

GENERAL REQUIREMENTS

HVAC HEAT GAIN & LOSS CALCULATIONS

Air System Sizing Summary for AHU-1 (Metal Fab)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-1 (Metal Fab)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **6178.2** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **24.5** Tons
Total coil load **293.6** MBH
Sensible coil load **293.6** MBH
Coil CFM at Jul 1400 **20000** CFM
Max block CFM **20000** CFM
Sum of peak zone CFM **20000** CFM
Sensible heat ratio **1.000**
CFM/Ton **817.4**
ft²/Ton **252.5**
BTU/(hr·ft²) **47.5**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **87.0 / 74.0** °F
Leaving DB / WB **73.4 / 70.1** °F
Coil ADP **71.9** °F
Bypass Factor **0.100**
Resulting RH **70** %
Design supply temp. **55.0** °F
Zone T-stat Check **1 of 1** OK
Max zone temperature deviation **0.0** °F

Central Heating Coil Sizing Data

Max coil load **1383.6** MBH
Coil CFM at Des Htg **20000** CFM
Max coil CFM **20000** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **224.0**
Ent. DB / Lvg DB **7.0 / 71.1** °F

Supply Fan Sizing Data

Actual max CFM **20000** CFM
Standard CFM **19978** CFM
Actual max CFM/ft² **3.24** CFM/ft²

Fan motor BHP **27.51** BHP
Fan motor kW **21.83** kW
Fan static **4.00** in wg

Return Fan Sizing Data

Actual max CFM **20000** CFM
Standard CFM **19978** CFM
Actual max CFM/ft² **3.24** CFM/ft²

Fan motor BHP **13.76** BHP
Fan motor kW **10.91** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **20000** CFM
CFM/ft² **3.24** CFM/ft²

CFM/person **376.65** CFM/person

Zone Sizing Summary for AHU-1 (Metal Fab)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-1 (Metal Fab)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **6178.2** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	20000	20000	3.24	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	48.2	Jul 1400	52.3	6178.2

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
C004 METAL FABRICATION	1	49.3	Jul 1400	19505	46.2	5716.6	3.41
C004A - OFF	1	2.7	Jul 1100	200	2.1	127.6	1.57
C004D TOOL CRIB	1	0.0	Jan 0000	75	0.6	81.3	0.92
C004E STORAGE	1	0.0	Jan 0000	220	3.2	252.7	0.87

Air System Sizing Summary for AHU-2 (Auto Collision)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-2 (Auto Collision)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **6960.9** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **23.1** Tons
Total coil load **277.6** MBH
Sensible coil load **277.6** MBH
Coil CFM at Aug 1400 **20003** CFM
Max block CFM **20003** CFM
Sum of peak zone CFM **20003** CFM
Sensible heat ratio **1.000**
CFM/Ton **864.5**
ft²/Ton **300.9**
BTU/(hr·ft²) **39.9**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Aug 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **87.0 / 74.0** °F
Leaving DB / WB **74.1 / 70.3** °F
Coil ADP **72.7** °F
Bypass Factor **0.100**
Resulting RH **69** %
Design supply temp. **55.0** °F
Zone T-stat Check **1 of 1** OK
Max zone temperature deviation **0.0** °F

Central Heating Coil Sizing Data

Max coil load **1366.7** MBH
Coil CFM at Des Htg **20003** CFM
Max coil CFM **20003** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **196.3**
Ent. DB / Lvg DB **7.0 / 70.3** °F

Supply Fan Sizing Data

Actual max CFM **20003** CFM
Standard CFM **19981** CFM
Actual max CFM/ft² **2.87** CFM/ft²

Fan motor BHP **27.52** BHP
Fan motor kW **21.83** kW
Fan static **4.00** in wg

Return Fan Sizing Data

Actual max CFM **20003** CFM
Standard CFM **19981** CFM
Actual max CFM/ft² **2.87** CFM/ft²

Fan motor BHP **13.76** BHP
Fan motor kW **10.91** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **20000** CFM
CFM/ft² **2.87** CFM/ft²

CFM/person **490.20** CFM/person

Zone Sizing Summary for AHU-2 (Auto Collision)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-2 (Auto Collision)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **6960.9** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	20003	20003	2.87	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	43.8	Jul 1100	36.4	6960.9

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
C022 Auto Collision	1	36.4	Jul 1100	19235	33.1	6339.8	3.03
C022A Service	1	1.7	Jul 1400	208	3.4	96.2	2.16
C022B Tool Crib	1	2.7	Jan 1100	110	0.0	134.9	0.82
C022E OFF	1	2.8	Jan 1100	250	0.0	179.0	1.40
C022F STOR	1	0.4	Jan 1100	200	0.0	211.0	0.95

Air System Sizing Summary for AHU-3 (Auto Tech)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-3 (Auto Tech)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **11267.0** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **26.4** Tons
Total coil load **316.8** MBH
Sensible coil load **290.9** MBH
Coil CFM at Aug 1400 **15745** CFM
Max block CFM **15745** CFM
Sum of peak zone CFM **15745** CFM
Sensible heat ratio **0.918**
CFM/Ton **596.3**
ft²/Ton **426.7**
BTU/(hr·ft²) **28.1**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Aug 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **87.0 / 74.0** °F
Leaving DB / WB **69.9 / 68.6** °F
Coil ADP **68.0** °F
Bypass Factor **0.100**
Resulting RH **68** %
Design supply temp. **55.0** °F
Zone T-stat Check **1 of 1** OK
Max zone temperature deviation **0.0** °F

Central Heating Coil Sizing Data

Max coil load **1146.0** MBH
Coil CFM at Des Htg **15745** CFM
Max coil CFM **15745** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **101.7**
Ent. DB / Lvg DB **7.0 / 74.5** °F

Supply Fan Sizing Data

Actual max CFM **15745** CFM
Standard CFM **15728** CFM
Actual max CFM/ft² **1.40** CFM/ft²

Fan motor BHP **21.66** BHP
Fan motor kW **17.18** kW
Fan static **4.00** in wg

Return Fan Sizing Data

Actual max CFM **15745** CFM
Standard CFM **15728** CFM
Actual max CFM/ft² **1.40** CFM/ft²

