profile or non-intensity parameter ramping

INTERFACES

- Two individually configurable ethernet ports
- ETCNet2, Net3 (powered by ACN), ArtNet and Avab UDP output protocols
- Four DMX/RDM ports
- Contact-closure triggers via D-Sub connector
- Two video connectors support display-port external displays (1280x1024) with optional single-touch or multi-touch screen control
- USB multipurpose (five ports)
- OSC Transmit/Receive
- UDP Transmit/Receive
- MIDI TimeCode, MIDI Show Control through Gateway
- SMPTE TimeCode through Gateway
- Contact closure (12 analog inputs, 12 SPDT contact outputs, RS-232) through Gateway

ELECTRICAL

- AC input (100 - 240V at 50/60 Hz)
- Power consumption (less external monitors) approximately 1 amp at 120V or 230/240V

PHYSICAL

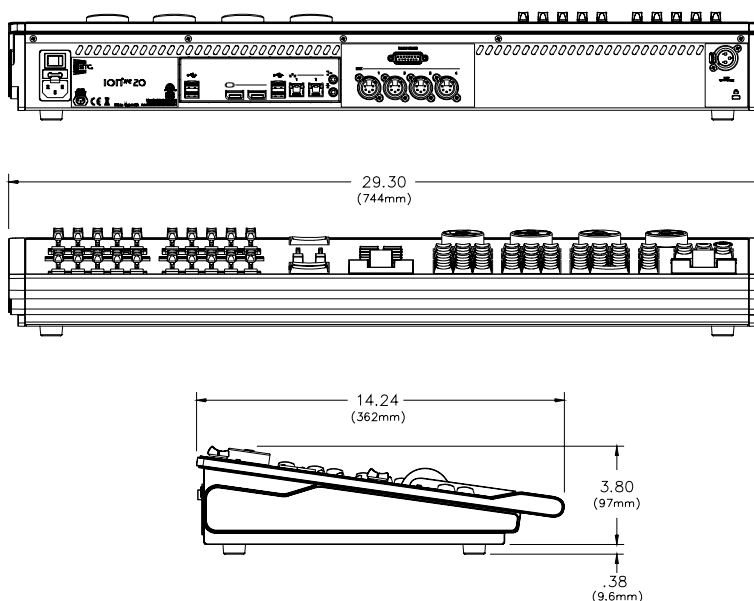
Ion Xe 20 Dimensions*

MODEL	HEIGHT		WIDTH		DEPTH	
	inches	mm	inches	mm	inches	mm
Ion Xe 20	4.10	104	29.30	744	14.24	362
Ion Xe 20 in shipping container	7.75	197	36.50	927	18.50	470
Ion Xe 20 in roadcase	8.34	212	45.12	1,146	19.45	494

Ion Xe 20 Weights*

MODEL	WEIGHT	
	lbs	kgs
Ion Xe 20 console	16.6	7.35
Ion Xe 20 in shipping container	22.5	9.98
Ion Xe 20 in roadcase	46.7	TBD

*Weight and dimensions typical



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Power Control Series

Type(s) Project Date Notes

GENERAL INFORMATION

ETC's Sensor IQ Intelligent Breaker System provides mains-fed power distribution for up to 48 branch circuits in the industry's most compact footprint. Sensor IQ breakers combine high-inrush rated overcurrent protection, switched power control, and power usage/breaker status reporting in a single device. With built-in station, sensor, DMX and TimeClock controls and Ethernet connectivity, plus optional 0–10 V dimming, DALI output, contact inputs, and isolated ground bar for audio loads, the Sensor IQ integration opportunities are limitless.

APPLICATIONS

- Theaters
- Schools
- Houses of worship
- Conference centers
- Studios
- Arenas and stadiums

FEATURES

- Mains Feed: Three-phase 120 / 208 V four-wire plus ground or single (bi) phase 120 / 240 V three-wire plus ground
- 12-, 24- or 48-position breaker subpanel
- Breakers
 - Hydraulic magnetic breaker with high inrush trip curve
 - 22 kA SCCR (up to 65 kA series rated with main breaker)
 - Freely mix one-, two- and three-pole breakers up to 30 A
 - Integrated air-gap relay switching
 - Integrated on/off/tripped and connected load feedback
 - No power required for handle operation at the breaker
- Echo, sACN, DMX-512, TimeClock, or stand-alone control
- Built-in EchoConnect power supply for up to 6 Echo stations/sensors and 5 output products
- Built-in network interface provides:
 - Advanced control of relays over streaming ACN (sACN)
 - Measured energy usage reporting per branch circuit
 - Web UI for configuration
- Available 0–10 V, contact input or DALI control cards
- UL924 Listed emergency control bypass with load shedding



ORDERING INFORMATION

Panel Models

MODEL	DESCRIPTION
IQ12MLO	120 / 208 V 12-circuit breaker panel, main lug only
IQ12	120 / 208 V 12-circuit breaker panel, MCB optional
IQ24	120 / 208 V 24-circuit breaker panel, MCB optional
IQ48	120 / 208 V 48-circuit breaker panel, MCB optional
IQ12-1	120 / 240 V 12-circuit breaker panel, MCB optional
IQ24-1	120 / 240 V 24-circuit breaker panel, MCB optional
IQ48-1	120 / 240 V 48-circuit breaker panel, MCB optional

Note: Select surface or recess door below

Door Options

MODEL	DESCRIPTION
IQ DOOR 120-12MLR	Recess-mount door for IQ12MLO
IQ DOOR 120-12MLS	Surface-mount door for IQ12MLO
IQ DOOR 120-12R	Recess-mount door for IQ12/IQ12-1
IQ DOOR 120-12S	Surface-mount door for IQ12/IQ12-1
IQ DOOR 120-24R	Recess-mount door for IQ24/IQ24-1
IQ DOOR 120-24S	Surface-mount door for IQ24/IQ24-1
IQ DOOR 120-48R	Recess-mount door for IQ48/IQ48-1
IQ DOOR 120-48S	Surface-mount door for IQ48/IQ48-1

Optional Main Disconnects

MODEL	DESCRIPTION
IQ-MB100A22K*	Main Breaker: 120 / 208 V, 100 A, 22 kA SCCR
IQ-MB100A65K	Main Breaker: 120 / 208 V, 100 A, 65 kA SCCR
IQ-MB200A22K	Main Breaker: 120 / 208 V, 200 A, 22 kA SCCR
IQ-MB200A65K	Main Breaker: 120 / 208 V, 200 A, 65 kA SCCR
IQ-MB225A65K	Main Breaker: 120 / 208 V, 225 A, 65 kA SCCR
IQ-MB250A22K	Main Breaker: 120 / 208 V, 250 A, 22 kA SCCR
IQ-MB400A65K	Main Breaker: 120 / 208 V, 400 A, 65 kA SCCR
IQ1-MB100A22K*	Main Breaker: 120 / 240 V, 100 A, 22 kA SCCR
IQ1-MB200A22K	Main Breaker: 120 / 240 V, 200 A, 22 kA SCCR
IQ1-MB400A65K	Main Breaker: 120 / 240 V, 400 A, 65 kA SCCR
IQ-MF1003P	Main Fuse: 120 / 208 V, 100 A, 65 kA SCCR
IQ-MF2003P	Main Fuse: 120 / 208 V, 200 A, 65 kA SCCR
IQ1-MF1002P	Main Fuse: 120 / 240 V, 100 A, 65 kA SCCR
IQ1-MF2002P	Main Fuse: 120 / 240 V, 200 A, 65 kA SCCR

*100 A, 22 kA SCCR Main Breaker kits are not compatible with IQ48 panels.

NOTE: IQ panels with Main Fuse Kits to increase SCCR must be fed by an upstream breaker that is rated at the amperage of the fuse kit or greater.

Please see page 4 for Echo power requirement and supply information.

Please see page 5 for more accessory information.

SPECIFICATIONS

REGULATORY AND COMPLIANCE

- Breakers Listed to UL 489
- Enclosures listed to UL 67, UL 508, UL 924
- Complies with ANSI DMX512-A standard
- Complies with ANSI E1.31 streaming ACN standard

USER INTERFACE

- Graphical display
- Button interface
 - 0-9 number entry
 - Up, down and back-arrow navigation with enter
 - Test shortcut for local activation of preset, sequence and set level overrides
- USB interface for uploads of setup and software updates
- Onboard Web UI for simple configuration and management

BREAKER

- Hydraulic magnetic breaker maintains trip curve through entire thermal range, reducing nuisance tripping Bus connection type: Stab on
- One, two or three poles
- UL 489 Listed
- 15 A, 20 A or 30 A
- 50/60 hz frequency
- Inrush-pulse tolerance: 25 times rated current for half-cycle
- Integrated hall-effect sensors detect contact positions
- Integrated solenoid for remote operation
- Trips on overload even if handle is forcibly held in the "on" position
- Load lugs accept 14-6 AWG load wiring
- Multi-conductor rated output terminal
- Integral mechanically held air gap relay
- Integral current sensing
- Integral position and trip sensing
- Supports manual control of relay state using breaker handle without power
- Control and status provided by contact pads directly at bottom of the breaker case. No external wires or connections required for control or feedback
- Remote Feedback for breaker state, breaker type, current draw and phase voltage
- Visible state indication:

LED	HANDLE	INDICATION
LED on	Handle on	Output active
LED off	Handle on	Remotely controlled off
LED off	Handle off	Breaker tipped/Manually off

BREAKER CONTROL OPERATIONAL RATINGS

- No load-remote switching 1,000,000 cycles
- 24 A Resistive 100,000 cycles
- 15 A Electronic ballast (LED) 100,000 cycles
- Handle operations 10,000 cycles
- Duty cycle of 6 full cycles (12 operations) per minute
- Supports voltage isolation of 4000 V RMS
- Utilizes latching state relays
- Relays are mechanically held

SPECIFICATIONS

MECHANICAL

- Enclosure constructed of 16-gauge steel finished in black, fine-textured, scratch-resistant powder coat paint
- Removable outer panel includes integral locking door to limit access to electronics, breakers and local relay overrides
- Full front access with no side clearance required
- Removable covers for access to Class 1 and Class 2 wiring
- Complies with California building code - seismic zone four

ELECTRICAL

- Mains feed power input to support 120 / 208 V three-phase four-wire or 120 / 240 V bi-phase three-wire plus ground
- Max current input: 100 A at 12 circuits, 200 A at 24 circuits and 400 A at 48 circuits
- Quiescent draw: <10 W with relays at steady state
- Optional isolation between chassis and equipment grounding
- Short-circuit current rating: 22,000 A or 65,000 A symmetrical (see chart a right)
- Overloads occurs at 50 operations of 600% of rated current
- Integrated current transformer
- Current measurement range of 1–30 A. The maximum crest factor of primary current is 2.5
- Feeder entry supported at top or top side
 - Bottom or bottom side entry supported by rotating enclosure during installation
- Load wire entry supported on top, sides or bottom

SHORT-CIRCUIT CURRENT RATING AND LUG SIZING

TYPE	MAX RATING	SCCR RATING	INPUT LUG WIRE SIZE
Main Lug	100 A, 200 A, 400 A	22 kA	2x6 AWG-250 kcmil (or 1x500 kcmil w/ kit for 48ckt panels), 1x6 AWG-350 kcmil neutral (dual lug on 48-channel panel), 1x14 AWG-2/0 ground (1x6 AWG-350 kcmil on 48 channel panel)
Main Breaker	100 A	22 kA	1x4 AWG-1 AWG
	100 A 200 A 225 A	65 kA 22 kA, 65 kA 65 kA	1x1AWG-300 kcmil
	250 A	22 kA	1x4 AWG-300 kcmil
	400 A	65 kA	2x3/0 AWG-250 kcmil
Main Fuse	100 A	65 kA	2x6 AWG-250 kcmil
	200 A	65 kA	2x6 AWG-250 kcmil
Branch Breaker	15 A, 20 A, 30 A	22 kA	6-18AWG solid or stranded class B, C, K; 10, 12 or 14 AWG dual conductor
Branch GND/ Neutral	NA	NA	6-14 AWG

Note: Main feed lugs accept copper or aluminum wire; branch breakers accept copper wire only.

SPECIFICATIONS

ENVIRONMENTAL

- Thermal: 0°–40° C (32°–104° F) operating temperature
 - 24 A circuit (30 A breaker) - 1.4 W, 4.8 BTU/hr
 - 16 A circuit (20 A breaker) - 1 W, 3.4 BTU/hr
- Humidity: 5–95% non-condensing
- Complies with ESD immunity to IEC standard 1000-4-2

FUNCTIONAL

- **System-Wide control**
 - DMX input
 - Per-circuit patching
 - Per-circuit patch exclusions
 - Per-circuit threshold
 - 0-200 prioritization (matches sACN priorities)
 - Choice of DMX loss behavior: Hold last look or wait time
 - sACN input
 - Circuit-by-circuit patching
 - Circuit-by-circuit patch exclusions
 - 0-200 prioritization (matches sACN priorities)
 - Choice of sACN loss behavior: Hold last look or wait time
 - Global data loss behavior
 - UL 924 emergency lighting with load shedding
 - Load shedding requires a UPS Control Backup Wiring Kit (7131K1817) and Uninterruptable Power Supply (UPS) by others
 - UPS to supply 800 W–2400 W AC power to control processor
- **Application/Space segmented Control**
 - Space segmenting: up to 16 spaces per panel
 - Power sequencing
 - One 16-step sequence per space
 - Presets: up to 64 per space configurable via local UI or Echo Inspire control stations
 - Presets 1-16 can be configured remotely via Echo Access or integrated Web UI
 - Zone control: up to 16 zones per space
 - TimeClock (up to 50 events)
 - Event types: Preset and sequence activation, Flick warn
 - Timed hold (24 hours max.)
 - Auto-timed hold
 - Indefinite holds
 - Scheduled event overrides
 - Calendar and time of day based event scheduler
 - Holiday shut off
 - Astronomical time events: sunrise/sunset offsets
 - Integral station power supply (for up to six stations with up to six power panels connected)
- **Global monitoring**
 - Per circuit
 - Breaker-trip notification
 - Relay state
 - Current draw per circuit
 - Phase voltage
 - Energy usage
 - Per space
 - Active sequences
 - Active presets
 - Zone levels
 - Active-clock events

SPECIFICATIONS

OPTION CARDS AND ACCESSORIES

0-10 Dimming Option

- 24 outputs of 0–10 V sink dimming control rated for 400 mA per output

Contact Input Option

- 24 dry contact inputs which can be used to:
 - trigger presets and sequences, which will play at the priority configured for architectural sources, or;
 - directly control one or more outputs. The priority of these outputs is configurable. If nothing is configured, the last action takes precedence

DALI Control Option

- 24 control loops of broadcast DALI control
- Each loop supports up to 64 ballasts
- External DALI power supply required

Ride Thru Option

- Short-term power backup of control electronics
- Automatically engages when power is lost
- Recharges during normal power operation

UPS Backup Kit for Load Shedding

- Allows Power Control Processor to be powered via external UPS (by others)
- Required for load shedding applications
- UPS provides power to drive relays off when normal power is lost
- UPS for each Sensor IQ panel must be UL 924 Listed and rated for a minimum of 200 W peak load

Branch Circuit Fuse Kit

- Aids engineers in selective coordination* of emergency circuits

*Note: Selective coordination is a study on emergency systems that assures that an overcurrent on the output of any downstream branch circuit results in that branch tripping/clearing before the upstream mains breakers.

Echo Power Requirements

EchoConnect:	One unit of output power
Auxiliary Power:	Not required

Built-in EchoConnect Power Supply

EchoConnect:	Provides 6U of control power and an additional 5U of output power*
Auxiliary Power:	Not provided

*Note: Built in power supply can be disabled.

Echo Presets

Supports 64 Echo Presets per space; up to 16 Echo spaces
--

For more information, download the [Echo Quick Guide](#).

SENSOR IQ BREAKERS

GENERAL INFORMATION

ETC's Sensor IQ breaker is a high-quality, UL 489 Listed circuit breaker which incorporates the ability to rapidly switch the load using an internal solenoid when the breaker is in the 'on' position. The IQ breaker is designed with a high-inrush trip curve to handle the demands of modern entertainment and architectural lighting fixtures. IQ's unique hydraulic-magnetic trip mechanism maintains this trip curve throughout the operating temperature of the breaker, giving you outstanding protection against nuisance tripping.

A variant of the breaker without switching is available for standard breaker applications.

Sensor IQ breakers are designed for use in Sensor IQ panels only.

Intelligent Breakers with Switching

MODEL	RATED CURRENT	POLES
IQ SM B15	15 A	1-Pole
IQ SM B20	20 A	1-Pole
IQ SM B30	30 A	1-Pole
IQ SM B152	15 A	2-Pole
IQ SM B202	20 A	2-Pole
IQ SM B302	30 A	2-Pole
IQ SM B153	15 A	3-Pole
IQ SM B203	20 A	3-Pole
IQ SM B303	30 A	3-Pole

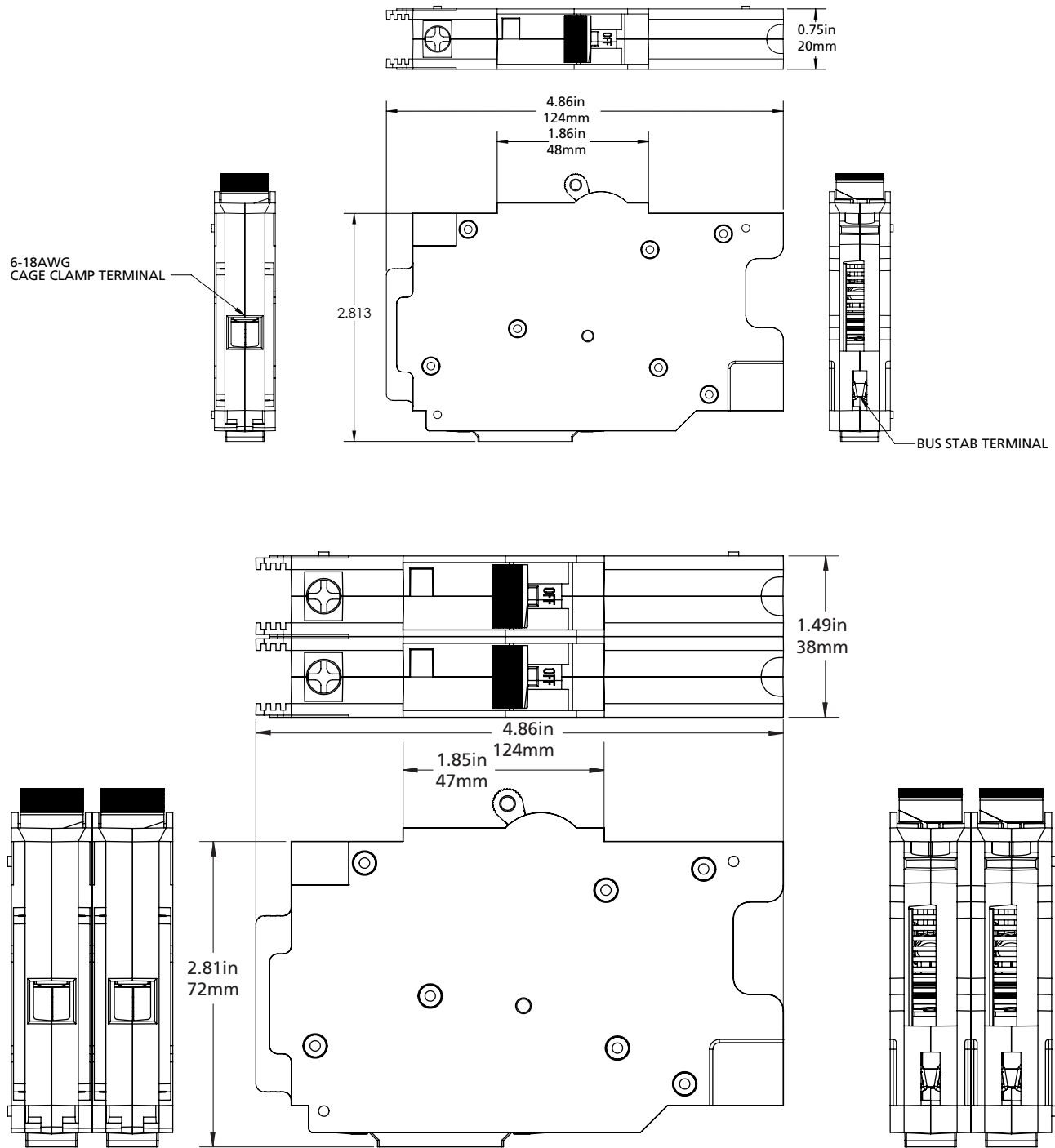
Standard Breakers without Switching

MODEL	RATED CURRENT	POLES
IQ B15	15 A	1-Pole
IQ B20	20 A	1-Pole
IQ B30	30 A	1-Pole
IQ B152	15 A	2-Pole
IQ B202	20 A	2-Pole
IQ B302	30 A	2-Pole
IQ B153	15 A	3-Pole
IQ B203	20 A	3-Pole
IQ B303	30 A	3-Pole

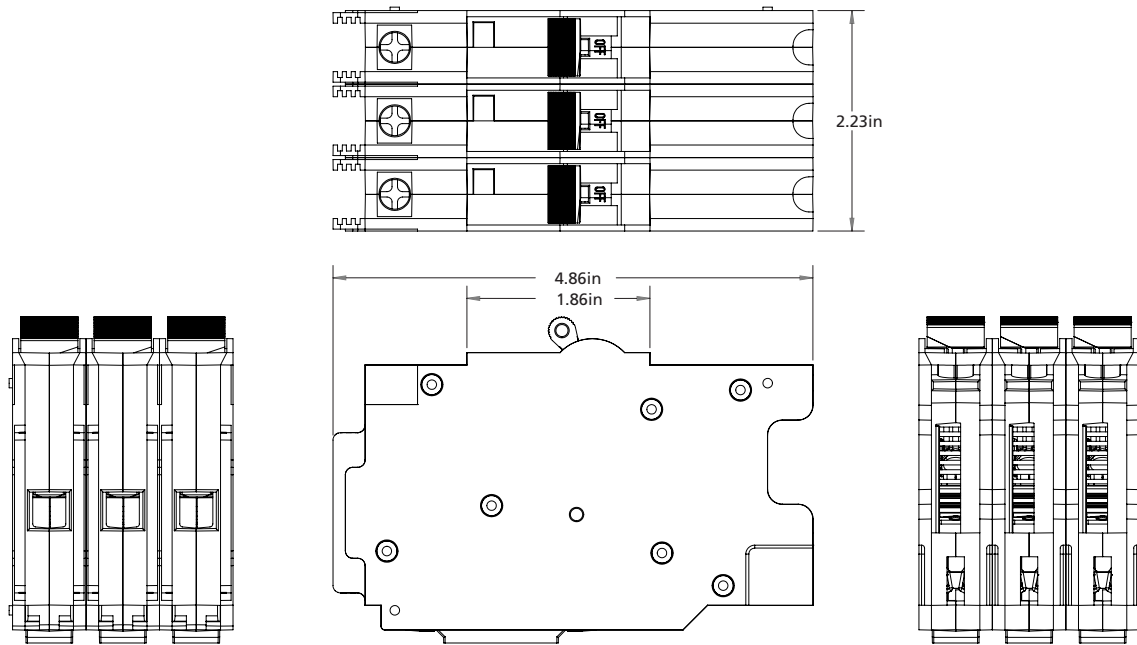
OPTION CARDS AND ACCESSORIES

MODEL	DESCRIPTION
IQ-LVD	0–10 V Dimming Control Option
IQ-DALI	DALI Control Option
IQ-CI	Contact Input Option
IQ-RTO	RideThru Option
IQ-UPS-KIT	UPS Control Backup Wiring Kit - required for shedding normal loads when the emergency state is active; a UL 924 Listed UPS (provided by others) with a minimum load rating of 200 W peak load is recommended for each Sensor IQ panel for load shedding applications
IQ277-500KCMIL	IQ-48 500 kcmil feeder lug kit for support of 400 A feeders up to 500 kcmil
IQSC-6, -12, -24	Branch circuit fuse boxes that may be used for selective coordination of loads (see page 4 for details)
IQ12/24 ISO GND, IQ48 ISO GND	Isolating ground bar
IQ-TAP	Mains feed tap kit for normal sense circuits for emergency lighting control
Unison Echo Devices	Echo Sensors, Stations, Zone Controllers, Station Power Modules and Interfaces

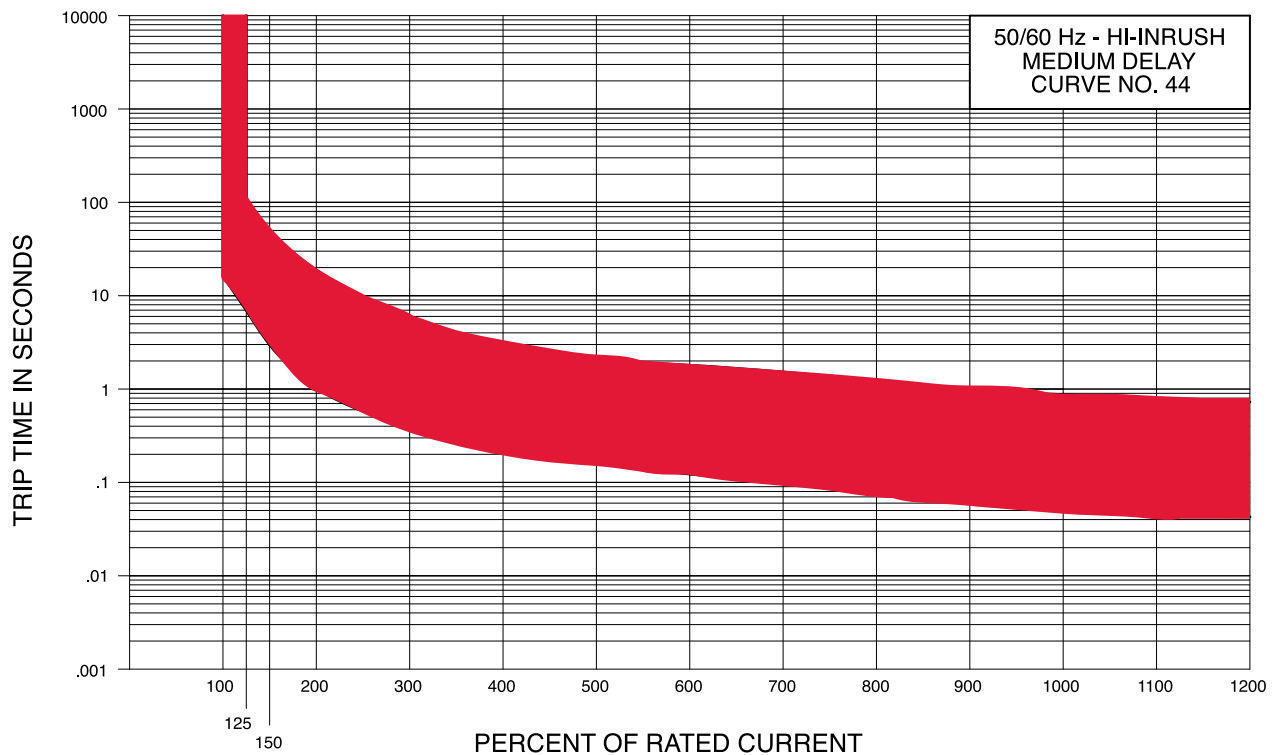
SENSOR IQ BREAKER PHYSICAL SPECIFICATIONS

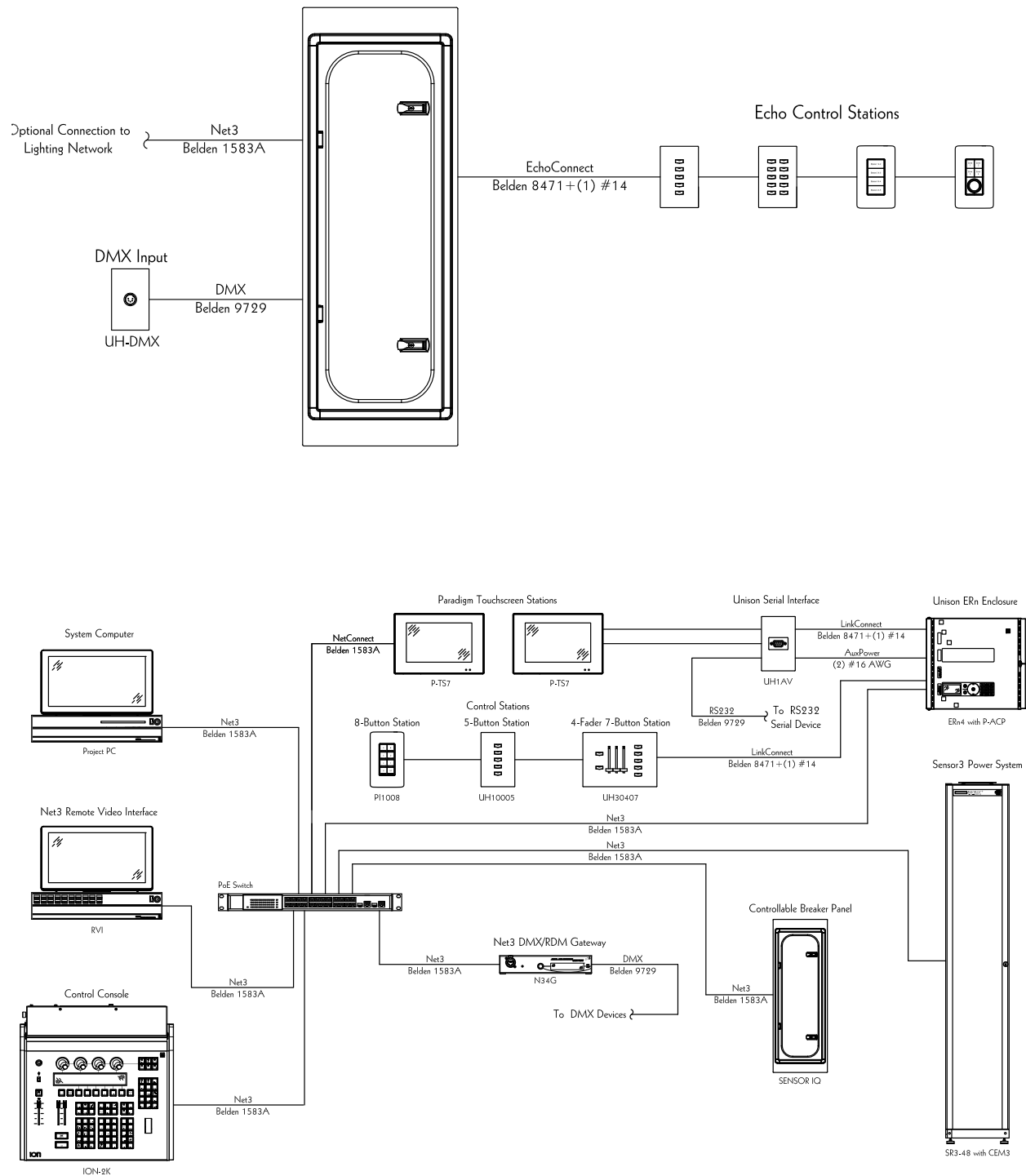


SENSOR IQ BREAKER PHYSICAL SPECIFICATIONS



TIME CURRENT CURVE





ETC

120 V Sensor IQ Intelligent Breaker System

Power Control Series

PHYSICAL

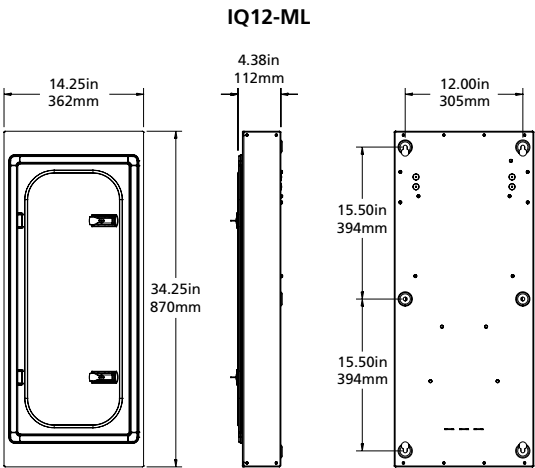
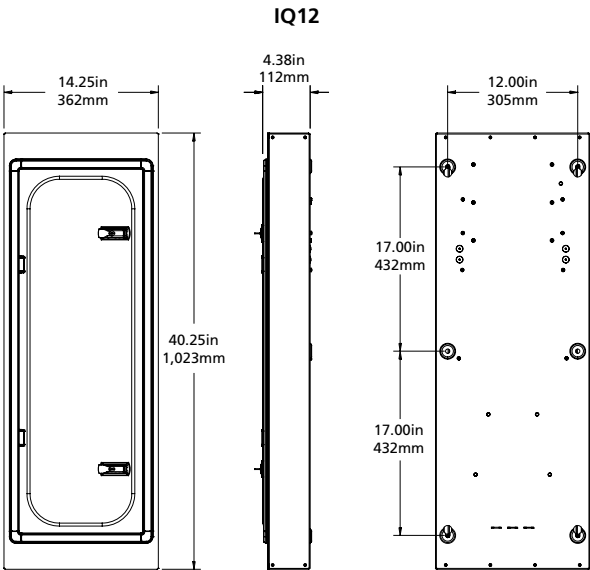
Sensor IQ Dimensions

MODEL	HEIGHT		WIDTH		DEPTH	
	in	mm	in	mm	in	mm
IQ12	41.25	1,048	14.25	362	3.85	98
IQ12-ML	34.25	870	14.25	362	3.85	98
IQ24	50.25	1,277	14.25	362	3.85	98
IQ48	64	1,626	20	508	5.11	130

*Note: Depth is 4.075 in with door attached

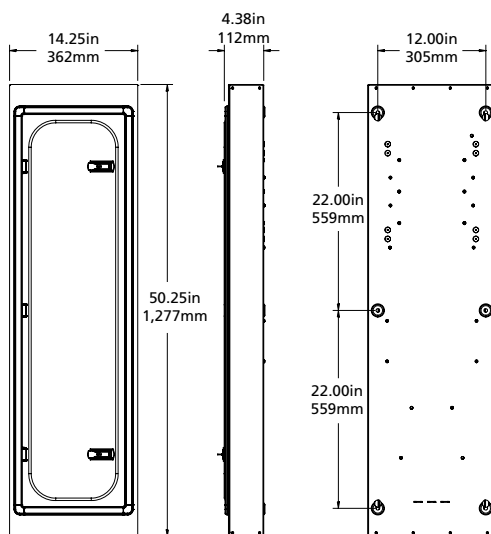
Sensor IQ Weights

MODEL	WEIGHT		SHIPPING WEIGHT	
	lb	kg	lb	kg
IQ12	40.0	18.2	44.6	20.3
IQ24	50.0	22.7	54.0	24.5
IQ48	86.0	39.0	91.3	41.4

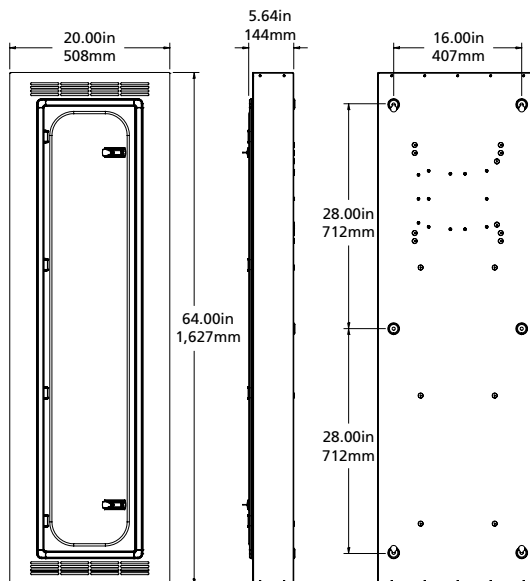


PHYSICAL

IQ24



IQ48



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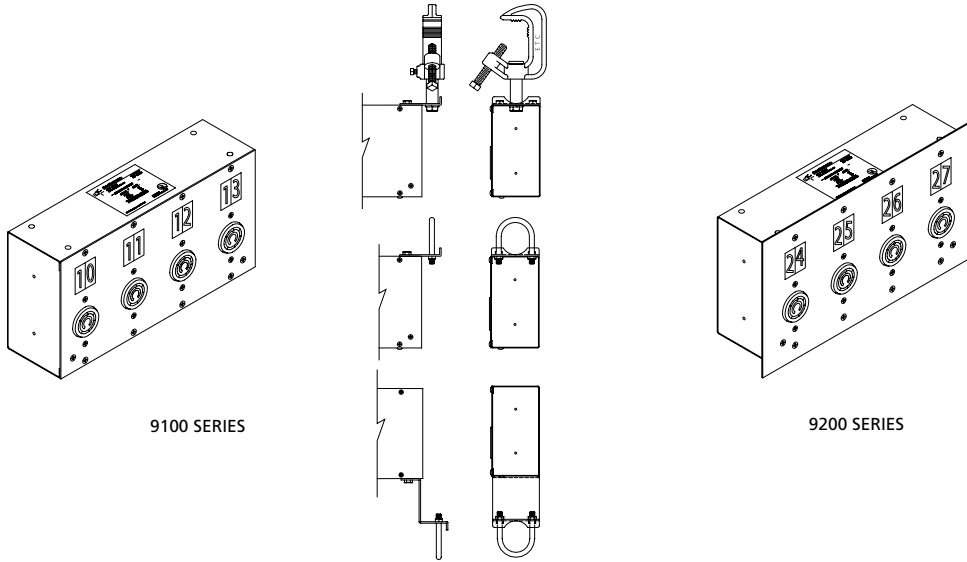
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*Trademark and patent info: etcconnect.com/IP

etcconnect.com



9100 SERIES

9200 SERIES

GENERAL INFORMATION

Outlet boxes are designed for surface or recess mounting in theatres, television studios and other spaces for distribution of lighting circuits.

FEATURES

- Surface and recess mounting available
- 1, 2, 3, 4, 5, 6, and 8 connectors
- Panel mount connector Options:
 - Edison (20A)
 - Stage Pin (20, 60 and 100 amp)
 - Grounded Twist-Lock (20A)
- Over- and Under-hung U-bolt and C-clamp pipe mount options available
- Listed by a nationally recognized test lab (NRTL)

PHYSICAL

- Fabricated from 18-gauge steel with 16-gauge covers and 14-gauge end caps
- Finished with black fine-textured, scratch-resistant powder coat
- 1.25" or .75" labels with white numbers on black background (sized to match product)
- Pin outlets spaced on 1.25" or 3" centers
- Edison or Twist-Lock outlets spaced on 3" centers only

	# of Outlets	Back box Dimensions	9100 Panel Widths	9200 Panel Widths
PIN 1.25" Centers	1	3" W x 6.25" H x 3.25" D	3"	4"
	2, 3, 4	6" W x 6.25" H x 3.25" D	6"	7"
	5, 6	9" W x 6.25" H x 3.25" D	9"	10"
	8	12" W x 6.25" H x 3.25" D	12"	13"
Other 3.00" Centers	1, 2	6" W x 6.25" H x 3.25" D	6"	7"
	3, 4	12" W x 6.25" H x 3.25" D	12"	13"
	5, 6	18" W x 6.25" H x 3.25" D	18"	19"
	8	24" W x 6.25" H x 3.25" D	24"	25"

ORDERING INFORMATION

Standard Surface Mount Outlet Boxes

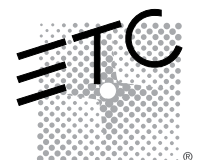
Outlet Qty.	Edison	Pin 3"	Pin 1.25"	Twistlock	MultiPin
1	9101A	9101B	9101BD	9101C	9101V
2	9102A	9102B	9102BD	9102C	9102V
3	9103A	9103B	9103BD	9103C	9103V
4	9104A	9104B	9104BD	9104C	
5	9105A	9105B	9105BD	9105C	
6	9106A	9106B	9106BD	9106C	
8	9108A	9108B	9108BD	9108C	

To any 9100 series box, add "-U" (U-Bolt), "-OU" (Offset U-Bolt), or "-C" (C-clamp) after the connector type to indicate pipe mount option. For example, 9104B-U indicates surface mount, 4-outlet box with stage pin connectors and U-bolt pipe mounting kit.

Standard Recessed Mount Outlet Boxes

Outlet Qty.	Edison	Pin 3"	Pin 1.25"	Twistlock
1	9201A	9201B	9201BD	9201C
2	9202A	9202B	9202BD	9202C
3	9203A	9203B	9203BD	9203C
4	9204A	9204B	9204BD	9204C
5	9205A	9205B	9205BD	9205C
6	9206A	9206B	9206BD	9206C
8	9208A	9208B	9208BD	9208C

For outlets not listed, use manufacturer's part number (must be UL listed).



Gateway Series

Type(s) Project Date Notes

GENERAL INFORMATION

ETC's Response Mk2 Four-Port Gateway provides data distribution using the quality and reliability of ETC's network technology. Built for Net3 using industry-standard sACN, DMX and RDM, the Response Gateway unlocks the power of your networked system.

APPLICATIONS

- Road houses
- Touring
- University/professional theaters
- Convention halls
- Tech tables
- Stage manager panels
- System integration

FEATURES

- Distributes DMX and RDM data to any input/output device over Ethernet
- Supports Net3 protocol powered by ACN
- Configurable DMX/RDM Output or Input
- Simple configuration and service of each port
- Onboard screen and buttons for labeling, status and configuration
- Power, network and port direction status indicators
- Touch to Wake Sensor
- Power over Ethernet (PoE) or external DC power supply
- Configurable using Concert Software

ORDERING INFORMATION

Four-Port Gateways

MODEL	DESCRIPTION
RSN-DMX4-O	Response Mk2 4-Port Gateway - 4 Output
RSN-DMX4-I	Response Mk2 4-Port Gateway - 4 Input
RSN-DMX4-3O1I	Response Mk2 4-Port Gateway - 1 In 3 Out
RSN-DMX4-T	Response Mk2 4-Port Gateway - 4 Terminal
RSN-DMX4-R	Response Mk2 4-Port Gateway - 4 RJ45

Four-Port Gateway Accessories

MODEL	DESCRIPTION
N34G-FP4F ¹	Gateway Front-Panel Kit - DMX 4 Out
N34G-FP4M ¹	Gateway Front-Panel Kit - DMX 4 Input
N34G-4P2M2F ¹	Gateway Front-Panel Kit - DMX 2 In 2 Out
PS-INTL ²	Gateway Universal Power Supply
N3GA-RM	Gateway Rack-Mount Kit
N3GA-HBU	Gateway Hanging-Bracket Kit with U-Bolt

¹Does not include required Rack-Mount kit

²Includes plugs for United States/Japan, Europe, and Great Britain.



SPECIFICATIONS

FUNCTIONAL

- Supports Net3/ACN (ANSI E1.31 and E1.17)
- Supports RDM (ANSI E1.20)
- Supports USITT DMX512-A (ANSI E1.11)
- USITT DMX512 and ANSI E1.11 DMX512-A compliant
- Flexible Output Patch allows a 512-address universe to begin at any output address
- Advanced Input Patch
- Support for per-address- or per-universe-level priority
- Maximum delay time from input to output not greater than one packet time
- Selectable DMX refresh rate with a maximum at least 40Hz
- Supports up to 256 total RDM devices

MECHANICAL

- Intuitive four-button interface
- Onboard display for identification, status and configuration
- Fabricated from 16-gauge cold-rolled steel
- Black, Fine-textured, powder-coat finish
- C-clamp and U-bolt hardware available
- Half 19" equipment rack width allows for up to eight DMX ports in 1U height
- Network, power and data activity LED indicators
 - Blue power indicator, green network activity indicator
 - Bi-color DMX activity indicator
- RJ45 for connection to lighting network
- Reset button for hard reset or forced reboot

ENVIRONMENTAL

- Ambient operating temperature: 0°–40° C (32°–104° F)
- Operating humidity: 5–95% non-condensing
- Storage temperature: -40°–70° C (-40°–158° F)

ELECTRICAL

- Compliant with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet
- 12–24 VDC power input for use with non-PoE systems
- Maximum seven watt current draw
- Screw down and IDC connector options provided for terminal version

CONFIGURATION

- Local configuration options
- Remote configuration provided by Net3 Concert
 - Supports up to 512 DMX addresses per port
 - Supports up to 63,999 Streaming ACN universes
- DMX data input or output configurable by user
- Multiple sources may be combined to the network with each source or address allowed an independent priority
- Individual port start address and offset
- User-configurable labeling

REGULATORY AND COMPLIANCE

- cETLus Listed
- CE compliant
- EAC certified
- RoHS compliant
- WEEE

ADDITIONAL INFORMATION

DMX512

Often shortened to DMX (Digital Multiplex), this communication protocol is used mainly to control dimmers and multi-parameter fixtures. A universe of DMX is defined as 512 channels. DMX sends a nearly continuous stream of level information for each control channel. It is a form of RS-485 digital serial communication.

RDM

Remote Device Management (ANSI E1.20) is a protocol enhancement to DMX512 that allows low-speed bidirectional communication between a system controller and attached RDM devices over a standard DMX line. This protocol will allow remote configuration, status monitoring, and management of devices.

sACN

Streaming ACN (ANSI E1.31), sends DMX-style control over TCP/IP networks. It provides a fast and efficient mechanism to transport the well-understood DMX protocol over Ethernet using an industry-standard protocol.

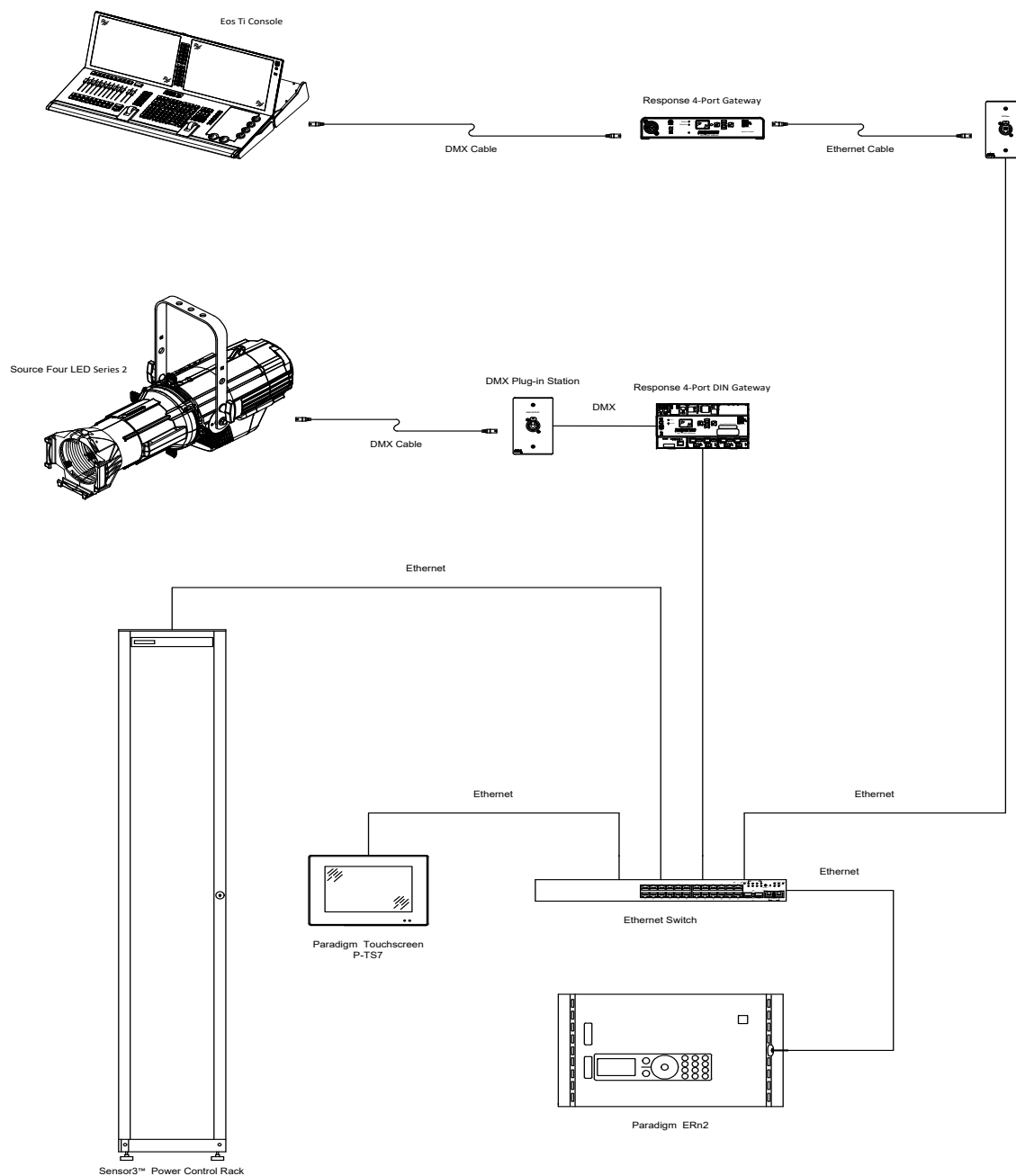
ACN

Architecture for Control Networks (ANSI E1.17) is a standard for high-speed bidirectional communication over TCP/IP on Ethernet network infrastructure. ACN is an open suite of protocols used between network devices for the purposes of greater and more adaptive control.

NET3

ETC's enhanced implementation of the standard ACN Protocol Suite (ANSI E1.17 and E1.31) including additional communication protocols for specialized applications and support of legacy systems.

TYPICAL SYSTEM RISER



PHYSICAL

Response Four-Port Gateway Dimensions

MODEL	HEIGHT		WIDTH		DEPTH	
	in	mm	in	mm	in	mm
Gateway	1.65	42	8.50	216	7.50	191

Response Four-Port Gateways Weights

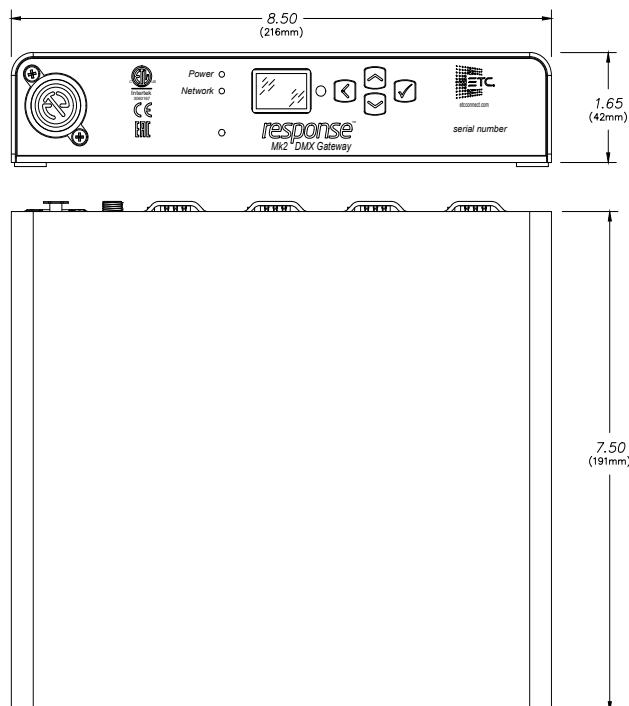
MODEL	WEIGHT		SHIPPING WEIGHT	
	lb	kg	lb	kg
RSN-DMX4-O	1.75	0.79	3.5	1.59
RSN-DMX4-I	1.75	0.79	3.5	1.59
RSN-DMX4-3O1I	1.75	0.79	3.5	1.59
RSN-DMX4-T	1.75	0.79	3.5	1.59
RSN-DMX4-R	1.75	0.79	3.5	1.59

Net3 Four-Port Gateway Accessories

MODEL	WEIGHT		SHIPPING WEIGHT	
	lb	kg	lb	kg
N34G-FP4F ¹	1.1	0.5	2.0	0.9
N34G-FP4M ¹	1.1	0.5	2.0	0.9
N34G-FP2M2F ¹	1.1	0.5	2.0	0.9
N3GA-PS	0.5	0.2	1.0	0.5
N3GA-RM	1.5	0.7	2.0	0.9
N3GA-HBU	0.8	0.4	1.0	0.5

¹Does not include required Rack-Mount Kit

Response Four-Port



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*Trademark and patent info: etcconnect.com/JP

etcconnect.com

Response Series

Type(s) Project Date Notes

GENERAL INFORMATION

The ETC Response Opto-Splitter provides quality and reliable DMX data distribution. Using industry-standard DMX and RDM, the Response Opto-Splitter unlocks the power of your DMX system.

FEATURES

- Multi-port DMX splitter with DMX-in and DMX-thru
- Optically isolated DMX512 ports
- Supports Remote Device Management (RDM) Protocol
- DIN rail and rack-mount versions
- Power and DMX presence status indicators
- Supports update of connected ETC fixtures
- DIN enclosures variants available for UL 924 Emergency ControlIn Bypass applications

APPLICATIONS

- Road houses and touring
- University/professional theatres
- Hotels and Convention halls
- System integration
- Houses of worship
- House lighting
- Museums
- Themed environments

ORDERING INFORMATION

Response Opto-Splitter

MODEL	DESCRIPTION	PART NUMBER
RSN-OPTO-12O	Response Opto - 12 Port Rack-mount - XLR	4267A1032
RSN-OPTO-16R	Response Opto - 16 Port Rack-mount - RJ45	4267A1033
RSN-OPTO-16T	Response Opto - 16 Port Rack-mount - Terminal	4267A1034
RSN-OPTO-8DIN	Response Opto - 8 Port DIN rail - Terminal	4267A1031
RSN-OPTO-DBOX	Response Opto - 16 Output - DIN box with dual 8 Opto	4267K1032
RSN-OPTO-BOX	Response Opto - 8 Output -DIN box with single 8 Opto	4267K1031
RSN-OPTO-DBOX-E	Response Opto - 16 Output -DIN box with dual 8 Opto (Emergency)	4267K1132
RSN-OPTO-BOX-E	Response Opto - 8 Output -DIN box with single 8 Opto (Emergency)	4267K1131



SPECIFICATIONS

FUNCTIONAL

- No configuration required
- Supports DMX512, DMX512 (1990), and DMX512-A
- Supports ANSI E1.20 Remote Device Management (RDM)
- Supports up to 256 total RDM devices

MECHANICAL

- Rack-mount form factor:
 - Fabricated from aluminum
 - Black, Fine-textured, powder-coat finish
 - Full 19" equipment rack width
 - Front or rear facing mounting options
- DIN rail form factor:
 - Molded plastic enclosure
 - Mounting complies with DIN43880 (35/7.5 rail)
 - Unit is 9 DIN units wide
 - DIN installation enclosure available
- Power and data activity LED indicators
 - Blue power indicator
 - Green DMX activity indicator

ELECTRICAL

- Supports DMX input and DMX thru
- Provides optically isolated DMX/RDM outputs
- Rack-mount form factor:
 - 100–240 VAC 50/60 Hz power input
 - User configurable front or rear IEC C13 power connector position
 - 35 W max power draw
 - XLR, RJ45 and Terminal connector options
- DIN rail form factor:
 - 12–48 VDC power input
 - 8 W max power draw
 - Wiring connections use plugable rising clamp terminals
- Optional IDC termination kits available
- DIN Box form factors include a suitable power supply. For more details on using this power supply with other products please contact ETC's Application Engineering Department

ENVIRONMENTAL

- Ambient operating temperature: 0°–40° C (32°–104° F)
- Operating humidity: 5–95% non-condensing
- Storage temperature: -40°–70° C (-40°–158° F)

REGULATORY AND COMPLIANCE

- cETLus Listed
- cETLus Listed to UL 924 (Emergency DIN Boxes Only)
- CE compliant
- EAC certified
- RoHS compliant
- WEEE

ADDITIONAL INFORMATION

DMX512

Often shortened to DMX (Digital Multiplex), this communication protocol is used mainly to control dimmers and multi-parameter fixtures. A universe of DMX is defined as 512 channels. DMX sends a nearly continuous stream of level information for each control channel. It is a form of RS-485 digital serial communication.

RDM

Remote Device Management (ANSI E1.20) is a protocol enhancement to DMX512 that allows low-speed bidirectional communication between a system controller and attached RDM devices over a standard DMX line. This protocol allows remote configuration, status monitoring, and management of devices.

Mounting Accessories

MODEL	DESCRIPTION	PART NUMBER
RSN-OPTO-HBK	Response Opto - Hanging bracket kit	4267K1030
400CC	C-Clamp	7060A2009
DIN-RM	DIN rail Rack Mount Kit	4267A1015
DIN8	Mini DIN rail Enclosure - Horizontal	7180A1030
DIN14	Small DIN rail Enclosure - Vertical	7180A1019
DIN14-H	Small DIN rail Enclosure - Horizontal	7180A1019-H
DIN28	Large DIN rail Enclosure	7180A1018

Termination Accessories

MODEL	DESCRIPTION	PART NUMBER
IDCTERMKIT4X3	4-port 3-position IDC termination kit	4268K1003

PHYSICAL

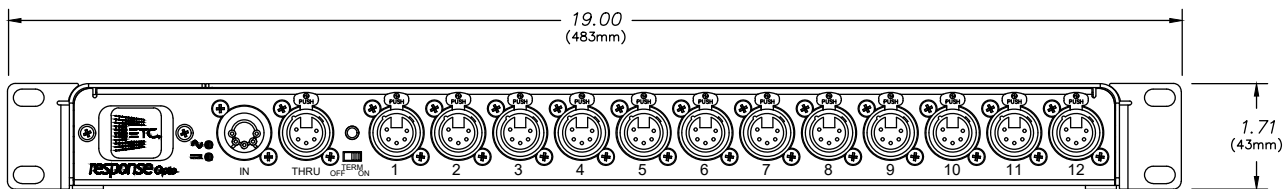
Response Opto-Splitter Dimensions

MODEL	HEIGHT		WIDTH		DEPTH	
	in	mm	in	mm	in	mm
Rack-mount	1.71	44	19.00	483	4.8	122

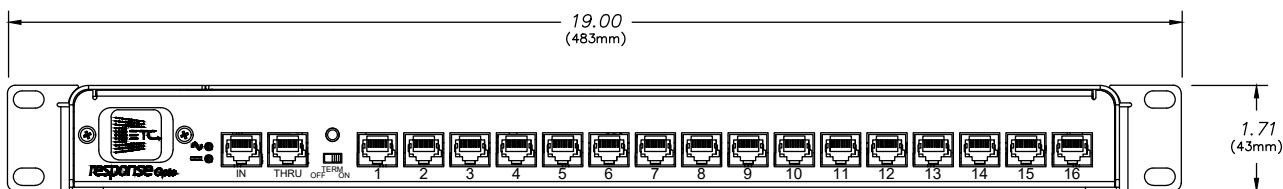
Response Opto-Splitter Weights

MODEL	WEIGHT		SHIPPING WEIGHT	
	lb	kg	lb	kg
Rack-mount	2.5	1.2	4	1.8

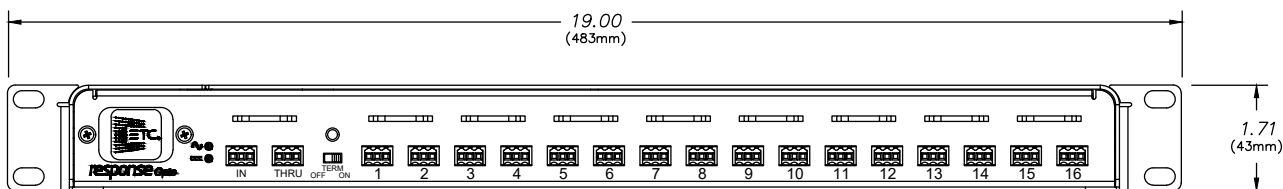
Response Opto-Splitter - XLR Connectors - Front View



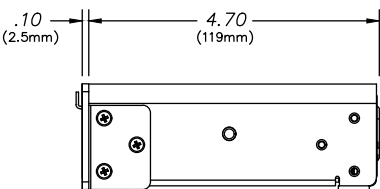
Response Opto-Splitter - RJ45 Connectors - Front View



Response Opto-Splitter - Terminal Connectors - Front View



Response Opto-Splitter - Side View



PHYSICAL

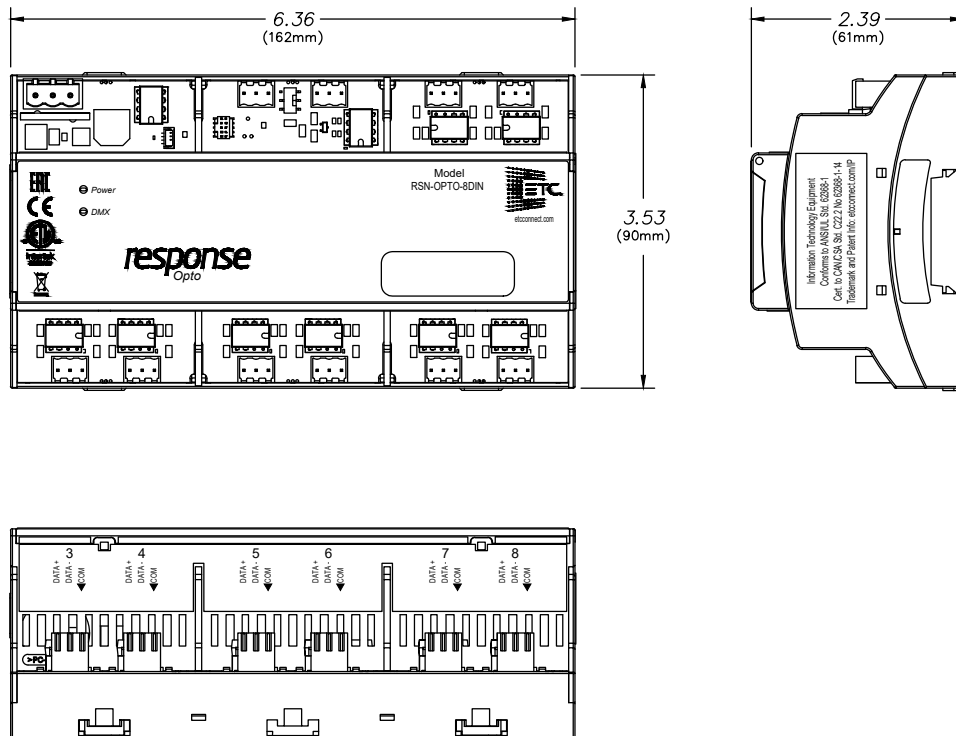
Response Opto-Splitter Dimensions

MODEL	HEIGHT		WIDTH		DEPTH	
	in	mm	in	mm	in	mm
DIN rail	3.53	90	6.36	162	2.39	61

Response Opto-Splitter Weights

MODEL	WEIGHT		SHIPPING WEIGHT	
	lb	kg	lb	kg
DIN rail	0.56	0.25	2.00	0.91

Response Opto-Splitter - DIN rail



PHYSICAL

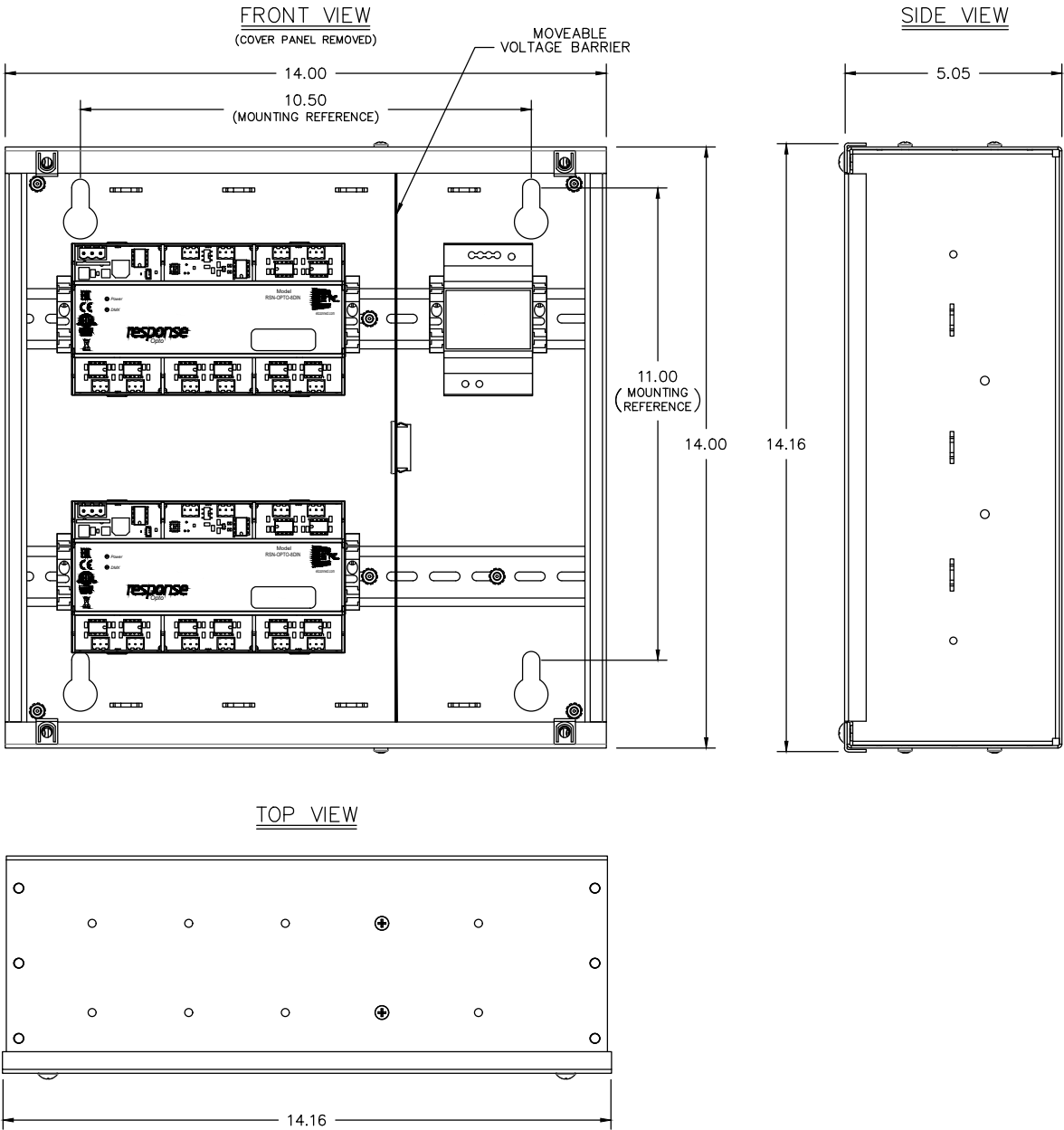
Response Opto-Splitter Dimensions

MODEL	HEIGHT		WIDTH		DEPTH	
	in	mm	in	mm	in	mm
DIN Dual Box	14	356	14	356	5.05	128

Response Opto-Splitter Weights

MODEL	WEIGHT		SHIPPING WEIGHT	
	lb	kg	lb	kg
DIN Dual Box	14.5	6.6	16.5	7.5

Response Opto-Splitter - DIN rail dual box



PHYSICAL

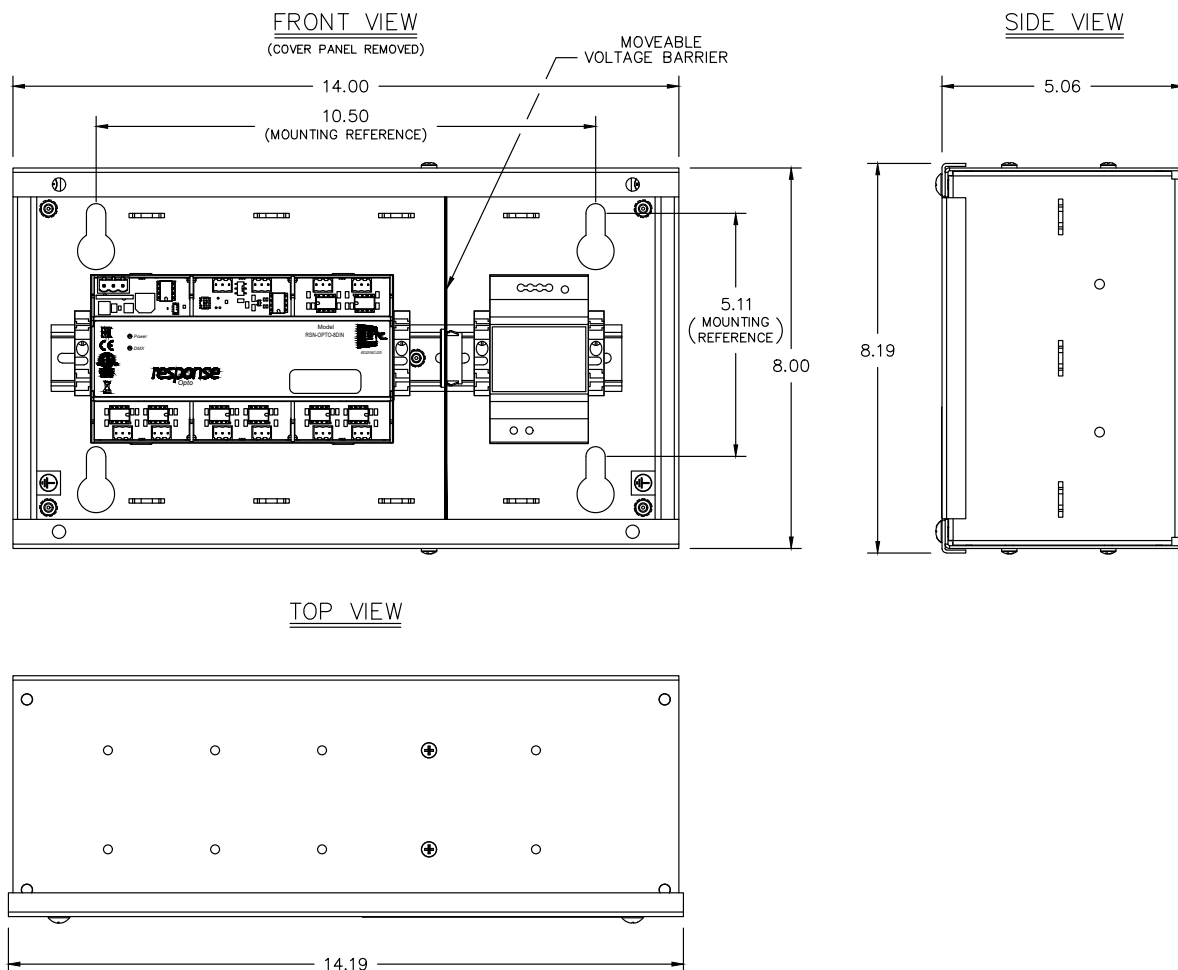
Response Opto-Splitter Dimensions

MODEL	HEIGHT		WIDTH		DEPTH	
	in	mm	in	mm	in	mm
DIN Box	8	203	14	356	5.05	128

Response Opto-Splitter Weights

MODEL	WEIGHT		SHIPPING WEIGHT	
	lb	kg	lb	kg
DIN Box	14.5	6.6	16.5	7.5

Response Opto-Splitter - DIN rail single box



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*Trademark and patent info: etconnect.com/ip

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SECTION 116620
ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for additional requirements that affect this Section whether or not specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. Furnish and install backboards, cables and other athletic equipment as indicated on Drawings, as specified herein, or both. Include delivery to the building, unpacking, setting in place and attachment, as required for complete installation.
- B. Verify all dimensions relative to equipment to be installed by taking actual field measurements at the job site prior to equipment fabrication.
- C. The Work of this Section includes, but is not limited to, the following:
 - 1. Motorized and folding basketball backstops.
 - 2. Wall padding.
 - 3. Volleyball net and standards.
 - 4. Motorized Gymnasium divider curtain.
 - 5. Scoreboard and shot clocks.
 - 6. Motorized retractable practice cages.
 - 7. Motorized wrestling mat storage system.
 - 8. Steel required to support backstops, athletic equipment and divider curtain from structure
- D. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council
 - 1. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
 - 2. Refer to Section 018111, SUSTAINABLE DESIGN REFERENCE DOCUMENTS.
- E. Products furnished, but not installed, under this Section include the following:
 - 1. Volleyball floor inserts, for installation under Division 09, athletic flooring sections.

2. Wall-mounted controls, installed under Section 260000 – ELECTRICAL.

- F. Related work includes but is not limited to the following work covered in other sections:
1. Power for electric basketball backstop winches, divider curtain, scoreboard and shot clocks, practice cages, wrestling mat system and installation of associated keyswitches and twist-lock receptacles: Section 260000 – Electrical.

1.3 SUBMITTALS

- A. Prepare and submit submittals in accordance with requirements of Section 013300 - Submittals and in the manner described therein.
- B. LEED Submittal: For each product specified, complete the PRODUCT DATA REPORTING FORM for LEED v4 PRODUCTS – See Section 018110 – SUSTAINABLE DESIGN REQUIREMENTS. All columns of information must be completed, and back-up documentation provided for all attributes being claimed as pertaining to the following credits:
1. MR Credit: Building Product Disclosure and Optimization (BPDO) – Environmental Product Declarations (EPD); See Section 018110 - 2.3B.
 2. MR Credit: Building Product Disclosure and Optimization (BPDO) – Sourcing of Raw Materials; See Section 018110 - 2.3C.
 3. MR Credit: Building Product Disclosure and Optimization (BPDO) – Material Ingredients; See Section 018110 - 2.3D.
- C. Shop Drawings:
1. Scale: No less than 1/4" scale and shall show layout of all equipment and all electrical connections required.
 2. 1/2" scale Shop Drawings shall be submitted for all fabricated and shop-made equipment showing details of construction and attachment to work of other trades.
 3. The exact location of all connections shall be dimensioned on Shop Drawings for all equipment and labeled with information necessary for coordination of work with other trades.
 4. Obtain and verify all dimensions, measurements and conditions, and assume responsibility for correctness of same.
- D. Samples:
1. Gymnasium divider curtain Fabric: Not less than 4 inches square of open mesh, and of opaque fabric.
- E. Manufacturer's Data: Submit manufacturer's product data with performance, operating and electrical characteristics for all equipment together with catalogue cuts.
- F. No fabrication, shipment, or installation shall take place until Shop Drawings and manufacturer's cuts have been approved.

1.4 OPERATION INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Instruct to the owner's satisfaction such persons as the Owner designates, in the proper operation and maintenance of the equipment and their parts.

- B. Furnish in accordance with Division 1, operating and maintenance manuals and forward same to the Architect for transmittal to the Owner.
- C. For maintenance purposes, provide Shop Drawings, parts lists, specifications and manufacturer's maintenance bulletins for each piece of equipment.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of athletic equipment from a single manufacturer with resources to provide materials of consistent quality in appearance and physical properties without delaying the work.

1.6 GUARANTEES

- A. Attention is directed to provisions of the GENERAL CONDITIONS regarding guarantees and warranties for work under this Contract.
- B. Manufacturers shall provide their standard guarantees for work under this Section. However, such guarantees shall be in addition to and not in lieu of all other liabilities that manufacturers and Contractor may have by law or by other provisions of the Contract Documents.
- C. Upon receipt of notice from the Owner of failure of any part of the equipment during the guarantee period, the affected part or parts shall be replaced.
- D. Furnish, before final payment is made, a written guarantee covering the above requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
 - 1. Basketball backstops, mat storage, wall padding, volleyball equipment:
 - a. Draper, Inc.
 - b. Performance Sports Systems.
 - c. Porter Athletic Equipment Company.
 - d. Approved equal.
 - 2. Gymnasium Divider Curtains:
 - a. Draper Inc.
 - b. Performance Sports Systems.
 - c. Porter Athletic Equipment Company.
 - d. Approved equal.
 - 3. Basketball scoreboards and shot clocks:
 - a. Daktronics, Inc.

- b. Sportable Scoreboards
 - c. NEVCO, Inc.
 - d. Approved equal
- B. Retractable practice cages:
- 1. Jaypro
 - 2. Approved equal

2.2 MOTORIZED FORWARD-FOLDING BACKSTOPS

- A. General: Ceiling suspended, forward-fold, front-braced, motorized basketball backstop with adjustable goal height and rectangular glass backboard. Refer to Drawings for locations.
- 1. System: Steel pipe component assembly, regulation bank, official goal with a no-tie net, and a motorized safety hoist.
 - 2. Support: Each backstop shall be suspended from 3-1/2" o.d. or heavier steel pipe to provide the required support and span available structural steel. Overhead members spanning more than 16 feet shall be bridged or reinforced according to manufacturer's engineering instructions.
 - 3. Backstops shall be operable on the swing-up principle, storing in minimal area when not in use.
- B. Product: Porter Athletic Equipment Company, *Model 90949-000*, or equal by approved manufacturer.
- C. Materials:
- 1. Fittings: Certified malleable iron castings or heavy gauge steel stampings.
 - 2. Pipe: Certified wrought iron or heavy gauge steel meeting ASTM A513.
 - 3. Factory Finish: Provide manufacturer's high performance finish system in colors as selected by Architect from manufacturer's full range.
- D. Hoisting Equipment:
- 1. Cable: 1/4" diameter 7 x 19 aircraft cable with a breaking strength of 7,000 lbs.
 - 2. Pulleys: Swivel and fixed pulleys shall be machined and polished steel 3" diameter x 1" wide complete with 1/2" diameter self-lubricating bronze oilite bushings. Pulley holders shall be fully enclosed providing a fail-safe system that will capture and retain the hoist cable.
 - 3. Safety Strap: Nylon webbing safety strap to prevent accidental drop of backboard from "up" position.
 - a. Strap shall be rated to withstand 1,000 lb. free fall load.
 - b. Product: Porter Athletic Equipment Company, *Model No. 797 Saf-Strap* or equal by backstop manufacturer.
- E. Frame:
- 1. Main Vertical Mast: 6 5/8" o.d. steel pipe. Mast shall be offset 4" for positive locking.
 - 2. Bracing: Anti-sway braces shall be rectangular 2 1/2" x 1 1/2" steel bracing welded to mast to form a unitized frame. Backstop shall have a rigid hinged front brace of 1-7/8" o.d. pipe designed to jack knife when closing.
 - 3. The entire assembly shall be self-aligning in the down position and self-releasing at the beginning of the folding cycle.
- F. Backboards:

1. Dimensions: Official 3'-6" x 6'-0" rectangular.
 2. Material:
 - a. Backboard: Fully tempered glass, 1/2" thick with extruded aluminum frame.
 - b. Markings: Backboard border and center target shall be fired into glass with brilliant white vitreous enamel.
 3. Frame: Welded, unitized construction fabricated from heavy wall rectangular steel tubing.
 4. Product: Porter Athletic Equipment Company, *Model 00208-000 Center-Strut Mount Rectangular Glass Backboard*, or equal by manufacturer of backstop.
- G. Padding:
1. Type: Bolt-on, molded profile with steel attachment channels; self-aligning with interlocking joints; provide square molded corners and lengths to cover entire bottom edge and lower portions of side edges.
 2. Material: 1-1/2" thick x 2" wide shock absorbing vinyl or neoprene foam pad with durable integral skin, in color as selected by Architect from manufacturer's standard range.
 3. Product: Porter Athletic Equipment Company, *Model 00326-00 Pro-Pad Backboard Padding Kit*, or equal by manufacturer of backstop.
- H. Goal: Positive lock, movable rim goal with pressure release mechanism.
1. Rim: 5/8" diameter cold drawn alloy steel, round formed to 18" diameter ring, with integral net attachment system; epoxy paint finish.
 2. Pressure Release Mechanism: Adjustable, positive lock, pressure release mechanisms to provide rebound characteristics identical to those of a non-movable ring.
 3. Mounting: Rigid steel bracing, welded in position.
 4. Net: Anti-whip net.
 5. Product: Porter Athletic Equipment Company, *Model 00245-500 Ultra-Flex Goal*, or equal by manufacturer of backstop
- I. Adjustment: Unit shall be provided with a 6" adjustment up or down for obtaining proper goal height. Goal shall be adjustable in height from 8'-0" to 10'-0" above the finished floor.
1. Product: Porter Athletic Equipment Company, *Model 00900-506 Center-Strut Height Adjustment System*, or equal by manufacturer of backstop.
- J. Motorized Winch: Worm gear type, 1/2 horsepower electric winch designed to hold backstop at any position when raising or lowering.
1. Materials:
 - a. Winch housing, base, cable drum and bracket: Machined from high strength aluminum alloy.
 - b. Worm: High strain tempered steel bar.
 - c. Worm gear: Machined from high strength forged bronze alloy.
 2. Hoisting Capacity: 1200 pounds.
 3. Electrical Characteristics: 1/2 horsepower, 60 cycle, 115 volt, single phase electric motor with automatic thermal overload protection, manufactured to MEMA specifications.
 4. Power Connections: 6'-0" long SJO cord with twist-lock type plug and 4-pole twist-lock receptacle.
 5. Product: Porter Athletic Equipment Company, *Model No. 00706-000 1/2 H.P. Electric Winch*, or equal by manufacturer of backstop.
- K. Control Switch for Motorized Winch: Flush, wall-mounted key switch with separate up and down keys. Product: Porter Athletic Equipment Company, No. 791 Key Switch Control System for Electric Winches.

- L. Accessories: Provide all fastenings and other accessories as required for a fully functioning backstop installation.

2.3 WALL PADDING

- A. General: Fire-retardant wall padding with concealed attachment to walls.
 - 1. Overall dimensions of each pad: 2'-0" (610 mm) wide by 6'-0" (1.9 m) high.
- B. Core: 1-1/2" thick fire-retardant, open cell neoprene foam filler bonded to 7/16" oriented strand wood board.
 - 1. Density: 5.5 lb/cubic foot.
 - 2. Indentation Force Deflection: 25-45 lb.
- C. Cover: 14-ounce non-tear vinyl laminated industrial polyester.
 - 1. Vinyl facing material shall be mildew and rot resistant.
 - 2. Covering shall be flame retardant with a rating according to ASTM E-84 as follows:
 - a. Class: A.
 - b. Flame spread: 0-25.
 - c. Smoke development: 0-450.
 - 3. Color: As selected by the Architect from manufacturer's standard colors. Provide 3 colors and custom graphics. Graphics to match Owner's artwork.
- D. Fabrication:
 - 1. The fabric shall be placed over the filler, folded and blind stitched.
 - 2. Provide concealed fastening system using "Z" Clips or as recommended by manufacturer.
 - 3. Pads shall be reversible.
- E. Accessories:
 - 1. Provide suitable wall attachment clips, hooks or other such devices as approved by the Architect.
 - 2. Molded Inserts: Fire-retardant, molded inserts designed to accommodate pad thickness specified, in size to fit electrical receptacles and switch plates indicated on Drawings.
 - a. Product: Porter Athletic Equipment Company, *Model No. 00342-124 Double-Gang/Graphite*, or equal by manufacturer of padding.
- F. Product: Porter Athletic Equipment Company, 00575-1XX 2 Fire Safe Wall Pad, or equal by approved manufacturer.

2.4 VOLLEYBALL EQUIPMENT

- A. Volleyball Standards: Two pair of rigid-braced, telescoping, portable standards with adjustable height net attachment.
 - 1. Poles: Aluminum pole uprights, for installation in floor sleeves, constructed as follows:
 - a. Material: Extruded high-strength, lightweight aluminum, 6063T alloy.
 - b. Finish: Clear anodized.
 - c. Bottom upright: 3-1/2-inch (89 mm) diameter, with foot designed to protect finished floor when moving standards.
 - d. Upper telescoping upright: Infinitely adjustable upright with integral pulley.
 - 2. Height Markings: Labels designating "Boys'/Men's", "Girls'/Women's" and "12 Years and Un-

- der" height settings.
- 3. Pads: One pair of protective pads to fit specified uprights.
 - a. Product: Porter Athletic Equipment Company, *Model 00839-003* or equal by manufacturer of volleyball standards.
- 4. Winch: Tensioning winch incorporating a heavy-duty, self-locking ratchet mechanism with a compression, disc-brake type release mechanism.
 - a. Product: Porter Athletic Equipment Company, *Model 00026-000 Powr-Winch* or equal by manufacturer of volleyball standards.
- B. Net: Regulation 32'-0" x 39" net.
 - 1. Include all rigging and attachment devices.
 - 2. Product: Porter Athletic Equipment Company, *Model 02295-640 Powr-Line Volleyball Net* or equal by manufacturer of volleyball standards.
- C. Floor Inserts: Furnish floor sleeves with cover plate assemblies designed by manufacturer of volleyball standards for installation in raised athletic wood flooring system. Refer to Drawings for locations and quantities.
 - 1. Cover Assembly: Brass cover plate flush with surface of flooring, secured to floor sleeve collar by swivel hinge and lock.
 - 2. Sleeve: 9-inch (229 mm) long brass sleeve with diameter to fit 3-1/2" diameter pole.
 - 3. Adapters for elevated slab conditions: Provide Draper - Model #501007, or approved equal; fully welded 6" OD steel tube with anchoring accessories.
- D. Product: Porter Athletic Equipment Company, *Model No. 01991-000 Powr-Line International Competition Volleyball Standards (Pair)*, or equal by approved manufacturer.

2.5 GYMNASIUM DIVIDER CURTAINS

- A. Gymnasium Divider Curtains: Electrically operated, roll up, and as follows:
- B. Upper Curtain, Mesh: Woven fabric of 100 percent polyester yarn coated with PVC weighing not less than 6.5 oz./sq. yd (220 g/sq. m).
 - 1. Mesh Color: As selected by Architect from manufacturer's full range.
- C. Lower Curtain, Solid: Woven polyester coated with PVC, 18 oz./sq. yd (610 g/sq. m), embossed, 8-foot (2.4-m) height above floor.
 - 1. Fabric Color(s): As selected by Architect from manufacturer's full range for one color.
- D. Gymnasium Divider Curtain Flame-Resistance Ratings: Passes NFPA 701, inherently and permanently flame resistant.
 - 1. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or treated with flame-retardant chemicals, and whether it will require retreatment after designated time period or cleaning.
- E. Curtain Fabrication: Fused seams and the following:
 - 1. Top Hem: Reinforce with double thickness mesh for continuous pipe batten.
 - 2. Bottom Hems for Roll-up Curtains: Floor-length curtains with hems 2 inches (50 mm) above finished floor and with manufacturer's standard 3-1/2- to 4-inch- (89- to 102-mm) roll-up tube

and lifting tape.