Fan motor BHP **10.83** BHP
Fan motor kW **8.59** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **15745** CFM
CFM/ft² **1.40** CFM/ft²

CFM/person **190.16** CFM/person

Zone Sizing Summary for AHU-3 (Auto Tech)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-3 (Auto Tech)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **11267.0** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	15745	15745	1.40	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	95.0	Jul 1100	106.8	11267.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
D003 AUTO TECHNOLOGY	1	83.8	Jul 1100	13625	96.7	9245.1	1.47
D003A OFF	1	2.5	Jan 1400	100	0.0	164.4	0.61
D003F - TOOL CRIB	1	0.5	Jan 1100	70	0.0	267.3	0.26
D003G Stor	1	0.6	Jan 1100	75	0.9	283.6	0.26
D003H Small Engines	1	7.9	Jan 1400	1625	5.2	1200.1	1.35
D003J STOR	1	0.5	Jul 1500	250	4.0	106.5	2.35

Air System Sizing Summary for AHU-4 (Electrical Tech)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-4 (Electrical Tech)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **10477.0** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **17.6** Tons
Total coil load **211.8** MBH
Sensible coil load **179.4** MBH
Coil CFM at Aug 1400 **9405** CFM
Max block CFM **9405** CFM
Sum of peak zone CFM **9405** CFM
Sensible heat ratio **0.847**
CFM/Ton **532.9**
ft²/Ton **593.6**
BTU/(hr·ft²) **20.2**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Aug 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **83.0 / 70.7** °F
Leaving DB / WB **65.4 / 64.2** °F
Coil ADP **63.4** °F
Bypass Factor **0.100**
Resulting RH **58** %
Design supply temp. **55.0** °F
Zone T-stat Check **1 of 1** OK
Max zone temperature deviation **0.0** °F

Central Heating Coil Sizing Data

Max coil load **136.1** MBH
Coil CFM at Des Htg **9405** CFM
Max coil CFM **9405** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **13.0**
Ent. DB / Lvg DB **59.5 / 72.9** °F

Supply Fan Sizing Data

Actual max CFM **9405** CFM
Standard CFM **9395** CFM
Actual max CFM/ft² **0.90** CFM/ft²

Fan motor BHP **12.94** BHP
Fan motor kW **10.26** kW
Fan static **4.00** in wg

Return Fan Sizing Data

Actual max CFM **9405** CFM
Standard CFM **9395** CFM
Actual max CFM/ft² **0.90** CFM/ft²

Fan motor BHP **6.47** BHP
Fan motor kW **5.13** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **1960** CFM
CFM/ft² **0.19** CFM/ft²

CFM/person **25.33** CFM/person

Zone Sizing Summary for AHU-4 (Electrical Tech)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-4 (Electrical Tech)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **10477.0** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	9405	9405	0.90	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	95.1	Jul 1400	51.1	10477.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
B104 ELECTRICAL TECH	1	90.3	Jul 1400	8914	51.1	9325.1	0.96
B104C TOOL CRIB	1	1.2	Jan 1100	121	0.0	608.3	0.20
B104D TOOL CRIB	1	0.7	Jan 1100	65	0.0	327.5	0.20
B104H OFF	1	3.1	Jan 1100	304	0.0	216.1	1.41

Air System Sizing Summary for AHU-5 (HVAC Tech)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-5 (HVAC Tech)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **7847.1** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **15.8** Tons
Total coil load **189.8** MBH
Sensible coil load **152.5** MBH
Coil CFM at Aug 1400 **7275** CFM
Max block CFM **7275** CFM
Sum of peak zone CFM **7275** CFM
Sensible heat ratio **0.803**
CFM/Ton **459.9**
ft²/Ton **496.1**
BTU/(hr·ft²) **24.2**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Aug 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **83.6 / 70.6** °F
Leaving DB / WB **64.2 / 63.0** °F
Coil ADP **62.1** °F
Bypass Factor **0.100**
Resulting RH **55** %
Design supply temp. **55.0** °F
Zone T-stat Check **1 of 1** OK
Max zone temperature deviation **0.0** °F

Central Heating Coil Sizing Data

Max coil load **163.6** MBH
Coil CFM at Des Htg **7275** CFM
Max coil CFM **7275** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **20.9**
Ent. DB / Lvg DB **54.4 / 75.2** °F

Supply Fan Sizing Data

Actual max CFM **7275** CFM
Standard CFM **7267** CFM
Actual max CFM/ft² **0.93** CFM/ft²

Fan motor BHP **10.01** BHP
Fan motor kW **7.94** kW
Fan static **4.00** in wg

Return Fan Sizing Data

Actual max CFM **7275** CFM
Standard CFM **7267** CFM
Actual max CFM/ft² **0.93** CFM/ft²

Fan motor BHP **5.00** BHP
Fan motor kW **3.97** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **2091** CFM
CFM/ft² **0.27** CFM/ft²

CFM/person **31.40** CFM/person

Zone Sizing Summary for AHU-5 (HVAC Tech)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-5 (HVAC Tech)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **7847.1** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	7275	7275	0.93	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	82.7	Aug 1400	52.5	7847.1

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
B103 HVAC TECHNOLOGY	1	78.1	Aug 1400	6893	52.0	7203.3	0.96
B103F TOOL CRIB	1	1.0	Jul 1100	80	0.3	150.0	0.54
B103G TOOL CRIB	1	0.3	Jul 1400	28	0.2	150.0	0.19
B103H TOOL CRIB	1	0.3	Jan 1100	26	0.0	163.9	0.16
B103I OFF	1	3.1	Jan 1100	247	0.0	179.9	1.37

Air System Sizing Summary for AHU-6 (Plumbing and Pipefitting)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-6 (Plumbing and Pipefitting)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **7324.5** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **15.7** Tons
Total coil load **188.8** MBH
Sensible coil load **146.3** MBH
Coil CFM at Jul 1400 **6570** CFM
Max block CFM **6570** CFM
Sum of peak zone CFM **6570** CFM
Sensible heat ratio **0.775**
CFM/Ton **417.5**
ft²/Ton **465.4**
BTU/(hr·ft²) **25.8**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **84.0 / 70.6** °F
Leaving DB / WB **63.3 / 62.1** °F
Coil ADP **61.0** °F
Bypass Factor **0.100**
Resulting RH **54** %
Design supply temp. **58.0** °F
Zone T-stat Check **1 of 1** OK
Max zone temperature deviation **0.0** °F

Central Heating Coil Sizing Data

Max coil load **160.2** MBH
Coil CFM at Des Htg **6570** CFM
Max coil CFM **6570** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **21.9**
Ent. DB / Lvg DB **52.0 / 74.6** °F

Supply Fan Sizing Data

Actual max CFM **6570** CFM
Standard CFM **6563** CFM
Actual max CFM/ft² **0.90** CFM/ft²

Fan motor BHP **9.04** BHP
Fan motor kW **7.17** kW
Fan static **4.00** in wg

Return Fan Sizing Data

Actual max CFM **6570** CFM
Standard CFM **6563** CFM
Actual max CFM/ft² **0.90** CFM/ft²

Fan motor BHP **4.52** BHP
Fan motor kW **3.59** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **2110** CFM
CFM/ft² **0.29** CFM/ft²

CFM/person **26.34** CFM/person

Zone Sizing Summary for AHU-6 (Plumbing and Pipefitting)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-6 (Plumbing and Pipefitting)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **7324.5** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	6570	6570	0.90	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	76.8	Jul 1400	46.4	7324.5

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
B101 PLUMBING - PIPEFITT	1	72.5	Jul 1400	6192	46.4	6421.4	0.96
B101F OFF	1	3.0	Jan 1100	253	0.0	180.1	1.41
B101G TOOL CRIB	1	0.8	Jan 1100	69	0.0	398.8	0.17
B101H TOOL CRIB	1	0.7	Jan 1100	56	0.0	324.3	0.17

Air System Sizing Summary for AHU-7 Carpentry

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-7 Carpentry**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **9205.5** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **16.3** Tons
Total coil load **195.7** MBH
Sensible coil load **160.7** MBH
Coil CFM at Aug 1400 **8265** CFM
Max block CFM **8265** CFM
Sum of peak zone CFM **8265** CFM
Sensible heat ratio **0.821**
CFM/Ton **506.9**
ft²/Ton **564.5**
BTU/(hr·ft²) **21.3**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Aug 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **83.5 / 71.1** °F
Leaving DB / WB **65.5 / 64.3** °F
Coil ADP **63.5** °F
Bypass Factor **0.100**
Resulting RH **58** %
Design supply temp. **55.0** °F
Zone T-stat Check **1 of 1** OK
Max zone temperature deviation **0.0** °F

Central Heating Coil Sizing Data

Max coil load **165.0** MBH
Coil CFM at Des Htg **8265** CFM
Max coil CFM **8265** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **17.9**
Ent. DB / Lvg DB **54.1 / 72.6** °F

Supply Fan Sizing Data

Actual max CFM **8265** CFM
Standard CFM **8256** CFM
Actual max CFM/ft² **0.90** CFM/ft²

Fan motor BHP **11.37** BHP
Fan motor kW **9.02** kW
Fan static **4.00** in wg

Return Fan Sizing Data

Actual max CFM **8265** CFM
Standard CFM **8256** CFM
Actual max CFM/ft² **0.90** CFM/ft²

Fan motor BHP **5.69** BHP
Fan motor kW **4.51** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **2400** CFM
CFM/ft² **0.26** CFM/ft²

CFM/person **36.04** CFM/person

Zone Sizing Summary for AHU-7 Carpentry

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-7 Carpentry**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **9205.5** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	8265	8265	0.90	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	83.3	Jul 1400	40.8	9205.5

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
A141 CARPENTRY	1	77.9	Jul 1400	7713	40.8	8103.8	0.95
A141E STOR	1	0.7	Jan 1100	69	0.0	342.7	0.20
A141F OFF	1	3.9	Jan 1100	391	0.0	300.2	1.30
A141G TOOL CRIB	1	0.9	Jan 1100	92	0.0	458.8	0.20

Air System Sizing Summary for AHU-8 (Cafeteria)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-8 (Cafeteria)**
Equipment Class **SPLT AHU**
Air System Type **VAV**

Number of zones **7**
Floor Area **11030.2** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **37.2** Tons
Total coil load **446.8** MBH
Sensible coil load **323.8** MBH
Coil CFM at Jul 1400 **10831** CFM
Max block CFM at Jul 1400 **11460** CFM
Sum of peak zone CFM **11609** CFM
Sensible heat ratio **0.725**
CFM/Ton **290.9**
ft²/Ton **296.2**
BTU/(hr·ft²) **40.5**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **79.1 / 64.8** °F
Leaving DB / WB **51.4 / 50.2** °F
Coil ADP **48.3** °F
Bypass Factor **0.100**
Resulting RH **45** %
Design supply temp. **55.0** °F
Zone T-stat Check **5 of 7** OK
Max zone temperature deviation **0.7** °F

Preheat Coil Sizing Data

No heating coil loads occurred during this calculation.

Supply Fan Sizing Data

Actual max CFM at Jul 1400 **11460** CFM
Standard CFM **11448** CFM
Actual max CFM/ft² **1.04** CFM/ft²

Fan motor BHP **17.74** BHP
Fan motor kW **14.07** kW
Fan static **4.50** in wg

Return Fan Sizing Data

Actual max CFM at Jul 1400 **11460** CFM
Standard CFM **11448** CFM
Actual max CFM/ft² **1.04** CFM/ft²

Fan motor BHP **7.88** BHP
Fan motor kW **6.25** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **7025** CFM
CFM/ft² **0.64** CFM/ft²

CFM/person **13.79** CFM/person

Zone Sizing Summary for AHU-8 (Cafeteria)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-8 (Cafeteria)**
Equipment Class **SPLT AHU**
Air System Type **VAV**

Number of zones **7**
Floor Area **11030.2** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	3212	1285	1.91	103.2	-	0.0	-	3212
Zone 2	5886	5297	0.91	228.6	-	0.0	-	0
Zone 3	894	268	1.45	27.1	-	0.0	-	894
Zone 4	140	28	0.98	4.0	-	0.0	-	140
Zone 5	751	300	0.69	13.0	-	0.0	-	0
Zone 6	263	88	0.59	8.2	-	0.0	-	263
Zone 7	116	116	0.20	5.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	54.8	Jul 1400	79.7	1679.8
Zone 2	127.0	Sep 1400	28.1	6469.6
Zone 3	13.8	Jul 1400	22.2	616.9
Zone 4	1.9	Jul 1400	3.5	143.0
Zone 5	16.2	Jul 1100	1.2	1091.8
Zone 6	3.8	Jul 1400	6.5	449.8
Zone 7	1.2	Jan 1100	0.0	579.3