F. Accessories:

1. Curtain Battens: Fabricate battens from steel pipe with a minimum number of joints. As necessary for required lengths, connect pipe with drive-fit pipe sleeve not less than 18 inches (450 mm) long, and secure with 4 flush rivets, plug welds, threaded couplings, or another equally secure method. Shop-paint completed pipe battens with black paint.
 - a. Steel Pipe: ASTM A 53/ A 53M, Grade A, standard weight (Schedule 40), black, 1-1/2-inch (40-mm) nominal diameter, unless otherwise indicated.

G. Gymnasium Divider Curtain Operator: Roll-up drive tube.

H. Gymnasium Divider Curtain Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.

1. Operator Type: Electric motor, enclosed gear-head-reduction drive, with chain and sprocket secondary drive.
2. Motor Characteristics: Sufficient to start, accelerate, reverse, and operate connected loads at designated speeds within installed environment and with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1, and the following:
3. Voltage: 120 V.
4. Horsepower: 3/4 hp.
5. Enclosure: Manufacturer's standard.
6. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
7. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
8. Phase: One.
9. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting, momentary-contact, three-position switch-operated control.
 - a. Keys: Provide two key(s) per station.
 - b. Product: Porter Athletic Equipment Company, *Model No. 791 Key Switch Control*, or equal by approved manufacturer.

I. Product: Porter Athletic Equipment Company, *Model No. 90675-00 Roll-Up Gymnasium Divider Curtain*, or equal by approved manufacturer.

2.6 SCOREBOARD AND SHOT CLOCKS

A. General: Scoreboard and shot clocks shall meet requirements for FCC Class A.

1. [Provide two scoreboards and six shot clocks in Gymnasium.]

B. Basketball Scoreboard: Standard electronic scoreboard with LED displays controlled by wireless remote control system.

1. General:
 - a. Scoreboard face and perimeter material: 0.063" (1.60 mm) thick aluminum.

- b. Scoreboard back material: 0.050" (1.27 mm) thick aluminum.
 - c. Overall Dimensions: 4'-0" (1.2 m) tall by 8'-0" (2.4 m) long by 8 inches (203 mm) deep.
 - d. Finish: Powder-coat; color as selected by Architect from manufacturers full range.
 - 2. Display:
 - a. Digits: 100,000 hour-rated, LED digits, minimum 13 inches high,
 - b. Dots and Arrows: 100,000 hour-rated, LED circular or triangular shapes, 3 inches (76 mm) high.
 - c. Captions: Vinyl lettering to identify each type of information.
 - 3. Information displayed: Scoreboard shall display the following information:
 - a. Three-digit HOME score; red LED
 - b. Three-digit GUEST score; red LED
 - c. One-digit PERIOD; orange LED
 - d. Home and Guest BONUS circular dots; red LED
 - e. Home and Guest POSSESSION arrows; red LED
 - f. Four-digit count-down CLOCK; orange LED
 - 4. Product: Daktronics Model BB-2101-15, or equal by approved manufacturer.
- C. Shot Clocks
 - 1. General:
 - a. Shot clock face and perimeter material: 0.063" (1.60 mm) thick aluminum.
 - b. Shot clock back material: 0.050" (1.27 mm) thick aluminum.
 - c. Overall Dimensions: 2'-0" (610 mm) tall by 2'-0" (610 mm) long by 8 inches (203 mm) deep.
 - d. Finish: Powder-coat; color as selected by Architect from manufacturers full range.
 - e. Quantity: Two shot clocks for each scoreboard.
 - 2. Display: 100,000 hour-rated, LED digits, 13 inches (330 mm) high,
 - 3. Information displayed: Scoreboard shall display the following information: Two-digit count-down CLOCK; orange LED
 - 4. Product: Daktronics BB-2114-15 or equal by approved manufacturer.
- D. Remote Control for Scoreboard and Shot Clocks: Manufacturer's standard wireless system comprising the following:
 - 1. Controller: Universal LCD keyboard controller, with nine keypad inserts for basketball, volleyball and wrestling.
 - 2. Transformer: 12-volt DC wall transformer
 - 3. Transmitter: FCC Part 15-certificed, 2.4 GHz transmitter connected to keyboard
 - 4. Receiver: 2.4 GHz receiver, in conformance with the requirements of FCC Part 15, connected to scoreboard.
- E. Power Requirements:
 - 1. Scoreboard: Hard-wired into 20-amp, 120-volt, 60-Hz grounded AC circuit.
 - 2. Shot Clock: Hard-wired into 20-amp, 120-volt, 60-Hz grounded AC circuit
 - 3. Keyboard: Plug-in to receptacle on 20-amp, 120-volt, 60-Hz grounded AC circuit.

2.7 WRESTLING MAT STORAGE SYSTEM

- A. Wrestling Mat Storage System: Provide an overhead-supported storage system for wrestling mats equal to Draper, *Model No. 502060*.
1. Location: As indicated on Drawings.
 2. Standard Hoist, Load Bar, and Sling: Capable of lifting and supporting standard wrestling mat weighing 1 pound per square foot.
 3. Attachment: Provide storage system framing and attachment to overhead structural support members.
- B. Wrestling Mat Storage System Hoisting Unit:
1. Each Hoisting Unit: 1.5-hp, C-faced, electric motors, with integral 6 ft./lb. brake mechanisms and automatic overload protection, attached to 200:1 ratio gearbox assembly. Operating with 208 volts, 3.6 amps, 230 volts, 3.4 amps, or 460 volts, 1.7 amps; in 3 phase. Coordinate with electrical contractor.
 2. Under No-Load Conditions: Motor 1,725 rpm. Drum 8.625 rpm.
 3. Approximate Hoist Speed: 8.5 feet per minute, in both up and down travel cycles.
 4. Key Switch: Motors shall be controlled by dual-keyed, flush, wall-mounted, momentary key switch, which cannot be instantly reversed, providing safety provision to prevent damage to motor.
 5. Key Switch Assembly: Switch assembly shall be furnished with 4-1/2-inch square stainless steel cover plate for mounting into masonry wall box as specified in Division 26 electrical section.
 6. Locate Key Switch: To allow operator full view of Mat-Mover during raising and lowering.
- C. Wrestling Mat Storage System Control Panel: Hoist mechanisms shall be monitored by factory-wired, preset control panel, and shall provide following safety/monitoring systems:
1. Enclosure: 20-inch by 20-inch by 8-inch steel enclosure, complete with lock and keys, house master control system including:
 - a. Main Disconnect Switch: 208 volts, 230 volts, or 460 volts, 3-phase, 60 Hz; coordinate with electrical contractor.
 - b. Control Circuit Transformer: Primary and secondary protection.
 - c. Two full-voltage reversing contacts, with motor circuit protection.
 - d. Motion Logic Controller: Monitor take-up and pay-out of cable at each hoist, ensuring units remain synchronized throughout up/down cycle.
 - e. Watchdog Timers: Ensure motion of each hoist is transmitted to control system minimum of 8 times per 12 inches of travel, providing consistent, level operation.
 - f. Audible Motion Alarm: Activates when unit is in raising or lowering cycle, to increase athlete's awareness of mats being moved into and out of storage.
 2. Mount Control Panel: Within close proximity of Mat-Mover for ease in field wiring and effectiveness of motion alarm system.
- D. Hoisting:
1. Hoisting of Mats: Accomplished with two 5/16-inch, 6-strand, 37 wires per strand, fiber-core, 4.26-ton breaking strength, steel cables. Each cable secured to 4-inch diameter drum, and terminating at heavy-wall, 2-inch by 6-inch by 40'-0" long steel load bar.
 2. Sling: Mats shall be carried by 19 ounce per square yard vinyl fabric sling with antibacterial,

fungi-resistant, and flame-retardant chemicals.

- a. Conformance: ASTM E 84, Class A Rating (25 flame spread, 450 smoke development); NFPA 701 large scale; ULC S-109 large and small scale; and California test requirements.
- b. Attach Sling to Load Bar: 2-inch wide nylon strap, encompassing full sling perimeter, terminating at load bar with load-rated ring with 5,000-pound breaking strength.
- c. Sling Capacity: Govern lift capacity of system.
- d. Sling Color: As selected by Architect from manufacturer's full range.

2.8 RETRACTABLE PRACTICE CAGES

- A. Basis of Design: Provide Jaypro model BBC-700M Multi Sport Cage or approved equal.
- B. Components: Provide cages, winches, switches, attachments, netting, wire ropes, tubing, and all accessories as required for a complete motorized retractable practice cage system. Refer to drawings for locations and configuration.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine space in which specified work is to be installed to assure the conditions are satisfactory for the installation of backstop work. Report in writing to the Contractor, any unsatisfactory conditions affecting work of this Section. Commencement of work shall be construed as acceptance of conditions.
- B. Obtain and verify all measurements and conditions on the job, and assume all responsibility for correctness of conditions prior to commencement of installation.
- C. Become familiar with all building conditions to coordinate installation of backstops with ductwork, lighting and structural steel. Refer to related drawings for other trades.

3.2 INSTALLATION OF BACKSTOPS , MAT HOISTS, AND PRACTICE CAGES

- A. Modify superstructure as required and provide new fittings. Frames shall remain securely and permanently attached to building construction. Attach new equipment in strict accordance with manufacturer's instructions.
- B. Coordinate installation with the work of Section 260000 – Electrical, for power supply and completion of the keyswitch controls for equipment.

3.3 INSTALLATION OF WALL PADDING

- A. Install wall padding on walls where shown on Drawings, in accordance with manufacturer's instructions.

- B. Field cut all cutouts in pads as required to preserve access to wall-mounted electrical devices and other wall-mounted items.
- C. Notch the back of panels as required to cover pilasters and corners.

3.4 INSTALLATION OF VOLLEYBALL EQUIPMENT

- A. Furnish floor inserts for volleyball standards to the Contractor for installation under Division 09 FINISHES, Athletic Flooring specification sections.
- B. Install standards in strict accordance with manufacturer's instructions.
- C. Distance between volleyball standards shall be approximately 35'-0".

3.5 INSTALLATION OF GYMNASIUM DIVIDER CURTAIN

- A. Install curtain in strict accordance with manufacturer's instructions.
- B. Mount curtain from overhead structure, using supports and framing as recommended by manufacturer.
- C. Coordinate installation with the work of Section 260000 – Electrical, for power supply and completion of the keyswitch controls for raising and lowering curtain

3.6 INSTALLATION OF SCOREBOARD AND SHOT CLOCKS

- A. Install scoreboard and shot clocks in strict accordance with manufacturer's instructions.
- B. Mount enclosures to substrate as indicated, using type and quantity of fasteners recommended by manufacturer for substrate.
- C. Coordinate installation with the work of Section 260000 – Electrical, for power supply and wiring for the remote control system.

3.7 TESTING AND DEMONSTRATION

- A. General: Test all electrically operated athletic equipment to verify its proper operation. Demonstrate operation to Owner in accordance with Division 1 - Closeout Procedures.

3.8 CLEANING UP

- A. All debris and surplus materials resulting from installation of work in this Section shall be removed promptly as work progresses to a location indicated by the Contractor.
- B. Following completion, and before Substantial Completion, lubricate and clean finished surfaces in accordance with the manufacturer's instructions, and leave work free of imperfections.

3.9 PROTECTION OF WORK

- A. Protect work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.
- B. Protect adjacent work during installation. Damaged work shall be repaired or replaced as determined by the Architect.

END OF SECTION

SECTION 11 68 00
PLAYGROUND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. This section is only a portion of the Contract Documents. All of the Contract Documents, including Conditions of the Contract and Division 1 General Requirements, apply to this section.

1.02 DESCRIPTION OF WORK

- A. The work of this section includes, but is not limited, to the following:
1. Composite Sensory Panels
 2. Vibra Chimes
 3. Signage: Age-appropriate signage, play equipment rules sign, and all stickers and/or signage per CPSC/CPSI guidelines
- B. The following items shown on the Drawings and/or noted herein shall be furnished and installed under their Sections of the specifications:
1. Concrete for concrete footings under 03 30 00 Cast in Place Concrete
 2. Playground fencing under 32 31 00 Fencing
 3. Rubber tile playground surfacing system under 32 18 16.13 Playground Protective Surfacing
- C. Sustainable Building Requirements:
1. The Contractor is to implement practices and procedures to meet the project's sustainable performance goals, which include achieving LEED v4 **Silver** certification based on USGBC's "LEED Version 4 for Building Design and Construction: Schools" (LEED v4 BD+C: Schools).
 2. The work of this Section includes responding to Architect or Contractor requests for additional information or product data and may be required following initial Green Building Certification Institute (GBCI) review of LEED Application.
 3. Product substitution requests are subject to additional LEED submittal requirements including, but not limited to, Environmental Product Declarations (EPD), Health Product Declarations (HPD), and General Emissions Testing.

1.03 RELATED WORK

- A. Carefully examine all the Contract Documents for requirements that affect the work of this Section. Other specification sections that directly relate to the work of this Section include, but are not limited to the following:
1. Section 31 00 00 – Earthwork

2. Section 31 10 00 – Site Clearing and Preparation
3. Section 32 12 16 – Asphalt Paving
4. Section 32 13 13 – Exterior Concrete
5. Section 32 16 00 – Curbing
6. Section 32 18 16.13 – Playground Protective Surfacing
7. Section 32 30 00 – Site Improvements
8. Section 32 31 00 – Fencing

1.04 SUBMITTALS

- A. Provide detailed shop drawings for all play equipment and individual components for review and approval by the Landscape Architect prior to ordering materials. This submittal must include the following items to be considered complete:
 1. Large-scale drawing showing all play components including color choices, their attachment to each other and the associated use zones.
 2. Manufacturer's specifications for all play components.
 3. Manufacturer's recommended installation, including surface mounting for rooftop application.
 4. Evidence of compliance with IPEMA certification (ASTM F 1487-95) "Standard Consumer Safety Performance Specification for Playground Equipment for Public Use."
 5. Supply documentation stating the system installer is a manufacturer's certified installer.
- B. Provide manufacturer's product material information and system performance data along with material and system samples for each item specified in this Section for the Architect's review and approval prior to ordering materials.
- C. The Contractor shall verify by field inspection that all items within this section conform to the specified requirements and approved submittals prior to installation.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products and provide adequate protection against damage. Handle in strict compliance with manufacturer instructions and recommendations and store off the ground. Protect from all possible damage including, but not limited to chipping, staining, cracking, and other damage.
- B. Deliver materials in manufacturer's original unopened and undamaged packages with labels legible and intact.
- C. Store materials in unopened packages in a manner to prevent damage from the environment and construction operations.
- D. Handle in accordance with manufacturer's instructions.

1.06 COORDINATION

- A. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work as necessary to assure the steady progress of the work of this Contract.
- B. Substrates: Proceed with work only when substrate construction and penetrating work is complete.

1.07 GUARANTEE

- A. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTARY GENERAL CONDITIONS, the Contractor shall provide the manufacturers' standard written warranty for each product within this specification. All of these guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law or other provisions of the Contract Documents.

1.08 DEFINITIONS

- A. The following items are included herein and shall mean:
 - 1. S.S.H.B. - Standard Specifications for Highway and Bridges, the Commonwealth of Massachusetts, Department of Public Works, latest edition.
 - 2. A.S.T.M. - American Society for Testing and Materials. The following standard specifications are applicable to the associated items as listed.
 - 1) F1487 ...Playground Equipment for Public Use
 - 2) A36...Steel
 - 3) A153...Zinc Coating (hot-dip) on hardware
 - 4) A307...Carbon Steel bolts 66000 psi tensile
 - 3. CPSC - Consumer Product Safety Commission.
 - 4. ADA - Americans with Disabilities Act and its current regulations.
 - 5. MAAB: Massachusetts Architectural Access Board
 - 6. AWS: American Welding Society
 - 7. SSPS: Steel Structures Painting Council
- B. Quality Assurance
 - 1. After installation of equipment, safety surfacing and immediate surrounding improvements, the playground installation contractor shall provide written certification by a Certified Playground Safety Inspector (CPSI) that the installed equipment conforms to all applicable safety and accessibility standards including, but not limited to ASTM, CPSC, ADA, and MAAB. The Owner reserves the right to retain an independent CPSI to inspect the playground equipment and surfacing after reinstallation. The Contractor will be responsible for correcting any deficiencies at their own expense to the satisfaction of the Landscape Architect.
 - 2. Equipment Installer Qualifications: An experienced and certified installer who has completed work with similar equipment, materials, and design, and to the extent similar with this project and whose work has resulted in construction with a record of successful performance in a minimum of 10 installations over 5 years. Contractor to

provide their subcontractor's appropriate qualifications including references and experience. Installer shall follow manufacturer's instructions and installation documentation for all equipment.

PART 2 - PRODUCTS

2.01 PLAY EQUIPMENT

- A. The new playground equipment and play elements have been selected to meet the needs and fit within the site layout, grading and function. In order for another product to be considered equal, it must meet or exceed the basis of design in every aspect including, but not limited to play value, type & quantity of play components, design character, material type & quality, colors & finishes, durability and warranty
- B. All play equipment specified (except communication sign board) is by Landscape Structures, Inc., (www.playlsi.com) For accurate cost estimation, please contact rep John McConkey (john.mcconkey@obrienandsons.com) Contact: 508-359-4200
 1. Composite Sensory Panels shall be "Sensory Play Center Wall, "Sensory Play Center End," "bongo with xylofun panel combo," "imagination table," "kaleidospin panel;" color shall be selected by Landscape Architect during submittals.



2. Rhapsody Vibra Chimes shall be "Chime 1," "Chime 3" and "Chime 5;" and color shall be selected by Landscape Architect during submittals.



3. Signage: 2-5 age-appropriate sign and all stickers as recommended by CPSC/ASTM guidelines.

PART 3 - EXECUTION

3.01 PLAY EQUIPMENT

- A. The Contractor shall coordinate with the playground manufacturer's representative to ensure the timely completion of tasks necessary to install the equipment.
- B. The Contractor shall prepare the subgrade, drainage system and coordinate with subsurface utilities. The Contractor shall coordinate the surface mounting for a rooftop mounting application. After the area is prepared and play equipment installed, the Contractor is responsible to complete the installation of the remainder of the site work (fencing, rubber tile playground surface system, etc.)
- C. Play equipment to be installed per manufacturer's directions. Provide safety use zones in accordance with ASTM, CPSC and ASTM standards and coordinates with layout as shown on drawings.
- D. Roof Top Installation - Surface Mounting Footings
 1. The Contractor shall do all necessary preparation required for the installation of all equipment, including preparation of the reinforced concrete slab to accept the steel plates and anchoring hardware per the manufacturer's requirements.
 2. Surface mounting shall meet the manufacturer's requirements and allow for the installation of rubber tile playground surface system to meet the depth requirement for the fall height and safety zone of the play equipment.
 3. The Contractor shall coordinate the profile with all disciplines to ensure positive drainage at the play equipment.
- E. Equipment shall be assembled to conform to the approved shop drawings. All fastenings shall be made as shown on the drawings and shall be securely tightened. Per manufacturer's specs all work shall be done so that no hazardous projections shall be left on the finished work.
- F. Cleanup: Upon completion of the work under this Section, all excess materials and debris resulting from work under this Section shall be cleaned up, removed from the Site, and properly disposed of.
- G. Manufacturer's Guarantees and Insurance
 1. Product Liability Insurance: The manufacturer of the playground equipment shall maintain, and have in effect at the time of the completed installation, an insurance policy covering completed operations (Product Liability) with a minimum limit of \$1,000,000.00 (One Million Dollars). A certificate of insurance shall be available to the project owner on request.
 2. Guarantees: The manufacturer shall furnish a written guarantee, covering the replacement of any damaged Structures or components, at no extra charge for the period of 15 (Fifteen) years. This guarantee does not cover Structures damaged by improper use or vandalism. Labor is not covered in this guarantee.

H. Warranties

1. 10-Year Limited Warranty for all stainless-steel fasteners, aluminum posts, clamps, beams and caps, against structural failure due to corrosion/natural deterioration or manufacturing defects. This warranty does not include any cosmetic issues or wear and tear from normal use.
2. 15-Year Limited Warranty for all plastic and steel components, against structural failure due to corrosion/natural deterioration or manufacturing defects. This warranty does not include any cosmetic issues or wear and tear from normal use.
3. The Contractor shall warrant that all structures and/or equipment installed will conform in kind and quality to the specifications set forth above and will be free of defect in workmanship and material.
4. The Contractor shall offer a 10-year limited warranty for all aluminum and all posts, clamps, beams, and caps against structural failure due to corrosion, deterioration, or workmanship (cosmetic issues excluded).
5. The Contractor shall offer a 10-year limited warranty for all plastic and steel components against structural failure due to corrosion, deterioration, or workmanship (cosmetic issues excluded).
6. The Contractor shall offer a 1-year limited warranty for all moving parts, swing seats and swing hangers bumpers and other equipment not included above against failure due to corrosion, deterioration, or workmanship.
7. An authorized representative of the play equipment manufacturer must inspect and approve the completed installation. The play equipment will not be accepted by the play equipment manufacturer or the Owner until they are satisfied with the installation. No additional compensation will be given for any necessary corrective work. Contractor shall submit written certification from Manufacturer's Representative that all play equipment has been installed in accordance with manufacturer's prescribed standards.

3.02 CLEANING, REPAIR AND PROTECTION

- A. Repair minor damage to eliminate all evidence of repair. Remove and replace work that cannot be satisfactorily repaired.
- B. Provide temporary protection to ensure that the work will be without dirt, stains, damage or deterioration at time of final acceptance. Clean up stains and spills as they occur. Remove protections and clean as necessary immediately before final acceptance.
- C. Upon completion of the work and before acceptance, the Contractor shall remove and dispose of in an approved manner all surplus materials, rubbish, etc. which the Contractor may have accumulated during the course of the work and shall leave the site in a clean and orderly condition. The Contractor shall not abandon any material at or near the site regardless of whether or not it has any value.

END OF SECTION

SECTION 11 68 33
ATHLETIC FIELD EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions, Division 0 and Division 1, General Requirements, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

- A. The work of this section includes, but is not limited, to the following:

1. Grading and Compaction of Sub-base
2. Concrete Footings for all Field Equipment
3. Football Goal Posts & Pads
4. Players Benches
5. Foul Poles
6. Softball/Baseball Fence Safety Cap
7. Batting Tunnel with Synthetic Turf Surface
8. Softball/Baseball Home Plate, Bases, and Pitcher's Rubber
9. Sports Netting system at multi-purpose fields.
10. Bleachers
11. Dugout Shelter
12. Discus Cage and Throwing Ring
13. Shot Put Throwing Circle
14. Shot Put Toe Board
15. Tennis/pickle ball nets, posts, and center tie downs.
16. Pole vault box
17. Long and Triple Jump Pits and Take-off Boards
18. Cleaning Repair and Protection

- B. The following items shown on the Drawings and/or noted herein shall be furnished and installed under their Sections of the specifications:

1. Concrete for concrete footings included herein
2. Materials for grading and compacting subbase under 312000 EARTH MOVING

C. Sustainable Building Requirements:

1. The Contractor is to implement practices and procedures to meet the project's sustainable performance goals, which include achieving LEED v4 Silver certification based on USGBC's "LEED Version 4 for Building Design and Construction: Schools" (LEED v4 BD+C: Schools).
2. The work of this Section includes responding to Architect or Contractor requests for additional information or product data and may be required following initial Green Building Certification Institute (GBCI) review of LEED Application.
3. Product substitution requests are subject to additional LEED submittal requirements including, but not limited to, Environmental Product Declarations (EPD), Health Product Declarations (HPD), and General Emissions Testing.

1.03 RELATED WORK

- A. Carefully examine all the Contract Documents for requirements that affect the work of this Section. Other specification sections that directly relate to the work of this Section include, but are not limited to the following:

- 1) Section 012300 – Alternates.
- 2) Section 133416 - Bleachers.
- 3) Section 312000 - Earth Moving.
- 4) Section 321313 – Concrete Pavement.
- 5) Section 321813 – Synthetic Turf.
- 6) Section 321823.13 – Baseball and Softball Field Surfacing
- 7) Section 321823.39 – Resilient Sport Surfacing.
- 8) Section 323000 - Site Improvements.
- 9) Section 323100 – Fencing.
- 10) Section 329200 - Turf and Grasses.

1.04 SUBMITTALS

- A. Refer to individual site improvements for additional submittal requirements.
- B. Provide manufacturer's product material information and system performance data along with material and system samples for each item specified in this Section for the Landscape Architect's review and approval prior to ordering materials.
- C. The General Contractor shall verify by field inspection that all items within this section conform to the specified requirements and approved submittals prior to installation.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products and provide adequate protection against damage. Handle in strict compliance with manufacturer instructions and recommendations and store off the ground. Protect from all possible damage including, but not limited to chipping, staining,

cracking and other damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.06 COORDINATION

- A. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work as necessary to assure the steady progress of the work of this Contract.
- B. Substrates: Proceed with work only when substrate construction and penetrating work is complete.

1.07 GUARANTEE

- A. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTARY GENERAL CONDITIONS, the Contractor shall provide the manufacturers' standard written warranty for each product within this specification. All of these guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law or other provisions of the Contract Documents.

1.08 REFERENCE STANDARDS

- A. National Federation of State High School Associations (NFSHSA)
- B. Massachusetts Interscholastic Athletic Association (MIAA)
- C. National Collegiate Athletic Association (NCAA)

PART 2 - PRODUCTS AND EXECUTION (Combined)

2.01 GRADING AND COMPACTION OF SUB-BASE

- A. Do all necessary grading in addition to that specified under Section 312000 EARTH MOVING to bring subgrade or foundation after final compaction to required grades and sections to obtain a foundation of uniform bearing surface. In absence of specific requirements, compact foundation by such means as shall provide firm base and insurance against settlement of superimposed work.
- B. Sub-base preparation, including material, shall be of properly approved quality as specified under Section 312000 EARTH MOVING. Start of work under this Section shall constitute acceptance of the foundation conditions to which this work is to be applied. Any defects in work resulting from such conditions shall be corrected under this Section - Play Field Equipment, at no additional cost to the Owner.

2.02 CONCRETE FOOTINGS FOR FIELD EQUIPMENT

- A. Construct concrete footings where shown on the Drawings.
- B. Concrete for footings shall be 4,000 psi concrete as specified in Section 321313 Concrete Pavement
- C. Place concrete on moist subgrade or against prepared footings in continuous operation between transverse joints or individual sections. Vibrate all concrete. Do not place concrete

in freezing temperatures or on frozen base.

2.03 FOOTBALL GOAL POSTS AND PADS

- A. Provide and install football goal posts in the locations shown on the Drawings and per manufacturer's recommendations. Submit manufacturer's product data and installation details for approval before ordering materials.
- B. The Contractor shall submit detailed shop drawings for footings for approval prior to installation. Drawings shall be prepared and sealed by a professional structural engineer (P.E.) experienced in design of similar structures and licensed in Massachusetts.
- C. Football goal posts shall be one of the following or Landscape Architect approved equal:
 - 1. Model No GP-820HSPL, "Football Goal Posts – 8' Offset and 20' Uprights" as manufactured by SportsField Specialties, P.O. Box 231, 41155 St. Hwy 10, Delhi, NY 13753, (888) 975-3343.
 - 2. Gilman Gear Pro Goal Aluminum Goal Post - 8' Offset by Gilman Gear, 30 Gilman Road, Gilman, CT, 06336, (800) 243-0398.
 - 3. UCS High School Goal Post with 8' Offset Model#751-6140 as manufactured by UCS Inc., 511 Hoffman Road, Lincolnton, NC, 28092, (800) 526-4856. or approved equal
- D. Football Goal Support Post and Crossbar shall consist of 6 to 6 5/8-inch O.D. Schedule 40 aluminum gooseneck and cross bar, 4" Schedule 40 aluminum uprights, and 8-foot offset. Uprights to be 20-feet high. Finish to be powder coated white.
- E. Goal post shall be base plate mounted installed with galvanized hardware and anchor bolts embedded in a concrete footing according to the shop drawings and manufacturer's recommendations. Access frame kit shall be furnished and installed at each post footing.
- F. Top of concrete footing shall be 8" below finish grade. Measurement from finish grade to top of crossbar shall be 10'-0".
- G. Access Frame Kit: 1/8" (0.125") Aluminum Construction with 1" PVC Drain Stub, Includes Two (2) Half Moon Filler Plugs, Optional Full Size Filler Plug and SG2S® Patented Soccer Goal Rear Bottom Ground Bar Retractable Safety Clamp System Available, Use GFAFIT for Synthetic Turf Installation Applications and GPAFNG for Natural Grass Installation Applications
- H. Football Goal Post Pads shall be manufactured by one of the following or Landscape Architect approved equal:
 - 1) Model No Model No GPAFIT, "Round Goal Post Pad, Fully Encapsulated", as manufactured by SportsField Specialties, P.O. Box 231, 41155 St. Hwy 10, Delhi, NY 13753, (888) 975-3343.
 - 2) Model No F302, "Football Goal Post Pads", as manufactured by Gill Athletics, 2808 Gemini Court, Champaign, IL 61822, (800) 637-3090.

- 3) Model No SEF302, "Goal Post Pads" (entire coverage), as manufactured by Sports Edge, P.O. Box 837, Troutman, NC, 28166, (800) 334-6057. or approved equal

- I. Pads shall be for 6 to 6 1/2-inch O.D. posts, constructed of min. 5-inch thick cylindrical high-density polyurethane foam filler with rear cutout. Heavy coated vinyl cover shall completely enclose foam filler. Vinyl cover shall have full-length Velcro closure flap. Pads to be 6' high. Color shall be selected by the Landscape Architect. Large vertically aligned Vinyl "TEXT-TEXT-TEXT" lettering shall be of a 2nd color.

2.04 ALUMINUM PLAYERS BENCHES WITH BACKREST – SEMI- PERMANENT

- A. Furnish and install new and fully assembled players benches.
- B. Players Benches shall be provided from one of the following suppliers:
 - a) AAE Sports, 1000 Enterprise Drive, Royerford, PA 19468, (610) 825-6565.
 - b) Gill Athletics, Champaign, IL 800 637-3090
 - c) Jay-Pro Sports: 976 Hartford Tpk, Waterford, CT 06385. 800-243-0533
- C. Benches shall be constructed of heavy-duty extruded aluminum with a powder coated finish. Color selection by Landscape Architect. Frame shall be 2-3/8" O.D galvanized steel. Bench shall have a 10" wide continuous aluminum seat, end caps and a backrest.
- D. Surface mount bench to concrete pavement utilizing galvanized or stainless-steel tamperproof anchor bolts.

2.05 FOUL POLES

- A. Furnish and install Foul Poles, as shown on the drawings.
- B. Foul Poles shall be one of the following or Landscape Architect approved equal:
 - a) Long Gone Foul Pole provided by Sportsfield Specialties 888-975-3343.
 - b) Standard Foul Poles provided by Beacon Athletics, 800-747-5985
 - c) Varsity Foul Poles provided by On Deck Sports, 800- 365-6171
- C. Foul Poles shall be 20' height, 4" O.D. minimum aluminum pipe with 8' aluminum mesh wing. Poles shall be ground sleeve insert mounted in a concrete footing.
- D. Softball Foul Poles shall be powder coated white, Baseball shall be powder coated yellow.
- E. Foul Poles shall be integrated in the chain link fencing as line post where shown on the drawings.

2.06 SOFTBALL AND BASEBALL FENCE GUARD (SAFETY CAP)

- A. Furnish and install chain link fence guard (safety cap) where indicated in the drawings
- B. Product: Premium Fence Guard available at Beacon Athletics, Middleton,WI 800-747-5985 or approved equal.
- C. Product shall be UV Treated Polyethylene with teardrop shaped profile predrilled to accept ties at 23" O.C. Color shall be yellow or black. 3"Wx4-1/2"Tx7'L each section

2.07 BATTING TUNNEL AT SOFTBALL AND BASEBALL

- A. Furnish all equipment and materials and all work necessary to install the batting tunnel posts, footings, nets and accessories in accordance with the details indicated on the drawings at baseball and softball fields.
- B. Shop Drawings: Provide drawings of the manufacturers recommended installation and foundation requirements prior to actual field installation work, for Architects or Owners representatives review.
- C. Batting Tunnel model shall be the following or approved equal:
 - 1. BTOSS and BTOBS – Single overhead softball/Baseball Tunnel, Ground sleeve inserted by SportsField Specialties, P.O. Box 231, 41155 St. Hwy, Delhi, NY 13753, (888) 975-3343 or approved equal.
 - 1) Components
 - 2) Batting Tunnel:
 - 3) Softball: 55' length. Baseball: 75' length.
 - 4) Upright Poles: 4" Aluminum (4" O.D. x 0.125" Wall) Tube
 - 5) Alignment Notch
 - 6) Crossbars: 4" Aluminum (4" O.D. x 0.125" Wall) Tube
 - 7) Ground Sleeve:
 - 8) 30" Depth
 - 9) Aluminum Construction
 - 10) Welded Leveling Plate
 - 11) Alignment Bolt
 - 12) Press Fit Ground Sleeve Plug
 - 13) Extension Arms: 3/8" Steel Plate x 18" Long
 - 14) Crossbar Supports: 4" x 3/16" wall Square Steel Tube
 - 15) Super Durable Black Powder Coated Finish (Enhanced Resistance to UV)
 - 16) Tension Cable Support: 1/4" 7x19 Black Powder Coated Galvanized Aircraft Cable with 1/2" x 6" Jaw and Jaw Turnbuckles
 - 17) 13'H x 14'W x 55'L Softball Standard #36 Black Nylon Net, 1-3/4" Square Mesh with Rope Bound Perimeter (4'W x Full Height Overlapped Entryways, Black Vinyl Encased 1/4" Galvanized Chain Ground Weight)
 - 18) Fully Retractable Double Pulley System
 - 19) Model Specific Hardware Kit and Installation Instructions
- D. Provide drawings of the manufacturers recommended installation and foundation requirements prior to actual field installation work, for Landscape Architects or Owners representative's review. Install batting cage as recommended per manufacturers written instructions and as indicated on the drawings.
- E. Concrete anchoring foundations to be determined by others based on local soil conditions and building codes.
- F. Ground plane at the batting cage shall be a synthetic turf surfacing with sand infill only with flush embedded concrete edgers by steel reinforcing bar as shown on the drawings.
- G. Synthetic Turf at Batting Tunnel: Refer to Section 321823

2.08 BASEBALL/SOFTBALL HOME PLATE, BASES, AND PITCHER'S RUBBER

- A. Furnish and install home plate, bases, and pitcher's rubber, per manufacturer's specifications for all softball fields and bullpens. These items shall be home plate (Hollywood LMB Pro Style with 6" stanchion and accessories), bases (Hollywood-Style Base with 7" Stanchion), and Pitcher's rubber (24" Hollywood Dual stanchion removable pitching rubber and accessories) as manufactured and/or Supplied by Schutt, Litchfield, IL, 800-426-9784. Or one of the following:

- 1) BSN Sports, Dallas TX, 800-856-3488
- 2) Bulldog Field Equipment, Roanoke VA, 540-315-6453

2.09 SPORTS NETTING AT MULTI-PURPOSE AND SOFTBALL FIELDS

- A. Provide manufacturer's product data for approval prior to ordering.
- B. Provide and install sports netting/backstop netting posts, tension posts, netting, hardware and tie downs in accordance with the Details indicated on the Drawings.
- C. Submittals: Contractor shall submit for approval by landscape architect,
- D. Manufacturers product data, installation requirements and color samples.
- E. Shop drawings: structural engineered calculations accounting for wind loads, soil conditions including footings/foundations and post sizes. The netting system shop drawings shall be an engineered system stamped and signed by a P.E.
- F. Quality Assurance: The Manufacturer shall have a current American Sports Builders Association (ASBA) Supplier Certificate of Distinction designation.
- G. Pole-to-pole Tension Netting Containment System Basis of Design shall be as manufactured by Sportsfield Specialties or approved equal.
- H. Engineer, Furnish and install 4 separate netting installations. At each multipurpose field, the net shall extend to 20' total height.
- I. Where applicable The netting shall be installed in conjunction with the posts for the chain link fencing with shared posts and the netting shall terminate at the top of the fence.
- J. Other approved vendors:
- 1) AAE, 1000 Enterprise Dr., Royersford, PA 19468 tel 1-800 523-5471,
 - 2) Beacon Athletics, tel 800-747-35985. Or approved equal.

K. Sports netting pre-engineered pole system system components:

1. Schedule 40 Steel Pipe (6" O.D.), standard Powder Coated Black Finish. Refer to the drawings for heights.
2. Ground Sleeves with Welded Base Plates: aluminum tube with alignment bolt
3. Net with Perimeter Rope Binding:

4. Overall dimensions in accordance with the drawings, 1-3/4" Square Mesh
 - 1) Dyneema® Ultra-High Molecular Weight Polyethylene (UHMWPE) SK-75 Black Fiber Construction
 - 2) 4 Ply, 1.2 mm (0.0472") Diameter Twine
 - 3) 95% Open Mesh Area (See-Through Visibility)
 - 4) 58,445 psi Minimum Breaking Strength
 - 5) 30% Maximum Elongation at Break
 - 6) 1-3/4" (44 mm) Square Mesh Size, 0.009 lbs. per Square Foot
 - 7) 4-Strand, Braided, Continuous Monofilament Dyneema® Fiber
 - 8) Black Multi-Filament Polypropylene Solid Braid Derby Rope Sewn Binding on Perimeter Edges - 1/4" Diameter, 530 lb. Minimum Breaking Strength
 - 9) Urethane Black Bonded Finish
 - 10) Strong Resistance to Ultraviolet (UV) Light Degradation
 - 11) Excellent Resistance to Chemicals and Water Absorption
 - 12) Length, Height, and Configuration as Required
- L. Accessories: Stainless Steel and/or Galvanized Steel Assembly Hardware, Fixed Welded Upper Tab and Adjustable Lower Bracket with Tensioned Vertical Slide Cable System, Secure Snap Clips for Net Attachment, 3/16" Diameter Galvanized Wire Rope Black Vinyl Coated to 1/4" Diameter, Black Plastic Friction Fit Ground Sleeve Caps,
 1. Wire Rope Support Structure:
 2. 7 x 19 GAC Galvanized Aircraft Cable - 5/16" Diameter Main Horizontal Support, 9,800 lb. Minimum Breaking Strength, 3,267 lb. Minimum Working Load Limit
 3. 7 x 19 GAC Galvanized Aircraft Cable - 1/4" Diameter Vertical and Bottom Horizontal Supports, 7,000 lb. Minimum Breaking Strength, 2,333 lb. Minimum Working Load Limit
 4. Hot Dipped Galvanized Attachment and Assembly Hardware - Quantities, Sizes and Configurations

2.10 DUGOUT SHELTER – BASEBALL AND SOFTBALL

- A. The basis of design for the dugout shelters shall be model GD8X32 - GameShade® Dugout 8'W x 32'L (height as indicated on dwgs) as Manufactured and Supplied by Sportsfield Specialties, Inc. P.O. Box 231 41155 State Highway 10 Delhi, NY 13753 p. 607-746-1460 www.sportsfieldspecialties.com
- B. Approved equal shall meet all criteria specified herein and as indicated on the Drawings.
 1. Model 8'W x 32'L (custom length) Premium Team Dugout – as manufactured by Beacon Athletics, 8233 Forsythia St STE 120 Middleton WI 53562
 2. Custom fabrication.
- C. SUBMITTAL REQUIRED: Stamped and Sealed Shop Drawings and Calculations by a Licensed Professional Engineer of Record in the State of Project Location
- D. DESIGN CRITERIA:

- 1) Building Code: ASCE 7-10
- 2) 2. Maximum Wind Speed Rating: 140mph, Exposure Category C
- 3) 3. Maximum Ground Snow Load: 60psf
- 4) 4. Seismic Design: Category E, $S_s=1.5g$, $S_1=0.75g$
- 5) 5. Roof Pitch: 2" Rise Back-to-Front

E. COMPONENTS:

1. Overall Dimensions: 8'W x 32'L
2. Structural Columns Fabricated of:
 - 1) 3-1/2" x 3-1/2" x 3/16" (0.1875") Structural Steel Tube with Factory Pre-Drilled 9" x 9" x 5/8" (0.625") A36 Steel Base Mounting Plates and 9" x 9" x 5/8" (0.625") A36 Steel Roof and Column Cap Plates
 - 2) Fully Welded Construction
 - 3) Maximum Allowable Spacing Between Structural Steel Columns is Fifteen (15') On-Center
3. Roof Frame Fabricated of:
 - 1) 5" x 2" x 3/16" (0.1875") Structural Steel Rectangular Perimeter, Transverse, and Longitudinal Roof Tubes
 - 2) Fully Welded Construction
4. Structural Steel Columns and Roof Frame Receive a Powder Coated Primer and Coated Finish, Various Standard and Custom Colors Available
5. Roofing Material is 29 Gauge, Classic Rib® Style Corrugated Metal with J-Channel Drip Cap Installed on Front and Sides, Various Standard Paint Finish Colors Available. Submit standard paint colors for review and approval.
6. Structural Columns Attached to Roof Structure with Galvanized Hardware
7. Includes Carbon Steel Anchoring Hardware, Epoxy and Lifting Eye Bolts
8. Model Specific Hardware Kit and Installation Instructions
9. Representative photo of the GameShade Dugout



F. INSTALLATION OF EQUIPMENT

1. Dugout Shelter and Accessories shall be installed as recommended per manufacturer's written instructions and as indicated on the drawings. Concrete anchoring foundations to be determined by others based on local soil conditions and building codes. Installer should have a minimum of five (5) baseball/softball equipment installations or similar experience in the previous three (3) years.

2.11 BLEACHERS

- A. Furnish and install aluminum bleachers where indicated on the drawings. Refer to Section 133416 HEAVY DUTY ALL-ALUMINUM BLEACHER for details.

2.12 SHOT PUT THROWING CIRCLE

- A. Furnish and install (1) Rolled Aluminum Depressed Pad Shot Put Throwing Circle which shall be one of the following or Landscape Architect approved equal.
 1. Model TRSPHAA as manufactured by Sportsfield Specialties 888-975-334
 2. UCS Model#725-2575 Model #369 as manufactured by UCS Inc., 511 Hoffman Road, Lincolnton, NC, 28092, (800) 526-4856.
 3. Model # SC-2/2 as manufactured by AAE Sports, 1000 Enterprise Drive, Royerford, PA 19468, (610) 825-6565 or approved equal
- B. Shall comply with NCAA and NFHS requirements.

2.13 SHOT PUT TOE BOARD

- A. Furnish and install one (1) new, Shot Put Toe Board which shall be one of the following or Landscape Architect approved equal:
 1. Model # 359 Synthetic Shot Toe Board - as manufactured by Gill Athletics, 2808 Gemini Court, Champaign, IL 61822, (800) 637-3090.
 2. Model # 3943 Polyethylene Shot Toe Board – as manufactured by VS Athletics, 1450 W. 228th St. #8, Torrance, CA 90501, (800) 676-7463.
 3. Model # STB Synthetic Toe Board – as manufactured by AAE Sports, 1000 Enterprise Drive, Royerford, PA 19468, (610) 825-6565.
- B. Toe Board shall be installed level with concrete pad throwing area.