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
A114 CAFE EXT	1	54.8	Jul 1400	3152	79.7	1679.8	1.88
Zone 2							
A114 CAFETERIA	1	127.0	Sep 1400	5886	28.1	6469.6	0.91
Zone 3							
A111 STAFF LUNCH RM	1	13.8	Jul 1400	877	22.2	616.9	1.42
Zone 4							
A104 OFF	1	1.9	Jul 1400	137	3.5	143.0	0.96
Zone 5							
A112 SERVERY	1	16.2	Jul 1100	751	1.2	1091.8	0.69
Zone 6							
A110 RECEIVING	1	3.8	Jul 1400	259	6.5	449.8	0.57
Zone 7							
A117 CHAIR STORAGE	1	1.2	Jan 1100	116	0.0	579.3	0.20

Air System Sizing Summary for AHU-9 Prefunction Corridor

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-9 Prefunction Corridor**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **12735.8** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **18.7** Tons
Total coil load **224.1** MBH
Sensible coil load **166.9** MBH
Coil CFM at Jul 1400 **6581** CFM
Max block CFM **6581** CFM
Sum of peak zone CFM **6581** CFM
Sensible heat ratio **0.745**
CFM/Ton **352.5**
ft²/Ton **682.1**
BTU/(hr·ft²) **17.6**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **78.1 / 65.1** °F
Leaving DB / WB **54.5 / 53.4** °F
Coil ADP **51.9** °F
Bypass Factor **0.100**
Resulting RH **52** %
Design supply temp. **58.0** °F
Zone T-stat Check **0 of 1** OK
Max zone temperature deviation **0.2** °F

Central Heating Coil Sizing Data

Max coil load **4.6** MBH
Coil CFM at Des Htg **6581** CFM
Max coil CFM **6581** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **0.4**
Ent. DB / Lvg DB **70.9 / 71.5** °F

Preheat Coil Sizing Data

No heating coil loads occurred during this calculation.

Supply Fan Sizing Data

Actual max CFM **6581** CFM
Standard CFM **6574** CFM
Actual max CFM/ft² **0.52** CFM/ft²

Fan motor BHP **9.05** BHP
Fan motor kW **7.18** kW
Fan static **4.00** in wg

Return Fan Sizing Data

Actual max CFM **6581** CFM
Standard CFM **6574** CFM
Actual max CFM/ft² **0.52** CFM/ft²

Fan motor BHP **4.53** BHP
Fan motor kW **3.59** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **932** CFM
CFM/ft² **0.07** CFM/ft²

CFM/person **2.07** CFM/person

Zone Sizing Summary for AHU-9 Prefunction Corridor

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-9 Prefunction Corridor**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **12735.8** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	6384	6384	0.50	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	108.6	Jul 1400	21.2	12735.8

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
C105 CORRIDOR South	1	35.4	Jan 1400	1933	0.0	2591.1	0.75
C201 CORRIDOR South	1	13.1	Jul 1400	781	12.6	2263.4	0.35
C206 CORRIDOR	1	3.0	Jul 1100	361	1.4	1442.1	0.25
D201 CORRIDOR	1	11.9	Jan 1400	649	0.0	1303.4	0.50
C105 CORRIDOR North	1	35.8	Jul 1400	1951	0.6	2682.2	0.73
C204 PHYS ED STOR	1	0.1	Jul 1500	28	0.2	112.8	0.25
C205 PHYS ED STOR	1	0.3	Jul 1700	151	2.4	222.5	0.68
C201 CORRIDOR North	1	9.0	Jul 1400	530	4.0	2118.3	0.25

Air System Sizing Summary for AHU-10 (Multi Use Space)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-10 (Multi Use Space)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **10366.3** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **40.9** Tons
Total coil load **490.7** MBH
Sensible coil load **360.8** MBH
Coil CFM at Jul 1400 **9894** CFM
Max block CFM **9894** CFM
Sum of peak zone CFM **9894** CFM
Sensible heat ratio **0.735**
CFM/Ton **241.9**
ft²/Ton **253.5**
BTU/(hr·ft²) **47.3**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **85.4 / 67.2** °F
Leaving DB / WB **51.5 / 50.1** °F
Coil ADP **47.8** °F
Bypass Factor **0.100**
Resulting RH **47** %
Design supply temp. **55.0** °F
Zone T-stat Check **0 of 1** OK
Max zone temperature deviation **0.2** °F

Central Heating Coil Sizing Data

Max coil load **218.4** MBH
Coil CFM at Des Htg **9894** CFM
Max coil CFM **9894** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **21.1**
Ent. DB / Lvg DB **61.3 / 81.8** °F

Preheat Coil Sizing Data

No heating coil loads occurred during this calculation.

Supply Fan Sizing Data

Actual max CFM **9894** CFM
Standard CFM **9883** CFM
Actual max CFM/ft² **0.95** CFM/ft²

Fan motor BHP **13.61** BHP
Fan motor kW **10.80** kW
Fan static **4.00** in wg

Return Fan Sizing Data

Actual max CFM **9894** CFM
Standard CFM **9883** CFM
Actual max CFM/ft² **0.95** CFM/ft²

Fan motor BHP **6.81** BHP
Fan motor kW **5.40** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **6622** CFM
CFM/ft² **0.64** CFM/ft²

CFM/person **9.20** CFM/person

Zone Sizing Summary for AHU-10 (Multi Use Space)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **AHU-10 (Multi Use Space)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **10366.3** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	9894	9894	0.95	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	203.5	Jul 1400	153.4	10366.3

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
C117 MULTIPURPOSE ROOM	1	202.6	Jul 1400	9388	145.2	10053.0	0.93
C117C STORAGE	1	0.5	Jul 2100	297	4.8	127.2	2.33
C117D STORAGE	1	0.5	Jul 1400	209	3.4	186.1	1.12