2.14 DISCUS CAGE AND THROWING RING

- A. Provide one (1) new, fully assembled, including ground sleeves, removable discus cage.
- B. Discus Cage shall be one of the following or Landscape Architect approved equal:
 - 1) Model # DCHS High School Discus Cage – as manufactured by SportsField Specialties, P.O. Box 231, 41155 St. Hwy, Delhi, NY 13753, (888) 975-3343.
 - 2) UCS High School Discus Cage with Ground Sleeves, Powder Coated Black -

Model#570-0100R - as manufactured by UCS Inc., 511 Hoffman Road,
Lincolnton, NC, 28092, (800) 526-4856

- 3) Gill Athletics High School Brutus Discus Cage, Powder Coated Black -
Model#9010 - as manufactured by Gill Athletics, 2808 Gemini Court,
Champaign, IL 61822, (800) 637-3090. or approved equal

- C. Discus Cage shall be all aluminum construction with stainless steel hardware. Posts to be powder coated black.
- D. Netting shall be 1-3/4" mesh, weather treated black nylon. Backup net shall be included.
- E. Throwing Ring Shall be a rolled aluminum 3/4" Depressed Pad Throwing Ring Model TFD099AL by Sportsfield Specialties or approved equal.

- 1) Other approved suppliers: Gill Athletics and AAE Sports

2.15 TENNIS/PICKLE BALL POSTS, NET AND CENTER TIE DOWN ANCHORS

- A. Provide manufacturer's product data for Landscape Architect approval prior to ordering.
- B. Provide and install one pair of tennis net posts for each new tennis court in accordance with the Details indicated on the Drawings. Care shall be taken to preserve the integrity of the asphalt concrete paving and underlying soils while excavating and installing concrete footings. Concrete footings must conform to the size and shape indicated on the Detail, or the Contractor shall be required to remove and replace the footings at their expense.
- C. The basis of design for the Tennis posts (or Landscape Architect approved equal):
 - 1. Model No 3002, "Edwards Wimbledon Tennis Post" & Model No. 2001 #30 LS "Edwards Tennis Net, as manufactured by Edwards Sports Products, England and available through N.J.P. Sports, 548 W. Arden Ave., Glendale, CA 91203, (800) 773-4657.
 - 2. Model # 63032BR, Premier XS as manufactured by Douglas, 3441 S 11th Ave., Eldridge, IA 52748. 1-800-553-8907
 - 3. Model # A67-010, "Royal Square Tennis Posts" and Model # A67-120. "JA Cissel 711CI Deluxe Tapered Tennis Net" as supplied by Anthem Sports, 1-800-688-6709.
- D. Posts shall be constructed of 3-1/2" heavy wall steel tubing and factory finished with polyester powder coating, color to be approved by Landscape Architect. Winder handle shall be a brass or bronze and removable. Ground sleeves shall be aluminum.
- E. Provide and install complete tennis nets as shown on the Drawings and as specified herein. Tennis nets shall be one of the following or Landscape Architect approved equal.
- F. Nets shall be constructed of 3 mm braided black polyethylene netting quadruple-stitched heavy-duty polyester web headband with a 3/16-inch dia. vinyl coated steel cable. At least top five rows shall be double mesh. Bottom edge shall be synthetic-taped. Side pockets

shall be grommeted with dowel. Model #62-18-0039 by Gold Medal Recreation Products or approved equal, represented by ME Obrien of Medfield Ma 508-359-4200

- G. Provide and install net center strap and tie down anchors in concrete foundation in accordance with the detail. Coordinate elevations with paving work.

2.16 POLE VAULT BOX

- A. Furnish and install pole vault box, cover and plug which shall be model Model PVBSS Stainless Steel Pole Vault Box Equipment and Accessories as Manufactured and/or Supplied by Springfield Specialties, Delhi NY. Or of the following:

- 1) Gill Athletics Model#504 – as manufactured by Gill Athletics, 2808 Gemini Court, Champaign, IL 61822, (800) 637-3090.
- 2) UCS Model#711-1200 as manufactured by UCS Inc., 511 Hoffman Road, Lincolnton, NC, 28092, (800) 526-4856.

2.17 LONG JUMP/TRIPLE JUMP PIT FORMS WITH COVERS

- A. Furnish and install two (2) new, fully assembled Long Jump/Triple Jump Pits, including Sand pit modular forming systems catchers, metal grates, rubber mats, vinyl covers and sand.
- B. Long Jump/Triple Jump Pits systems shall be one of the following or Landscape Architect approved equal:

1. SP6020 JumpForm® (SPSCHS) High School 3M x 7M Sand Pit with Sand Catchers as manufactured by SportsField Specialties, P.O. Box 231, 41155 St. Hwy, Delhi, NY 13753, (888) 975-3343. Vinyl cover shall be a model SPCVRM or approved equal, color to be selected by Landscape Architect
2. UCS Long Jump/Triple Jump Pit Form, Sand Catcher and Cover - Model#519-3216 - as manufactured by UCS Inc., 511 Hoffman Road, Lincolnton, NC, 28092, (800) 526-4856.
3. Gill Athletics Long Jump/Triple Jump Pit Form, Sand Catcher and Cover - F46225 and F44023C - as manufactured by Gill Athletics, 2808 Gemini Court, Champaign, IL 61822, (800) 637-3090. or approved equal

- C. Sand shall conform to latest MIAA standards for jump pit sand. Sand shall be a washed sand, without organic components, maximum 2mm granules, of which not more than 5% in weight is less than 0.2mm.
- D. Equipment and Accessories shall be installed as recommended per manufacturer's written instructions and as indicated on the drawings. Installer shall have a minimum of five (5) track and field equipment installations or similar experience in the previous three (3) years.

2.18 LONG JUMP TAKEOFF BOARDS

- A. Furnish and install two (2) new, Long Jump Takeoff Boards (one each runway) which shall be one of the following or Landscape Architect approved equal:
1. Model # LTJTOB8, 8" Long Jump Take-Off Board - as manufactured by SportsField Specialties, P.O. Box 231, 41155 St. Hwy, Delhi, NY 13753, (888) 975-3343.

2. Model # 4445 Synthetic Take Off Board with Base – as manufactured by Gill Athletics, 2808 Gemini Court, Champaign, IL 61822, (800) 637-3090.
3. UCS Model#519-2200 Long Jump Take-Off board as manufactured by UCS Inc., 511 Hoffman Road, Lincolnton, NC, 28092, (800) 526-4856. or approved equal

2.19 CLEANING, REPAIR AND PROTECTION

- A. Repair minor damage to eliminate all evidence of repair. Remove and replace work that cannot be satisfactorily repaired.
- B. Provide temporary protection to ensure that the work shall be without dirt, stains, damage or deterioration at time of final acceptance. Clean up stains and spills as they occur. Remove protections and clean as necessary immediately before final acceptance.
- C. Upon completion of the work and before acceptance, the Contractor shall remove and dispose of in an approved manner all surplus materials and rubbish. which the Contractor may have accumulated during the course of the work and shall leave the site in a clean and orderly condition. The Contractor shall not abandon any material at or near the site regardless of whether or not it has any value.

END OF SECTION

SECTION 118129

FACILITY FALL PROTECTION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Tie back and lifeline anchors for fall protection, exterior maintenance, and window cleaning applications.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING.
 - 2. Section 053000 - STEEL DECKING.
 - 3. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roof system assembly.

1.3 DESIGN AND PERFORMANCE REQUIREMENTS

- A. The equipment supplier is responsible for the design and erection of equipment and anchors and for coordination and proper relation of his work to the building structure and to the work of all trades. The equipment supplier shall verify all dimensions of the building that relate to fabrication of the equipment and shall notify the Architect of any discrepancy before the order for the equipment is finalized.
- B. Design a system that complies with applicable regulatory requirements.
- C. Design anchor components to provide an adequate attachment means suited to current practices and compatible with industry standard equipment.
- D. Ensure that anchor components meet proper engineering principles and have been designed by a company qualified in required applications and safety.

- E. Design a horizontal lifeline system which allows the worker to walk freely along without having to manipulate his lanyard in order to pass by an intermediate bracket (hand free). Include any hardware required to attach the components to the building structure.
- F. The system must be designed with fall arrest capability (FAS). The system shall comply with Federal OSHA regulatory requirements for FAS limiting the total fall to 6 feet, ensure a user is not exposed to maximum arrest force (MAF) in excess of 1800 lbs. System shall include all hardware, two safelink lanyards attached to the horizontal life line system complete with body harnesses.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, installation instructions, use limitations and recommendations for window washing equipment and accessories specified.
 - 1. Provide certifications stating that products comply with specified requirements.
- B. Shop Drawings: Provide shop drawings for fabrication, layout, and configuration of the system, including all installation and erection of all parts of the work, and including all accessories. Shop drawings shall meet the relevant health and safety standards of all agencies having jurisdiction. Shop drawings shall identify necessary restrictive and non-restrictive working usage notes and general safety notes.
 - 1. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others.
 - 2. Show the general arrangement of all components, clearances and principal dimensions, assemblies of equipment.
 - 3. Include weights of components and maximum loads and spacings.
 - 4. Include the seal of a qualified Professional Engineer.
 - 5. As part of shop drawings, include a safety inspection log book for yearly inspections.
 - 6. Submit two copies of as-built shop drawings showing anchor locations and details. This drawing shall be posted near exits onto the roof.
- C. Operation and Maintenance Manuals: Submit operation and maintenance data.
- D. Welding certificates.
- E. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm shall be specialized in the design, fabrication, and installation of fall arrest roof anchors.
 - 1. Equipment supplier/installer shall carry specific liability insurance, products and completed operations insurance, in an amount of not less than \$2,000,000.00. This insurance shall cover the failure of the safety anchor itself.
- B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated for this Project in material, design, and extent.
- D. Regulatory Requirements: Strictly comply with applicable codes, regulations, and requirements of authorities having jurisdiction, including but not limited to the following:
 - 1. OSHA 1910.66 Subpart F, "Powered Platforms" and Subpart I "Fall Protection".
 - 2. OSHA 1910.66 Subpart D, "Walking and Working Surfaces and Personal Protective Equipment (Fall Protection Systems).
 - 3. 29 CFR 1910 - Occupational Safety and Health Standards and 29 CFR 1910.306 - Specific Purpose Equipment and Installations.
 - 4. AISC Specifications.
- E. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver equipment and accessories in accordance with manufacturer's recommendation. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide products of one of the following manufacturers that meet or exceed specified requirements, or approved equal.:
 - 1. Guardian.
 - 2. Hayn Enterprises, LLC.
 - 3. Pro-Bel Enterprises, Limited.
 - 4. Thaler Metal USA Inc.
- B. Other manufacturers producing equipment meeting this specification may be submitted for Architect's review provided that proposed substitute supplier can demonstrate qualifications and experience and furnish evidence of insurance coverage.

2.2 EQUIPMENT

- A. General: Provide equipment required to satisfy design requirements and proposed equipment layout.

B. Tieback Lifeline Anchors:

1. System shall resist pullout with force of 5000 pounds in any direction.
2. Safety anchoring eye, bolts and connecting hardware shall be fabricated of stainless steel.
3. Steel bases shall be fabricated of hot-dipped galvanized mild steel.

2.3 MATERIALS

- A. Exposed Structural Components: Stainless steel, conforming to ASTM A 276 or A 666, Type 304, with minimum yield strength of 42 ksi.
- B. Cast-In-Place Inserts: Stainless steel, conforming to ASTM A 276 or A 666, Type 304.
- C. Nonexposed Steel: Steel, conforming to ASTM A 36, Type 350W with 50 ksi yield strength for HSS and 43 ksi for plate and all other sections; hot dip galvanized to ASTM A 123 or A 153.
- D. Exposed Non-Structural Aluminum: Aluminum, conforming to ASTM B 221 or ASTM B 209, seamless spun type, alloy and temper as recommended by manufacturer.
- E. Cold-Formed Sections: Steel tubing, conforming to ASTM A 500, yield strength 55 ksi, tensile strength 66 ksi.

2.4 FLASHINGS

- A. Provide proper flashing at anchors. Coordinate with Division 07 Roofing Sections.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION

- A. Erect and install tieback and lifeline anchor systems complete in accordance with the approved shop drawings and all applicable codes, and in accordance with manufacturer's recommendations.

3.2 ERECTION SERVICES

- A. The fall arrest equipment manufacturer shall provide supervisory erection services, including the services of a registered professional engineer to oversee installation of equipment.

END OF SECTION

SECTION 122216

VERTICAL LOUVER BLINDS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Vertical louver blinds.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking and grounds for mounting horizontal louver blinds and accessories.

1.3 SUBMITTALS

- A. Samples: Submit single sample of each vertical blind type to Architect for approval, to determine manufacturer and product type and quality. Include complete line of fabric samples for Architect's selection and approval.
- B. Product Data: Submit complete product data to Architect for approval, including complete manufacturer's specifications and installation instructions sufficient to fully describe the proposed materials and installation.
- C. Do not order materials or begin installation work until Architect's approval of submittals has been obtained.

1.4 STANDARDS AND CERTIFICATION

- A. Vertical louver blinds, including fabric materials, shall meet or exceed the fire hazard requirements of the local Fire Department.
- B. Provide manufacturer's written certifications of compliance with these requirements.

PART 2 - PRODUCTS

2.1 VERTICAL LOUVER BLINDS

- A. Vertical louver blinds shall be "Sol-R-Veil Vertical Blinds", manufactured by Sol-R-Veil Inc., Bronx, NY 10451-5435; or approved equal by Hunter Douglas or Levelor.
 - 1. Blind shall be of the traverse and rotating vane type.
 - 2. Blind shall have top track to support vanes with bottom vane spacing chains.
 - 3. Blind shall be chain operated with controls on one side.
 - 4. Vanes shall be stacking to one side.
 - 5. Each blind shall include concealed mounting brackets and hardware.
- B. Fabric vanes shall 3-1/2 in. wide fabric constructed of clean cut, unraveled fray. Vane shall have 1 in. face trim with fabric finish.
- C. Fabric shall be comprised of an nonflammable woven vinyl yarn woven, meeting NFPA Class A requirements. Color and weave shall be selected by the Architect from manufacturer's full range of available colors.
- D. Each blind shall be made to tilt and traverse, one way draw in the direction indicated on the Drawings with the placement of the controls as indicated on the Drawings.

PART 3 - EXECUTION

3.1 MEASUREMENTS

- A. Vertical louver blind installer shall field-measure finished openings.
- B. Each opening and blind shall be numbered. In multiple installations, opening shall be considered as space required for each blind. Numbers may be stamped on unexposed surface of openings. Blinds shall have corresponding brass or aluminum plates with numbers fastened to back of head track.

3.2 INSTALLATION

- A. Vertical louver blinds shall be delivered and installed by approved manufacturer or authorized dealer or agent, in strict accordance with approved Submittals, including manufacturer's published installation instructions and recommendations, submitted to Architect as specified hereinbefore.
- B. Install tracks in accordance with manufacturer's recommendations. Install all components level, true, and properly centered in, and fitted to, window openings. Upon completion, adjust for proper operation.

3.3 PROTECTION AND CLEAN-UP

- A. Protect vertical louver blinds against defacement, warpage of vanes, and bending of rails. Warped or damaged vanes shall be removed from the site immediately and replaced. Scratches and other defacements shall be repaired or replaced, subject to Architect's approval.

- B. Upon completion, remove cartons, wrappings, and debris, and leave work areas broom clean.

END OF SECTION

SECTION 122400

SHADES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roller shades with manual and motorized shade operators.
 - 2. Tension shade system at skylight electrically operated.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking and grounds for mounting roller shades and accessories.
 - 2. Division 26 - ELECTRICAL for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized shade operation.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
 - 2. Motorized Shade Operators: Include operating instructions.
 - 3. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. LEED Submittals:
 - 1. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For shadecloth, submit Cradle to Cradle (C2C) certifications, Health Product Declarations (HPD), or Declare product labels.

2. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2–2017.
 - a. For shade cloth materials, submit GreenGuard Gold certification.
- C. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.
 1. Motorized Shade Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 2. Wiring Diagrams: Power, system, and control wiring.
- D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 1. Ceiling suspension system members and attachment to building structure.
 2. Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
 3. Shade mounting assembly and attachment.
 4. Size and location of access to shade operator and adjustable components.
 5. Minimum Drawing Scale: 1/4 inch = 1 foot.
- E. Samples for Initial Selection: For each colored component of each type of shade indicated.
 1. Include similar Samples of accessories involving color selection.
- F. Samples for Verification:
 1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
 2. For the following products:
 - a. Shade Material: Not less than 12-inch- square section of fabric, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.
 - b. Valance: Full-size unit, not less than 12 inches long.
- G. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.
- H. Product Certificates: For each type of roller shade, signed by product manufacturer.
- I. Qualification Data: For Installer.
- J. Product Test Reports: For each type of roller shade.
- K. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:

1. Methods for maintaining roller shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.
4. Motorized shade operator.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Source Limitations: Obtain roller shades through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 1. Flame-Resistance Ratings: Passes NFPA 701.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 EXTRA MATERIALS (ATTIC STOCK)

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Draper Inc.
 2. Hunter Douglas Contract; Nysan Shading Systems.
 3. Lutron Electronics Co.
 4. MechoShade Systems, Inc.

2.2 ROLLER SHADES

- A. Shadecloth: 100% polyester or PLA biopolymer fabric, PVC-free.
 1. Solar Control Type: Provide transparent type shadecloth with percentage as acceptable to Architect.
 2. Black-Out Type: Provide black-out type shadecloth at selective locations as directed by Architect.
 3. Fire-Test-Response Characteristics: Passes NFPA 701, with no chemical flame retardants.
 4. Building Product Disclosure and Optimization, Material Ingredients: Cradle to Cradle (C2C) Gold certification.
 5. Low-Emitting Materials: Provide adhesives and sealants in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - a. GreenGuard Gold certification.
 6. Bottom Hem: Straight.
 7. Colors: To be selected by Architect from manufacturer's full range.
- B. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with removable spline fitting integral channel in tube for attaching shade material.
 1. Direction of Roll: Regular, from back of roller
- C. Mounting Brackets: Galvanized or zinc-plated steel.
- D. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as indicated on Drawings removable design for access.

- E. Top/Back Cover: L-shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.
- F. Pocket-Style Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with a bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.
- G. Bottom Bar: Steel or extruded aluminum. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.
- H. Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.
- I. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.

2.3 ROLLER SHADE FABRICATION

- A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.
- B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - 1. Lifting Mechanism: With permanently lubricated moving parts.
- C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
 - 2. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
- F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

2.4 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.

2.5 MOTORIZED ROLLER SHADE OPERATORS

- A. General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.
- B. Comply with NFPA 70.
- C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- D. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.
 - 1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - 2. Motor Characteristics: Single phase, 220 V, 60 Hz.
 - 3. Motor Mounting: Within manufacturer's standard roller enclosure.
- E. Position of Motor and Electrical Connection: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings.
- F. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following devices for remote-control activation of shades:
 - 1. Control Stations: Keyed, maintained-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
 - a. Color: White.
 - 2. Group Control Stations: Maintained-contact, three-position, rocker-style, wall switch-operated control station with open, close, and center off functions for single-switch group control.

- a. Color: White
- 3. Microprocessor Controls: Electronic programmable means for setting, changing, and adjusting control features. Provide unit isolated from voltage spikes and surges.
- G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.
- H. Operating Function: Stop and hold shade at any position
- I. Operating Features: Include the following:
 - 1. Group switching with integrated switch control; single face plate for multiple switch cut-outs.
 - 2. Capable of interface with audiovisual control system.
 - 3. Capable of accepting input from building automation control system.
 - 4. Override switch.
 - 5. Backup gear and crank operator for manual operation during power failures with detachable handle, length required to make operation convenient from floor level

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to Division 01 Sections for contract closeout procedures.

END OF SECTION

DIVISION 123000

MANUFACTURED CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other section of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. Furnish and install plastic casework and accessories as shown and listed on drawings, and specified herein. Includes all countertop types, epoxy sinks, cutouts for plumbing, HVAC and electrical fixtures, splashes, supports, shelving, and filler panels necessary for a complete casework installation.
- B. Furnish plumbing fixtures, including nipples and locknuts, required for mounting in or on the equipment. Furnish all fixtures unattached and unassembled to the Plumbing Subcontractor appropriately tagged and identified with installation information. Casework Contractor shall provide and install epoxy resin integral sinks. Casework shall coordinate and provide cut outs for plumbing utilities
- C. Furnish sinks, including overflows, plugs, strainers and tailpieces which occur above the floor and required for mounting in the casework. Furnish sink basins installed in the cabinet work. Furnish fittings unattached and unattached and unassembled to the Plumbing Subcontractor tagged and identified with installation information.
- D. Furnish electrical service fixtures, including nipples, required for mounting in or on casework and equipment. Furnish all fixtures unattached and unassembled to the Electrical Subcontractor appropriately tagged and identified with installation information.
- E. Furnish light fixtures including switches, integral convenience receptacles and other components, as required, for installation in or on the casework.
- F. Furnish all items requiring air exhaust.
- G. Furnish and provide all materials and services as may be additional and/or separately described under other sections of this Specification.

- H. Verify and confirm all building dimensions relative to the casework and equipment items to be furnished and installed taking actual field measurements at the job site prior to fabrication.
- I. Provide joint sealant for joints between work of this section and adjacent construction. Joint sealant materials and procedures shall comply with Section 079200 – JOINT SEALANTS.
- J. Coordinate installation of sealants to allow final Painting by Section 099000 to occur in sequence with final painting of adjacent surfaces.

1.3 RELATED WORK UNDER OTHER SECTIONS

- A. Connecting all plumbing and electrical service fixtures to building services.
- B. Furnishing, installing, and connecting all service lines, traps, drain lines, vents, piping and conduit within equipment, in service turrets or tunnels, trough, under, or along the backs of work surfaces.
- C. Furnishings of all building plumbing, electrical and vented roughing-in within the area of the equipment to accommodate all services called for in the Specifications and shown on the Drawings.
- D. Furnishings of framing and reinforcement for walls, floors, and ceilings to support the casework and equipment and all blocking and material grounds required for proper anchoring of casework and equipment.
- E. Furnishing, installing, and connecting all ductwork, blowers, blower platforms, switches and other exhaust system components from the equipment duct stub connection to the atmosphere on all equipment requiring mechanical exhausting.

1.4 RELATED SECTIONS:

- A. Section 018110 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- B. Section 018111 - SUSTAINABLE DESIGN REFERENCE DOCUMENTS.
- C. Section 055000 – Metal Fabrications
- D. For Blocking within walls where indicated: Section 061000 – Rough Carpentry
- E. Millwork, trim and custom Cabinetry: Section 064020 – Interior Architectural Millwork
- F. Section 079200 - Joint Sealers.
- G. Section 096500 - Resilient Flooring: Base material.
- H. Section 099000 – Painting and Coating
- I. Section 114500 – Residential Appliances
- J. Division 22 and 23 – Plumbing and HVAC for Sinks and service fixtures, service waste lines, connections, and vents.
- K. Division 26 – Electrical for electrical service fixtures.

1.5 REFERENCES

- A. ANSI-A135: for all hardboard
- B. ANSI-161. 2-1998: for performance of fabricated high-pressure decorative laminate countertops.
- C. Architectural Woodwork Institute (AWI): Architectural Woodwork Quality Standards Illustrated, latest edition.
- D. National Electrical Manufacturers Association
- E. ANSI-A208.1-2016: for grade M-3i mat-formed wood particleboard
- F. BHMA A156.9: for grade-1 hinge requirements

- G. NEMA 3 LD-2005 – for performance requirements of high pressure laminates
- H. SEFA 8PL Recommended Practices: for cabinet construction.

1.6 FILTERED FUME HOOD REFERENCES

- A. SEFA 1-2010, Scientific Equipment and Furniture Association, Recommended Practices for Laboratory Fume Hoods.
- B. SEFA 9-2010, Recommended Practices for Ductless Enclosures (DH III)
- C. SEFA 8-2010, Recommended Practices for Laboratory Grade Metal Casework, 8.0 Cabinet Surface Finish Tests.
- D. NEPA 45-2011, National Fire Protection Association, Fire Protection for Laboratories Using Chemicals.
- E. AFNOR NFX 15-211 Standard
- F. ASHRAE 110-2016, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Method of Testing performance of Laboratory Fume Hoods.
- G. ANSI/AIHA Z9.5-2011, American Industrial Hygiene Association, Laboratory Ventilation.
- H. OSHA, Federal Register 29 CFR Part 1910, Occupational Safety & Health Administration, U.S. Department of Labor, Occupational exposures to hazardous chemicals in laboratories

1.7 DEFINITIONS

- A. Exposed: In casework, surfaces visible when drawers and opaque doors (if any) are closed; behind clear glass doors; bottoms of cabinets 42" or more above finished floor; and tops of cabinets less than 78" above finished floor.
- B. Semi-Exposed: In casework, surfaces that become visible when opaque doors are open, or drawers are extended; bottoms of cabinets more than 30" or tops of cabinets less than 42" above finished floor.

1.8 DESIGN REQUIREMENTS

- A. Manufacturers shall provide AWI custom grade construction.
 - 1. Casework shall meet or exceed load tests as outlined in ANSI A161.1.
 - 2. Manufacturers shall comply, per architect's specifications, with special requirements related to the Americans with Disabilities Act, Title II Regulations, ADA Standards for Accessible Design and Massachusetts Architectural Access Board Regulations, MAAB.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED v4 Green Building Rating System, of the US Green Building Council. Refer to Section 01 8113 Sustainable Design Requirements – for compliance with certain prerequisites and credits needed for Project to obtain "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) Silver certification based on USGBC's LEED v4 BD+C: Schools.
- C. Items shall suit space conditions and where equipment is intended to occupy fixed locations, the physical conditions, roughing-in, etc., of the building are to control the absolute sizes and arrangements.
- D. Filtered fume hoods shall function as enclosed workspaces, designed to capture, contain and filter fumes, vapors and particulate matter produced or generated within the enclosure.
- E. Filtered fume hood control module shall include sash sensor that can be programmed to function as either constant blower speed or proportional blower speed based on sash opening position.

F. Project Standard:

1. Stock numbers of items of equipment, as indicated on Equipment Schedules, have been selected from one manufacturer's catalog for design purposes only.
2. Items of equipment by approved manufacturers (other than the Project Standard) need not be identical to the items indicated, however, they must satisfy the same requirements, provide the same facilities (doors, drawers, etc.) and fulfill the same functions as the specified items.
3. Where items of equipment by approved manufacturers (other than Project Standard) are not of the same lengths as the items indicated, adjust equipment layouts as follows:
 - a. Where items of equipment are against the wall and confined by walls at both ends.
 - 1) Add a filler panel that does not exceed 2 inches, and/or
 - 2) Increase the length of one or more units, and/or
 - 3) Add an additional item of equipment.
 - b. Where items of equipment are freestanding or are not confined by walls at both ends, adjust as above, except that overall length need only be approximate.
4. Conditions where toe-kicks of two corner cabinets come together, provide filler to conceal the gap.
5. Materials used by all manufacturers must meet the requirements of these specifications; it is understood that the manufacturers vary in joinery; these specifications describe the construction offered by the first-named manufacturer.
6. It is intended that wood dowels shall secure cabinet body components and glue, but the use of concealed interlocking mechanical fasteners as approved by AWI 1600B-S-4.A especially designed for use with particleboard shall be acceptable.
7. Where items of equipment by approved manufacturers (other than the Project Standard) necessitate changes in mechanical or electrical services, said changes shall be the Contractor's responsibility and shall be coordinated and accomplished at no additional cost to the Owner.

1.9 SUBMITTALS

- A. Prepare and submit Shop Drawings in accordance with requirements of Division 1 and in the manner described therein.
- B. Shop Drawings:
 1. Indicate casework locations, large-scale plans, elevations, cross sections, rough in and anchor placement dimensions, tolerances and clearances required.
 2. Include utility rough-in dimensions.
- C. Product Data:
 1. Submit component dimensions, configurations, construction details, joint details, and attachments, utility and service requirements and locations.
 2. Include associated components, including grommets, sink, sink fittings, appliances, fume hoods and other items as indicated on drawings.
 3. Include manufacturer's literature.
- D. Samples (per Architect's request): shall be prepared and submitted in accordance with requirements of Division 1.
 1. Wood samples
 2. High Pressure Laminate samples
 3. Finish samples
 4. Edge banding
 5. Hinges
 6. Pulls

7. Catches
8. Grill
9. Grommets
10. Fume hood exterior finishes, interior lining and epoxy work tops.

E. Sample Unit:

1. When requested by the Architect, submit full-size cabinet, as herein specified.
2. Submitted cabinets may be used in the Project.

F. Coordination Submittals:

1. Copy same submittals to other trades and other Prime Contractors who have connecting or adjacent Work for coordination review and for locating their Work connected to or adjacent to the equipment specified herein.

G. Provide test results per ANSI A161.1.

1.10 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years of experience.

B. Mockup (per architect's request):

1. Section 014000 - Quality Requirements: Mockup requirements.
2. Construct full size mockup including base and upper cabinet, complete with drawers, door and adjustable shelf.
3. Locate where directed by Architect.
4. Incorporate accepted mockup as part of Work.

1.11 DELIVERY, STORAGE AND HANDLING

A. Provide warranty for manufactured product.

B. Accept casework on site; inspect on arrival for damage.

C. Store and handle casework in manner to prevent damage and deterioration.

D. All casework and lab fume hoods shall be blanket wrapped or covered with cardboard and foam for protection during shipping.

E. Protect finished surfaces of the Fume Hood during handling and installation with protective covering of polyethylene film or another suitable material.

F. Store casework in a protected dry area, provided by the owner, away from direct sunlight, with temperature 70 degrees F (+/- 10) and relative humidity of 25–50%. Casework shall be stored elevated above moisture contact. Storage area must be isolated from outside weather conditions. Casework shall be installed only in areas where temperature and humidity are maintained within the above-stated range. Storage and installations in conditions other than those stated above will void all product warranties.

- G. All cabinets to be complete with hardware attached (or provided loose where not practical to ship attached) with all necessary scribes, fillers and molding; all items to be marked on outside of packaging for identification.
- H. Protect exposed finish surfaces by suitable means.
- I. Coordinate size of access and route to place of installation.

1.12 SEQUENCING AND SCHEDULING

- A. Coordinate casework installation with location and installation of service utilities.
- B. Sequence installation to accommodate required utility connections.

1.13 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.14 WARRANTY

- A. The manufacturer shall guarantee the casework against defects in materials and workmanship for a period of one year from date of acceptance.
- B. Warranty shall cover the repair or replacement, at the manufacturer's discretion of defective material.
- C. Non-manufactured components and accessories, such as faucets, fittings, and fume hoods, shall be covered by the specific manufacturer's warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Drawings and standards for casework and equipment are based on Plastic Laminated casework as manufactured by Case Systems, 2700 James Savage Road, Midland, Michigan 48642 (989) 496-9510 and/or approved dealers.
 - 1. The specifications outline a quality standard necessary for required performance. Only products, which meet or exceed these standards, shall be considered acceptable.
 - 2. Acceptance of a bid for the required materials does not indicate product acceptance. All manufacturers must meet minimum construction requirements, must submit necessary materials and documentation for approved substitution and must revise their construction as necessary to meet the standards set forth herein.
 - 3. Acceptable Manufacturers:
 - a. Case Systems, Midland, MI 48642

- b. Stevens Industries, 704 West Main Street, Teutopolis, IL 62467
- c. Advanced Cabinet Systems (ACS), 1629 S. Joaquin Drive, Marion, IN 46953
- d. OnePointe Solutions, 1112 Swenson Blvd., Elgin, TX 78621

2.2 PLASTIC LAMINATE FACED CABINETS

A. Particleboard Core:

1. All particleboard shall be ULEF/FSC M-3i and shall meet or exceed all requirements as set by ANSI-A208.1-2016.

Modulus of Rupture	2176 psi
Modulus of Elasticity	362600 psi
Internal Bond	73 psi
Linear Expansion	0.40%
Thickness Tolerance	+/- 0.008"
Face Screw Holding	225 pounds Min

- a. MR (Moisture Resistant)/FSC Core shall be:
 - 1) Interior-Grade moisture resistant particleboard.
 - 2) Meet or Exceed M-3i Grade, according to ANSI-A208.1-2016.
- b. Surface Material:
 - 1) Acceptable laminate color, pattern, and finish as either scheduled or otherwise indicated on drawings or as selected by Architect from manufacturer's standard types and nominal thickness including:
 - a) Vertical surface decorative grade VGS.
 - b) General purpose decorative grade HGS.
 - c) Cabinet decorative liner grade CLS.
 - d) Non-decorative backer grade BKH.
 - e) Thermally fused melamine laminate
 - f) Chemical resistant decorative laminate
 - 2) Edge banding: shall be 3mm PVC applied utilizing hot melt adhesive and radiused by automatic trimmers.
 - 3) Adhesive:
 - a) PVA – Adhesive shall be ULEF mechanically applied.
 - b) EVA – Adhesive shall be mechanically applied

2.3 Hardware

A. Hinges:

1. Standard hinges for wall cabinets, base cabinets and tall cabinet doors shall be of the heavy-duty, wrap around, institutional type with five-knuckles, non-removable pin and rounded ends. Hinges for overlay door construction shall be 2-¾" high by .095" thick and hinges for lipped Radius construction shall be 2-½" high by .072 thick. Hinge swing shall be 270 degrees. Hinges shall be finished in colors selected from the manufacturer's standard colors. The door of the tall cabinet against a wall shall be provided with 90- degree swing.

2. Offset kitchen cabinet type, plain butt hinges or hinges with removable pins will not be acceptable.
3. Hinge screws shall be concealed when door is closed.
4. Doors up to 36" in height shall have 2 hinges and doors over 36" in height shall have three hinges.

B. Pulls

1. ADA Compliant wire pulls shall be satin aluminum bent wire style with 4" centers.

C. Drawer Slides

1. Standards slides shall be single extension, bottom-mounted, epoxy powder-coated with positive in stop, out-stop and out keeper, lift-out disconnect, stay-closed design. Slides shall have captive nylon rollers both front and rear, 100-pound load rating and manufacturer's lifetime warranty
2. File and paper storage drawers shall have full extension, 3-part, progressive opening slide, with 150-pound load rating, zinc-coated or epoxy-coated at manufacturer's option.

D. Catches

1. Elbow Catches shall be magnetic, spring activated and come complete with strike plate.
2. Door catches shall be magnetic at base and wall, 2 rollers at tall.
3. Roller Catch shall have heavy-duty, spring-loaded roller, with molded plastic bumper mounted at door top to keep door securely shut.
4. Chain pulls shall be zinc plated, spring-loaded door catch used to hold door securely shut.
5. Chain stops shall be zinc plated, looped chain used to limit door swing as specified, mounting plated at each end of chain shall use (4) #7 x 5/8" screws to secure to cabinet door and end panel. They shall be on cabinets at adjoining walls and where casework and countertops can interfere with the door swing of the tall cabinet.

E. Adjustable Shelf supports

1. Shelf supports shall be twin-pin design with anti-tip up shelf restraints for both 3/4" and provide slot to mechanically fasten shelf to clip. Load rating shall be minimum 300 pounds per shelf support.

F. Locks

1. Locks shall be of a removable core design with 5-disk tumbler. Cabinets to be keyed alike per room, each room keyed differently and master-keyed, unless otherwise noted on drawings.
2. Two keys shall be provided per lock.
3. Six master keys shall be provided.

4. Provide locks on all doors and drawers on base cabinets, wall cabinets, tall storage and wardrobe units. Keyed alike per room and mastered key.
- G. Wardrobe Rod and Mirror
1. Wardrobe rod and flanges to be 1 1/16" inch chrome rod supported by chrome flanges.
 - a. Rod: Knappe & Vogt #750 1
 - b. Flange: Knappe & Vogt #632
 2. At all wardrobe cabinet, provide an 1/8" thick 12" wide x 18" high break and impact resistant acrylic mirror with a shelf on a rod side door.
- H. Tote Tray: Tote tray shall be tan, high impact resistant polystyrene, with label holder permanently attached to face of tray. Supported by individual polycarbonate channels mounted to cabinet ends and partitions with two integral 5mm diameter pins and secured with one-euro style screw. Height adjustable on 32mm (1-1/4") centers. Quantity and locations as indicated on the drawings.
- I. Grills: shall be provided as specified on the drawings. Manufacturer's standard grills shall be installed on both sides of door openings to provide a uniform appearance. Punched metal louvers with exposed sharp edges shall not be permitted.
- J. Grommets at Counters: Molded-plastic grommets and matching plastic caps with slot for wire passage shall be provided where shown on drawings.
- K. Adjustable Shelf Standards and Supports: [BHMA A156.9, B04071; with shelf rests, B04081] [BHMA a156.9, b04102; with shelf brackets, B04112].
1. Standards: 304 stainless steel standard with brushed finish, 5/8" inch wide; Knappe & Vogt, 87SS Standard, or equal.
 2. Bracket for 18 inches deep shelves: 12 gauge cold-rolled steel with electro-zinc-plated and clear lacquered finish, with polyamide resin lock lever; Knappe & Vogt, 187 Shelf Bracket with Anochrome finish, or equal.
- L. Plastic Laminated Countertop Support bracket: Extruded aluminum complying with ASTM B221, 6063-T5, TIG welded along both 45 degree mitered sides and across the back. Ground and debur all edges. Provide pre-drilled holes for mounting. One-piece construction rated to support 450 lbs.
1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following or equal:
 - a. A&M Hardware
 - b. Richelieu, North Reading, MA
 - c. Rangine Corporation, Millis, MA
 2. Basis of Design Products: Rakks Counter Bracket by Rangine Corporation, Needham, MA or equal.
 - a. Model EH-1824 for 30 inch deep tops
 - b. Model EH-1818 for 25 inch deep tops
 - c. Model EH-1212 for 18 inch deep tops.
- M. "H" Bar Assembly at Science Demo Table: The rods and fitting shall be manufactured from machined aluminum. The rods shall be 3/4" in diameter. The rod socket shall provide a taper fit

design. The apparatus rod assembly shall consist of (2) 46" upright rods, (1) 36" crossbar and (2) adjustable clamps.

2.4 SPECIALTY CABINETS

- A. Flammable Cabinet (FA-CAB) and Corrosive Cabinet (CO-CAB): Basis of design, SciMatco, SC8080 Flammable Cabinet and SC8082 Corrosive Cabinet. Dimension: 30" wide x 18-1/2" deep x 32-1/2" high. Construction: Cabinets shall be constructed of 1" multiply, exterior grade plywood, finished with chemical resistant paint. All joints shall be rabbeted and shall be fastened in two directions with wood screws. Doors shall be constructed with a rabbeted overlap of not less than 1 inch. Doors shall be equipped with a means of latching, and hinges shall be constructed and mounted in such a manner as to not lose their holding capacity when subjected to fire exposure. A raised sill or pan capable of containing a 2-inch depth of liquid shall be provided at the bottom of the cabinet. The cabinets shall meet and exceed all applicable NFPA and OSHA standards and shall be UL listed.
- B. Safety Cabinet (G-CAB): Basis of design, Sellstrom #2000, Constructed of heavy gauge steel with baked white enamel finish and vandal-resistant locking double doors. Equipped with rack to hold up to forty (40) pairs of safety goggles. Built-in germicidal lamp fully shielded to prevent accidental exposure from front. Automatic timer shall control sanitizing period. Provide 7-6" grounded plug and cord. Dimensions: 24-1/2" wide x 9-1/2" deep x 32" high.

2.5 FABRICATION

- A. General Cabinet Body Construction:
 - 1. Cabinet box style shall be reveal overlay.
 - 2. Cabinet core shall be ULEF/FSC particleboard. At sink cabinets the cabinet box core shall be MR/FSC board.
 - 3. Bottoms and ends of cabinets, and tops of tall cabinets and tops and bottoms of wall cabinets (all structural components) shall be 3/4" thick.
 - 4. All panels shall be manufactured with balanced construction.
 - 5. Fixed interior components such as fixed shelves, dividers and cubicle compartments shall be full 3/4" thick and attached with concealed interlocking mechanical fasteners.
 - 6. Cabinet body exterior and exposed surfaces shall be VGS.
 - 7. Cabinet body interior surfaces shall be thermally fused.
 - 8. Cabinet body front edge shall be 3mm PVC. Mounting stretchers shall be 3/4" thick structural components fastened to end panels and back by mechanical fasteners and shall be concealed by the cabinet back.
 - 9. Backs of cabinets shall be 1/2" thick surfaced both sides for balanced construction and fully captured on both sides and bottom.
 - 10. A 5mm diameter row hole pattern 32mm (1-1/4") on center shall be bored in cabinet ends for adjustable shelves. This row hole pattern shall also serve for hardware mounting and replacement and/or relocation of cabinet components.
- B. Base Cabinets:
 - 1. All base cabinets, except sink cabinets, shall have a solid 3/4" thick sub-top of core (as specified above), fastened between the ends with interlocking mechanical fasteners.
 - 2. Sink cabinets shall be constructed with a vertical high head rail at both the front and rear of the cabinet. A false drawer head will be applied over the front high head rail.
 - 3. A fixed bottom and removable back shall be provided for all sink cabinets.
 - 4. At location as indicated on the drawings provide cabinets without base/floor to accommodate plaster traps (provided by PLUMBING). Recessed toe-kicks for these cabinets shall be integrated/attached to the cabinet doors.

- C. Tall Cabinet Construction:
 - 1. All tall cabinets shall be provided with an intermediate fixed shelf to maintain internal dimensional stability under heavy loading conditions as well as an intermediate $\frac{3}{4}$ " thick stretcher located behind the back panel and be secured between the cabinet ends with mechanical fasteners. The stretcher shall be secured to the shelf through the back with #8 x 2" plated flat head screws.
- D. Wall Cabinet Construction:
 - 1. A lower $\frac{3}{4}$ " thick stretcher shall be located behind the back panel and attached between the end panels with mechanical fasteners. The stretcher shall also be secured through the back and into the cabinet bottom. Wall cabinets over 36" in width shall receive a fixed intermediate partition.
 - 2. All wall cabinet exterior bottoms shall match exterior surface.
 - 3. All wall cabinet tops shall be $\frac{3}{4}$ " thick.
- E. Tall and Wall Cabinet edges shall be .020" PVC at top of end panels, stretchers and back.
- F. Tall and Wall Cabinet exterior top finish shall be CLS to match interior.
- G. Base, Tall, Wall and Upper door reveal shall be 3mm reveal.
- H. Toe Base of Cabinet:
 - 1. Individual based shall be constructed of MR/FSC board factory applied to base and tall cabinets and shall support and carry the load of the end panels, and the cabinet bottom, directly to the floor. The base shall be let in from the sides and back of the cabinet to allow cabinets to be installed tightly together and tight against a wall, also to conceal to the top edge of applied vinyl base molding (not supplied by casework manufacturer). There shall be a front to back center support for all based over 30" wide.
 - 2. Toe base height shall be 102mm (nominal 4 inch) high unless otherwise indicated on the drawings.
- I. Drawer Fronts and Solid Doors:
 - 1. All drawer fronts and solid door components shall be $\frac{3}{4}$ " ULEF/FSC particleboard surfaced both sides with balanced construction. The drawer fronts and solid door surfaces shall be HPL grade VGS on the exterior and interior. The interior to match inside surface color. The door and drawer front edge shall be 3mm PVC.
- J. Drawer Boxes:
 - 1. Drawer box constructed with a full $\frac{1}{2}$ " thick core shall be pre-finished hardwood veneer plywood non-racking, non-deflecting platform bottom that is carried directly by "L" shaped, bottom mount drawer glides.
 - 2. Drawer slides shall be secured with 1-1/4" long screws driven through the platform and into the sides. Drawer box sides, backs, sub-front, and bottom shall be 1/2". The top edge shall be nominal 1mm (.020") PVC matching the drawer color. Drawer box corners shall be joined with fluted hardwood dowels and glue spaced at a minimum of 32mm on center. Drawer box fronts shall be removable and attached to drawer box sub-front with screws from inside of drawer. Horizontal parting rails between drawers shall be 3/4" thick core, with balanced surfaces, secured to and further reinforcing cabinet ends. File drawer box shall have full-height sides supporting a heavy-duty support rail for hanging file folders constructed of pre-finished hardwood veneer plywood dovetail drawer boxes.

K. Doors:

1. Solid doors shall be $\frac{3}{4}$ " thick as per paragraph 2.5.1
2. Frame Glazed doors shall be $\frac{3}{4}$ " thick with clear acrylic panels. The panels shall be $\frac{1}{4}$ " thick. Glazing panel shall be set into the doorframe without the use of a separate molding. Glazing shall be held in place with removable stops.

L. Shelves:

1. Adjustable shelves:
 - a. Adjustable shelves shall be ULEF/FSC particleboard core with balanced surfaces. Shelves shall be finished with HGS HPL on both sides.
 - b. Adjustable shelves in closed cabinets shall be $\frac{3}{4}$ " shelves, 1" for shelves over 36" wide cabinets.
 - c. All adjustable shelves in open cabinets shall be 1" thick, except for special use cabinets such as mail, cubbies, or locker type units.
 - d. Adjustable shelf edge shall be 3mm PVC on front and back and .020" on sides.
 - e. Shelves shall be full depth and adjustable on 32 mm centers.
2. Fixed:
 - a. Fixed shelves shall be ULEF/FSC particleboard core with balanced surfaces. Shelves shall be finished with HGS HPL on both sides with 3mm PVC edge band.
 - b. Fixed shelves in closed cabinets shall be $\frac{3}{4}$ " shelves, 1" for shelves over 36" wide cabinets.
 - c. All fixed shelves in open cabinets shall be 1" thick, except for special use cabinets such as mail, cubbies, or locker type units.

M. Cubbies:

1. Top bottom, sides, and shelves shall be $\frac{3}{4}$ " thick MR/FSC board finished with VGS, vertical surface decorative laminate with 3mm vinyl edge.
2. Backs shall be $\frac{1}{2}$ " thick MR/FSC board surface both sides for balanced construction and fully captured on both sides and bottom.
3. External hanger rails, $\frac{3}{4}$ " thick and a minimum of 3" high, shall be mechanically fastened to sides, top and bottom.
4. Subbases to be separate, water-resistant plywood containing no added urea formaldehyde, with concealed fastening to cabinet bottom.
5. At open cubbies, provide single coat hook on back and sides as indicated on the drawings.
6. The doors at 3-Tier (6 compartment) cubbies shall be $\frac{3}{4}$ " thick as per paragraph 2.5.1

N. Countertops

1. High Pressure Plastic Laminated Top
 - a. Countertop shall be constructed of 1" thick solid core conforming to NEMA Standard LD3-2005 and ANSI A161.2-1998.
 - b. HGS high pressure laminate on horizontal surface bonded to M-3i MR/FSC particleboard core with PVA rigid adhesives. Core shall be balanced with backing grade BKL.
 - c. All joints shall be secured with biscuits for alignment and tight joint fasteners.
 - d. Provide 4" high back splashes with thickness matching countertop thickness where shown and at all ends abutting walls and adjacent cabinets.
 - e. Provide 3mm PVC edging at countertop and back splashes.
 - f. Incorporate maximum lengths of 12' HPL buildup particleboard top where possible.
 - g. Colors: Provide up to 4 different colors as selected by Architects. The colors shall be selected from a full range of Formica, Nevamar, or Wilsonart colors available from the laminate manufacturer.

2. Epoxy Resin Countertops and Curbs

- a. Basis of Design: "Epoxy Resin" by Durcon, A Wilsonart Company.
- b. Physical Properties:
 - 1) Flexural Strength: Not less than 10,000 psi
 - 2) Modulus Elasticity: Not less than 2,000,000 psi
 - 3) Hardness (Rockwell M): Not less than 100
 - 4) Water Absorption (24 hours): Not more than 0.02 percent.
 - 5) Heat Distortion Point: Not less than 260 degrees Fahrenheit.
- c. Chemical Resistance: Epoxy-resin materials shall show no effect when tested with indicated reagents according to NEMA LD 3, test procedures 3.4.5.
- d. The countertops shall be 1 inch thick, unless otherwise shown on the Drawings, with drip grooves provided on the underside at all exposed edges. Further, all exposed edges except as indicated below, shall be eased at front top edge and at vertical corners. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
- e. 4" separate curbs shall be the same thickness as the tops, bonded to the surface of the top to form a square joint.
- f. Provide drop-in sinks with color to match adjacent work surface. Mold sinks from thermosetting epoxy resin. Mold interior corners to radius. Slope sink base to drain outlet.
- g. Sink cutouts shall be machined to accommodate sink lips.
- h. Joints shall be maximum 1/8", bonded with epoxy grout.
- i. Finish exposed edges. Exposed corners shall be eased slightly.
- j. Acceptable alternate manufacturers:
 - 1) American Epoxy Scientific, Mountain Home, AR
 - 2) Prime Industries, Inc., Lisle, IL
 - 3) One Pointe Solutions, Austin, TX

3. Galvanized Steel Countertops

- a. Countertop shall be of 18 gauge galvanized steel backed by 5/4" plywood substrate. Galvanized sheet shall be used in largest possible sheets with as few joints as necessary. Shop seams and corners shall be welded, ground smooth and polished. All features of the countertop shall be individually shaped or welded to the work surface with joints and surfaces polished.
- b. Countertop shall be 1-1/2" thick with melamine backing. The edge shall be 1/8" radius all top edges and vertical corners.
- c. Four inch curbs shall be the same thickness as the top, and shall be integral to the countertop.
- d. Finish: ASTM 123 hot-dipped zinc coating.

2.6 FINISH AND PERFORMANCE REQUIREMENTS

A. Source Quality Testing

- 1. Base Cabinet testing shall be done in accordance with SEFA 8PL Recommended Practices Paragraph 4.0 Base Cabinets. All testing shall be performed by SEFA certified independent testing facilities.

2. Door testing shall be done in accordance with SEFA 8PL, Recommended Practices Paragraph 5.0 Doors.
3. Drawer testing shall be done accordance with SEFA 8PL, Recommended Practices Paragraph 6.0 Drawers.
4. Cabinet surface finish test shall be done accordance with SEFA 8PL, Recommended Practices Paragraph 8.0, Cabinet Surface Finish Tests.
5. Edge delaminating tests shall be done accordance with SEFA 8PL, Recommended Practices Paragraph 8.5, Edge Delaminating Tests.
6. Wall, Counter Mounted, and Tall Cabinets Load Test shall be done in accordance with SEFA 8PL, Recommended Practices Paragraph 9.0.

- B. Joint Sealant: Provide joint sealants in accordance with requirements of Section 079200 – Joint Sealants at locations indicated herein below in Part 3.

2.7 SINKS AND SERVICE FIXTURES

A. Epoxy Resin Sinks and Miscellaneous Fittings:

1. Epoxy resin sinks and drain fittings shall be non-glaring, and black in color. Sinks shall be molded to one degree dishing to outlets in bottom and have a minimum of 1/2" thick side walls and 5/8" thick bottoms. Materials shall be heat resistant up to 350 degrees F., water absorption of 0.05 in 24 hours, tensile strength of 12,700 P.S.I., and a density of 1.90 GR/CC and a Rockwell-M-Hardness rating of 114. Sinks and drain fittings, specified herein, shall be equal to that manufactured by the Durcon Company, Dayton, Ohio. Refer to drawing Legends.
2. Provide epoxy resin sink covers for a quantity of 50% of epoxy resin sinks being supplied.
3. Only products meeting or exceeding this minimum standard shall be acceptable.
4. The receiving of a bid does not necessarily indicate the manufacturer's standard product is acceptable.
5. Acceptable Alternative Manufacturers:
 - a. American Epoxy Scientific, Mountain Home, AR.
 - b. Prime Industries, Inc, Lisle, IL.
 - c. One Pointe Solutions, Austin, TX

- B. Plumbing Fixtures: Plumbing fixtures shall be of modern design and materials specifically designed for laboratory use equal to Chicago Faucet Company, T & S Brass Company, or Water Saver Faucet Company, with chrome laboratory type finish, unless otherwise noted. All resin sinks shall be furnished with 1-1/2" I.P.S. outlets, overflows, tailpiece, and bead adaptor of black epoxy resin. All water fixtures of the gooseneck type and any others normally furnished or so specified with laboratory serrated hose nozzles shall be furnished with integral vacuum breakers. Fixtures shall be all from one manufacturer. Refer to drawing legends. All faucets shall be provided with 0.5 GPM flow regulators. All plumbing fixtures shall conform to State and Local Plumbing Regulations.

C. Stainless Steel Sink and Fixtures:

1. Stainless steel sinks and tops shall be welded, ground and polished of #18-gauge nickel bearing #18-8 Type 302 stainless steel. Exposed surfaces to be 180 grit-No. 4 uniform satin finish. Interior corners of sink shall be rounded to minimum of 1- 3/4" radius. Sound dampening shall be applied to underside of all sink basins and tops. Stainless steel sinks shall be self-rimmed and shall have a raised edge of 7/16". All handicap-accessible sinks shall be 5"D and provided with rear drain outlets.
2. Sinks and fittings are based upon products manufactured by Just Manufacturing Company, 9233 King Street, Franklin Park, Illinois 60131. Faucets are based upon products manufactured by Chicago Faucet Company.

- a. Type S/F-SS1
 - 1) Sink Fixture: JCDGUX-1830-A: Single compartment, under-mount, 10 1/2" deep. Construction of 18-gauge type 304 stainless steel. Top deck and interior surfaces polished to a non-porous Hand-Blended Just Finish, with a highlighted bowl rim. Fully coated underside insulates for sound and reduces condensation. Straight-sided compartment with large radius corners.
 - 2) Faucet: Chicago #2300-8ABCP
 - 3) Drain: Elkay #LK-35, 3-1/2 inch strainer with basket and neoprene stopper. CP brass 1-1/2 inch OD tailpiece.
 - b. Type S/F-SS2
 - 1) Sink Fixture: US-ADA-1830-A: Single compartment under-mount, 5-1/2 inch deep, ADA Compliant. Seamless die-drawn construction of 18 gauge, type 304, 18-8 stainless steel. Interior and top surfaces polished to a non-porous "hand-blended just finish" with highlighted bowl rim. Smooth, fully coated underside insulates for sound and reduces condensation. Certified to ASME A112.19.3/CSA B45.4, Canadian Standards Association CSA), Uniform Plumbing Code (UPC), International Plumbing Code (IPC).
 - 2) Faucet: Chicago #2300-8ABCP
 - 3) Drain: Elkay #LK-35, 3-1/2 inch strainer with basket and neoprene stopper. CP brass 1-1/2 inch OD tailpiece
 - c. Type S/F-S01
 - 1) Sink Fixture: Epoxy resin drop-in sink with drain and tail piece. Dimension: 25"L x 15"W x 11"D.
 - 2) Faucet: Chicago #930-369CP
 - d. Type S/F-S02
 - 1) Sink Fixture: Epoxy resin ADA drop-in sink with drain and tail piece. Dimension: 25"L x 15"W x 5"D.
 - 2) Faucet: Chicago #930-369CP
- D. Electrical Fixtures: Electrical fixtures shall be furnished with required holes or cut-outs where indicated on all cabinetwork or table tops. Pedestal boxes shall be cast aluminum type. Plates shall be polished stainless steel. Receptacles shall be equal to Arrow-Hart #GF-5342, duplex, 20.0 amp./120V GFI protected type; unless otherwise specified. Light fixtures shall be furnished complete per these specifications mounted in place with switch and lamps. Refer to drawing Legends.

2.8 FUME HOOD

A. Ductless Fume Hood (FH-1)

- 1. Basis of design: Erlab, Captair Ductless filtering fume hood, Model 483.
- 2. Dimensions: 50" wide x 29-1/2" deep x 59-5/8" High.
- 3. Air Flow: 660 m3/h – 390 CFM
- 4. Sash type: Reverso – adjustable sash.
- 5. Filtration module: Polypropylene
- 6. Structure: Corrosion resistant electro-galvanized steel coated with anti-acid polymer. Side and front panels to be made of chemical resistant acrylic.
- 7. Worksurface: Trespa Toplab

8. Technology Communication by LED pulsation system: fan settings, usage timer, fan failure, face velocity, automatic filter saturation detection.
 9. Filtration Technology: 1-4 columns that can be configured to handle liquids, powders or both.
 10. Internal lighting: LED lighting >650 Lux
 11. Connectivity: RJ45 cable connection
 12. Electronic Anemometer: to indicate the face velocity of the unit.
 13. eGuard app: App for remote control to monitor the hood, change the settings, and deliver safety alerts immediately to Android and iOS devices.
 14. ADA Compliant base: Basis of design: Labconco, 3730410. The base shall be construction of 1.75" tubular, epoxy-coated steel frame with rear cross bar supports. The base dimension shall be 50.5" wide x 29" deep. The base shall feature telescoping legs with height adjustability in 1" increments from 27.5" to 34.5". The casters shall be 5" diameter, made of non-marking polyurethane and feature toe-locking and bearings for quiet operation.
 15. Only products meeting or exceeding this minimum standard shall be acceptable.
 16. Acceptable Alternative Manufacturers:
 - a. Air Master Systems Corporation: 6480 North Center Drive, Muskegon, MI 49441.
 - b. Air Science: 120 6th Street, Fort Myers, FL 33907
 - c. AirClean Systems: 2179 East Lyon Station Road, Creedmoor, NC 27522
- B. Benchtop Bio Safety Filtered Fume Hood (FH-2)
1. Basis of design: Erlab, Captair Bio 391 Smart – 1C1P
 2. Dimensions: 40" wide x 26-3/8" deep x 41-3/4" High.
 3. Air Flow: 245 m³/h – 144 CFM
 4. Sash type: Hinged sash
 5. Filtration module: Polypropylene
 6. Structure: Corrosion resistant electro-galvanized steel coated with anti-acid polymer. Side and front panels to be made of chemical resistant acrylic.
 7. Particulate Filter (1P): HEPA H14: The filtration technology traps particulates larger than 0.1 µm with 99.995% efficiency according to the MPPS method set forth in the EN 1822-1 standard.
 8. Carbon Filter (1C): Allows protection of your samples from VOCs.
 9. Particulate Pre-filter: Protect particulate filters from dust contained in the laboratory environment.
 10. Worksurface: Trespa Toplab
 11. Bactericidal UV Lights: 15W – Wavelength: 254nm; 0.13 mJ/ s/cm²
 12. Internal lighting: LED - IP 44 - 6000K; 950 lux
 13. Connectivity: RJ45 cable connection
 14. Electronic Anemometer: Anemometer monitors a drop in pressure that indicates pre-filter or filter replacement is required
 15. eGuard app: Mobile app for real time remote control of Smart devices
 16. Side panel utility ports: For allow electrical cables and/or fluid lines to enter the enclosure with ease - 2 per unit
 17. ADA Compliant base: Basis of design: Erlab 391 Bechcap. 39.6" wide x 38.3" deep x 34.9" High. 304 stainless steel construction.

2.9 COLORS

- A. Selected by the architect from the manufacturer's standard color selection. Color selection shall include no less than ten standard colors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install casework, components, and accessories under manufacturer representative's supervision whenever possible, using skilled labor especially trained for this work. Cabinets are to be installed in a professional and industry-accepted manner, including all scribes, moldings, and necessary trim, complete and in operating condition according to outlined plans and specifications.
- B. Set casework items plumb and square, securely anchored to building structure.
- C. Furnish and install casework complete with trim strips, fillers, backs, chase covers as required for finished assembly. All cutouts required for plumbing and electrical fixtures and utilities shall be made by the casework supplier.
- D. Coordinate electrical cut outs within casework.
- E. Field touch-up blemishes to original finish as approved and accepted by the Architect.
- F. Provide joint sealant for joints between work of this section and adjacent construction. Joint sealant materials and procedures shall comply with section 079200 – Joint Sealants.
- G. Coordinate installation of sealants to allow final Painting of installed sealants by Section – 099000 to occur in sequence with final painting of adjacent surfaces.

3.2 ADJUSTING

- A. Adjust doors, drawers, hardware and other moving or operating parts to function smoothly.
- B. Adjustable shelves shall be installed consistent with the shop drawings.

3.3 CLEANING

- A. All packaging material and installation-related debris shall be placed in an owner-provided dumpster on the construction site. The work area shall be left broom clean.
- B. Installer shall remove all pencil marks, adhesive and sawdust resulting from this work.
- C. Casework shall be cleaned inside and out to remove the installation related dust and debris.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.
- B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the Contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.
- C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by and to the satisfaction of the Architect.

END OF SECTION

SECTION 12 35 70

DENTAL CASEWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. Furnish all items of equipment listed in this Section and/or shown on the equipment drawings. Include delivery to the building, unpacking, setting in place, leveling and scribing panels to walls, soffits, and floors as required.
- B. Remove all debris, dirt and rubbish accumulated as a result of this installation and leave the premises clean and ready for use.
- C. Verify and confirm all building dimensions relative to equipment to be furnished and installed by taking actual field measurements at the job site prior to equipment fabrication.
- D. Become familiar with job conditions and building measurements to coordinate the planning, design, delivery, and installation of equipment furnished under these specifications, with all other related trades and associated work during the term of this contract.
- E. This Dental Cabinetry Subcontractor shall supply an installation of equipment that is equal to or exceeding the quality and function described in this minimum requirement Specification and shown on the Drawing.

1.3 SUBMITTALS

- A. Prepare and submit Shop Drawings in accordance with requirements of Division 1 and in the manner described therein.
- B. The Drawings shall be 1/4" scale and shall show the layout of all equipment. 1/2" scale Drawings shall be submitted for all fabricated or shop-made equipment.
- C. The exact location of all connections shall be dimensioned for all equipment and labeled with the necessary information. This Dental Cabinetry Subcontractor shall obtain and verify all dimensions, measurements, and conditions, and shall assume all responsibility in respect to same.
- D. No fabrication, shipment, or installation shall take place until drawings and manufacturer's cuts have been approved and returned to the Dental Cabinetry Subcontractor.

- D. LEED Submittal – refer to Division 01 Section “LEED v4 BD+C Requirements”
1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
 2. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified work comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - b. Include statement indicating costs for each certified wood product
 4. Product Data for Credit IEQ 4.1: For installation adhesives, including printed statement of VOC content.
 5. Product Data for Credit IEQ 4.4:
 - c. For each composite-wood product used, documentation indicating that the bonding agent contains no added urea formaldehyde.
 - d. For each adhesive used, documentation indicating that the adhesive contains no added urea formaldehyde.
 6. Plastic Components: Labeled with ASTM recycling code.

1.4 SAMPLES

- A. Submit samples of all materials required by the Architect.
- B. Samples shall be prepared and submitted in accordance with requirements of Division 1.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 PERMIT, LAWS, ORDINANCES AND CODES

- A. Comply with laws, ordinances, rules and regulations of all local, state and federal authorities having jurisdiction, the rules and regulations of the National Board of Fire Underwriters and the local electric code.

1.6 OPERATING INSTRUCTIONS AND MAINTENANCE MANUAL

- A. Instruct to the Owner's satisfaction such persons as the Owner designates, in the proper operation and maintenance of the equipment and their parts.
- B. Furnish in accordance with Division 1, operating and maintenance manuals and forward same to the Architect for transmittal to the Owner.
- C. For maintenance purposes, provide shop Drawings, parts lists, Specifications and manufacturer's maintenance bulletins for each piece of equipment.
- D. Provide name, address, and telephone number of the manufacturer's representative and service company for each piece of equipment, so that service or spare parts can be readily obtained.

1.7 GUARANTEE

- A. Attention is directed to provisions of Division 1 regarding guarantees and warranties for work under this Contract.

- B. Manufacturers shall provide their standard guarantees for work under this Section. However, such guarantees shall be in addition to and not in lieu of all other liabilities which manufacturers and the Dental Cabinetry Subcontractor may have by law or by other provisions of the Contract Documents.
- C. Upon receipt of notice from the Owner of failure of any part of the equipment during the guarantee period, the affected part or parts shall be replaced.
- D. Furnish, before the final payment is made, a written guarantee covering the above requirements.

PART 2 - PRODUCTS

- 2.1 Drawings for the Sterilization Room (labeled with "D" prefix) are based on Midmark, Synthesis Cabinetry – 60 Vista Drive, Versailles, OH 45380.
 - 1. The specifications outline a quality standard necessary for required performance. Only products, which meet or exceed these standards, shall be considered acceptable.
 - 2. Sizes and Configuration: As indicated on the Drawings.
 - 3. Metal Finish: 7 mil high performance finish applied to powdercoated steel frame.
- 2.2 METAL CASEWORK:
 - A. Cabinet:
 - 1. Powder coated 18 gauge cold rolled steel; multi-piece shell and frame design; riveted and press joined.
 - 2. Filler and Trim: Manufacturer's standard coordinated components.
 - B. Door:
 - 1. Front/Back: 12 Mil. Seamless polymer-covered front; melamine back.
 - 2. Core: 45 lb. LEED IEQ compliant MDF board, 3/4 inch thick. All composite wood material to meet CARB P2 emission std of CARB reg. 91320.2.
 - 3. Hinges shall be concealed type, self-closing, 110 deg. opening, nickel-plated metal, clip-on mount, three adjustment points.
 - 4. Pulls shall be 128mm ADA compliant.
 - C. Adjustable Shelving: Powdercoated 18 gauge cold rolled steel, painted to match cabinet color. Support clip shall be die cast zinc.
 - D. Locks:
 - 1. Doors: Manufacturer's standard Timberline, individually mounted, cam style lock with removeable plug. Locks shall be keyed alike with two keys per lock.
 - 2. Drawers: Manufacturer's standard Timberline lock body with removable lock plug with 14 gauge cold rolled steel pivoting lock bar for central lock system; locks keyed alike with two keys per lock.
 - E. Drawers: One piece molded polystyrene drawer bodies w/ rounded corners.
 - 1. Front/Back: 12 Mil. Seamless polymer-covered front; melamine back.
 - 2. Core: 45 lb. LEED IEQ compliant MDF board, 3/4 inch thick. All composite wood material to meet CARB P2 emission std of CARB reg. 91320.2.
 - 3. Slide: Accuride Aero (100 lb. capacity) ball bearing slides; Accuride Model 3832 (100 lb. capacity) for pullout writing surfaces and waste cans; and heavy duty Accuride Model 3640 (200 lb. capacity) slide for file drawers and heavy-duty pull-out shelves.
 - 4. Pulls shall be 128mm ADA compliant.

- F. Filler Panel/Leg Supports: LEED IEQ compliant MDF core. Composite wood material to meet CARB P2 emission standards of CARB regulation 91320.2
- G. Countertop
 - 1. Solid Surface Countertop and Curbs:
 - a. Provide products with LEED V4 compliant Material Ingredient Reporting.
 - b. Material: Homogeneous solid sheets of filled plastic resin complying with ISFA-2
 - 1) Flammability: Class 1 and A when tested to UL 723
 - 2) Food Equipment Material Compliance: Food Zone to NSF/ANSI 51.
 - 3) Adhesive for bonding to other products: one component silicone to ASTM C920
 - 4) Sealant: A mildew-resistant, FDA/UL and NSF/ANSI 51 compliant in Food Zone area, recognized silicone color matched sealant or clear silicone sealants.
 - c. Fabricate tops in largest pieces possible with integrated backsplash. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Comply with solid surface material manufacturer's recommendations for adhesives, sealers, fabrication and finishing.
 - d. Thickness: As indicated on drawings.
 - e. Substrate: Medium density moisture resistant fiberboard.
 - f. Joint Adhesive: Manufacturer's standard one or two-part adhesive kit to create inconspicuous, non-porous joints.
 - g. Reinforce joints with strip of polymer material. Provide holes and cutouts indicated on approved shop drawings. Rout cutouts and complete by sanding all edges smooth.
 - h. Colors: As selected by Architect from manufacturer's standards.
 - i. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dupont Corian
 - 2) Wilsonart LLC
 - 3) Formica Corporation
 - 4) Meganite
- H. Plumbing Fixtures: Sinks and faucets as scheduled on the Drawings, selected from manufacturer's standard options.
- I. Task Lights:
 - 1. Manufacturer: Light Corporation.
 - 2. Lengths: 17 inches and 31 inches as applicable.
 - 3. LED Rated Lifespan: 50,000 hours.
 - 4. Color Temperature: 3500K.
 - 5. Color Rendering Index: 84.
 - 6. Dimmer: Brightness adjustability, 100% to 15% with continuous touch-and hold.
 - 7. Automatic Turn-Off: 10 hours (plus or minus 15 minutes).
 - 8. Color Finish: Silver aluminum with white end caps.
 - 9. Housing material: Clear anodized aluminum.
 - 10. Cord Length: 9 feet with 15W power supply, or 12 feet with 60W power supply as applicable.
 - 11. Certifications: ETL, TAA, BAA.

PART 3 - EXECUTION

3.1 EXAMINATION AND ACCEPTANCE

- A. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of work shall be construed as acceptance of space conditions.
- B. This Dental Cabinetry Subcontractor shall obtain and verify all measurements and conditions on the job and shall assume all responsibility in respect to same.

3.2 CLEAN UP

- A. All debris and surplus materials resulting from installation work shall be removed promptly as work progresses by this Dental Cabinetry Subcontractor, to a location indicated by the General Contractor.
- B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.

3.3 PROTECTION OF WORK

- A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.
- B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the Contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.
- C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by and to the satisfaction of the Architect.

END OF SECTION

SECTION 124810

ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roll-up aluminum-tread rail floor mats with aluminum hinges.
 - 2. Carpet-type matting.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete work, including forming, placing, and finishing concrete floor slabs, and for concrete materials for grouting and filling around and under recessed mats and frames.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. LEED Submittals:
 - 1. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - a. For adhesives, submit test results, including TVOC emissions and VOC content.
 - b. For wet-applied products, submit volume used.
- C. Shop Drawings: Show the following:

1. Items penetrating floor mats and frames, including door control devices.
2. Divisions between mat sections.
3. Perimeter floor moldings.

D. Samples for Verification: For each type of product indicated.

1. Floor Mat: 12-inch- square, assembled sections of floor mat.
2. Frame Members: 12-inch- long Sample of each type and color.

E. Maintenance Data: For floor mat and frames to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.
- B. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and the Massachusetts Architectural Access Board.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor mats and frames.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Roll-up Aluminum Rail Hinged Mats:
 - a. AFCO-USA.
 - b. Balco, Inc.
 - c. Construction Specialties, Inc.
 - d. Mats Inc.
 - e. Nystrom.
 2. Carpet-Type Matting:
 - a. AFCO-USA.
 - b. Mats Inc.
 - c. Milliken.

- d. Nystrom.
- e. Shaw Contract.
- f. Tennessee Mat Company, Inc.

2.2 METAL FRAME MATERIALS

- A. Extruded Aluminum: ASTM B 221 alloy 6061-T6 or alloy 6063-T5, T6, or T52 as standard with manufacturer.

2.3 CONCRETE FILL AND GROUT MATERIALS

- A. Provide concrete materials complying with Section 033000 - CAST-IN-PLACE CONCRETE for grout and fill around and under recessed mats and frames that produce concrete equivalent in strength to cast-in-place concrete slabs. For concrete fill, adjust aggregate size to not exceed one-third fill thickness.

2.4 FLOOR MATS

- A. General: Provide colors, patterns, and profiles of materials, including metals and metal finishes indicated or specified. If not indicated, provide colors, patterns, and profiles selected by Architect from manufacturer's standards.
- B. Roll-up Aluminum Rail Hinged Mats: Clear-anodized finish, extruded-aluminum tread rails sitting on continuous vinyl cushions with 1-1/2-inch-wide by 3/8-inch-thick, tread rail modules. Provide aluminum hinges and 28-oz./sq. yd. weight, level-cut, nylon-pile, fusion-bonded carpet tread inserts].
 - 1. Tapered Rigid Frame: Tapered extruded-aluminum frame members, not less than 1-1/2 inches wide, with mitered corners and finish to match tread-slat extrusions.
- C. Loop Filament Matting: 3M's "Nomad" loop filament vinyl material 3/8 inch thick, with solid vinyl sheet backing and built-in chemical agents to reduce fungus and mildew. Provide color specified or scheduled or, if not specified or scheduled, as selected by Architect.
 - 1. Flexible Edging: 2-inch-minimum, vinyl edge strip in matching color, bonded to each end of mat material or backing sheet.
- D. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated.
 - 1. Low-Emitting Materials: Provide adhesives and sealants in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 2. VOC Content: 50 g/L or less.
 - 3. Do not use adhesives that contain urea formaldehyde.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives and sealants.

2.5 FABRICATION

- A. General: Where possible, verify sizes by field measurement before shop fabrication.
- B. Floor Mats: Shop fabricate units to greatest extent possible in sizes as indicated. If not otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- C. Recessed Metal Mat Frames: Extruded aluminum of size and style to fit floor mat type specified, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
 - 1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
- D. With manufacturer's standard protective coating, coat surfaces of aluminum frames that will contact cementitious material.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.
 - 1. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
 - 2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.
- B. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION

SECTION 124820

ENTRANCE FLOOR GRILLES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Recessed stainless foot grilles and frames.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Division 03 Section "Cast-In-Place Concrete": for concrete floor substrate receiving the entrance tile flooring finish.
 - 2. Division 03 Section "Concrete Moisture Vapor Alkalinity Control System": for concrete floor substrate moisture vapor mitigation.
 - 3. Division 08 Section "Aluminum -Framed Entrances and Storefronts - Exterior": for abutting aluminum thresholds at aluminum entrances.
 - 4. Division 08 Section "Door Hardware": for abutting thresholds.
 - 5. Division 09 – Finishes: for various abutting finish flooring.
 - 6. Division 09 Section "Rubber Wall Base": for abutting finish wall base.

1.3 SUBMITTALS

- A. Product data: Manufacturer's technical product specifications, performance data, physical properties, for each item furnished hereunder, including floor mat , accessories, adhesives, and leveling materials. Include manufacturer's application methods or installation instructions for each item furnished hereunder.
 - 1. Certified test reports showing compliance with specified performance characteristics and physical properties
 - 2. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation.

- B. Verification samples: After initial selection of tread insert swatches has been made by the Architect: 18 by 36 inch sample of selected floor mat for final approval of the Architect. Approved samples shall be used as the standard of quality and colors for materials furnished under this Contract.
- C. LEED Submittals: prepare and submit required documentation for the work of this Section in accordance with USGBC LEED Reference Guide for Building Design and Construction (v4) and Division 01 Section "LEED v4 BD+C: School Requirements".
 - 1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
 - 2. Building product disclosure and optimization: Provide required documentation to secure the maximum MR credits, including but not limited to:
 - a. Environmental product declarations.
 - b. Sourcing of raw materials.
 - c. Material ingredients.
 - 3. Project material cost data: Provide invoices, receipts, statements, and other evidence required to document total cost for materials used for Project.
 - 4. Waste management and disposal records complying with Division 01 Section "Construction Waste Management and Disposal".
 - a. For products diverted from disposal in landfills and incinerators, and where recycled resources are directed back to the manufacturing process. Include a statement indicating percentage of materials diverted and recycled and the costs associated with each.
- D. Shop Drawings: Show the following:
 - 1. Items penetrating floor grilles and frames, including door control devices.
 - 2. Divisions between grille sections.
 - 3. Perimeter floor moldings.
- E. Samples for Initial Selection: For each type of product indicated.
 - 1. Floor Grille: 12-inch- square, assembled sections of floor grille.
 - 2. Frame Members: 12-inch- long Sample of each type and color.
- F. Maintenance Data: For floor grille and frames to include in maintenance manuals.

1.4 REFERENCES

- A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. The Standards listed here are identified with a designation number, title or other designation established by the issuing authority.
 - 1. American Society for Testing and Materials (ASTM):
 - 2. ASTM C1028 Static Coefficient of Friction
 - 3. ASTM E648 Critical Radiant FLux

B. Massachusetts:

1. 521 CMR – Massachusetts Architectural Access Board Regulations.
2. 780 CMR – Massachusetts State Building Code

C. Sustainability:

1. LEED v4 BD+C:School.

1.5 QUALITY ASSURANCE

- A. Installer: Installer should be 5_year_experienced in performing work of this section, having previously done work similar to that required for this project.
- B. Source Limitations: Obtain floor grilles and frames through one source from a single manufacturer.
- C. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and the Massachusetts Architectural Access Board.

1.6 DELIVERY STORAGE AND HANDLING

- A. Delivery: Deliver materials in Manufacturer's original, unopened, undamaged packaging.
- B. Storage: Store materials at temperature and in humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.
1. Store all mat materials under cover in dry, well-ventilated spaces as soon as delivered. Protect floor matting from damage, dirt, stain, moisture, and mildew.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor grilles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the requirements specified herein, provide products from one of the following listed manufacturers:
1. Mats Inc. Stoughton MA.
 2. Space-Links Inc Youngstown, OH.

3. HiLine Inc. Minneapolis, Minnesota.
4. Or equal.

B. Basis of Design: "Ultra Entry" as manufactured by Mats Inc. Stoughton MA.

C. Designated on drawings as FGC.

2.2 MATERIALS

A. Vinyl Foot Grid: Constructed from 30 percent post-industrial recycled polyvinyl chloride (PVC) if gray or other colors, and up to 100 percent post-industrial recycled PVC if black. Welded in a non-hinged, grille design with an embossed non-skid surface, (non-embossed surfaces not acceptable) to sizes indicated with the following characteristics:

1. Extruded PVC Grid, "Gray" color, with polyamide nylon 6.6 fiber insert in "Dark Gray" color.

B. Framing and Nosing Accessories for Vinyl Foot Grille

1. Recessed Application: 3/8": provide mill finish aluminum, "J" frame or "R" frame. Provide 3/8" "T" Section Divider where necessary.
2. Surface Mounted Application: provide 3/8" inches grid and beveled, heavy-duty attached nosing.

C. Product Testing for Vinyl Foot Grille:

1. ASTM:
 - a. ASTM C1028 Static Coefficient of Friction: Wet, 1.01; Dry, 0.97.
 - b. ASTM E648 Critical Radiant Flux: Class 1.

D. LEED v4:

1. MR Sources of Raw Materials Credit: Black 86% pre-consumer, 1.4% post consumer and Gray 27.52% pre-consumer, 1.4% post-consumer.
2. MR Regional Material Credit: Material must be manufactured within 100 miles of project location.
3. IEQ Enhanced Indoor Quality Strategies Credit: LEED acceptable permanent entryway system.

2.3 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete materials complying with Section 033000 - CAST-IN-PLACE CONCRETE for grout and fill around and under recessed grilles that produce concrete equivalent in strength to cast-in-place concrete slabs. For concrete fill, adjust aggregate size to not exceed one-third fill thickness.

2.4 FOOT GRILLES

- A. General: Provide manufacturer's standard foot-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.
- B. Stainless-Steel Foot Grille: Type 304.
 - 1. Surface Treads: Cross-cut square grid.
 - 2. Support Rods: Spaced 1 inch o.c., welded to each wire.
 - 3. Mat Grating: 5/8 inch deep.
 - 4. Pit Grating: 1-1/8 inches deep.
 - 5. Stainless-Steel Finish: No. 4 finish.
 - 6. Grille Size: As indicated.
- C. Lockdown: Manufacturer's standard hidden.

2.5 FRAMES

- A. Provide manufacturer's standard frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

2.6 SUPPORT SYSTEM

- A. Level Bed Applications: Provide manufacturer's standard, vinyl cushion support system.

2.7 FABRICATION

- A. Shop fabricate foot grilles to greatest extent possible in sizes as indicated. Unless otherwise indicated, provide each grille as a single unit; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in grilles are necessary, space symmetrically and away from normal traffic lanes.
- B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.9 STAINLESS-STEEL FINISHES

- A. Directional Satin Finish: No. 4.

1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor grilles.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install recessed grille frames to comply with manufacturer's written instructions. Set grille tops at height recommended by manufacturer for most effective cleaning action; coordinate top of grille surfaces with bottom of doors that swing across grilles to provide clearance between door and grille.
 1. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
 2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under grilles. Finish grout and fill smooth and level.

3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.
- B. Defer installation of floor grilles until Project is near Substantial Completion.

END OF SECTION

SECTION 126600
TELESCOPING STANDS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Attention is directed to the Contract and General conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, the following:
 - 1. Motorized, wall-attached telescoping bleachers.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council
 - 1. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
 - 2. Refer to Section 018111, SUSTAINABLE DESIGN REFERENCE DOCUMENTS.
- C. Related work includes but is not limited to the following work covered in other sections:
 - 1. Wood flooring at gymnasium: Section 096466 – Wood Athletic Flooring.
 - 2. Finish painting, except as specified herein: Section 099000 – Painting and Coating.
 - 3. Gymnasium equipment, except as specified herein; Section 116600 – Athletic Equipment.
 - 4. Rough-in and final connection of electrical work: Section 260000 – Electrical.
 - 5. Bracing and support framing for wall-attached telescoping bleachers: Section 054000 – Cold-Formed Metal Framing.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Engineer, fabricate and install telescopic seating systems to support the following loads without exceeding allowable design working stresses of materials involved, including anchors and connections.
- B. Seat Assembly: Bleachers shall support, in addition to their own weight, the following:

1. Uniformly distributed live load: Not less than 100 pounds per square foot of gross horizontal projection.
 2. All seat and footboard members shall be designed for live loads of not less than 120 pounds per linear foot.
 3. Bleachers shall resist a horizontal sway force applied to the seats in a direction parallel to their length of 24 pounds per linear foot and a force of 10 pounds per linear foot perpendicular to length of seats.
- C. Railings, posts and sockets shall be designed to withstand 50 pounds per foot acting outward at top rail and 25 pounds per foot acting outward at mid-rail, applied separately.
- D. Units shall comply with all applicable codes.

1.4 SUBMITTALS

- A. Prepare and submit the following submittals in accordance with the requirements of Section 013300 – Submittals.
- B. LEED Submittal: For each product specified, complete the PRODUCT DATA REPORTING FORM for LEED v4 PRODUCTS – See Section 018110 – SUSTAINABLE DESIGN REQUIREMENTS. All columns of information must be completed, and back-up documentation provided for all attributes being claimed as pertaining to the following credits:
1. MR Credit: Building Product Disclosure and Optimization (BPDO) – Environmental Product Declarations (EPD); See Section 018110 - 2.3B.
 2. MR Credit: Building Product Disclosure and Optimization (BPDO) – Sourcing of Raw Materials; See Section 018110 - 2.3C.
 3. MR Credit: Building Product Disclosure and Optimization (BPDO) – Material Ingredients; See Section 018110 - 2.3D.
- C. Product Data: Submit manufacturer's product data demonstrating that products meet the requirements specified herein.
- D. Shop Drawings; Submit Shop Drawings of all telescoping bleacher work for Architect's approval before fabrication.
1. Shop Drawings shall be at not less than 1/4" scale with details of fabricated items at 1/2" scale or larger.
 2. Show all dimensions, details of construction, details of installation, electrical connections, relation of adjoining work, reinforcement, welds, fastenings, anchorage and specifications of shop finishes.
 3. Show special graphics and logo.
 4. Take field measurements where required.
 5. Do no work without approved Shop Drawings.
- E. Calculations: Submit certified engineering calculations indicating forces impacting framing in adjacent wall assemblies. Coordinate with Section 054000 - Cold-Formed Metal Framing.
- F. Furnish samples of all materials and finishes requested by Architect.
- G. Qualification Data: For professional engineer licensed in the project location.

1.5 QUALITY ASSURANCE

- A. Certification by a Professional Engineer registered in the Commonwealth of Massachusetts that the equipment meets or exceeds the design criteria specified herein and all applicable Code requirements.

1.6 OPERATING INSTRUCTIONS AND MAINTENANCE MANUAL

- A. Instruct to the Owner's satisfaction such persons as the Owner designates, in the proper operation and maintenance of the equipment and its parts.
- B. Furnish in accordance with requirements of Division 1, operating and maintenance manuals and forward same to the Architect for transmittal to the Owner.
- C. For maintenance purposes, provide Shop Drawings, Specifications and manufacturer's maintenance bulletins for each piece of equipment.
- D. Provide name, address and telephone number of the manufacturer's representative and service company for each piece of equipment, so that service and spare parts can be readily obtained.

1.7 GUARANTEE

- A. Attention is directed to provisions of the GENERAL CONDITIONS regarding guarantees and warranties for work under this Contract.
- B. Manufacturers shall provide its standard guarantees for work under this Section. However, such guarantees shall be in addition to and not in lieu of all other liabilities which manufacturer and Contractor may have by law or by other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
 - 1. Hussey Seating Co.
 - 2. Interkal Inc.
 - 3. Universal Gym Equipment.
 - 4. Approved equal.
- B. Basis of Design: Products below are designated in terms of names of products manufactured by Hussey Seating, Inc., to establish the general character and materials required for telescoping seating for this project. Equivalent products by acceptable manufacturers will be approved.
 - 1. Product: MAXAM Telescopic Gym Seat System by Hussey Seating Company
 - a. Model: MAXAM26 Series Telescopic Gym Seats, adjustable row spacing in two inch increments from 22 inches to 26 inches.

- b. Aisle Type: foot level aisles, front steps and intermediate aisle steps.
 - c. Seat Type: 10" Courtside plastic seat modules
 - 1) Seat color finish: As selected by Architect from manufacturers standard colors; allow for three (3) colors in random pattern.
 - 2) Graphics: Large scale decorative graphic logo applied to front vertical surface of seat modules and intermediate aisle steps; StepSign Graphic Logo by Hussey Seating System. Graphics to match artwork supplied by Architect.
 - d. Rail Type: Self-storing end rail and store-in-place aisle hand rails.
 - 1) Rail color finish: As selected by Architect from manufacturer's standard colors.
 - e. Operation: electrical power.
 - 1) Electrical Power System: Integral power with pendant control.
2. Product Description/Criteria:
- a. Bank Length: 7 banks at 20'-6" and 1 bank at 22'-0".
 - b. Aisle Widths: 4'-6"
 - c. Net Capacity: 993 net seats total
3. Handicap Seating Provisions: Provide recoverable Flex Row handicapped locations to comply with ADA, as noted on drawings.
4. Special Seating Graphics: Provide contrasting or matching seats to create graphic pattern matching artwork supplied by Architect.