Dedicated Outdoor Air System (DOAS) Sizing Summary for ERU-1 (Admin Area A)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **ERU-1 (Admin Area A)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **15**
Floor Area **7133.3** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **0.5** Tons
Total coil load **5.8** MBH
Total coil load **1429.2** CFM/Ton
Sensible coil load **5.8** MBH
Coil CFM at Aug 1400 **695** CFM
Max coil CFM **695** CFM
Sensible heat ratio **1.000**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Aug 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **80.2 / 72.1** °F
Leaving DB / WB **72.4 / 69.8** °F
Bypass Factor **0.100**

Heating Coil Sizing Data

Max coil load **9.7** MBH
Coil CFM at Des Htg **695** CFM
Max coil CFM **695** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **54.5 / 67.4** °F

Ventilation Fan Sizing Data

Actual max CFM **695** CFM
Standard CFM **694** CFM
Actual max CFM/ft² **0.10** CFM/ft²

Fan motor BHP **0.72** BHP
Fan motor kW **0.57** kW
Fan static **3.00** in wg

Exhaust Fan Sizing Data

Actual max CFM **695** CFM
Standard CFM **694** CFM
Actual max CFM/ft² **0.10** CFM/ft²

Fan motor BHP **0.48** BHP
Fan motor kW **0.38** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **695** CFM
CFM/ft² **0.10** CFM/ft²

CFM/person **14.30** CFM/person

Zone Sizing Summary for ERU-1 (Admin Area A)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **ERU-1 (Admin Area A)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **15**
Floor Area **7133.3** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	14.5	14.5	75.3 / 65.4	62.2 / 61.0	-	Sep 1600	2.01
Zone 2	9.5	4.6	75.5 / 69.5	55.0 / 54.7	-	Aug 1000	0.09
Zone 3	18.5	15.1	75.5 / 64.9	58.5 / 57.5	-	Jul 1500	0.91
Zone 4	7.0	4.1	75.6 / 66.9	55.0 / 54.3	-	Jul 1200	0.46
Zone 5	7.8	5.9	75.5 / 66.3	60.4 / 59.5	-	Jul 0900	1.22
Zone 6	2.9	2.6	75.4 / 65.4	60.3 / 59.3	-	Aug 1500	1.26
Zone 7	3.0	2.7	75.4 / 65.0	59.8 / 58.8	-	Sep 1500	1.27
Zone 8	5.4	4.9	75.7 / 65.5	60.8 / 59.8	-	Sep 1500	1.19
Zone 9	3.3	2.9	75.7 / 65.4	60.2 / 59.2	-	Sep 1200	1.22
Zone 10	3.2	2.8	75.7 / 65.1	59.8 / 58.8	-	Sep 1300	1.25
Zone 11	6.5	5.8	75.6 / 64.4	58.5 / 57.4	-	Sep 1100	1.15
Zone 12	7.7	6.4	75.5 / 63.8	56.5 / 55.4	-	Aug 1000	1.02
Zone 13	9.8	6.6	76.0 / 65.5	55.0 / 54.1	-	Aug 1000	0.29
Zone 14	2.2	1.2	76.1 / 67.3	55.0 / 54.3	-	Aug 1000	0.19
Zone 15	4.5	4.0	75.4 / 65.0	59.9 / 58.9	-	Jul 0900	1.61

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	18.7	69.3 / 86.2	-	1028	0.000	0.000	0
Zone 2	0.0	0.0 / 0.0	0.00	207	0.000	0.000	150
Zone 3	11.6	69.3 / 82.3	-	824	0.000	0.000	120
Zone 4	0.7	69.8 / 73.3	-	186	0.000	0.000	90
Zone 5	6.6	69.2 / 86.1	-	364	0.000	0.000	75
Zone 6	2.8	68.9 / 85.5	-	156	0.000	0.000	15
Zone 7	2.8	68.9 / 85.5	-	158	0.000	0.000	15
Zone 8	5.5	68.9 / 85.5	-	307	0.000	0.000	20
Zone 9	3.1	69.1 / 86.1	-	172	0.000	0.000	15
Zone 10	2.9	68.9 / 85.5	-	164	0.000	0.000	15
Zone 11	5.6	69.1 / 85.9	-	312	0.000	0.000	25
Zone 12	5.6	69.0 / 85.7	-	313	0.000	0.000	35
Zone 13	0.0	0.0 / 0.0	0.00	292	0.000	0.000	80
Zone 14	0.0	0.0 / 0.0	0.00	55	0.000	0.000	25
Zone 15	4.3	69.1 / 85.8	-	239	0.000	0.000	15

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	75.1	6.3	70.4
Estimated Piping / Line Losses	0.0	0.0	0.0

Zone Sizing Summary for ERU-1 (Admin Area A)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Total Required ODU Capacity	75.1	6.3	70.4

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	13.9	Sep 1600	18.9	510.7
Zone 2	4.5	Jan 1100	0.0	2203.1
Zone 3	12.5	Aug 1500	11.9	908.8
Zone 4	4.0	Jul 1400	0.8	407.7
Zone 5	5.2	Jul 1400	6.7	299.0
Zone 6	2.5	Sep 1500	2.9	123.7
Zone 7	2.5	Sep 1500	2.9	125.0
Zone 8	4.7	Sep 1500	5.6	258.8
Zone 9	2.7	Sep 1300	3.1	141.2
Zone 10	2.6	Sep 1300	3.0	131.3
Zone 11	5.0	Sep 1100	5.7	270.2
Zone 12	5.3	Jul 1100	5.7	307.4
Zone 13	6.3	Jan 1100	0.0	1015.1
Zone 14	1.2	Jan 1400	0.0	282.7
Zone 15	3.4	Jul 1000	4.4	148.6

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
A118 VEST	1	13.9	Sep 1600	1028	18.9	510.7	2.01
Zone 2							
A119 LOBBY	1	4.5	Jan 1100	207	0.0	2203.1	0.09
Zone 3							
A120 WAITING	1	1.4	Jul 1400	67	0.3	193.0	0.35
A121 RECEPTION	1	2.8	Jul 1400	128	0.2	196.0	0.66
A122 ATTENDANCE	1	1.8	Sep 1600	171	3.1	105.6	1.62
A123 SECRETARY	1	4.4	Jul 1700	268	4.9	166.1	1.61
A124 OFFICE-MAIN	1	2.9	Aug 1700	178	3.3	138.1	1.29
A139 MAIL	1	0.3	Jul 1400	12	0.1	110.0	0.11
Zone 4							
A140 CONF	1	4.0	Jul 1400	186	0.8	407.7	0.46
Zone 5							
A138 SPED CONF	1	5.2	Jul 1400	364	6.7	299.0	1.22
Zone 6							
A126 SRO	1	2.5	Sep 1500	156	2.9	123.7	1.26
Zone 7							
A127 PRINCIPALS SECRETAR	1	2.5	Sep 1500	158	2.9	125.0	1.27
Zone 8							
A128 PRIN OFF	1	4.7	Sep 1500	307	5.6	258.8	1.19
Zone 9							
A129 COOP COORD	1	2.7	Sep 1300	172	3.1	141.2	1.22
Zone 10							
A129a - COOP COORD	1	2.6	Sep 1300	164	3.0	131.3	1.25
Zone 11							

Zone Sizing Summary for ERU-1 (Admin Area A)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
A130 ADULT ED	1	5.0	Sep 1100	312	5.7	270.2	1.15
Zone 12							
A135 SPED OFF	1	2.7	Aug 1100	149	2.7	161.3	0.92
A136 SPED OFF	1	2.6	Jul 1100	164	3.0	146.1	1.12
Zone 13							
A131 DUPLICATING	1	4.8	Jan 1100	221	0.0	265.0	0.83
A125 CORRIDOR	1	1.5	Jan 1100	70	0.0	750.1	0.09
Zone 14							
A132 RECORDS	1	1.2	Jan 1400	55	0.0	282.7	0.19
Zone 15							
A137 SPED DIR	1	3.4	Jul 1000	239	4.4	148.6	1.61

Dedicated Outdoor Air System (DOAS) Sizing Summary for ERU-2 (Dept Staff)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **ERU-2 (Dept Staff)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **5**
Floor Area **2091.2** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **0.2** Tons
Total coil load **2.5** MBH
Total coil load **1367.3** CFM/Ton
Sensible coil load **2.5** MBH
Coil CFM at Jul 1400 **285** CFM
Max coil CFM **285** CFM
Sensible heat ratio **1.000**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **80.5 / 72.2** °F
Leaving DB / WB **72.4 / 69.8** °F
Bypass Factor **0.100**

Heating Coil Sizing Data

Max coil load **3.8** MBH
Coil CFM at Des Htg **285** CFM
Max coil CFM **285** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **54.9 / 67.4** °F

Ventilation Fan Sizing Data

Actual max CFM **285** CFM
Standard CFM **285** CFM
Actual max CFM/ft² **0.14** CFM/ft²

Fan motor BHP **0.29** BHP
Fan motor kW **0.23** kW
Fan static **3.00** in wg

Exhaust Fan Sizing Data

Actual max CFM **285** CFM
Standard CFM **285** CFM
Actual max CFM/ft² **0.14** CFM/ft²

Fan motor BHP **0.20** BHP
Fan motor kW **0.16** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **285** CFM
CFM/ft² **0.14** CFM/ft²

CFM/person **16.67** CFM/person

Zone Sizing Summary for ERU-2 (Dept Staff)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name ERU-2 (Dept Staff)
Equipment Class TERM
Air System Type VRF

Number of zones 5
Floor Area 2091.2 ft²
Location Boston, Massachusetts

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Sum of space airflow rates
Space CFM Sizing Individual peak space loads

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	2.7	1.8	76.5 / 65.7	55.0 / 54.1	-	Jul 1000	0.53
Zone 2	2.7	1.9	76.5 / 65.7	55.0 / 54.1	-	Jul 1000	0.52
Zone 3	15.6	10.5	76.4 / 65.7	55.0 / 54.1	-	Jul 1000	0.35
Zone 4	1.7	0.8	75.0 / 70.6	57.4 / 57.2	-	Jul 0900	0.18
Zone 5	4.7	2.6	76.0 / 67.7	55.0 / 54.4	-	Jul 1000	0.45

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.0	0.0 / 0.0	0.00	79	0.000	0.000	25
Zone 2	0.0	0.0 / 0.0	0.00	80	0.000	0.000	25
Zone 3	0.0	0.0 / 0.0	0.00	453	0.000	0.000	130
Zone 4	0.0	0.0 / 0.0	0.00	40	0.000	0.000	40
Zone 5	0.0	0.0 / 0.0	0.00	116	0.000	0.000	65

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	17.5	1.5	0.0
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	17.5	1.5	0.0

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	1.7	Jan 1100	0.0	150.1
Zone 2	1.7	Jan 1100	0.0	152.3
Zone 3	9.8	Jan 1100	0.0	1301.8
Zone 4	0.6	Jan 1400	0.0	227.0
Zone 5	2.5	Jan 1400	0.0	259.9

Zone Sizing Summary for ERU-2 (Dept Staff)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
B219 ACAD PROG	1	1.7	Jan 1100	79	0.0	150.1	0.53
Zone 2							
B226 AP1	1	1.7	Jan 1100	80	0.0	152.3	0.52
Zone 3							
B218G DEPART HEADS	1	9.8	Jan 1100	453	0.0	1301.8	0.35
Zone 4							
B227 RECORDS	1	0.6	Jan 1400	40	0.0	227.0	0.18
Zone 5							
B229 CONF	1	2.5	Jan 1400	116	0.0	259.9	0.45

Dedicated Outdoor Air System (DOAS) Sizing Summary for ERU-3 (Child Dev)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **ERU-3 (Child Dev)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **7**
Floor Area **3644.5** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **0.7** Tons
Total coil load **8.8** MBH
Total coil load **1453.9** CFM/Ton
Sensible coil load **8.8** MBH
Coil CFM at Jul 1400 **1065** CFM
Max coil CFM **1065** CFM
Sensible heat ratio **1.000**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **80.1 / 72.1** °F
Leaving DB / WB **72.4 / 69.8** °F
Bypass Factor **0.100**

Heating Coil Sizing Data

Max coil load **15.1** MBH
Coil CFM at Des Htg **1065** CFM
Max coil CFM **1065** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **54.2 / 67.4** °F