2.2 MATERIALS

- A. Lumber: ANSI/Voluntary Product 20, B & B Southern Pine
- B. Plywood: ANSI/Voluntary Product PS1, APA A-C Exterior Grade.
- C. Structural Steel Shapes, Plates and Bars: ASTM A 36.
- D. Uncoated Steel Strip (Non-Structural Components): ASTM A569, Commercial Quality, Hot-Rolled Strip.
- E. Uncoated Steel Strip (Structural Components): ASTM A570 Grade 33, 40, 45, or 50, Structural Quality, Hot-Rolled Strip.
- F. Uncoated Steel Strip (Structural Components): ASTM A607 Grade 45 or 50, High-Strength, Low Alloy, Hot-Rolled Strip.
- G. Galvanized Steel Strip: ASTM A653 Grade 40, zinc coated by the hot-dip process, structural quality.
- H. Structural Tubing: ASTM A500 Grade B, cold-formed.
- I. Polyethylene Plastic: ASTM D 1248, Type III, Class B; molded, color-pigmented, textured, impact-resistant, structural formulation; as selected by Architect from manufacturer's standard colors. Allow for three (3) colors.
- J. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.3 UNDERSTRUCTURE FABRICATION

A. Frame System:

1. Wheels: Not less than 5" diameter by 1 1/4" with non-marring soft rubber face to protect wood floor surfaces, with molded-in sintered iron oil-impregnated bushings to fit 3/8" diameter axles secured with E-type snap rings.
2. Lower Track: Continuous Positive Interglide System interlocks each adjacent CPI unit using an integral, continuous, anti-drift feature and through-bolted guide at front to prevent separation and misalignment. CPI units at end sections of powered banks and manual sections shall contain a Low Profile Posi-Lock LX to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.
3. Slant Columns: High tensile steel, tubular shape.
4. Sway Bracing: High tensile steel members through-bolted to columns.
5. Deck Stabilizer: High tensile steel member through-bolted to nose and riser at three locations per section. Interlocks with adjacent stabilizer on upper tier using low-friction nylon roller to prevent separation and misalignment. Incorporates multiple stops to allow field adjustment of row spacings.
6. Deck Support: Securely captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section.

B. Deck System:

1. Section Lengths: Each bank shall contain sections not to exceed 25'-6" in length with a minimum of two supporting frames per row, each section.
2. Nose beam and Rear Riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653 grade 40, Riser beam shall be continuously roll-formed of ASTM A653 grade 40. Nose and Riser beam shall be designed with no steel edges exposed to spectator after product assembly.
3. Attachment: Through-Bolted fore/aft to deck stabilizers, and frame cantilevers.
4. Decking: 5/8", AC grade, interior type with exterior glue, 5-ply, all plies Douglas Fir or Southern Pine, as standard with manufacturer, with plugged crossbands, produced in accordance with National Bureau of Standards PS-1-97. Plywood shall be cut and installed with top, center and bottom ply grain-oriented from front of deck to rear of deck (nose beam to riser beam). Adjacent pieces shall be locked together with tongue and groove joint from front to rear of deck. Longest unsupported span: MAXAM 26, 21 1/2".
5. Deck End Overhang: Not to exceed frame support by more than 5'-7".

2.4 SEATING FABRICATION

A. Plastic Seat System:

1. Seat Modules: 18" long assembled, injection-molded, high density polyethylene modules which provide scuff resistant textured 10" wide seat surface with 1/2" minimum interlock on seat and face. Unit structural tested to 360 lbs occupant load.
2. Comfort Profile: Designed with anatomically contoured seat surface using multiple internal reinforcement ribs that allow form-fit deflection for maximum spectator comfort. Cantilevered to the rear to provide not less than 3" smooth toe space beneath the seat.
3. Seat Support: Each plastic seat module shall be supported by internal steel structural members secured against fore/aft movement by 3/8" grade 5 steel fasteners creating a steel-to-steel connection, tying the seat structure firmly to the steel nose beam.

4. Number Plates: Seat module shall have recessed pockets to accept seat number plates.
5. End Caps: Each end of row shall be enclosed with matching end caps. End caps shall be designed flush with end-edge of seat top and provide indent for row letters. Color to match seat top.

2.5 SHOP FINISHES

- A. Understructure: For rust resistance, steel understructure shall be finished on all surfaces with black "Dura-Coat" enamel. Understructure finish shall contain a silicone additive to improve scratch resistance of finish.
- B. Wear Surfaces: Surface subject to normal wear by spectators shall have a finish that does not wear to show different color underneath:
 1. Steel nosing and rear risers shall be pre-galvanized with a minimum spangle of G-60 zinc plating.
 2. Decking shall have use-surfaces to receive both a sealer coat and wear-resistant high gloss clear urethane finish. Decking shall have 0.030" laminated polyethylene wear surface.
 3. Injection Molded plastic seats to be selected from (15) fifteen standard colors. Colors shall be per manufacturer's standards. Allow for three (3) colors.
- C. Railings: Steel railings shall be finished with powder-coated semi - gloss colors.

2.6 FASTENINGS:

- A. Welds: Performed by welders certified by AWS standards for the process employed.
- B. Structural Connections: Secured by structural bolts with prevailing torque lock nuts, free-spinning nuts in combination with lock washers, or Riv-nuts in combination with lock washers.

2.7 ELECTRICAL OPERATION

- A. Integral Power: Furnish and install Hussey PF2, an integral automatic electro-mechanical powered frame propulsion system, to open and close telescopic seating. Integral Power and Control System shall be Underwriters Laboratories, Inc. (UL) approved and listed.
 1. Operation shall be with a removable pendant control unit which plugs into seating bank for operator management of stop, start, forward, and reverse control of the power operation.
 2. Each Powered Frame unit shall consist of output shaft gear reducer with 6" diameter x 4" wide wheels covered with non-marring 1/2" thick composite rubber. Reducers shall be fitted with 3 phase induction motors which will provide an average operating speed of (46/25) f.p.m.
 3. Operating Loads: Each Powered Frame provides (220 / 550) lbs pull force which equals approximately (28 / 35) psi lateral force on the floor..
 4. Electrical: Seating Manufacturer shall provide all wiring within seating bank including pendant control.
 - a. Each unit for PF2 is power operated by a 1/2 horsepower, 1725 R.P.M., 208 Volts,

50/60 Hz., three phase 1.25 service factor motor. This motor draws a full load current of 2.2 amperes. Power supply required shall be 120/208 volts three phase 5 wire plus ground service with 20 amps. Motors, housing, and wiring shall be installed and grounded in complete accord with the National Electrical Code.

2.8 ACCESSORIES

- A. Front Aisle Steps: Provide at each vertical aisle location front aisle step. Front steps shall engage with front row to prevent accidental separation or movement. Steps shall be fitted with four non-skid rubber feet each 1/2" in diameter. Blow molded end caps shall have full radius on all four edges. Quantity and location as indicated.
- B. Non-Slip Tread: Provide at front edge of each aisle location an adhesive-backed abrasive non-slip tread surface.
- C. Foot Level Aisles: Provide deck level full width vertical aisles located as indicated.
- D. Intermediate Automatic Rotating Aisle Handrails: Provide single pedestal mount handrails 34" high with terminating mid rail. Permanently attached handrail shall rotate in a permanently mounted socket for rail storage. Rail shall automatically rotate, lock in the use position, unlock and rotate back to the stowed position as the gym seats open and close. Ends of the handrail shall return to the post, and not extend away from it.
- E. Self Storing End Rails: Provide steel self-storing 42" high above seat, end rail with tubular supports and intermediate members designed with 4" sphere passage requirements.
- F. Safety Accessories: Provide the following safety features:
 - 1. Coin Round or Roll all edges of exposed metal on top and underneath Bleacher to eliminate sharp edges. Provide safety ease edges, coined edges, or rounded edges for the bleacher understructure components, including but not limited to, diagonal or X braces and deck support or deck stabilizers. Systems provided with sharp edges or corners, to be rounded off in the field and field painted.
 - 2. Provide plastic end cap on nose metal at Bank ends to close off edges to prevent spectator injury.
 - 3. Provide plastic end cap on back of deck supports on 1st 7 Rows to prevent spectator injury.
 - 4. On 1st Row, provide front and side skirt boards any where there is an exposed end to prevent players/balls from sliding underneath the 1st Row.
 - 5. Provide metal cover over motor chains and wheels to protect chains from debris and provide a safety switch that if cover is taken off the power system will not work.
 - 6. Provide metal end deck cover on each row to cover exposed edge of plywood at the ends of the bleachers.
 - 7. Powered frames systems without a metal protective housing, covering drive chain and drive wheels are not permitted under this specification
 - 8. Top seat flush filler mounted between top seat and rear wall.
 - 9. Audio-visual warning that activates when bleachers are in motion.
- G. Flex-Row: Provide first row modular recoverable seating units to be utilized by persons in wheelchairs and able-bodied persons. Each Flex-Row unit shall have an unlock handle for easy deployment if wheelchair or team seating access is needed. Unlock handle shall lock the bleacher seats into position when fully opened.

1. Provide a black full-surround steel skirting with no more than ¾" floor clearance for safety and improved aesthetics.
 2. Provide a black injection molded end cap for the nose beam for safety and improved aesthetics.
 3. Provide a mechanical positive lock when the Flex-Row system is in the open and used position.
 4. Flex-Row modular units are designed to achieve multi-use front row seating to accommodate team seating, ADA requirements and facility specific requirements. Flex-Row units are available in modular units from 2 to 7 seats wide as well as full section widths.
 5. Provide Flex-Row modular unit in each bank of bleachers in quantity as required by accessibility regulations.
- H. End Closure Curtains: Provide closure curtains fabricated of vinyl-coated 14oz Polyester fabric on open ends of telescopic seating. Curtains to be permanently attached to wall or rear closure panel and secured to individual rows of seating. Curtain to open with seating unit into taut secure configuration and fold automatically as seating unit closes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify area to receive telescoping gym seats are free of impediments interfering with installation and condition of installation substrates are acceptable to receive telescoping gym seats in accordance with telescoping gym seats manufacturer's recommendations. Do not commence installation until conditions are satisfactory.

3.2 INSTALLATION

- A. Manufacturer's Recommendations: Comply with telescoping gym seats manufacturer's recommendations for product installation requirements.
- B. General: Manufacturer's Certified Installers to install telescoping gym seats in accordance with manufacturer's installation instructions and final shop drawings. Provide accessories, anchors, fasteners, inserts and other items for installation of telescoping gym seats and for permanent attachment to adjoining construction.
- C. Coordinate with electrical trades for connections to building power.

3.3 ADJUSTMENT AND CLEANING

- A. Adjustment: After installation completion, test and adjust each telescoping gym seats assembly to operate in compliance with manufacturer's operations manual.
- B. Cleaning: Clean installed telescoping gym seats on both exposed and semi-exposed surfaces. Touch-up finishes to restore damage or soiled surfaces.

3.4 PROTECTION

- A. General: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer to ensure telescoping gym seats are without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 126623

TELESCOPIC CHAIR PLATFORM

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wall attached Telescoping Platform Seating includes, either manually or electrically operated systems of multiple-tiered seating rows comprising of seat, deck components, understructure that permits closing without requiring dismantling, into a nested configuration for storing or for moving purposes.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 – CAST IN PLACE CONCRETE for leveling requirements
 - 2. Section 061000 – ROUGH CARPENTRY for in wall blocking
 - 3. Section 087100 - DOOR HARDWARE for gate interlock.
 - 4. Section 092110 – GYPSUM BOARD ASSEMBLIES for anchoring, plumbness and support of unit
 - 5. Section 096516 – RESILIENT FLOORING AND ACCESSORIES.
 - 6. Division 26 – ELECTRICAL.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer, fabricate and install telescopic gym seating systems to the following structural loads without exceeding allowable design working stresses of materials involved, including anchors and connections. Apply each load to produce maximum stress in each respective component of each gym seat unit.
 - 1. Design Loads: Comply with ICC 300
- A. Manufacturer's System Design Criteria:
 - 1. Gymnasium seat assembly; Design to support and resist, in addition to it's own weight, the following forces:
 - a. Live load of 120 lbs per linear foot [162.69 N/m] on seats and decking

- b. Uniformly distributed live load of not less than 100 lbs per sq. ft. [135.58N/m] of gross horizontal projection.
 - c. Parallel sway load of 24 lbs. [32.53 N/m] per linear foot of row combined with (b.) above
 - d. Perpendicular sway load of 10 lbs. [13.56 N-m] per linear foot of row combined with (b.) above
2. Hand Railings, Posts and Supports: Engineered to withstand the following forces applied separately:
 - a. Concentrated load of 200 lbs. [90.72 kg] applied at any point and in any direction.
 - b. Uniform load of 50 lbs. per foot [.344 N/mm2] applied in any direction.
3. Guard Railings, Post and Supports: Engineered to withstand the following forces applied separately:
 - a. Concentrated load of 200 lbs. [90.72 kg] applied at any point and in any direction along top rail.
 - b. Uniform load of 50 lbs. per foot [.344 N/mm2] applied horizontally at top rail and a simultaneous uniform load of 100 lbs. per foot [.689 N/mm2] applied vertically downward.
4. Member Sizes and Connections: Design criteria (current edition) of the following shall be the basis for calculation of member sizes and connections:
 - a. AISC: Manual of Steel Construction
 - b. AISI: Specification for Design of Cold Formed Steel Structural Members
 - c. AA: Specification for Aluminum Structures

B. NFOPA: National Design Guide For Wood Construction

1. Chairs
 - a. Seats:
 - b. Shall be cantilevered, self-centering, automatic three-quarters lift with over center retracting feature for ease of row passage and janitorial access.
 - c. Seat shall be tested and professionally certified through an independent testing laboratory to support and withstand an evenly distributed 600 lb [2669 N] static load without failure or irregularities that would impair usefulness.
 - d. Self-lifting seat shall be tested and professionally certified through an independent testing laboratory to withstand 350,000 operating cycles without failure of seat mechanism or measurable component wear.
 - e. Seat shall be tested and professionally certified to withstand 10,000 impacts of a 40 lb [178 N] sandbag dropped on the center of the seat from each of the following heights: 6"[152mm], 8"[203mm], 10"[254mm], and 12"[305mm]. The rate of impacts shall be approximately 18 per minute with the total quantity of impacts equaling 40,000.
2. Backs:
 - a. Back shall withstand an evenly distributed front or rear static load of 450 lbs [2002 N].
 - b. Back shall be tested and professionally certified to withstand, without failure, 40,000 swinging impacts each to the front and rear of the back by means of two opposing

40 lb. [18 Kg] sandbags. The sandbags shall be moved horizontally and equally for 10,000 cycles each at the following distances of 6"[152mm], 8"[203mm], 10"[254mm], and 12"[305mm] at a rate of 35 cycles per minute.

- c. Back shall withstand, without failure, an evenly distributed Horizontal Traverse Static Load of 200 lbs [890 N] The load shall be applied to the top of the back at a 45-degree angle to the row of seats.

- 3. Armrests shall be tested and professionally certified to withstand, without failure, a 200 lb [890 N] static load applied both perpendicular to and vertically down on the arm.
- 4. Materials (Flammability) shall satisfy applicable test, codes, standards, or requirements as follows:
 - a. Copolymer polypropylene shall have a burn rate of 1 inch [25 mm] per minute or less per ASTM 635.
 - b. Upholstery materials shall meet requirements as set forth in the state of California Bureau of Home Furnishings Technical Bulletin 117.
 - c. Fire-performance Characteristics of Seat Padding: Provide seating that complies with test method: California Technical Bulletin 117.
 - d. Cushioning and padding shall be self-extinguishing as defined in the requirements as set forth in the State of California Bureau of Home Furnishings Technical Bulletin 117.
 - e.

C. Minimum Flooring Requirements:

- 5. Flooring shall be level and rear wall plumb within 1/8" [3mm] in 8'-0 [2438mm]. Maximum bleacher force on the floor, of a 25'-6" [7772] section, shall be a static point load of less than 300 psi [2.068 N/mm²].

1.4 MANUFACTURERS SYSTEM ENGINEERING DESCRIPTION

- A. Structural Performance: Engineer, fabricate and install telescopic gym seating systems to the following structural loads without exceeding allowable design working stresses of materials involved, including anchors and connections. Apply each load to produce maximum stress in each respective component of each gym seat unit.

- 1. Design Loads: Comply with ICC 300

B. Manufacturer's System Design Criteria:

- 1. Gymnasium seat assembly; Design to support and resist, in addition to it's own weight, the following forces:
 - a. Live load of 120 lbs per linear foot [162.69 N/m] on seats and decking
 - b. Uniformly distributed live load of not less than 100 lbs per sq. ft. [135.58N/m] of gross horizontal projection.
 - c. Parallel sway load of 24 lbs. [32.53 N/m] per linear foot of row combined with (b.) above
 - d. Perpendicular sway load of 10 lbs. [13.56 N-m] per linear foot of row combined with (b.) above

2. Hand Railings, Posts and Supports: Engineered to withstand the following forces applied separately:
 - a. Concentrated load of 200 lbs. [90.72 kg] applied at any point and in any direction.
 - b. Uniform load of 50 lbs. per foot [.344 N/mm²] applied in any direction.
 3. Guard Railings, Post and Supports: Engineered to withstand the following forces applied separately:
 - a. Concentrated load of 200 lbs. [90.72 kg] applied at any point and in any direction along top rail.
 - b. Uniform load of 50 lbs. per foot [.344 N/mm²] applied horizontally at top rail and a simultaneous uniform load of 100 lbs. per foot [.689 N/mm²] applied vertically downward.
 4. Member Sizes and Connections: Design criteria (current edition) of the following shall be the basis for calculation of member sizes and connections:
 - a. AISC: Manual of Steel Construction
 - b. AISI: Specification for Design of Cold Formed Steel Structural Members
 - c. AA: Specification for Aluminum Structures
- D. NFOPA: National Design Guide For Wood Construction.
- Chairs
1. Seats:
 - a. Shall be cantilevered, self-centering, automatic three-quarters lift with over center retracting feature for ease of row passage and janitorial access.
 - b. Seat shall be tested and professionally certified through an independent testing laboratory to support and withstand an evenly distributed 600 lb [2669 N] static load without failure or irregularities that would impair usefulness.
 - c. Self-lifting seat shall be tested and professionally certified through an independent testing laboratory to withstand 350,000 operating cycles without failure of seat mechanism or measurable component wear.
 - d. Seat shall be tested and professionally certified to withstand 10,000 impacts of a 40 lb [178 N] sandbag dropped on the center of the seat from each of the following heights: 6"[152mm], 8"[203mm], 10"[254mm], and 12"[305mm]. The rate of impacts shall be approximately 18 per minute with the total quantity of impacts equaling 40,000.
 2. Backs:
 - a. Back shall withstand an evenly distributed front or rear static load of 450 lbs [2002 N].
 - b. Back shall be tested and professionally certified to withstand, without failure, 40,000 swinging impacts each to the front and rear of the back by means of two opposing 40 lb. [18 Kg] sandbags. The sandbags shall be moved horizontally and equally for 10,000 cycles each at the following distances of 6"[152mm], 8"[203mm], 10"[254mm], and 12"[305mm] at a rate of 35 cycles per minute.

- c. Back shall withstand, without failure, an evenly distributed Horizontal Traverse Static Load of 200 lbs [890 N] The load shall be applied to the top of the back at a 45-degree angle to the row of seats.
 3. Armrests shall be tested and professionally certified to withstand, without failure, a 200 lb [890 N] static load applied both perpendicular to and vertically down on the arm.
 4. Materials (Flammability) shall satisfy applicable test, codes, standards, or requirements as follows:
 - a. Copolymer polypropylene shall have a burn rate of 1 inch [25 mm] per minute or less per ASTM 635.
 - b. Upholstery materials shall meet requirements as set forth in the state of California Bureau of Home Furnishings Technical Bulletin 117.
 - c. Fire-performance Characteristics of Seat Padding: Provide seating that complies with test method: California Technical Bulletin 117.
 - d. Cushioning and padding shall be self-extinguishing as defined in the requirements as set forth in the State of California Bureau of Home Furnishings Technical Bulletin 117.
- C. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:

1.5 REFERENCE

1. ICC 300 – Standard for Bleachers, Folding and Telescopic Seating and Grandstands
2. American Welding Society (AWS)
3. AWS D1.1 Structural Welding Code – Steel
4. WS D1.3 Structural Welding Code - Sheet Steel
5. American Institute of Steel Construction (AISC):
6. AISC - Design of Hot Rolled Steel Structural Members.
7. American National Standards Institute (ANSI).
8. American Iron & Steel Institute (AISI):
9. AISI - Design Cold Formed Steel Structural Members.
10. Aluminum Association (AA):
11. AA - Aluminum Structures, Construction Manual Series.
12. American Society for Testing Materials (ASTM):
13. ASTM - Standard Specification for Properties of Materials.

14. National Forest Products Association (NFoPA):
15. NFoPA - National Design Specification for Wood Construction.
16. Southern Pine Inspection Bureau (SPIB):
17. SPIB - Standard Grading Rules for Southern Pine.
18. National Bureau of Standards/Products Standard (NBS/PS):
19. PS1 - Construction and Industrial Plywood.

1.6 SUBMITTALS

- A. Product to be supplied shall have a current evaluation report issued by ICC Evaluation Services (ICC-ES) certifying that it meets all structural design requirements of the current ICC 300 Standard for Bleachers, Folding and Telescopic Seating, and Grandstands, including all specified load combinations.
- B. Provide Current Welding Certification[s] AWS or CSA.
- C. Provide Manufacturers Certification of Insurance coverage of not less than \$5,000,000 and Errors and Omission Insurance of not less than \$2,000,000
- D. Provide Installer Name, Current Certification Number and Product Qualifications
- E. Provide Manufacturers' standard warranty documents.
- F. Shop Drawings: For telescoping stands in both stacked and extended positions. Show seat heights, row spacing and rise, aisle widths and locations, assembly dimensions, anchorage to supporting structure, material types and finishes.
 1. Electrical: Indicate power supply requirements.
 2. Graphic Drawing Proofs & Layouts
- G. Samples: Seat materials and color finish as selected by Architect from manufacturers standard offered color finishes.

1.7 Project Conditions

- A. Field Measurements: Coordinate actual dimensions of construction affecting telescoping bleachers installation by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid delay of Work.

1.8 QUALITY ASSURANCE

- A. Installer qualifications: Bleacher installer shall be Factory Certified by the Manufacturer. Proof of Factory Certified Installation Certificate shall be provided.
- B. Service capability: The Bleacher Contractor must be able to show proof of full time service capability by factory certified technicians directly employed by the Bleacher Contractor.

- C. Manufacturer's Warranty: Includes the repair or replacement of the defective product; or defective component thereof, with a comparable product; or component thereof, or a refund of the purchase price prorated over the warranty period.
 - 1. Includes: Labor, materials, and freight for replacement or repairs.
 - 2. Structural Component parts of Understructure Warranty Period: 10 years from Date of Acceptance
 - 3. Decking systems, seating collections, electrical, end closure curtains, surface material finishes Warranty Period 5 years from Date of Acceptance.

1.9 MAINTENANCE AND OPERATION

- A. Instructions: Both operation and maintenance shall be transmitted to the Owner by the manufacturer of the seating or his representative.
- B. Service: Maintenance and operation of the seating system shall be the responsibility of the Owner or his duly authorized representative, and shall include the following:
 - 1. Operation of the Seating System shall be supervised by responsible personnel who will assure that the operation is in accordance with the manufacturer's instructions.
 - 2. Only attachments specifically approved by the manufacturer for the specific installation shall be attached to the seating.
 - 3. An annual inspection and required maintenance of each seating system shall be performed to assure safe conditions. At least biannually the inspection shall be performed by a professional engineer or factory qualified service personnel.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
 - 1. Hussey Seating Company, U.S.A.
 - 2. Irwin Seating Company
 - 3. Telescopic Seating Systems LLC
 - 4. Approved Equal
- B. Basis of Design: Products below are designated in terms of names of products manufactured by Hussey Seating Company, USA, to establish the general character and materials required for telescoping seating for this project. Equivalent products by acceptable manufacturers will be approved.
 - 1. Product: MAXAM+ Telescopic Platform System by Hussey Seating Company
 - a. MAXAM+ Series Telescopic Platform Seats, adjustable row spacing: 33 inches [838].

- b. MAXAM+ Series Telescopic Platform Seats, adjustable rise: 11 5/8" [295] row rise at any dimensional increments. Variable/ Combination Rise solutions also available upon request. Consult your Hussey Representative for engineering details.
 - c. Aisle Type: Front steps and intermediate aisle steps.
 - (1) Seat Type:
 - (a) Metro Chairs color finish: Manufacturers 19 standard colors.
 - d. Rail Type: Self-storing end rail, store-in-place aisle hand rails, folding aisle hand rails.
 - (1) Rail color finish: Standard black
 - e. Operation: Electric
 - (1) Electrical Power System: SELECT: Integral power with pendant Control, motion monitor, and limit switches.
 - f. Platform Type:
 - g. Wall Attached Telescoping Platform
 - h. Chair Quantity: 585 Fixed Seats, 8 Handicap Seats
 - i. Chair Operation: Manual
 - (1) Manual Operation with foot-assist: Chairs shall be ganged in group(s) of two to four, manually raised and lowered with foot-assist. Armrests shall be manually flipped down during raising of chairs.
 - j. Chair Dimensions
 - (1) Seat up envelope: 15 1/8" [384]
 - (2) Seat down envelope: 21 1/2" [546]
 - (3) Seat height: 17 5/8" [448]
 - (4) Armrest height: 25 1/4" [641]
 - (5) Back height: 31 3/4" [806]
 - k. Chair Construction:
upholstered seat, upholstered back
2. Product Description/Criteria
- a. Bank Length: 58'-5" (60'-5" with end rails)
 - b. Aisle Widths: 4'-6"
 - c. Number of Tiers: 20
 - d. Row Spacing(s): 33"
 - e. Open Dimension: 54'- 7-5/16"
 - f. Closed Dimension: 4'-5"
 - g. Overall Unit Height: 19'- 2-13/16"
 - h. Net Capacity: 600

2.2 MATERIALS

- B. Lumber: ANSI/Voluntary Product 20, B & B Southern Pine
- C. Plywood: ANSI/Voluntary Product PS1, APA A-C Exterior Grade.
- D. Structural-Steel Shapes, Plates, and Bars: ASTM A36.
- E. Galvanized-Steel Sheet: ASTM A653, Grade 40 (276 MPa) coating designation G60.
- F. Uncoated Steel Strip; Non-Structural Components: ASTM A1011, Commercial Quality, Type B, Hot-Rolled Strip.

- G. Uncoated Steel Strip; Structural Components: ASTM A1011 Grade 33 (228 MPa), Grade 36 (249 MPa), Grade 40 (276 MPa), Grade 45 (311 MPa), or Grade 50 (345 MPa), Structural Quality, Hot-Rolled.
- H. Galvanized Steel Strip: ASTM A653 Grade 40 (276 MPa), or Grade 64 (441 MPa), structural quality, coating designation G60.
- I. Tubing: ASTM A500, cold formed; Grade B, or ASTM A513, 46ksi min yield
- J. Polyethylene Polymer: ASTM D 1248, Type III, Class B; molded, color-pigmented, textured, impact-resistant, structural formulation; in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- K. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.3 UNDERSTRUCTURE FABRICATION

L. Frame System:

- 1. Wheels: Not less than 5" [127] diameter by 1 1/4" [32] with non-marring soft rubber face to protect wood and synthetic floor surfaces, with molded-in sintered iron oil-impregnated bushings to fit 3/8" [10] diameter axles secured with E-type snap rings.
- 2. Lower Track: Continuous Positive Interglide System interlocks each adjacent CPI unit using an integral, continuous, anti-drift feature and through-bolted guide at front to prevent separation and misalignment. CPI units at end sections of powered banks and manual sections shall contain a Low Profile Posi-Lock LX to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.
- 3. Slant Columns: High tensile steel, tubular shape.
- 4. Sway Bracing: High tensile steel members through-bolted to columns.
- 5. Deck Stabilizer: High tensile steel member through-bolted to nose and riser at three locations per section. Interlocks with adjacent stabilizer on upper tier using low-friction nylon roller to prevent separation and misalignment. Incorporates multiple stops to allow field adjustment of row spacings.
- 6. Deck Support: Securely captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section.

M. Deck System:

- 1. Section Lengths: Each bank shall contain sections not to exceed 19'-5" [5944] in length with a minimum of two supporting frames per row, each section.
- 2. Nose beam and Rear Riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653 grade 40 (276 MPa). Riser beam shall be continuously roll-formed of ASTM A653 Grade 64 (441 MPa). Nose and Riser beam shall be designed with no steel edges exposed to spectator after product assembly Attachment: Through-Bolted fore/aft to deck stabilizers, and frame cantilevers.
- 3. Deck End Overhang: Not to exceed frame support by more than 5'-11" [1804].
- 4. Decking Option
 - a. Classic Wood Deck: 3/4" [19], AC grade clear-top-coated tongue and groove Southern Yellow Pine; or BC grade polyethylene-top-coated tongue and groove Douglas Fir plywood; both of interior type with exterior glue, 5-ply, all plies with plugged cross-bands, produced in accordance with National Bureau of Standards PS-1-97. Plywood shall be cut and installed with top, center and bottom ply grain-oriented from front of deck to rear

of deck (nose beam to riser beam). Adjacent pieces shall be locked together with tongue and groove joint from front to rear of deck. Longest unsupported span: MAXAM+, 28 ½" [724].

2.4 SEAT FABRICATION

N. Metro Telescopic Platform Chair System

1. Chair System: Beam-mounted design, consisting of chairs independently mounted and armrests independently mounted to transverse beam. Top of support arms shall be designed to capture and secure the beam in place. Support arms articulate from manual assist or semi-automatic operating mechanism.
2. Seat Support:
 - a. Each of the independent seat hinges shall be fitted with up and down stops as well as double acting; self-centering, preloaded coiled seat return springs with silencers.
 - b. Chairs must be designed with two independent return springs which position seat pan in 3/4 fold position with 100 percent (100%) fold position available for added aisle passage. Seat action shall be dampened for a constant velocity return and no final oscillations to the rest position.
 - c. Hinges, seat support, return springs, and stops shall be enveloped and concealed by the seat and back shells. Seat shall have the ability to achieve a full fold position when rearward pressure is applied. Superior comfort shall be derived through careful ergonomic engineering.
3. Upholstered Seats / Backs: (seats and backs)
 - a. Each seat and back shall be textured one-piece gas-assist injection molded pigmented polypropylene shells.
 - b. Upholstery shall be a complete self-retaining unit, welded to the seat and back surfaces using a hot plate welding technique.
 - c. Each unitized upholstery panel shall be comprised of medium density virgin urethane foam on a precision injection molded polypropylene backer. The fabric cover shall be tensioned over and neatly enclose both foam and backer.
 - d. Each seat and back shall be internal structured with peripheral gas channel frame. The frames shall support, resist, and transmit design loads to the aluminum chair beam.
 - e. Seat foam cushion shall be not less than 1 1/2" thick; back foam cushion shall not be less than 1" thick.
 - f. Seat "covers" shall be of a three-piece construction, without welts, taut, and securely retained.
 - g. Tailoring shall evidence a superior level of design, workmanship and fit.
 - h. Seat (bottom) closure shall be textured plastic with front and sides turned 180 degrees to regain and protect cover. Pan materials, texture, and color shall match chair back; non-matching seat pan/back construction materials and finishes are not acceptable.
4. Armrests: Shall be of injection-molded, leather textured polypropylene secured to polypropylene armrest base with concealed fasteners. Armrest standard to be of powder-coated cast aluminum grade AA 380 and independently secured to mounting beam.
5. Chair Beam: Shall be constructed of extruded aluminum with polymer end caps and serve as the focal attachment and shall in turn transmit all forces to the beam support.

6. Beam support: Shall be cast steel support arms. Closed seam steel tube standards are unacceptable. Top of support arms shall be designed to capture and secure the beam in place. Support arms articulate from manual assist or semi-automatic operating mechanism.

2.5 SHOP FINISHES

- O. Understructure: For rust resistance, steel understructure shall be finished on all surfaces with black "Dura-Coat" enamel. Understructure finish shall contain a silicone additive to improve scratch resistance of finish.
- P. Wear Surfaces: Surface subject to normal wear by spectators shall have a finish that does not wear to show different color underneath:
 1. Steel nosing and rear risers shall be pre-galvanized with a minimum spangle of G-60 zinc plating.
 2. Decking shall have use-surfaces to receive both a sealer coat and wear-resistant high gloss clear urethane finish. Optional decking to have 0.030" laminated polyethylene wear surface.
- Q. Railings: Steel railings shall be finished with powder-coated semi - gloss black or optional 15 standard colors to match polymer seat color.
- R. Chair Components
 1. FINISH FOR Steel / Aluminum Components: (Indoor) Material shall be pre-treated in an iron phosphate wash system prior to finish application. Finish shall be a specially blended polyester T.G.I.C./Epoxy powder coating with a minimum dry film thickness of 1.5 mils [0.038 mm].
 2. Injection molded polypropylene or nylon: Shall be pigmented, in one of manufacturers standard colors and have a textured surface.
 3. Fabric: Upholstery material shall be one of manufacturers standard grade fabric offerings.
 4. Color: Shall be per manufacturer's standards. Seating Contractor shall submit color samples for owner's approval prior to manufacture.

2.6 FASTENINGS

- S. Welds: Performed by welders certified by AWS standards for the process employed.
- T. Structural Connections: Secured by structural bolts with prevailing torque lock nuts, free-spinning nuts in combination with lock washers, or Riv-nuts in combination with lock washers.

2.7 ELECTRICAL OPERATION SYSTEMS

- A. Integral Power
 1. Default operation shall be with a removable pendant control unit which plugs into seating bank for tethered operator management of stop, start, forward, and reverse control of the power operation. Other modes of operation are optional.
- B. PF4: Furnish and install Hussey PF(4), an integral automatic electro mechanical powered frame propulsion system, to open and close telescopic seating.
 1. Electrical - Seating Manufacturer shall provide all wiring within seating bank, including pendant control. Motors, housing, and wiring shall be installed and grounded in complete accord with the National Electrical Code. The control system shall operate at low voltage (24V). The electrical

contractor shall perform all connections at and upstream of the equipment specified herein and ensure that supplied voltage drops no more than 4% below nominal where power connects thereto.

2. Each unit for PF(4) is driven by a 1/2 horsepower, 1725 RPM motor.
 - a.) 208V 3 Phase:
 - 1.) This 1.25 Service Factor motor runs on 208V at 60 Hz and draws a full load current of 1.8 amperes. The required power supply shall be 3 asynchronous phases of 120 Volts each, plus neutral plus ground, each with 20 Amp capacity.
 - 2.) This system shall be UL Listed in its entirety (motors, circuit protection, motor controls, user interface, enclosures, conductors and connectors all evaluated and approved for correct sizing and compatibility under maximum rated load on the motors) under UL Product Category FHJU, titled Electrical Drive and Controls for Folding and Telescopic Seating.
 - b.) 115V 1 Phase
 - 1.) This 1.25 Service Factor motor runs on 115V at 60 Hz and draws a full load current of 6.2 amperes. The required power supply shall be a single phase of 115 Volts, plus neutral plus ground, each with current capacity per the following schedule:
 - PART 2** 30 Amps when 3 or 4 motors on the power supply
 - PART 3** 40 Amps when 5 or 6 motors on the power supply
 - 2.) 230V 1 Phase This 1.25 Service Factor motor runs on 230V at 50 Hz and draws a full load current of 5.5 amperes. The required power supply shall be a single phase of 230 Volts, plus neutral plus ground, each with current capacity per the following schedule:
 - a. 20 Amps when 3 or 4 motors on the power supply
 - b. 30 Amps when 5 or 6 motors on the power supply
 - 3.) This system shall consist of UL Listed or Recognized components throughout (motors, circuit protection, motor controls, user interface, enclosures, conductors and connectors, all correctly sized and compatible under maximum rated load on the motors).
 - b.) Each pair of Powered Frames shall consist of output shaft gear reducer with [6 inch (152mm)] diameter x [4 inch (102mm)] wide wheels covered with non-marring [1/2 inch (13mm)] thick composite rubber, and operate the bleacher as follows:
 - 1.) PF1 – Pulls at 46 feet / min [16.8 meters / min] with ½ Hp through 60:1 speed reduction to 2 drive wheels. Max pull approx 261 lbs [1161 N];
 - 2.) PF2 – Pulls at 46 feet / min [16.8 meters / min] with ½ Hp through 60:1 speed reduction to 4 drive wheels. Max pull approx 261 lbs [1161 N];
 - 3.) PF3 – Pulls at 25 feet / min [9.3 meters / min] with ½ Hp through 111:1 speed reduction to 4 drive wheels. Max pull approx 478 lbs [2126 N];
 - 4.) PF4 – Pulls at 25 feet / min [9.3 meters / min] with 1 Hp through 111:1 speed reduction to 4 drive wheels. Max pull approx 956 lbs [4253 N];
2. Annual Service Light
 - a.) The annual service light unit is a low voltage (24V) system that is integrated into the electrical control system on a powered bleacher.
 - 1.) This system shall be UL Listed under UL Product Category FHJU, titled Electrical Drive and Controls for Folding and Telescopic Seating (UL File No. E467277).
 - b.) This unit serves two main functions:

- 1.) Keep a continuous timer running that will indicate to the end user that an annual inspection of the bleacher is required.
 - a.) The unit will retain the counting data for no less than 6 months without power.
 - b.) There will be a light illuminated at the front of the bleacher once the counter reaches one calendar year.
 - c.) The counter and light can be reset by authorized personnel once an inspection has been completed.
- 2.) Record the forward, reverse, and total operating time of bleacher.
 - a.) This data can be viewed at any time from inside of the unit.
- c.) Manufacturer shall furnish parts and instructions for installing an annual service light unit on the primary seating bank.

B. Options

1. Limit Switches

- a.) Limit switches will automatically stop integral power operation when seating has reached the fully extended or closed position. Manufacturer shall furnish and install both open and closed limit switches for the integral power system. Power operation shall utilize a combination of contactors and limit switches to insure the wiring is not energized except during operation.

2.8 ACCESSORIES | STANDARD TELESCOPIC GYMSEAT ACCESSORIES

- A. Front Aisle Steps: Provide at each vertical aisle location front aisle step. Front steps shall engage with front row to prevent accidental separation or movement. Steps shall be fitted with four non-skid rubber feet each 1/2" [13] in diameter. Blow molded end caps shall have full radius on all four edges. Quantity and location as indicated. Steel Aisle Steps.
- B. Intermediate Aisle Steps: Intermediate aisle steps shall be of boxed fully enclosed type construction. Blow molded end caps shall have full radius on all four edges. Step shall have adhesive-backed abrasive non-slip tread surface. Quantity and location as indicated. Steel Aisle Steps.
- C. Intermediate Automatic Rotating Aisle Handrails: Provide single pedestal mount handrails 34" [864] high with terminating mid rail. Permanently attached handrail shall rotate in a permanently mounted socket for rail storage. Rail shall automatically rotate, lock in the use position, unlock and rotate back to the stowed position as the gym seats open and close. Ends of the handrail shall return to the post, and not extend away from it. Rails having openings to avoid interference with closed decks are not acceptable.
- D. Self-Storing End Rails: Provide steel self-storing 42" [1066] high above seat, end rail with tubular supports and intermediate members designed with 4" [102] sphere passage requirements.
- E. Safety Accessories: Provide the following safety features:
 1. Coin Round or Roll all edges of exposed metal on top and underneath Bleacher to eliminate sharp edges. Provide safety ease edges, coined edges, or rounded edges for the bleacher understructure components as follows. Diagonal or X braces and deck support or deck stabilizers. Systems provided with sharp edges or corners, to be rounded off in the field and field painted.

2. Provide polymer end cap on nose metal at Bank ends to close off edges to prevent spectator injury.
 3. Provide polymer end cap on back of deck supports on 1st 7 Rows to prevent spectator injury.
 4. On 1st Row, provide front and side skirt boards anywhere there is an exposed end to prevent players/balls from sliding underneath the 1st Row.
 5. Provide metal cover over motor chains and wheels to protect chains from debris and provide a safety switch that if cover is taken off the power system will not work.
 6. Provide metal end deck cover on each row to cover exposed edge of plywood at the ends of the bleachers.
 7. Powered frames systems without a metal protective housing, covering drive chain and drive wheels are not permitted under this specification.
- P. Armrests, Injection Molded Polymer: Armrests shall be of injection molded, leather textured polypropylene. Armrest to be secured to standard with concealed fasteners.
- Q. Armrest, ADA Easy Access: Armrest shall hinge on end standards to allow equal access for disabled patrons. Swing-up end arms shall be provided for one percent of fixed seating capacity to meet the Americans with Disabilities Act (ADA). Each accessible chair shall include the universal handicap symbol on the end aisle standard for clear identification.
- R. Chair Numbers: Black text with gray background on a 23/32" x 2 7/32" [18.5mm x 56.5mm] elliptical Lexan plate. Plate fitted in a vandal resistant recess located in rear of armrest and secured with adhesive.
- S. Row Letters: Black text with gray background on a 23/32" x 2 7/32" [18.5mm x 56.5mm] elliptical Lexan plate. Plate fitted in a vandal resistant recess located in rear of armrest and secured with adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify area to receive telescoping gym seats are free of impediments interfering with installation and condition of installation substrates are acceptable to receive telescoping gym seats in accordance with telescoping gym seats manufacturer's recommendations. Do not commence installation until conditions are satisfactory

3.2 INSTALLATION

- A. Manufacturer's Recommendations: Comply with telescoping gym seats manufacturer's recommendations for product installation requirements.
- B. General: Manufacturer's Certified Installers to install telescoping gym seats in accordance with manufacturer's installation instructions and final shop drawings. Provide accessories, anchors, fasteners, inserts and other items for installation of telescoping gym seats and for permanent attachment to adjoining construction.

3.3 ADJUSTING AND CLEANING

- A. Adjustment: After installation completion, test and adjust each telescoping gym seats assembly to operate in compliance with manufacturer's operations manual.
- B. Cleaning: Clean installed telescoping gym seats on both exposed and semi-exposed surfaces. Touch-up finishes restoring damage or soiled surfaces.

3.4 PROTECTION

- A. General: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer to ensure telescoping gym seats are without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 133416

HEAVY DUTY ALL-ALUMINUM BLEACHER

PART 1 GENERAL

1.01 Scope of Work

Furnish elevated and non-elevated bleachers equivalent to the Alum-A-Stand as manufactured by Dant Clayton Corporation, Louisville, KY at Football/Track, Baseball and Softball fields as indicated and the drawings.