Ventilation Fan Sizing Data

Actual max CFM **1065** CFM
Standard CFM **1064** CFM
Actual max CFM/ft² **0.29** CFM/ft²

Fan motor BHP **1.10** BHP
Fan motor kW **0.87** kW
Fan static **3.00** in wg

Exhaust Fan Sizing Data

Actual max CFM **1065** CFM
Standard CFM **1064** CFM
Actual max CFM/ft² **0.29** CFM/ft²

Fan motor BHP **0.73** BHP
Fan motor kW **0.58** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **1065** CFM
CFM/ft² **0.29** CFM/ft²

CFM/person **14.61** CFM/person

Zone Sizing Summary for ERU-3 (Child Dev)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **ERU-3 (Child Dev)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **7**
Floor Area **3644.5** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	4.7	3.6	75.6 / 64.2	55.9 / 54.9	-	Aug 1400	1.39
Zone 2	20.7	13.8	75.1 / 68.7	63.9 / 63.3	-	Jul 0800	1.36
Zone 3	1.3	0.6	75.0 / 70.6	57.0 / 56.8	-	Jul 1400	0.16
Zone 4	19.2	9.9	75.3 / 68.4	55.0 / 54.5	-	Aug 1400	0.81
Zone 5	7.9	5.1	75.4 / 66.2	56.6 / 55.8	-	Jul 1300	1.06
Zone 6	7.6	6.6	75.2 / 69.8	67.6 / 67.1	-	Aug 1400	3.35
Zone 7	10.2	5.1	75.4 / 70.2	62.0 / 61.6	-	Jul 1000	0.24

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	2.9	69.3 / 85.0	-	171	0.000	0.000	25
Zone 2	19.9	69.3 / 85.5	-	1141	0.000	0.000	425
Zone 3	0.4	70.0 / 81.9	-	30	0.000	0.000	30
Zone 4	6.2	69.8 / 82.5	-	453	0.000	0.000	300
Zone 5	4.5	69.4 / 86.1	-	250	0.000	0.000	85
Zone 6	14.7	69.3 / 86.2	-	811	0.000	0.000	85
Zone 7	6.2	69.3 / 85.7	-	354	0.000	0.000	115

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	43.4	3.6	54.9
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	43.4	3.6	54.9

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	3.7	Sep 1500	2.9	123.3
Zone 2	12.8	Jul 1400	20.9	836.2
Zone 3	0.6	Jul 1400	0.3	188.7
Zone 4	9.8	Sep 1400	6.2	559.0

Zone Sizing Summary for ERU-3 (Child Dev)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 5	4.8	Jul 1400	4.6	235.6
Zone 6	6.6	Jul 1400	14.9	242.1
Zone 7	4.5	Jul 1400	6.5	1459.6

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
C106F KITCHEN	1	3.7	Sep 1500	171	2.9	123.3	1.39
Zone 2							
C106 EARLY CHILDHOOD EDU	1	12.8	Jul 1400	1141	20.9	836.2	1.36
Zone 3							
C106A CUBBIES	1	0.6	Jul 1400	30	0.3	188.7	0.16
Zone 4							
C106B RELATED CR	1	9.8	Sep 1400	453	6.2	559.0	0.81
Zone 5							
C109 DRESSING	1	4.8	Jul 1400	250	4.6	235.6	1.06
Zone 6							
C110 DRESSING	1	6.6	Jul 1400	811	14.9	242.1	3.35
Zone 7							
C111 CORRIDOR	1	4.5	Jul 1400	354	6.5	1459.6	0.24

Dedicated Outdoor Air System (DOAS) Sizing Summary for ERU-4 (Media Center)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **ERU-4 (Media Center)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **10**
Floor Area **6710.6** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **1.6** Tons
Total coil load **18.8** MBH
Total coil load **1420.1** CFM/Ton
Sensible coil load **18.8** MBH
Coil CFM at Jul 1400 **2224** CFM
Max coil CFM **2224** CFM
Sensible heat ratio **1.000**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **80.2 / 72.1** °F
Leaving DB / WB **72.4 / 69.8** °F
Bypass Factor **0.100**

Heating Coil Sizing Data

Max coil load **31.1** MBH
Coil CFM at Des Htg **2224** CFM
Max coil CFM **2224** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **54.4 / 67.4** °F

Ventilation Fan Sizing Data

Actual max CFM **2224** CFM
Standard CFM **2221** CFM
Actual max CFM/ft² **0.33** CFM/ft²

Fan motor BHP **2.29** BHP
Fan motor kW **1.82** kW
Fan static **3.00** in wg

Exhaust Fan Sizing Data

Actual max CFM **2224** CFM
Standard CFM **2221** CFM
Actual max CFM/ft² **0.33** CFM/ft²

Fan motor BHP **1.53** BHP
Fan motor kW **1.21** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **2224** CFM
CFM/ft² **0.33** CFM/ft²

CFM/person **15.84** CFM/person

Zone Sizing Summary for ERU-4 (Media Center)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **ERU-4 (Media Center)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **10**
Floor Area **6710.6** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	147.4	113.5	75.7 / 65.8	59.2 / 58.3	-	Aug 1400	2.05
Zone 2	29.5	14.2	75.2 / 69.2	55.0 / 54.7	-	Jul 1200	0.62
Zone 3	4.9	2.5	75.3 / 68.5	55.0 / 54.6	-	Aug 1200	0.85
Zone 4	3.0	2.2	75.6 / 66.7	60.3 / 59.5	-	Jul 1400	1.26
Zone 5	3.0	2.2	75.4 / 66.7	60.3 / 59.5	-	Jul 1300	1.24
Zone 6	2.0	1.2	76.4 / 66.9	55.0 / 54.3	-	Aug 1000	0.35
Zone 7	4.5	2.5	76.2 / 67.8	55.0 / 54.4	-	Aug 1000	0.32
Zone 8	18.3	10.6	75.9 / 67.2	55.0 / 54.3	-	Jul 1000	0.49
Zone 9	1.2	0.5	75.3 / 70.8	55.0 / 54.9	-	Aug 1000	0.09
Zone 10	13.4	9.3	76.3 / 65.3	55.0 / 54.1	-	Aug 1000	0.83