A. Other acceptable manufacturers:

- a. E&D Specialty Stands Inc., 2081 Franklin Street, North Collins, NY 14111. 800.525.8515
- b. Outdoor Aluminum Inc. PO Box 118, Geneva, AL, 36340. 800-225-4249

1.02 Related Work

1. Section 116833 Athletic Field Equipment.
2. Section 312000 Earth Moving.
3. Section 321313 Concrete Pavements.
4. Section 323100 Fencing.

1.03 Submittals

Bidders with any deviation from the specifications must comply with the following requirements seven (7) days prior to the bid opening. Failure to comply with this requirement will cause immediate rejection of said bid.

A. Submit the following samples:

1. Seatboard
2. Footboard with slip and stain resistant finish
3. Riserboards

B. Shop Drawings: Complete detailed drawings prepared, signed and sealed by a Registered Professional Engineer (P.E.) licensed in the State of Massachusetts. Include:

1. Seating plan indicating aisles, seating sections.
2. End elevation indicating riser and row depth, deck configuration, railings, size of framing members.

C. Qualifications of Professional Engineer who seals the shop drawings and calculations.

1.04 Approvals

Any deviation from any item in overall specs shall be submitted to Owner/Architect Seven (7) days prior to bid for approval. This submittal shall include calculations by a registered engineer showing the deviations meet or exceed the specified item they are intending to replace. Failure of Bidder to comply with this requirement is cause for rejection.

HEAVY DUTY ALL-ALUMINUM BLEACHER

1.05 Design Criteria

- A. All material and workmanship shall be in accordance with the following:

AISC Manual, 8th Edition
ACI Building Code for Reinforced Concrete
Aluminum Association of America
Massachusetts State Building Code

- B. Design Loads:

Dead Load	6 psf	seat and footboards risers, etc.
Live Load	120 psf	to structural member
	120 plf	seatboards
	120 plf	footboards (individually)
Design Wind Speed	75 mph	on projected vertical surface
Sway	24 plf	parallel per ft. of seat parallel to seat run
	10 plf	perpendicular per foot of seat
Guardrail Loads	50 plf distributed or 200 lb concentrated load applied in any direction	

- C. Understructure Criteria:

The following criteria is used to establish a minimum requirement for strength, stiffness, and rigidity of the understructure components.

Moment of inertia of	.822
Section modulus of	.576
Radius of gyration of	.975
Axial loading of	.889

- D. Code Compliance: Submittals shall be based on specifications contained in the bid documents or the latest code edition adopted at the time of bidding.

1.06 Quality Assurance

- A. Manufacturer: Company specializing in spectator seating with a minimum of 10 years experience in manufacturing bleacher seating.
- B. Engineer Qualifications: The bleacher shall be designed under the supervision of a professional engineer registered in the state of Massachusetts.
- C. Warranty: Product shall be guaranteed for five (5) years on the structure and three (3) years on the finish together with labor. Damage resulting from abnormal use, vandalism, or incorrect installation (if done by other than authorized installer of the manufacturer) is not applicable. Any exposed mill finish aluminum surface will become discolored due to oxidation which is a natural phenomenon.

PART 2 PRODUCTS

2.01 Basis of Design Manufacturer

The basis of design manufacturer for seating is Dant Clayton Corporation, 1500 Bernheim Lane, Louisville, KY 40210, 800-626-2177.

2.02 Materials

A. Understructure:

1. Understructure shall be fabricated from 6061-T6 alloy aluminum extrusions.
2. Vertical members shall be 2 7/8" o.d. tubing or minimum L3.5x3.5x1/4 angles.
3. Horizontal members and footboard supports shall be 3" x 2 7/8" channel or minimum L2.5xL2.5x3/16 angles.
4. Cross braces and diagonals shall be 2 1/4" x 7/8" channel or 2"x2" angle.
5. Handrail support shall be 2 5/8" o.d. tubing.
6. The understructure shall be assembled from the above items in an interlocking design and 7/16" x 3 1/2" hot-dipped galvanized bolts.
7. The structure shall be designed so that in the event of accidental damage, the sub-component parts may be replaced using common hand tools. Field welding for repair purposes shall not be considered.
8. Primary structural members shall be bolted together, or calculations must be submitted verifying that the structure has taken into account the weakening of aluminum associated with welding per 2005 AA ADAMI sections 7.2.1 and 7.2.3

B. Guardrail Systems:

1. Guardrails shall be of anodized aluminum extruded channel, 3 x 2 7/8", 6061-T6 alloy, anodized to clear 204R1.
2. The guardrail system shall be of interlocking design with positive through bolt fastening. The top rail shall be designed to fully cover the rail support posts for a totally snag-free area and eliminate the potential of sharp edge contact with the spectators.
3. Grabrails shall be extruded aluminum pipe of 6063-T6 alloy, 1 – 15/16" o.d.
4. Chain link fence shall be 2" mesh, 9 gauge black vinyl coated fabric

C. Hand & Grab Rails

1. Hand and Grab Rails shall be located in all areas as shown on the drawings.

2. Hand and Grab Rails shall be 1 15/16" O.D. extruded aluminum pipe.
3. Two-Line mid-aisle handrails shall be located in all interior aisles. All mid-aisle rails shall feature internal fittings for both lines of rail. External fittings are not permitted.

D. Extrusions

1. Seats shall be 6063-T6 extruded aluminum with a fluted surface and a wall thickness of .078". Seatboards shall be a minimum of 9½" wide actual, with outside legs of 1 ¾" actual vertical height, and shall have two internal legs with a vertical height of 2 5/8". Seatboards shall attach with one 3/8" diameter bolt and shall be designed for positive physical fastening. Bolt clips, bolt runners or other friction type fastening devices are not acceptable. Seats shall be pre-treated and clear anodized.
2. Footboards shall be 6063-T6 extruded aluminum with a fluted surface and a wall thickness of .078". Each footboard member (individually) shall have two internal legs with 2 1/8" actual vertical height. All footboards shall attach without the use of hardware. Attachment shall be positive snap and interlock with the support structure. Use of bolt clips, bolt runners, or other friction type fastening devices are not acceptable.
3. Riserboards shall be 6063-T6 extruded aluminum and shall be pre-treated and powder coated in color selected by architect from manufacturers standard color options, minimum of 6 colors including Maroon Red and Black.

E. Stairs:

- i. Shall conform to all above pertinent criteria consistent with the component design of the grandstand.
- ii. Shall be self-supporting and shall not attach to or be suspended from any footboard of decking member.

F. Aisles:

Aisles shall be designed so that all vertical and horizontal areas within the 6' bay of the aisles area shall be fully closed.

G. Hardware:

- i. Bolts used for field installation shall be hot dipped galvanized.
- ii. Primary connections, i.e. seat, crossbrace, handrail (rail and posts) shall be made with minimum of 3/8" diameter hardware.
- iii. End Caps – All end caps (seatboard, footboard and handrail) shall be cast aluminum.

2.03 WALKING SURFACE REQUIREMENT - All aluminum footboards shall have an enhanced stain resistant and slip resistant finish at all locations intended for use as a walking surface.

- a. This finish shall be produced by the bleacher manufacturer in addition to the mill extrusion process and shall be uniform in appearance. The slip and stain resistant surface treatment must be achieved with a blasted and anodized process. The metallic media blasting option must be performed in a controlled factory environment to ensure consistency. Hand processes or sand blasting is strictly prohibited as they produce an inconsistent finish that is not uniform in appearance or performance.
- b. This surface finish shall prevent oxidation staining and be resistant to staining from beverage spills and organic matter. Oxidation staining prior to warranty expiration shall be grounds for product replacement at the manufacturer's expense.
- c. This surface finish shall exhibit enhanced slip resistance beyond the mill extrusion process, resulting in an improved coefficient of friction under wet conditions in all directions of travel.
- d. Untreated mill finish aluminum with raised extruded "flutes" or "ribs" does not meet this requirement.

2.04 Reinforced Concrete

- A. All concrete work and materials shall be in accordance with ACI 318-83.
- B. Cast-in-place concrete shall have minimum compressive strength of 5,000 psi at 28 days.
- C. All exterior concrete shall be air entrained to 6% +/- 1%.
- D. Reinforcing steel shall be in accordance with ASTM A615 grade 60.
- E. Cover on reinforcement shall be as follows, unless otherwise noted in the drawings:
 - 3" Place directly against earth
 - 2" Concrete exposed to earth or weather poured against forms
 - 1 ½" Columns (to ties)

PART 3 EXECUTION

3.01 Installation

- A. Installation: Shall be handled directly by the manufacturer or by a factory certified installation subcontractor.
- B. Erect per plans, shop drawings and specifications.
- C. Securely attach bleachers to concrete slab with galvanized hardware per manufacturer's recommendations.

3.02 Cleaning

- A. Clean all surfaces according to manufacturer's recommendations.
- B. Remove all packaging and construction debris.

SECTION 133420

PRE-ENGINEERED BUILDING SYSTEMS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Pre-engineered modular building.
- B. Related Work: The following items are included in the Work of this Section and are specified under the designated Sections:
 - 1. Provide products, materials, and assemblies as specified in separate sections throughout Project Manual.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design pre-engineered building systems, including comprehensive engineering analysis by a qualified professional structural engineer, currently registered in the Commonwealth of Massachusetts, using performance requirements and design criteria indicated.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of pre-engineered building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For the following pre-engineered building system components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Anchor-Bolt or Welded-Connection Plans: Submit anchor-bolt or welding plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts or welded connections required to attach pre-engineered building to foundation. Indicate column reactions at each location.
 - 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate bolted connections, distinguishing between shop and field applications. Indicate welds, distinguishing between sizes and types. Include transverse cross-sections.

PRE-ENGINEERED BUILDING SYSTEMS

- a. Show provisions for attaching parapets, roof curbs, service walkways, platforms, and pipe racks.
- 3. Wall Panel Layout Drawings: Show layouts of exterior panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - a. Show wall-mounted items including doors, windows, and lighting fixtures.
- 4. Show roof-mounted items including equipment supports, pipe supports and penetrations, and items mounted on roof curbs.
- 5. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
- C. Samples for Initial Selection: For units with factory-applied color finish.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:
 - 1. Exterior and Interior Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
 - 2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
- E. Delegated-Design Submittal: For pre-engineered building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional structural engineer, currently registered in the Commonwealth of Massachusetts and responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified erector, manufacturer, and professional engineer.
- B. Welding certificates.
- C. Pre-Engineered Building System Certificates: For each type of pre-engineered building system, from manufacturer.
 - 1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - a. Name and location of Project.
 - b. Order number.
 - c. Name of manufacturer.
 - d. Name of Contractor.
 - e. Building dimensions including width, length, height, and roof slope.
 - f. Governing building code and year of edition.
 - g. Design Loads: Include dead load, roof live load, collateral loads, equipment loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - h. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.

- i. Building-Use Category: Indicate category of building use and its effect on load importance factors.
 - D. Erector Certificates: For each product, from manufacturer.
 - E. Manufacturer Certificates: For each product, from manufacturer.
 - F. Material Test Reports: For each of the following products:
 - 1. Wood framing including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
 - H. Source quality-control reports.
 - I. Field quality-control reports.
 - J. Warranties: Sample of special warranties.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A qualified manufacturer and member of the Pre-engineered Building Systems Association.
 - 1. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional structural engineer, currently registered in the Commonwealth of Massachusetts.
 - B. Engineer of Record: The specialty Engineer for the Pre-Engineered Building Manufacturer shall be the Structural Engineer of Record (SER) for the steel framed superstructure and shall be responsible for all design and construction affidavits, structural tests and special inspections, and all other SER duties required by the applicable local Building Code and Building Official.
 - C. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
 - D. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
 - E. Source Limitations: Obtain pre-engineered building system components, including primary and secondary framing and panel assemblies, from single source from single manufacturer.
 - F. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

- G. Wood Framing: Comply with ANSI/AF&PA NDS-2005, "National Design Specification for Wood Construction."
 - H. Fire-Resistance Ratings: Where indicated, provide panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
 - 2. Combustion Characteristics: ASTM E 136.
 - I. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Refer to Section 014330 - MOCKUPS.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
 - 1. Review methods and procedures related to pre-engineered building systems including, but not limited to, the following:
 - a. Condition of foundations and other preparatory work performed by other trades.
 - b. Structural load limitations.
 - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Required tests, inspections, and certifications.
 - e. Unfavorable weather and forecasted weather conditions.
 - 2. Review methods and procedures related to wall panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
 - b. Structural limitations of girts and columns during and after wall panel installation.
 - c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect wall panels.
 - d. Temporary protection requirements for wall panel assembly during and after installation.
 - e. Wall observation and repair after wall panel installation.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver manufactured items so as not to be damaged or deformed. Package for protection during transportation and handling.
- 1.8 PROJECT CONDITIONS
- A. Weather Limitations: Proceed with installation only when weather conditions permit panels to be installed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements:

1. Established Dimensions for Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating panels without field measurements, or allow for field trimming panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts or welding connections into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Section 033000 - CAST-IN-PLACE CONCRETE.
- B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- C. Coordinate installation of materials and products specified in other Sections.

1.10 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Refer to Section 074200 - METAL WALL AND ROOF PANELS.
- B. Special Warranty on Rooftop Units (RTUs): Refer to Division 23 - HVAC Sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Armstrong Steel Building Systems.
 2. Butler Manufacturing Co.
 3. Ceco Building Systems
 4. Metallic Building Co.
 5. Star Building Systems.
 6. Vanguard Modular Building Systems, (Basis of Design).

2.2 PRE-ENGINEERED BUILDING SYSTEMS

- A. Description: Provide a complete, integrated set of structurally-framed pre-engineered building system manufacturer's standard mutually dependent components and assemblies that form a building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

1. Provide pre-engineered building system of size and with bay spacings, framing, roof slopes, and spans indicated.

2.3 PRE-ENGINEERED BUILDING SYSTEM PERFORMANCE

- A. Delegated Design: Design pre-engineered building system, including comprehensive engineering analysis by a qualified professional structural engineer, currently registered in the Commonwealth of Massachusetts, using performance requirements and design criteria indicated.
- B. Structural Performance: Pre-engineered building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 1. Design Loads: As indicated on Drawings and as required by the Massachusetts State Building Code, current Edition.
 - a. Floor Loads: 100 psf live load + 5 psf collateral load.
 - b. Mezzanine Loads: 125 psf live load + 5 psf collateral load.
 2. Deflection Limits: Design pre-engineered building system assemblies to withstand design live loads with deflections no greater than the following:
 - a. Purlins and Rafters: Vertical deflection of $L/180$ of the span.
 - b. Girts: Horizontal deflection of $L/240$ of the span.
 - c. Roof Panels: Vertical deflection of $L/240$ of the span.
 - 1) PhotoVoltaic (PV) Array Loads: 5 psf.
 - d. Floor Framing: Vertical deflection of $L/240$ of the span.
 - e. Wall Panels: Horizontal deflection of $1/240$ of the span.
 - f. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 3. Drift Limits: Engineer building structure to withstand design loads with drift limits no greater than the following:
 - a. Lateral Drift for Earthquake: As required by the applicable local Building Code.
 - b. Lateral Drift for Wind: Maximum of $L/240$ of the building height.
 4. Wall panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.
- C. Seismic Performance: Pre-engineered building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the applicable local Building Code.
- D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Air Infiltration for Wall Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at static-air-pressure difference of 1.57 lbf/sq. ft.

- F. Water Penetration for Wall Panels: No water penetration when tested according to ASTM E 331 at a wind-load design pressure of not less than 2.86 lbf/sq. ft.
- G. Wind-Uplift Resistance: Provide roof assemblies that comply with UL 580 for Class 90.
- H. Thermal Performance: Provide insulated panel assemblies with the following maximum U-factors and minimum R-values for opaque elements when tested according to ASTM C 1363 or ASTM C 518:
 - 1. Roof Assemblies:
 - a. R-Value: As indicated on the Drawings.
 - 2. Wall Panel Assemblies:
 - a. R-Value: As indicated on the Drawings.

2.4 ACCESSORIES

- A. General: Provide accessories as standard with pre-engineered building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to evaluate product.
- B. Testing: Test and inspect shop connections for pre-engineered buildings according to the following:
 - 1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.

C. Product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

2.6 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with AISC "Code of Standard Produce for Steel Building and Bridges."

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
4. Weld clips to frames for attaching secondary framing.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Shop Priming Uncoated Primary and Secondary Framing: Comply with SSPC-SP 2, "Hand Tool Cleaning."

2. Shop primer shall be compatible with finish paints, as specified per Section 099000 - PAINTING AND COATING.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and pre-engineered building system manufacturer's tolerances.
 1. Engage land surveyor to perform surveying. Coordinate with requirements of Section 011000 - GENERAL REQUIREMENTS.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURE

- A. Erect pre-engineered building system according to manufacturer's written erection instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from pre-engineered building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned.
- G. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Inspection of fabricators.
 2. Wood frame construction.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Pre-engineered Building Structural Engineer of Record or his delegated representative shall visit the site a minimum of two times during construction, once during performance of the work and once after the work is complete.
- D. Tests and Inspections:
 1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.

d. Radiographic Inspection: ASTM E 94.

- E. Survey the completed building frame layout and location, in accordance with Section 011000 - GENERAL REQUIREMENTS.
- F. Product will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 - 2. Apply a compatible primer of same type and color as shop primer used on adjacent surfaces.
- D. Touchup Painting: Cleaning and touchup painting are specified in Section 099100 - PAINTING AND COATING.
- E. Wall Panels: Replace wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 140001

ELEVATORS

(TRADE BID REQUIRED)

Trade Contractors on this CM-at-Risk project are required by law to provide payment and performance bonds for the full value of their trade contracts, and trade contractors must include the full cost of the required payment and performance bonds in the bid price they submit in response to this RFB.

Bids will only be accepted from trade contractors pre-qualified by the awarding authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 TRADE-BID REQUIREMENTS

- A. Time, Manner and Requirements for Submitting Sub-Bids
 - 1. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws (Ter. Ed.), Chapter 149, Sections 44A-44I, inclusive, as amended. The time, place and manner of submission of sub-bids shall be as set forth in the INSTRUCTIONS TO BIDDERS.
 - 2. Each sub-bid submitted for work under this Section shall be on a form furnished by the Awarding Authority, as required by Section 8 of Chapter 149A of the General Laws, as amended.
 - 3. Each sub-bid filed with the Awarding Authority shall be accompanied by a Bid Bond or Cash or Certified check or a Treasurer's or Cashier's Check issued by a responsible bank or trust company payable to the Awarding Authority in the amount of five percent of the bid. A sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- B. The work to be completed by the Trade Contractor for the work of this Section is shown primarily on the following listed Drawings (refer to Division 01 Section "List of Drawing Sheets"): Code Plans CD-1 through CD1-2, Architectural A0-1-1 through A9-1-10 Structural S0-0-1 through S5-0-2, Mechanical M0-0-0 through M4-1-04, Electrical E0-0-1 through E5-0-6, Technology T0-0-0 through AV-202
- C. Trade Contractor shall also examine all other Drawings and all other Sections of the Specifications for coordination and requirements therein affecting the work of this Section, not just those pertaining particularly to this sub-trade.

1.3 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. All Work of Section 142150 – GEARLESS MACHINE ROOM LESS TRACTION ELEVATORS

END OF SECTION

SECTION 142150
GEARLESS MACHINE ROOM LESS TRACTION ELEVATORS

(Part of Work of Section 140001-ELEVATORS, Trade-Bid Required)

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Section Includes: Gearless Machine Room Less (MRL) Traction elevators as follows:
 - 1. 2 Passenger Elevators, Cars PE1-PE2.
 - 2. 1 Service Elevator, Car SE1.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design measured and documented according to LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Lintels, sleeves, anchors, inserts, plates and similar items for elevators.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Elevator rail bracket inserts.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Camera provisions.
 - 2. Elevator security devices, control unit, mounting brackets, wiring materials, logic circuits, security system interface terminals, boxes, and relays.
 - 3. Car interior finishes.
 - 4. Car flooring.
 - 5. Monitoring system interface.
 - 6. Section 051200- Structural Steel FRAMING for the hoist beams, attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
 - 7. Section 055000 - METAL FABRICATIONS for miscellaneous framing and supports for hoisting machines, and for elevator door sills, cants in hoistways made from sheet steel, and elevator pit ladders.
 - 8. Division 26 - Electrical for telephone service to elevators.
 - 9. Division 26 - Electrical for electrical service for elevators to and including disconnect switches at machine room door and telephone wiring to elevator.
 - 10. Division 28 - ELECTRONIC SAFETY AND SECURITY for card readers.

1.2 ALLOWANCES

- A. Elevator Car Allowances:
 - 1. \$25,000.00 allowance per car to furnish cab finishes including flooring. 1500lb weight allowance per car including flooring. Installation cost to be included in base bid.
 - 2. Allowance includes furnishing and installing the following:
 - a. Car wall finishes including trim.
 - b. Car floor finishes including subfloor and fastening.

- c. Car ceiling components including lighting, wiring, and coordination of battery-operated emergency lighting to illuminate car lights.
- d. Car door sills and sill extension.
- e. Handrails.
- f. Cutouts and other provisions for installing elevator signal equipment in cars.
- g. Mounting for protective pads.
- h. Assistance of IUEC installers.

1.3 ACTION SUBMITTALS

A. Product Data:

- 1. Include capacities, sizes, performance data, operation, control, signal systems operation, safety features, finishes, and similar information.
- 2. Include product data for car enclosures and hoistway entrances.
- 3. Include product data for signal fixtures, lights, graphics, Tactile marking plates, and details of mounting.

B. Shop Drawings:

- 1. Provide scaled shop drawings of the following:
 - a. Plan and section layouts of hoistways, pits, overheads, machinery spaces and openings at each landing, to include the following:
 - 1) Location of all equipment.
 - 2) Static and dynamic loads imposed on building structure.
 - 3) Details of equipment isolation.
 - 4) Required clearances around equipment.
 - 5) Control room and machine heat release.
 - a) Provide heat loads based on a regenerative emergency power operation.
 - 6) Power requirements:
 - a) motor horsepower, code letter, starting current, full load running current, and demand factor.
 - b) Provide maximum and average power consumption.
 - 7) Service connections.
 - 8) Running Clearances.
 - 9) Location of fixtures.
 - b. Elevation section of hoistways:
 - 1) Overhead, pits: clearances, and runby.
 - 2) Entrance details.
 - 3) Sill support detail.
 - c. Pit Equipment:
 - 1) Buffers.
 - 2) Counterweight guards.
 - 3) Pit reactions.
 - 4) Service ladder, platform.
 - 5) Stop switches.
 - 6) Compensation equipment.
 - d. Elevator cabs:
 - 1) Car shell fabrication.
 - 2) Gasketing.
 - 3) Ventilation.
 - 4) Ceiling construction details.
 - 5) Wall construction details.

- 6) Lighting details.
 - 7) Handrail mounting details.
 - 8) Transom, entrance returns.
 - e. Fixtures:
 - 1) Car operating panel.
 - 2) Hall stations.
 - 3) Destination / landing input stations.
 - 4) Hall Lanterns.
 - 5) Position indicators.
 - 6) Access key switches.
 - 7) Remote fixtures.
 - a) Emergency Power selector switches.
 - 8) Two-way communication device at all master stations.
- C. Submittals:
 - 1. All submittals are delivered via Portable Document Format (.pdf)
 - 2. All submittals are clearly marked and identified with project name and appropriate device identification.
 - 3. All submittals are subject to approval.
 - 4. Corrections requested are incorporated onto the submittals.
- D. Samples for Initial Selection:
 - 1. For finishes involving surface treatment or paint.
- E. Samples for Verification:
 - 1. For exposed car, hoistway door and frame, and signal equipment finishes.
 - 2. Samples of sheet materials: 3" (75 mm) square.
 - 3. Running trim members: 4" (100 mm) lengths.
 - 4. Include full component samples, if requested:
 - a. Signal fixtures
 - b. Lighting
 - c. Graphics
 - d. Tactile markings

1.4 CLOSEOUT SUBMITTALS

- A. Continuing Maintenance Proposal:
 - 1. Submit executed Installer's standard five-year maintenance agreement, starting at the end of the warranty maintenance period.
 - 2. State services, obligations, conditions, and terms for agreement period and for future renewal options.
- B. Record Documents:
 - 1. The following record documents are furnished upon completion and before final payment and delivered via Portable Document Format (.pdf):
 - a. Shop Drawings:
 - 1) Complete sets of as installed plan and section layouts of hoistways, pits, overheads, and equipment spaces, to include the following:
 - a) Static and dynamic loads imposed on building structure.

- b) Details of equipment isolation.
 - c) Required clearances around equipment.
 - d) Control room heat release.
 - e) Power requirements.
 - 2) Elevation section of hoistways:
 - a) Overhead, pits and entrance details.
 - 3) Elevator cabs.
 - 4) Fixtures:
 - a) Car fixtures.
 - b) Hall fixtures.
 - c) Remote fixtures.
 - 5) Control room heat release and power requirements.
- b. Wiring Diagrams:
 - 1) Complete sets of as installed straight-line wiring diagrams, showing the electrical connections of all altered vertical transportation equipment, are furnished upon completion.
 - 2) A legend sheet is furnished with each set of drawings containing the following information:
 - a) Name and symbol of each relay, switch and other electrical or solid-state apparatus.
 - b) Location on drawings, drawing sheets, number and area of switches and relays, and location of all contacts.
 - c) Location of apparatus whether on controller, in hoistway or on elevator cab.
- c. Maintenance and Operating Manuals:
 - 1) Description and sequence of operation of all equipment installed, including operating use for Building Personnel and tenants, as well as system troubleshooting manuals for technicians.
 - 2) Maintenance instructions and procedures of all vertical transportation equipment installed, including parts lists, for each elevator system.
 - 3) Lubrication charts indicating all lubricating points and type of lubricant recommended for all equipment.
 - 4) Complete parts catalogs for all replaceable parts.

C. Tools:

- 1. The following equipment is furnished upon completion and before final payment:
 - a. The Elevator Contractor provides all the necessary tools, including laptop, hand-held devices, required software and manuals, required to troubleshoot, adjust, synchronize, calibrate, repair, and maintain the vertical transportation systems, as well as perform all necessary procedures to perform all safety tests as required by code and local governing authority.
 - b. Owner's equipment and software is updated regularly to properly troubleshoot, adjust, synchronize, calibrate, repair, maintain and test the vertical transportation systems. All equipment and/or software is of the same version as issued to technicians maintaining the vertical transportation systems.
 - c. The Elevator Contractor provides a backup copy of any software that resides on the troubleshooting tool.
 - d. Upon cancellation of service agreement, the Elevator Contractor provides all updates indicated above.

D. Keys:

- 1. Four sets of keys to operate all keyed switches and locks are furnished upon completion.

2. Keys properly tagged.
3. All keying arranged with the Contractor.

1.5 PERMITS, TESTS & CERTIFICATES

- A. Permits:
 1. The Elevator Contractor secures the permits required for work to be performed, including work of sub-contractors.
 2. The Elevator Contractor obtains and pays for all municipal and state permits necessary for execution of the elevator work, including fees for renewing permits.
 3. The Elevator Contractor is responsible for posting all permits as required by the AHJ.
 4. The Elevator Contractor is responsible for obtaining final sign-off and approval for each permit.
- B. Tests and Inspections:
 1. The Elevator Contractor performs all necessary tests as required by ASME A17.1 and recommended by A17.2.
 2. The Elevator Contractor is responsible for scheduling the necessary tests as required by the local authorities.
 - a. Any fees associated with a missed appointment, or for expediting of test or overtime tests due to delays caused by the Elevator Contractor are the responsibility of the Elevator Contractor.
- C. Certificates:
 1. Elevator Contractor is responsible for obtaining and providing Contractor with all temporary and final inspection certificates of the proper governing authorities and provides the Contractor with such certificates.
 2. The Elevator Contractor pays for all fees necessary for obtaining temporary and final inspection certificates.

1.6 QUALITY ASSURANCE

- A. Compliance with Regulatory Agencies:
 1. Comply with most stringent provisions of codes, laws, and/or authorities, including revisions and changes in effect.
- B. Progress Reviews:
 1. The Elevator Contractor is subject to reviews by the Consultant and/or Contractor at any time throughout the project.
 2. Contractor to assist without additional cost.

1.7 DELIVERY, STORAGE, AND HOISTING

- A. General:
 1. The protection of all equipment and exposed finishes is the responsibility of the Elevator Contractor during delivery, handling, and installation until final acceptance of elevator equipment.
 2. The Elevator Contractor replaces damaged materials with new, at no additional cost for material and labor.
- B. Delivery and Storage:

1. It is the responsibility of the Elevator Contractor to properly store and protect all materials in space provided or designated by the Contractor against damage, stains, scratches, corrosion, weather, construction debris and environmental conditions.
2. Deliver materials to the site in the manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name and manufacturer's name.
3. Store materials under cover in a dry and clean location, off the ground. Remove delivered materials that are damaged or not suitable for installation from the job site and replace with acceptable materials.

C. Hoisting:

1. All required hoisting and movement of equipment is the responsibility of the Elevator Contractor.

1.8 COORDINATION

A. General:

1. Coordinate the following requirements with the other trades.

B. Cast-in-Place Concrete:

1. Elevator Contractor to provide guide rail bracket inserts and the locations for the General Contractor to install.
2. Provide other hoistway and pit requirements, including location of sump pits.

C. Masonry Penetrations:

1. Provide locations in elevator control room/hoistway walls where conduit, ropes, and wiring penetrate walls and slabs.
2. Coordinate installation of sleeves, block outs, inserts, and items that are embedded in concrete or masonry for elevator equipment.
3. Furnish inserts, templates and installation instructions and deliver to Project site in time for installation.

D. Structural Steel:

1. Including, but not limited to, elevator control rooms, hoistways and pits, sill supports, rail supports.

E. Miscellaneous Steel:

1. Pit ladders, working platforms, inspection platforms, guard rails, divider beams.

F. Electric:

1. Electrical service, mainline disconnects, 110 VAC disconnects, outlets, lights, switches in elevator control rooms and pits.

G. HVAC:

1. Provide necessary information to General Contractor and coordinate installation of equipment for elevator control rooms.

H. Finishes:

1. Cab interiors, hoistway entrances, fixtures.

I. Elevator Cab Flooring:

1. Material and finish as specified.

2. Flooring installation must be coordinated to ensure car sill is installed level with finished floor.

J. Security Equipment:

1. Coordinate locations in elevator control rooms and cabs where cables, conduit, and other components for CCTV and/or security equipment must be installed.

1.9 WARRANTY

A. Manufacturer's Warranty:

1. Manufacturer agrees to repair, restore, or replace elevator equipment that fails due to defective materials or poor workmanship within specified warranty period.

B. Warranty Period: 12 months from date of Substantial Completion:

1. The Elevator Contractor guarantees that the materials and workmanship of the apparatus installed by them and any subcontractor, under this contract, is first class in every respect and that they will make good on any defects not due to ordinary wear and tear or improper use, which may develop within one year from the date of final acceptance of all equipment.
2. Manufacturer's warranty to repair or replace defective products or their components in the event of defects within a specified period.
3. Neither the final payment nor any provisions of the contract documents relieve the Elevator Contractor of any obligation provided by law. They shall remedy any defects and pay all expenses for any damage to other work.
4. The warranty as outlined above, for all devices, starts from the date of final acceptance of each device, by the Consultant and the Owner, of all work specified and intended under these contract documents.

1.10 MAINTENANCE

A. General:

1. All maintenance is performed according to the guidelines stated in manufacturer's Maintenance and Operations manuals.
2. Maintenance records for each device, including lubrication logs, check charts, are provided in each control room.

B. Construction Maintenance:

1. Upon substantial completion of a device, after receiving sign-off from the governing authorities and acceptance from consultant and/or Contractor, the device may be accepted for service before completion of the entire project.
2. During the Construction Maintenance period, the necessary preventive maintenance is performed on a scheduled basis.
3. Provide the necessary protection of the hoistway entrances and sills, hoistway fixtures, cab interiors and fixtures and car door sills.
4. Replacement or repair of components, due to misuse by others, is the responsibility of the Contractor/Owner.
5. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of ninety minutes or less.

C. Warranty Maintenance:

1. Upon final acceptance of each device, subsequent to receiving acceptance and sign-off from the governing authorities and final acceptance, each device is accepted for full operation.
 2. The warranty maintenance period begins for each device when all conditions in the above paragraph are met and will continue for a specified period.
 - a. Warranty Maintenance Period may begin at different times for each elevator.
 3. The warranty maintenance program includes the following:
 - a. Monthly examinations, including adjustments, cleaning, and lubrication of equipment.
 - b. 24-hour Emergency Call back service is provided at no additional cost to Owner.
 - c. Replacement of components as required, using only components produced by the original manufacturer.
 - 1) Each control room is equipped with a lockable storage cabinet to contain the necessary spare parts.
- D. Maintenance Specification:
1. Upon completion of the Warranty Maintenance period, the Elevator Contractor will provide the personnel to service the vertical transportation equipment.
 - a. Full-Service Maintenance Specification commences upon the completion of the warranty maintenance period for a term of five (5) years:
 - 1) If specifications for a comprehensive service agreement have not been provided, then the Contractor provides a proposal for a full-service agreement which covers the following:
 - a) All required inspections and tests.
 - b) 24-hour emergency call service at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 REFERENCES

- A. Definitions:
1. Terms used are defined in the latest edition of the Safety Code for Elevators and Escalators, ASME A17.1.
- B. American Society of Mechanical Engineers:
1. ASME A17.1 - Safety Code for Elevators and Escalators.
 2. ASME A17.2 – Guide for Inspection of Elevators, Escalators, and Moving Walks.
 3. ASME A17.5 – Elevator and Escalator Electrical Equipment.
 4. ASME A17.6 – Standard for Elevator Suspension, Compensation, and Governor Systems.
- C. International Building Code (IBC)
- D. National Fire Protection Association (NFPA):
1. NFPA 13 – Installation of Sprinkler Systems.
 2. NFPA 70 – National Electric Code.
 3. NFPA 80 – Fire Doors and Windows.
 4. NFPA 101 – Life Safety Code.
- E. Accessibility:
1. American National Standard Institute (ANSI):

- a. A117.1 - Accessible and Usable Buildings and Facilities.
- 2. ADAAG – Americans with Disabilities Act Accessibility Guidelines.
- F. Local Codes:
 - 1. Massachusetts Board of Elevator Regulations 524 CMR.
 - 2. Massachusetts Architectural Access Board 521 CMR.

2.2 MANUFACTURERS

- A. Subject to compliance with project requirements, provide products by one of the following:
 - 1. MRL Systems:
 - a. KONE Incorporated: MonoSpace 500.
 - b. Otis Elevator Company: Gen3, Edge
 - c. Schindler Elevator Corporation: 5500.
 - d. TK Elevator: EVO 200,
 - e. Manufacturer's standard components, including machines, controllers, door equipment, fixtures, and cab enclosures, are approved.
 - 2. Hoistway Entrance:
 - a. Wittur.
 - b. Columbia.
 - c. EDI-ECI.
 - d. National Elevator Cab & Doors.
 - e. Regency Elevator Cabs.
 - 3. Passenger Elevator Door Equipment (Operators, interlocks, pickup assemblies, Tracks, Hangers, and Closers):
 - a. GAL.
 - b. Otis.
 - c. Wittur.
 - 4. Elevator Car Enclosures:
 - a. Manufacturers Standard Collection.
 - 5. Fixtures vandal resistant:
 - a. Manufacturers Standard Collection.
 - b. EPCO.
 - c. Monitor.
 - d. Innovation.
 - 6. Two-Way Communication Device:
 - a. RingComm.
 - b. EMS.
 - c. TOA.

2.3 PERFORMANCE REQUIREMENTS

- A. Car Speed:
 - 1. $\pm 3\%$ of contract speed under any loading condition.
- B. Car Capacity:
 - 1. Safely lower, stop and hold 125% of rated load.
- C. Car Stopping Zone:
 - 1. $\pm 1/4"$ under any loading condition.

- D. Door Times:
 - 1. Seconds from start to fully open or fully closed:
 - a. Cars PE1, PE2: Door open 2.5 seconds, door close 4.0 seconds.
 - b. Car SE1: Door open 2.9 seconds, door close 4.8 seconds.
- E. Car Floor-to-Floor Performance Time:
 - 1. Seconds from start of doors closing until doors are 1/2 open for side opening doors, and car level and stopped at next successive floor under any loading condition or travel direction:
 - a. Cars PE1, PE2: 12 seconds.
 - b. Car SE1: 13.6 seconds.
- F. Car Ride Quality:
 - 1. Acceleration and Deceleration:
 - a. Smooth, constant, and not less than 2.5 feet/second² with an initial ramp between 0.5 and 0.75 second.
 - 2. Sustained Jerk:
 - a. Not more than 6 feet/second³ or twice the rate of acceleration.
 - 3. Horizontal and vertical acceleration within car during all riding and door operating conditions.
 - a. Not more than 15 mg peak to peak (adjacent peaks).
 - 4. Measurement Standards:
 - a. Measure and evaluate ride quality consistent with ISO 18738, using low pass cutoff frequency of 10 Hz and A95 peak-to-peak average calculations.
- G. Noise and Vibration Control:
 - 1. Airborne Noise:
 - a. Measured noise level of elevator equipment and its operation does not exceed 55 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.
 - b. Limit noise level in the control room and control space relating to elevator equipment and its operation to no more than 80 dBA.
 - c. All dBA readings to be taken 3'-0" off the floor and 3'-0" from the equipment using the "A" weighted scale.
 - 2. Vibration Control:
 - a. All elevator equipment is mechanically isolated from the building structure and other components to minimize noise and vibrations being transmitted to occupied areas of the building.

2.4 ELEVATORS

- A. Passenger Elevators Description:
 - 1. Elevator Identification: Car PE1.
 - 2. Capacity: 3500 lbs.
 - 3. Class of Loading: Class A.
 - 4. Contract Speed: 200 fpm.
 - 5. Roping: 2:1 Underslung
 - 6. Machine: Gearless.
 - 7. Machine Location: Overhead in Hoistway.
 - 8. Control System: Collective microprocessor-based: Simplex selective collective.
 - 9. Floors Served, Front: L, 2-4.
 - 10. Floors Served, Rear: *1.

11. Openings: Front 4.
12. Openings: Rear 1.
13. Minimum Clear Height to underside of canopy: 8'-0" High.
14. Entrance Size: 3'-6" Wide X 7'-0" High.
15. Entrance Type: Single-speed, side-opening.

B. Passenger Elevators Description:

1. Elevator Identification: Car PE2.
2. Capacity: 3500 lbs.
3. Class of Loading: Class A.
4. Contract Speed: 200 fpm.
5. Roping: 2:1 Underslung
6. Machine: Gearless.
7. Machine Location: Overhead in Hoistway.
8. Control System: Collective microprocessor-based: Simplex selective collective.
9. Floors Served, Front: *1-2
10. Openings: Front 2.
11. Minimum Clear Height to underside of canopy: 8'-0" High.
12. Entrance Size: 3'-6" Wide X 7'-0" High.
13. Entrance Type: Single-speed, side-opening.

C. Service Elevators Description:

1. Elevator Identification: Car SE1.
2. Capacity: 5000 lbs.
3. Class of Loading: Class C3.
4. Contract Speed: 200 fpm.
5. Roping: 2:1 Underslung.
6. Machine: Gearless.
7. Machine Location: Overhead in Hoistway.
8. Control System: Collective microprocessor-based: Simplex selective collective.
9. Floors Served, Front: *1-4.
10. Openings: Front 4.
11. Minimum Clear Height to underside of canopy: 8'-0" High.
12. Entrance Size: 4'-6" Wide X 7'-0" High.
13. Entrance Type: Two-speed, side-opening.

2.5 MATERIALS

A. Steel:

1. Sheet Steel (Furniture Steel for Exposed Work): Stretcher-leveled, cold-rolled, commercial quality carbon steel, complying with ASTM A366, matte finish.
2. Sheet Steel (for Unexposed Work): Hot-rolled, commercial quality carbon steel, pickled and oiled, complying with ASTM A568/A568M-03.
3. Structural Steel Shapes and Plates: ASTM A36.

B. Stainless-steel:

1. Type 302 or 304 series complying with ASTM A240, with standard tempers and hardness required for fabrication, strength, and durability.
2. Apply mechanical finish on fabricated work in the locations shown or specified, Federal Standard and NAAMM nomenclature, with texture and reflectivity required to match Architect's sample. Protect with adhesive paper covering.
 - a. No. 4 Satin:

- 1) Directional polish finish.
 - 2) Graining directions as shown or, if not shown, in longest dimension.
 - b. Textured:
 - 1) .050 inches mean pattern depth with bright directional polish (No. 4 satin finish).
 - 2) 2WL, 5WL, 4LB as manufactured by Rigidized Metals.
 - 3) Windsor pattern 5-SM as manufactured by Rimex Metals.
 3. Extruded stainless-steel:
 - a. 304 stainless-steel per ASTM A276.
 - b. Hot finished and stretched straightened.
 - c. Polished finish.
- C. Bronze:
 1. Stretcher-leveled, re-squared sheets composed of 60% copper and 40% zinc like Muntz Metal, Alloy Group 2, with standard temper and hardness required for fabrication, strength, and durability.
 2. Clean and treat bronze surfaces before mechanical finish.
 3. After completion of the final mechanical finish on the fabricated work, use a chemical cleaner to produce finish, Federal Standard, and NAAMM nomenclature, matching Architect's sample.
 - a. No. 4 Satin:
 - 1) Directional polish finish.
 - 2) Fine-satin clear-coated with clear-organic coating recommended by Fabricator.
 - 3) Provide graining direction as shown or, if not shown, in longest dimension.
 4. Extruded Bronze:
 - a. Muntz Metal, Alloy Group 2
 - b. Hot finished and stretched straightened.
 - c. No. 4 Satin Finish.
- D. Aluminum:
 1. Extrusions per ASTM B221; sheet and plate per ASTM B209.
 2. Die Cast Aluminum – ASTM B108, Alloy 356.0, T6.
 3. Extruded Aluminum – FS QQ-A 200/8, Alloy 6061, T6.
- E. Nickel-Silver:
 1. Extruded nickel-silver:
 - a. C77600 nickel-silver
 - b. Hot extruded, temper code M30
- F. Plastic Laminate:
 1. ASTM E84 Class A and NEMA LD3.1, Fire-Rated Grade (GP-50), Type 7, 0.050" ±.005" thick.
 2. Exposed Surfaces: Color and texture selected by Architect.
 3. Concealed Surfaces: Manufacturer's standard color and finish.
- G. Fire-Retardant Treated Particle Board Panels:
 1. Minimum 3/4" thick backup for natural finished wood and plastic laminate veneered panels, edged and faced as shown, provided with suitable anti-warp backing.
 2. Meet ASTM E84 with a flame-spread rating of 75 or less, and smoke development rating of 450 or less.

- H. Natural Finish Wood Veneer:
 - 1. Standard thickness, 1/40" thoroughly dried conforming to ASME/HPMA HP-1983, Premium Grade.
 - 2. Place veneer, tapeless spliced with grain running in direction shown, belt, and polish sanded, book matched.
 - 3. Meet ASTM E84 with a flame-spread rating of 75 or less, and smoke development rating of 450 or less.
- I. Paint Finishes:
 - 1. General:
 - a. Clean exposed metal parts and assemblies of oil, grease, scale, and other foreign matter and factory paint one shop coat of standard rust-resistant primer.
 - b. Galvanized metal need not be painted.
 - 2. Prime Finish:
 - a. Apply one coat of rust-resistant primer followed by a filler coat over uneven surfaces.
 - b. Sand smooth and apply final coat of primer.
 - 3. All equipment and metal work installed under this contract, which does not have a baked enamel or special architectural finish, and which is exposed in the hoistway, is cleaned, and painted one field coat of enamel.
 - 4. All control room equipment is painted upon completion of the installation with the manufacturer's standard machinery enamel.
 - 5. Elevator designation (number and/or letter) is prominently indicated on all control room and machinery space equipment, top of car crosshead and pit equipment.
- J. Baked Enamel Finish:
 - 1. Prime finish per above.
 - 2. Unless specified "prime finish" only, apply and bake three additional coats of enamel in the selected solid color.
- K. Powder Coating Finish
 - 1. Apply one coat of baked-on powder coat finish of selected color.
- L. Glass:
 - 1. Laminated safety glass, minimum 9/16" thick.

2.6 OPERATION

- A. General:
 - 1. Cars automatically slow down and stop level at floors in response to car and landing calls with stops made in sequence in the established direction of travel, regardless of order in which buttons are pressed.
 - 2. Landing calls are canceled when the assigned car arrives at the landing.
 - 3. Automatic Dispatch Failure: Provide auxiliary dispatch system to automatically dispatch elevators in the event of failure of the primary control system.
 - 4. Hall Call Button Failure: Should failure of hall call button system occur, initiate operation providing predetermined service to all landings; elevators respond normally to car calls.
 - 5. Automatic Leveling:
 - a. When arriving at a floor cars level to within 1/8" above or below the landing sill prior to opening doors, without travelling past the landing during leveling
 - b. Maintain leveling accuracy regardless of carload, direction of travel, rope slippage or stretch.

6. Power Conservation:
 - a. Shut off car interior illumination and ventilation after adjustable period (60-180 seconds) of no elevator demand.
 - b. turn on prior to opening car doors when elevator demand returns.
- B. Door Operation: All Cars:
 1. Automatically open doors when car arrives at a floor.
 2. Stop and reopen doors or hold doors in open position upon activation of "door open" button.
 3. At expiration of normal dwell time, or upon activation of "door close" button, close doors:
 - a. Prevent doors from closing and reverse doors at normal opening speed if door reopening device beams are obstructed while doors are closing, except during nudging operation.
 - b. In event of door reopening device failure, provide for automatic shutdown of car at floor level with doors open.
 - c. Close cycle does not begin upon activation of "door close" button until normal door dwell time for a car or hall call has expired, except firefighters' operation.
 4. Nudging Operation:
 - a. After beams of door reopening device are obstructed for a predetermined time interval (minimum 20.0-25.0 seconds), sound warning signal, and attempt to close doors with maximum of 2.5 foot-pounds kinetic energy.
 - b. Activation of the door open button overrides nudging operation and reopens doors.
 5. Interrupted Beam Time:
 - a. When beams are interrupted during initial door opening, hold door open a minimum of 3.0 seconds.
 - b. When beams are interrupted after the initial 3.0 second hold open time, reduce time doors remain open to an adjustable time of approximately 1.0-1.5 seconds after beams are reestablished.
 6. Differential Door Time:
 - a. Field adjustable time that doors remain open after stopping in response to calls.
 - b. Car Call: Hold open time adjustable between 3.0 and 5.0 seconds.
 - c. Hall Call:
 - 1) Hold open time adjustable between 5.0 and 8.0 seconds.
 - 2) Use hall call time when car responds to coincidental calls.
- C. Independent Service:
 1. When feature is activated from within the car, allow control of car from buttons and controls inside the car.
 2. Close doors by constant pressure on desired destination floor button or door close button.
 3. Open doors automatically upon arrival at selected floor.
- D. Load Weighing:
 1. Provide cars with adjustable load weighing device which monitors cable tension.
 2. Control system to provide dispatching at main floor in advance of normal intervals when car fills to a field adjustable, 10%-100%, percentage of rated capacity.
 3. Provide hall call by-pass when car is filled to a field adjustable, 10%-100%, percentage of rated capacity.
 4. Audible overload signaling device inside elevator cab shall be activated upon load weighing device sensing carload has reached or exceeded a pre-determined percentage of capacity.
 5. Doors will no close when overload signaling device is active.

- E. Simplex selective Collective Operation, All Cars:
1. Elevators operate via momentary pressure buttons to:
 - a. Place hall call by selecting direction of travel at each hall landing (up and down buttons at each intermediate landing, single buttons at each terminal landing).
 - b. Place car call by selecting destination floor from inside the car (individual buttons for each floor served).
 2. Hall calls, other than calls placed at the landing at which car is standing, start car, and cause the car to stop at first landing for which a call is registered in the direction of travel.
 3. Stops are made in order in which landings are reached, irrespective of sequence in which calls are registered.
 4. Parked Car (No Demand):
 - a. When feature is enabled, elevator remains at landing of last assignment (if no further demand) with doors closed, for a predetermined amount of time (programmable for any amount of time). Upon expiration of time, the elevator returns to the main egress landing with the doors closed.
 - b. If feature is disabled, if no further demand, the elevator remains at landing of last assignment with the doors closed until a hall call is registered.
 5. Car and Hall Lanterns:
 - a. Lanterns provide audio and visual signal upon each stop, regardless of responding to car or hall call.
 - b. Visual signal remains active from commencement of door opening until doors are completely closed.
- F. Standby or Emergency Power Operation:
1. The terms Standby Power and Emergency Power are both referred to as Emergency Power in this Section. Elevator operation is the same when either is provided.
 2. Where emergency power is provided to the elevator main disconnects and required by the Building Code the elevator installation shall comply with the Emergency Power Operation requirements of ASME A17.1 as modified by any superseding Building Code requirements.
 3. Operation is activated by a signal from an Automatic Transfer Switch (ATS) to elevator controls indicating the Emergency power source is operational.
 - a. Start and run one car in each group at contract car speed and capacity.
 - b. Illuminate "ELEVATOR EMERGENCY POWER" signals.
 4. Restoration of Normal Power:
 - a. At least 20 seconds prior to transfer from emergency power to normal power at the ATS, a pre-transfer signal is supplied to the elevator control system from the ATS.
 - b. Elevators operating on emergency power stop at the next available landing and remain there until normal power is restored.
- G. Firefighters' Emergency Operation:
1. Provide equipment and operation in accordance with code requirements.
- H. Motion Control:
1. Microprocessor-based AC variable-voltage, variable frequency with digitally encoded closed-loop velocity feedback suitable for operation specified and capable of providing smooth, comfortable car acceleration, retardation, and dynamic braking.
 2. Limit the difference in car speed between full load and no load to not more than $\pm 3\%$ of the contract speed.

- I. Emergency Lighting, Communication, and Alarm:
 - 1. Car mounted battery unit with solid-state charger to operate alarm bell, car emergency lighting, and communication system.
 - 2. Car lighting and communication shall be provided with a minimum of 4 hours of operation on back-up power during a loss of normal power, and a minimum of 1 hour of operation for car-mounted alarm and any remote alarm mounted at the designated level.
 - 3. Battery to be rechargeable with minimum five-year life expectancy.
 - 4. Provide constant pressure light test button in service compartment of car operating panel.
 - 5. Provide lighting integral with normal car lighting system.
- J. Card/Proximity Reader Security System:
 - 1. Provide provisions inside all cars for reader unit.
 - 2. Mount reader unit as directed by Architect. Connect to card reader via traveling cable to terminal interface and relays in control room.
 - 3. Provide output signal to facilitate system tracking of floor access.

2.7 EQUIPMENT SPACE EQUIPMENT

- A. Arrange equipment in spaces shown on drawings.
- B. Solid State Power Conversion and Regulation Unit:
 - 1. Provide solid-state, alternating current, variable voltage, variable frequency (ACV³F), IGBT converter/inverter regenerative drive.
 - 2. Design unit to limit current, suppress noise, and prevent transient voltage spikes into building power supply.
 - a. Provide internal heat sink cooling fans for the power drive portion of the converter panels.
 - b. Mechanically isolate unit to minimize noise and vibration transmission.
 - 3. Conform to IEEE standard 519-2014 for line harmonics and switching noise.
 - 4. Provide isolation transformers, filter networks, and choke inductors.
 - 5. Suppress solid-state converter noises, radio frequency interference, and eliminate regenerative transients induced into the mainline feeders or the building standby power generator.
 - 6. Supplemental direct-current power for the operation of hoist machine brake, door operator, dispatch processor, signal fixtures, from separate static power supply.
 - 7. ACV³F Drives are regenerative and utilize IGBT converter/inverter and dynamic braking during overhauling condition.
- C. Resistor Load Bank:
 - 1. Provide means of diverting regenerated power during emergency power operation and restoring regenerated power delivery back to the electrical distribution system following emergency power operation termination.
 - 2. Provide resistor load bank to discharge regenerative power during emergency power operation.
 - 3. Load bank is installed on the load side of the mainline disconnect.
- D. Encoder:
 - 1. Direct drive, solid-state, digital type. Update car position at each floor and automatically restore after power loss.
- E. Controller:
 - 1. UL/CSA labeled.

2. Compartment:
 - a. Securely mount all assemblies, power supplies, chassis switches, relays, on a substantial, self-supporting steel frame.
 - b. Completely enclose equipment with covers.
 - c. Provide means to prevent overheating.
3. Relay Design:
 - a. Magnet operated with contacts of design and material to insure maximum conductivity, long life, and reliable operation without overheating or excessive wear.
 - b. Provide wiping action and means to prevent sticking due to fusion.
 - c. Contacts carrying high inductive currents are provided with arc deflectors or suppressors.
4. Microprocessor Hardware:
 - a. Provide built-in noise suppression devices that provide a high level of noise immunity on all solid-state hardware and devices.
 - b. Provide power supplies with noise suppression devices.
 - c. Isolate inputs from external devices (such as pushbuttons) with opto-isolation modules.
 - d. Design control circuits with one leg of power supply grounded.
 - e. Safety circuits are not affected by accidental grounding of any part of the system.
 - f. System automatically restarts when power is restored.
 - g. System memory is retained in the event of power failure or disturbance.
 - h. Equipment is provided with Electro Magnetic Interference (EMI) shielding within FCC guidelines.
5. Wiring:
 - a. CSA labeled copper for factory wiring.
 - b. Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.
 - c. Provide labels for all extra or spare wires, neatly organized at base of controller cabinet.
6. Data Monitoring:
 - a. Provide an onboard monitor or screen, either inside the controller or in a stand-alone PC station, to display an easily understood format.
 - b. Upon command, the current operating parameters, individual car status, floor positions or other selected operational features will be displayed.
 - c. Display a minimum of 20 previous errors, which will be logged for statistical evaluation.
 - d. Provide means for hard copy printouts.
 - e. Diagnostic display will support monitoring of elevator motion, velocity, door operation parameters and timing functions.
 - f. Non-volatile memory is required to store group operation data with provisions for data logging and hard copy reporting.
 - g. Network connectivity provision is incorporated in the basic dispatching control system.
 - 1) This provision may be employed for traffic analysis, hard copy computation and/or remote monitoring of status conditions utilizing an isolated PC and compatible printer for reports or graphs.
 - 2) All reports are time and date stamped to confirm reporting period.
 - h. Monitor employs color video displays for the following information:
 - 1) Display screen (group operations statistics).
 - 2) Monitoring screen (diagnostics, system status).
 - 3) Performance screen (traffic analysis).

- i. Features required regarding remote and additional location monitoring, as indicated in other applicable sections, apply.
- 7. Permanently mark components with symbols shown on wiring diagrams.
- 8. Provide control panel compliant with UL 508A SB.SCCR of 5000A required.
- F. Electrical Wiring and Wiring Connections:
 - 1. Conductors and Connections:
 - a. Copper throughout with individual wires coded and connections on identified studs or terminal blocks.
 - 2. The use of splices or similar connections in wiring except at terminal blocks, control compartments, or junction boxes is prohibited. Conduit:
 - a. Galvanized steel conduit, EMT, or duct.
 - b. Flexible conduit length not to exceed 3'-0".
 - 3. Traveling Cables:
 - a. Tag spares in equipment space.
 - b. Provide cables from controller to car top.
 - 4. Auxiliary Disconnect:
 - a. Provide controller or machine mounted auxiliary, lockable "open" disconnect.
 - 5. Auxiliary Wiring:
 - a. Provide dedicated equipment space junction boxes for the following:
 - 1) Fire alarm initiating devices.
 - 2) Emergency two-way communication system.
 - 3) Network connectivity.
 - 4) CCTV.
 - 5) Digital video display.
 - 6) Security system and card reader interface terminals and relays.
 - 7) Intercom, announcement speaker and/or background music.
 - b. Provide conduit, wiring and connections from controller space junction box to each controller in the equipment space for the following:
 - 1) Fire alarm initiating devices.
 - 2) Emergency two-way communication system.
 - 3) Network connectivity.
 - 4) CCTV.
 - 5) Digital video display.
 - 6) Security system and card reader interface terminals and relays.
 - 7) Intercom, announcement speaker and/or background music.

2.8 HOISTWAY EQUIPMENT

- A. Gearless Traction Hoist Machine:
 - 1. AC induction or P.M.S.M. ACV³F gearless traction motor with brakes, drive sheave, and deflector sheave mounted in proper alignment.
 - 2. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.
 - 3. Provide machine with an electromechanical brake.
 - a. The brake is spring applied and electrically released.
 - b. Brake shoes are applied to the braking surface simultaneously and with equal pressure.
 - 4. Provide means to prevent ascending car over-speed and unintended car movement via dual modular redundant braking system.
 - 5. Provide ladders and platforms with handrails and toe boards for overhead sheave and governor access within the bounds of the equipment space.

- B. Machine and Equipment Support Beams:
 - 1. Provide structural steel beams required for direct support of and attachment to building structure of hoist machine, deflector sheaves, overhead sheaves, governor, and hoist rope dead-end hitch assemblies.
 - 2. Provide bearing plates, anchors, shelf angles, blocking, embedment, for support and fastening of machine beams or equipment to the building structure.
 - 3. Isolate machine and overhead sheave beams to prevent noise and vibration transmission to building structure.
- C. Governor:
 - 1. Centrifugal-type, car with pull-through jaws and bi-directional shutdown switches.
 - 2. Provide required bracketing and supports for attachment to building structure.
 - 3. Provide manual remote reset capability at controller.
- D. Guide Rails:
 - 1. Planed steel T-sections for car and counterweight of suitable size and weight for the application, including seismic reactions, including brackets for attachment to building structure.
 - 2. No additional structural points of attachment other than those shown on the Contract Documents will be provided.
 - 3. Provide rail backing and intermediate counterweight tie brackets.
 - 4. Provide bracketing, at top and bottom of floor beams.
- E. Sheaves:
 - 1. Machined grooves and sealed bearings.
 - 2. Provide mounting to machine beams, car, and counterweight structural members, or building structure.
- F. Counterweight:
 - 1. Steel frame with metal filler weights.
- G. Counterweight Guides:
 - 1. Spring dampened roller guides.
- H. Counterweight Runway Guard:
 - 1. Where counterweight is located between adjacent elevators, provide counterweight guard along entire runway next to the adjacent elevator.
- I. Seismic Equipment:
 - 1. Provide design, components, and operation per governing code.
 - 2. Dual counterweight derailment sensing wires located vertically on each side of counterweight the entire height of travel.
 - 3. Counterweight frame equipped with a minimum of four derailment rings.
 - 4. Provide dual axis seismic switch that activates at no less than 0.15 times gravity in the vertical or horizontal directions. A minimum of one seismic switch shall be provided per car or group of elevators.
 - 5. Counterweight retainer plates must be bolted.
 - 6.
- J. Governor Rope and Encoder Tape Tensioning Sheaves:
 - 1. Mount sheaves and support frame on pit floor or guide rail.

2. Provide frame with guides or pivot point to enable free vertical movement and proper tension of rope and tape.
- K. Suspension Means:
 1. 8 x 19 or 8 x 25 Seale construction, traction steel.
 - a. Fasten with staggered length, adjustable, spring isolated wedge shackles.
 2. Noncircular elastomeric-coated steel belt comprising of several steel cords arranged in parallel and molded within a coating.
 3. Approved governor rope.
- L. Terminal Stopping:
 1. Provide normal and final devices.
 2. Provide emergency terminal speed limiting devices where required by dimensional limitations.
- M. Electrical Wiring and Wiring Connections:
 1. Conductors and Connections:
 - a. Copper throughout with individual wires coded and connections on identified studs or terminal blocks.
 - b. The use of splices or similar connections in wiring except at terminal blocks, control compartments, or junction boxes is prohibited.
 - c. Provide 20% spare conductors for each wire type.
 - d. Run spare wires from car connection points to individual elevator controllers in the equipment space.
 2. Conduit:
 - a. Galvanized steel conduit, EMT, or duct.
 - b. Flexible conduit between isolated equipment, length not to exceed 3'-0".
 - c. Flexible heavy-duty service cord may be used between fixed car wiring and car door switches for door protective devices.
 - d. Coordinate conduit from the closest hoistway of each elevator or group or single elevator to the firefighters' control panel. Provide wiring.
 3. Traveling Cables:
 - a. Flame and moisture-resistant outer cover.
 - b. Prevent traveling cable from rubbing or chafing against hoistway or equipment within hoistway.
 - c. Provide the following minimum composition, which are not considered spares:
 - 1) Five pair of shielded 20-gauge wire for card reader.
 - 2) Two pair of shielded 18-gauge wire for CCTV, from car controller to car top junction box, plus 3'-0" excess loop at both ends.
 - 3) Two pair of 18-gauge wire for CCTV power.
 - 4) Two pair of 18-gauge wire for emergency communication system power.
 - 5) Two pair of 18-gauge wire for network connectivity power.
 - d. Provide eight pair of spare shielded communication wires in addition to those required to connect specified items.
 - e. Tag spares in control room. Provide cables from controller to car top.
 - f. Support traveling cable by suspending from supports by means that automatically tighten around the cable when tension is increased.
 4. Auxiliary Wiring:
 - a. Provide conduit, wiring and connections for systems specified.
- N. Entrance Equipment:

1. Two-point hanger roller with non-metallic roller surface and suspension with eccentric upthrust roller adjustment.
 2. Bar or formed, cold-drawn removable steel door tracks with smooth roller contact surface.
 3. Door Interlocks:
 - a. Operable door locks without retiring cam.
 4. Door Closers:
 - a. Spring, spirator, weighted, or jamb/strut mounted.
 - b. Design and adjust to ensure a smooth and quiet mechanical close of doors.
- O. Floor Numbers:
1. Stencil paint 4" high floor designations in contrasting color on inside face of hoistway doors and hoistway fascia. Must be visible from within car.

2.9 HOISTWAY ENTRANCES

- A. Entrance Assemblies:
1. Complete entrances bearing fire labels from a certified testing laboratory approved by authority having jurisdiction.
 2. Provide entrance assemblies bearing 1-1/2hr label.
 3. Paint all exposed ferrous metal black.
- B. Frames:
1. Bolted and lapped head to jamb assembly at all floors.
 2. Provide Arabic floor designation/Tactile marking plates:
 - a. Centered at 60" above finished floor.
 - b. Located on both side jambs of all entrances.
 - c. Minimum 4" in height.
 - d. Tactile indications below Arabic floor designation.
 3. Provide car identification label:
 - a. Mounted directly below floor designation/Tactile marking plates.
 - b. Located on both side jambs at the following levels:
 - 1) Designated Level.
 - 2) Alternate Level.
 - 3) Level designated for testing.
 - c. Finish and design to match floor designation/Tactile marking plates.
 4. Provide plates at main egress landing with "Star" designation.
 5. For designated emergency car, provide "Star of Life" cast designation plates at height of 78"-84" above finished floor on both side jambs at all floors.
- C. Door Panels:
1. Sandwich construction without binder angles.
 2. Provide one leading edge of doors with rubber astragals.
 3. Provide a minimum of two gibs per panel, one at leading and one at trailing edge with gibs in the sill groove entire length of door travel.
 4. Provide one separate 4" steel reinforcement safety gib mounted between door gibs, where not integrated with door gibs.
 5. Architectural metal cladding wraps around leading and trailing edge of panel and return a minimum of 1/2" on rear side of leading edge of panel at all floors.
- D. Sight Guards:
1. Same material, finish, and height as hoistway entrance door panels.

2. Construct without sharp edges.
 - E. Sills:
 1. PE1, PE2: Extruded aluminum.
 2. SE1: Extruded nickel silver.
 - F. Sill Supports:
 1. Structural or formed steel designed to support sill load.
 2. Design to eliminate need for grout under the sill.
 3. SE1: Provide 5" x 5" x 1/2" structural steel angle, extending full width of hoistway. Fasten to building structure at maximum 18" O.C.
 - G. Fascia, Platform Guards and Hanger Covers:
 1. 16-gauge furniture steel with Contractor's standard finish.
 2. Provide full height fascia, platform guards, and hanger covers where rear entrances are not provided.
 3. Provide front and/or rear fascia for express hoistway travel.
 - H. Struts and Headers:
 1. Provide support of all entrances to building structure including connections to building structure.
 2. Provide door open bumpers on entrances equipped with vertical struts.
 - I. Finish of Frames and Doors:
 1. Satin finish stainless-steel.
 2. Provide final painting requirements to General Contractor where factory prime finish is specified.
 - J. Hoistway Access:
 1. Hoistway Door Unlocking Device:
 - a. Provide unlocking device in door panel at all floors, with finish to match adjacent surface.
 2. Hoistway Access Switches:
 - a. Mount in entrance frame side jamb at top floor.
 - b. Provide switch faceplate.
- 2.10 PIT EQUIPMENT
- A. Buffers:
 1. Provide Oil type with blocking and support channels.
 2. Stencil car number on buffer.
 - B. Pit Access:
 1. Hoistway Access Key Switch:
 - a. Provide key switch at lowest terminal landing.
 - b. Mount in entrance frame side jamb.
 - c. Provide switch faceplate.
 2. Provide pit stop switches.
 - C. Counterweight Guard:

1. Metal guard in pit in front of counterweight where no compensation is provided or where there is no space greater than 20 inches between the compensation means, suspension means, counterweight rails, or guards.

2.11 CAR EQUIPMENT

- A. Frame:
 1. Welded or bolted or formed steel channel construction to meet load classification specified.
- B. Safety Device:
 1. Type "B," flexible guide clamp.
- C. Platform:
 1. Design and construct to accommodate load classification requirements.
 - a. PE1, PE2: Provide Class "A" construction for passenger elevators
 - b. SE1: Provide Class "C3" construction for service elevators
 2. The car platform consists of a steel frame with necessary steel stringers, all securely welded together.
 3. Isolate the passenger elevator platform.
 - a. The support frame includes rubber pads on which the platform rests.
 - b. No mechanical connections between platform and frame.
 4. Work Light Fixtures & AC Receptacles:
 - a. Provide permanent mounted work light fixtures below platform, complete with proper lamp guards.
- D. Platform Guard:
 1. Minimum 48" high, reinforced and braced to car platform front and rear with Manufacturer's standard finish
- E. Cartop Guard Rail:
 1. Provide a railing system provided on the outside perimeter of the car top on all sides where the horizontal distance between the edges of the car top and the adjacent hoistway enclosure exceeds 12 inches.
- F. Car Guides:
 1. Roller type with three or more spring dampened, sound-deadening rollers per shoe. Minimum 3 1/4" outside diameter.
- G. Cab Steadying Plates:
 1. Provide and install top of car steadying plates.
 2. Emphasis is placed on proper tension to car styles allowing minimal lateral movement of the cab.
 3. Steadying plates are isolated using non-metallic guides or rollers.
- H. Sills:
 1. One-piece extrusion with extension between car entrance columns to face of car front return.
 2. Extruded extension to match finish of sill.
 3. Cars PE, PE2: Aluminum.
 4. Car SE1: Nickel silver.

- I. Door Panels:
 - 1. Sandwich construction without binder angles.
 - 2. Provide one leading edges of doors with rubber astragals.
 - 3. Provide a minimum of two gibs per panel, one at leading and one at trailing edge with gibs in the sill groove entire length of door travel.
 - 4. Construct door panels with interlocking, stiffening ribs.
 - 5. Architectural metal cladding wraps around leading and trailing edge of panel and return a minimum of 1/2" on rear side of leading edge of panel.
- J. Door Hangers:
 - 1. Two-point suspension.
 - 2. Hanger roller with non-metallic surface and eccentric roller adjustment.
- K. Door Track:
 - 1. Bar or formed, cold-drawn removable steel track with smooth roller contact surface.
- L. Door Header:
 - 1. Construct of minimum 12-gauge steel, shape to provide stiffening flanges.
- M. Door Electrical Contact:
 - 1. Prohibit car operation unless car door is closed.
 - 2. Provide car door interlock to prevent opening of car doors outside the unlocking zone, where clearance between the car platform and hoistway enclosure exceeds code maximum on the loading side.
- N. Door Clutch:
 - 1. Heavy-duty clutch, linkage arms, vane assembly and pickup rollers or cams to provide positive, smooth, quiet door operation.
 - 2. Design clutch so car doors can be closed while hoistway doors remain open.
- O. Restricted Opening Device:
 - 1. Provide mechanical car-door restrictor to prevent opening of doors when outside unlocking zone.
 - 2. Plunger type restrictors are not applicable.
 - 3. Utilize mechanical angle to prevent door opening
- P. Door Operator:
 - 1. High speed, heavy-duty door operator capable of opening doors at no less than 2.5 fps.
 - 2. Accomplish reversal within 2½" of door movement.
 - 3. Provide solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current.
 - 4. Provide a minimum of four controller-based motion profiles, per floor, per door, to maintain consistent, smooth, and quiet door operation at all floors, regardless of door weight or varying air pressure.
- Q. Door Reversing Device:
 - 1. Infrared Reopening Device:
 - a. Black fully enclosed device with full screen infrared matrix or multiple beams extending vertically along leading edge of each door panel to minimum height of 74" above finished floor.
 - b. Reverse doors at normal opening speed if beams are obstructed while doors are closing, except during nudging operation.

- c. In event of device failure, provide for automatic shutdown of car at floor level with doors open.
 - 2. Nudging Operation:
 - a. After door close is obstructed for a predetermined time interval (minimum 20.0-25.0 seconds), warning signal sounds, and doors close with a maximum of 2.5 foot-pounds kinetic energy.
 - b. Door open button overrides nudging operation and reopen doors.
 - 3. Interrupted Beam Time:
 - a. When beams are interrupted during initial door opening, hold door open a minimum of 3.0 seconds.
 - b. When beams are interrupted after the initial 3.0 second hold open time, reduce remaining adjustable open time to 1.0-1.5 seconds after beams are reestablished.
 - 4. Differential Door Time:
 - a. Provide separate adjustable timers to vary door dwell time after stopping in response to calls.
 - b. Car Call:
 - 1) Hold open time adjustable between 3.0 and 5.0 seconds.
 - c. Hall Call:
 - 1) Hold open time adjustable between 5.0 and 8.0 seconds.
 - 2) Use hall call time when car responds to coincidental calls.
- R. Car Operating Panel:
 - 1. Passenger Cars:
 - a. One car operating panel without faceplate:
 - 1) Consisting of a metal box containing the vandal resistant operating fixtures, mounted behind the car swing front return panel.
 - b. Suitably identify floor buttons, alarm button, door open button, door close button and emergency push-to-call button with cast stainless tactile symbols recessed flush mounted.
 - c. Pushbuttons:
 - 1) Provide minimum 3/4" diameter raised or flush floor pushbuttons which illuminate to indicate call registration.
 - 2) Provide brushed stainless-steel buttons with illuminated LED halo.
 - 3) Include 5/8" high floor designation on face of pushbutton.
 - d. Locate operating controls no higher than 48" above the car floor; no lower than 35" for emergency push-to-call button and alarm button.
 - e. Locked Firefighters Operation Panel:
 - 1) For fire officer use and independent service only.
 - 2) Openable by the same key which operates the Fire Operation switch.
 - 3) Including the following features:
 - a) Phase II fire access switch.
 - b) Firefighters' visual indication.
 - c) Call cancel button.
 - d) Stop switch, manually operated.
 - e) Door open button.
 - f) Door close button.
 - g) Floors served.
 - f. Provide "door open" button to stop and reopen doors or hold doors in open position.
 - g. Provide "door close" button to activate door close cycle.
 - 1) Cycle does not begin until normal door dwell time for a car or hall call has expired, except firefighters' operation.
 - 2. Service Car:

- a. One car operating panel with faceplate:
 - 1) Consisting of a metal box containing the vandal resistant operating fixtures, mounted behind the car stationary front return panel.
 - 2) Faceplates are hinged and constructed of No. 4 satin finish stainless-steel.
- b. Suitably identify floor buttons, alarm button, door open button, door close button and emergency push-to-call button with cast stainless tactile symbols surface flush mounted.
- c. Pushbuttons:
 - 1) Provide minimum 3/4" diameter raised or flush floor pushbuttons which illuminate to indicate call registration.
 - 2) Provide brushed stainless-steel buttons with illuminated LED halo.
 - 3) Include 5/8" high floor designation on face of pushbutton.
- d. Locate operating controls no higher than 48" above the car floor; no lower than 35" for emergency push-to-call button and alarm button.
- e. Locked Firefighters Operation Panel:
 - 1) For fire officer use and independent service only.
 - 2) Openable by the same key which operates the Fire Operation switch.
 - 3) Including the following features:
 - a) Phase II fire access switch.
 - b) Firefighters' visual indication.
 - c) Call cancel button.
 - d) Stop switch, manually operated.
 - e) Door open button.
 - f) Door close button.
 - g) Floors served.
- f. Provide "door open" button to stop and reopen doors or hold doors in open position.
- g. Provide "door close" button to activate door close cycle.
 - 1) Cycle does not begin until normal door dwell time for a car or hall call has expired, except firefighters' operation.
- 3. Service Compartment:
 - a. Provide lockable service compartment with recessed flush door.
 - b. Door material and finish matches car return panel or car operating panel faceplate.
 - c. Inside surface of door contains an integral flush window for displaying the elevator operating permit.
 - d. Include the following controls in lockable service cabinet with function and operating positions identified by permanent signage or engraved legend:
 - 1) Access switch.
 - 2) Light switch.
 - 3) 4-position Exhaust blower switch.
 - 4) Independent service switch.
 - 5) Constant pressure test button for battery pack emergency lighting.
 - 6) 120-volt, AC, GFCI protected electrical convenience duplex outlet.
 - 7) Card reader override switch.
 - 8) Keyed stop switch.
- 4. Provide black filled, engraved, or approved etched signage as follows with approved size and font:
 - a. Phase II firefighters' operating instructions on inside face of firefighters' compartment door.
 - b. Red filled engraved firefighters' operation on outside face of compartment door.
 - c. Building identification car number on car operating panel.
 - d. Car capacity in pounds on service compartment door.
 - e. Loading classification and description on service compartment door.

- f. "No Smoking" on car operating panel.
- S. Car Top Control Station:
 - 1. Mount to provide safe access and utilization while standing on car top.
 - 2. Operating device contains Up and Down direction buttons, a Run button, an Inspection/Automatic switch and Emergency Stop switch.
 - 3. Operating device contains an audible and visible indicator that fire recall has been initiated.
 - 4. This station is fixed to the car crosshead or may be portable provided the extension cord and housing are permanently attached to the car crosshead.
 - 5. The car will be operated by constant pressure on the appropriate direction button and the Run button simultaneously.
 - 6. Normal operating devices will be inoperative while this device is in use.
- T. Emergency Audible Signaling:
 - 1. Provide on top of each elevator.
 - 2. Activation of the Alarm Button or Emergency Stop switch will cause Emergency Audible Signal.
 - 3. Provide auxiliary power supply to provide 1hr power in the event of normal power loss.
- U. Work Light and Duplex Plug Receptacles:
 - 1. GFCI protected outlet at top and bottom of car.
 - 2. Include on/off switch and lamp guard.
 - 3. Provide additional GFCI protected circuit and dedicated junction box on car top for installation of car CCTV
 - 4. Provide additional GFCI protected circuit and dedicated junction box on car top for installation of car digital video display.

2.12 CAR ENCLOSURE

- A. Passenger Elevators, PE1, PE2: Provide complete as specified herein.
 - 1. Shell:
 - a. Reinforced formed furniture steel panels with baked enamel interior finish.
 - b. Apply sound-deadening mastic to exterior.
 - c. Provide concealed ventilation cutouts.
 - 2. Canopy:
 - a. Reinforced formed furniture steel panels with lockable, contacted, hinged emergency exit.
 - b. Interior finish white color reflective baked enamel.
 - 3. Front and Rear (where applicable) Swing Return Panels and Integral Entrance Columns:
 - a. Reinforced furniture steel clad with satin stainless-steel.
 - b. Swing entire unit on substantial pivot points for service access to car operating panels.
 - c. Locate pivot points to provide full swing of return panel without interference with side wall finish or handrail.
 - d. Secure in closed position with concealed three-point latch.
 - e. Provide firefighters' and service compartments with recessed flush cover and cutouts for operating switches.
 - 4. Transom:
 - a. Reinforced furniture steel clad with satin stainless-steel full width of enclosure.
 - 5. Base:
 - a. Baked enamel with concealed ventilation cutouts.

6. Finish Floor Covering:
 - a. Furnished under other sections.
 7. Interior Wall Finish:
 - a. Removable panels faced and edged, with color core plastic laminate, color and finish as selected.
 8. Ventilation:
 - a. Forced Ventilation
 - 1) 3-speed blower mounted to car canopy.
 - 2) Exhaust blower meets noise and vibration criteria.
 9. Lighting:
 - a. Provide LED fixtures with wiring and hookup.
 - b. Coordinate with emergency lighting requirements.
 10. Suspended Ceiling:
 - a. Six-section satin finish stainless-steel panels with lighting cutouts in each panel.
 11. Handrails:
 - a. Minimum 1¼" diameter stainless-steel tubular grab bar with backing plates and captive nuts across side walls.
 - b. Bolt rails through car walls from back and mount on 1½" deep solid round stainless-steel standoff spacers no more than 18" O.C.
 - c. Provide at 32 in. above finished floor, as indicated on Architectural drawings.
 - d. Return handrail/guardrail ends to car walls.
 12. Pads and Buttons, All Cars:
 - a. Three-piece removable pads.
 - b. Two pads covering side walls and adjacent front returns and one covering rear wall.
 - c. Provide cutouts to access main car operating panel.
- B. Service Elevator: Provide complete as specified herein.
1. Shell:
 - a. Reinforced satin finish stainless-steel formed panels no more than 18" wide with light-proof joints.
 - b. Apply sound deadening mastic to exterior.
 2. Canopy:
 - a. Reinforced furniture steel formed panels with lockable, contacted, hinged emergency exit.
 - b. Interior finish white reflective baked enamel.
 3. Front Stationary Return Panel:
 - a. Reinforced furniture steel clad with satin finish stainless-steel.
 4. Entrance Columns and Transom:
 - a. Reinforced furniture steel clad with satin finish stainless-steel.
 5. Base:
 - a. Baked enamel with concealed ventilation cutouts.
 6. Finish Floor Covering:
 - a. Furnished under other sections.
 7. Ventilation:
 - a. Forced Ventilation
 - 1) 3-speed blower mounted to car canopy.
 - 2) Exhaust blower meets noise and vibration criteria.
 8. Lighting:
 - a. LED fixture flush mounted in canopy with expanded metal protective diffuser and steel guard over fixtures on car top.
 - b. Provide protective LED covers.
 9. Handrails/Guardrails:

- a. Two rows.
 - b. Top handrail line minimum 1½" diameter stainless-steel grab bar with backing plates and captive nuts.
 - c. Lower guardrail line 4" x 3/8" solid stainless-steel flat stock bars mounted on both sides of the car.
 - d. Locate bottom guardrail line at 8" above car floor and handrail line at 32" above the car floor.
 - e. Bolt rails through car walls from back and mount on 1½" deep solid round stainless-steel standoff spacers no more than 18" O.C.
 - f. Return handrail/guardrail ends to car walls.
10. Pads and Buttons:
- a. Removable pads.
 - b. Two pads covering side walls and adjacent front returns and one covering rear wall.
 - c. Provide cutouts to access main car operating panel and fire service panel.

2.13 HALL CONTROL STATIONS

- A. Pushbuttons:
1. Provide one riser pushbutton risers.
 2. Provide flush mounted faceplates.
 3. Include pushbuttons for each direction of travel that illuminate to indicate call registration.
 4. Include variable message system at all evacuation and primary egress levels.
 5. Include engraved message and pictorial representation prohibiting use of elevator during fire or other emergency as part of faceplate.
 6. Pushbutton design matches car operating panel pushbuttons.
 7. Provide vandal resistant pushbutton and light assemblies.
 8. Provide LED illumination.
 9. Provide Phase I Fire Service key switch, engraved operating instructions and illuminating jewel.
 10. Provide communication check failure indication and silence key switch.
 11. Provide illuminating jewels indicating standby power status.
 12. Incorporate all items required by Code at the primary egress level into a single hall fixture.

2.14 SIGNALS

- A. Hall Direction Lantern, All Cars:
1. Provide at each entrance to indicate travel direction of arriving car.
 2. Illuminate up or down LED lights and sound tone once for up and twice for down direction prior to car arrival at floor.
 3. Illuminate light until the car doors start to close.
 4. Sound level adjustable from 20-80 dBA measured at 5'-0" in front of hall control station and 3'-0" off floor.
 5. Provide advanced hall lantern notification to comply with ADA hall call notification time.
 6. Provide advanced predictive hall lantern notification to comply with ADA hall call notification time.
 7. Provide adjustable car door dwell time to comply with ADA requirements relative to hall call notification time.
 8. Hall direction lenses are arrow shaped with faceplates.
 9. Lenses are minimum 2½" in their smallest dimension.

- B. Hall Position Indicator, All Cars:
 - 1. Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 2½" high to indicate floor served and direction of car travel.
 - 2. Mount integral with hall lanterns at first floor.
 - 3. Provide only at the Primary landing.
 - 4. Provide vandal resistant indicator and light assemblies.
- C. Car Position Indicator:
 - 1. Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 2" high to indicate floor served and direction of car travel.
 - 2. Locate fixture in car front return panel above each car operating panel.
 - 3. When a car leaves or passes a floor, illuminate indication representing position of car in hoistway.
 - 4. Illuminate proper direction arrow to indicate direction of travel.
 - 5. Provide multi-numeral vandal resistant indicator and light assemblies.
- D. Fixture Faceplate Material and Finish:
 - 1. Satin stainless-steel all fixtures.
- E. Floor Passing Tone:
 - 1. Provide an audible tone of no less than 20 decibels and frequency of no higher than 1500 Hz, to sound as the car passes or stops at a floor served.
- F. Voice Synthesizer:
 - 1. Provide electronic device with easily reprogrammable message and female voice to announce car direction, floor, emergency exiting instructions.

2.15 COMMUNICATION

- A. Car Communication System:
 - 1. Hands-Free Phone System:
 - a. Two-way communication instrument in car with automatic dialing, tracking, and recall features, with shielded wiring to car controller in control room.
 - b. Provide dialer with automatic rollover capability with minimum two numbers:
 - 1) Actuate two-way communication via "Help" button.
 - 2) Adjacent light jewel illuminates and flash when call is acknowledged.
 - 3) Button matches car operating panel pushbutton design.
 - 4) Provide "Help" button tactile symbol, engraved signage, and Tactile marking adjacent to button mounted integral with car front return panel.
 - 2. Emergency Personnel Communication:
 - a. Communication system is provided allowing emergency personnel to establish communications with each elevator individually.
 - b. Emergency Personnel Communication overrides any existing connection outside of building.
 - c. Adjacent light jewel illuminates and flashes when call is acknowledged.
 - d. Provide operating instructions.
 - e. On the same car operating panel as the phone push button, provide capability to communicate with and obtain responses from passengers.
 - f. Provide display video capability for entrapment assessment.
 - 3. Communication for deaf, hearing and speech impaired:

- a. On the same car operating panel as the phone push button, provide capability to communicate visually with and obtain responses from passengers, including those passengers who cannot communicate verbally or hear.
- b. Provide shielded twisted pair wiring to communicate to control room network box.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to beginning installation of equipment examine hoistway and control room areas.
- B. Verify no irregularities exist that affect execution of work specified.
- C. Verify electrical power location and characteristics in coordination with equipment requirements.
- D. Do not proceed with installation until work in place conforms to project requirements.

3.2 INSTALLATION

- A. Install all equipment in accordance with Contractor's instructions, referenced codes, specification, and approved submittals.
- B. Install control room equipment with clearances in accordance with referenced codes and specification.
- C. Install all equipment so it may be easily removed for maintenance and repair.
- D. Provide any required hoisting/safety beams.
- E. Install all equipment to afford maximum accessibility, safety, and continuity of operation.
- F. Remove oil, grease, scale, and other foreign matter from the following equipment and apply one coat of field-applied machinery enamel.
 - 1. All exposed equipment and metal work installed as part of this work which does not have architectural finish.
 - 2. Control room equipment, hoistway equipment including guide rails, guide rail brackets, and pit equipment.
 - 3. Neatly touch up damaged factory-painted surfaces with original paint color. Protect machine-finish surfaces against corrosion.
- G. Fill hoistway door frames, back boxes for hallway stations and signal devices, and sills.
- H. Clean all architectural finishes and replace or restore any surfaces damaged during construction to like new condition.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing:
 - 1. On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
 - 2.

- B. Advise Contractor, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

- C. Independent Testing by Owner's Consultant.

3.4 CONSTRUCTION TOLERANCES

- A. Install rails plumb and align vertically with tolerance of 1/16" in 100'-0".
 - 1. Secure joints without gaps and file any irregularities to a smooth surface.

3.5 ADJUSTING

- A. Static balance car to equalize pressure of guide shoes on guide rails.
 - 1. Dynamically balance car and counterweight.
- B. Lubricate all equipment in accordance with Contractor's instructions.
- C. Adjust motors, power conversion units, brakes, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks, and safety devices to achieve specified performance levels.

3.6 CLEANING

- A. Keep work areas orderly and free from debris during progress of project.
- B. Remove packaging materials on a daily basis.
- C. Remove all loose materials and filings resulting from work.
- D. Clean Control room equipment and floor.
- E. Clean hoistways, car, car enclosure, entrances, operating and signal fixtures.
- F. Clean pit equipment and floor.

3.7 DEMONSTRATION:

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate all aspects of elevators while in normal operation.
- B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period.
 - 1. Determine that operation systems and devices are functioning properly.

3.8 PROTECTION

- A. Temporary Use: Comply with the following requirements for each elevator used for construction purposes:
 - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - 2. Provide strippable protective film on entrance and car doors and frames.

3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service.
 - a. Include preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity.
 - b. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage Elevator Installer to restore damaged work, if any, so no evidence remains of correction.
 - a. Return items which cannot be refinished in the field to the shop, make required repairs, and refinish entire unit, or provide new units as required.

END OF SECTION