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @ 20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	115.2	69.5 / 86.3	-	6368	0.000	0.000	1189
Zone 2	11.4	69.8 / 86.0	-	652	0.000	0.000	504
Zone 3	0.0	0.0 / 0.0	0.00	116	0.000	0.000	78
Zone 4	2.4	69.3 / 86.1	-	133	0.000	0.000	30
Zone 5	2.4	69.4 / 86.3	-	133	0.000	0.000	31
Zone 6	0.0	0.0 / 0.0	0.00	53	0.000	0.000	17
Zone 7	0.0	0.0 / 0.0	0.00	110	0.000	0.000	48
Zone 8	5.2	69.6 / 79.8	-	473	0.000	0.000	207
Zone 9	0.0	0.0 / 0.0	0.00	24	0.000	0.000	19
Zone 10	0.0	0.0 / 0.0	0.00	403	0.000	0.000	101

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	158.5	13.2	136.7
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	158.5	13.2	136.7

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

	Zone Cooling	Time of	Zone Heating	Zone Floor
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Zone Sizing Summary for ERU-4 (Media Center)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Sensible (MBH)	Peak Sensible Cooling Load	Load (MBH)	Area (ft²)
Zone 1	112.4	Aug 1400	116.8	3106.7
Zone 2	14.1	Jul 1400	11.9	1048.4
Zone 3	2.5	Jan 1400	0.0	136.6
Zone 4	2.2	Nov 1400	2.4	105.6
Zone 5	2.2	Nov 1400	2.4	107.9
Zone 6	1.1	Jan 1100	0.0	150.4
Zone 7	2.4	Jan 1400	0.0	350.1
Zone 8	10.2	Jul 1400	5.5	959.8
Zone 9	0.5	Jan 1100	0.0	259.0
Zone 10	8.7	Jan 1100	0.0	486.1

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
A221 MEDIA CENTER	1	112.4	Aug 1400	6368	116.8	3106.7	2.05
Zone 2							
A221a MEDIA CENTER	1	14.1	Jul 1400	652	11.9	1048.4	0.62
Zone 3							
A219 MC Small Group	1	2.5	Jan 1400	116	0.0	136.6	0.85
Zone 4							
A220 Small Group	1	2.2	Nov 1400	133	2.4	105.6	1.26
Zone 5							
A217 Small Group	1	2.2	Nov 1400	133	2.4	107.9	1.24
Zone 6							
A222 MC Office	1	1.1	Jan 1100	53	0.0	150.4	0.35
Zone 7							
A216 MC Workroom	1	2.4	Jan 1400	110	0.0	350.1	0.32
Zone 8							
A214 Career Center	1	10.2	Jul 1400	473	5.5	959.8	0.49
Zone 9							
A218 CORRIDOR	1	0.5	Jan 1100	24	0.0	259.0	0.09
Zone 10							
A215 TV Studio	1	8.7	Jan 1100	403	0.0	486.1	0.83

Dedicated Outdoor Air System (DOAS) Sizing Summary for ERU-7 (Admin Area A4)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **ERU-7 (Admin Area A4)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **10**
Floor Area **2062.8** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **0.2** Tons
Total coil load **2.1** MBH
Total coil load **1460.8** CFM/Ton
Sensible coil load **2.1** MBH
Coil CFM at Jul 1400 **250** CFM
Max coil CFM **250** CFM
Sensible heat ratio **1.000**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **80.0 / 72.1** °F
Leaving DB / WB **72.4 / 69.8** °F
Bypass Factor **0.100**

Heating Coil Sizing Data

Max coil load **3.6** MBH
Coil CFM at Des Htg **250** CFM
Max coil CFM **250** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **54.2 / 67.4** °F

Ventilation Fan Sizing Data

Actual max CFM **250** CFM
Standard CFM **250** CFM
Actual max CFM/ft² **0.12** CFM/ft²

Fan motor BHP **0.26** BHP
Fan motor kW **0.20** kW
Fan static **3.00** in wg

Exhaust Fan Sizing Data

Actual max CFM **250** CFM
Standard CFM **250** CFM
Actual max CFM/ft² **0.12** CFM/ft²

Fan motor BHP **0.17** BHP
Fan motor kW **0.14** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **250** CFM
CFM/ft² **0.12** CFM/ft²

CFM/person **12.08** CFM/person

Zone Sizing Summary for ERU-7 (Admin Area A4)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name ERU-7 (Admin Area A4)
Equipment Class TERM
Air System Type VRF

Number of zones 10
Floor Area 2062.8 ft²
Location Boston, Massachusetts

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Sum of space airflow rates
Space CFM Sizing Individual peak space loads

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	2.5	2.1	75.4 / 67.3	63.2 / 62.4	-	Jul 1400	1.01
Zone 2	2.3	1.2	75.5 / 68.2	55.0 / 54.5	-	Jul 1200	0.14
Zone 3	5.6	4.1	76.0 / 64.5	55.0 / 54.0	-	Jul 1000	0.61
Zone 4	2.5	2.0	75.5 / 66.4	61.3 / 60.4	-	Jul 1400	1.02
Zone 5	2.7	2.2	75.5 / 66.0	60.5 / 59.6	-	Jul 1400	0.91
Zone 6	2.7	2.1	75.4 / 66.0	60.5 / 59.6	-	Jul 1300	0.91
Zone 7	2.7	2.1	75.4 / 66.0	60.5 / 59.6	-	Jul 1300	0.91
Zone 8	6.2	4.5	75.4 / 65.6	58.2 / 57.3	-	Aug 1400	0.97
Zone 9	2.5	2.0	75.3 / 66.3	61.3 / 60.4	-	Jul 1300	1.08
Zone 10	5.2	3.6	75.6 / 65.3	55.6 / 54.7	-	Jul 1400	0.64

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @ 20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	2.9	69.0 / 85.7	-	159	0.000	0.000	15
Zone 2	0.7	69.6 / 81.5	-	54	0.000	0.000	25
Zone 3	3.3	69.4 / 86.0	-	182	0.000	0.000	35
Zone 4	2.4	69.0 / 85.7	-	133	0.000	0.000	15
Zone 5	2.5	69.2 / 86.2	-	134	0.000	0.000	15
Zone 6	2.5	69.2 / 86.2	-	134	0.000	0.000	15
Zone 7	2.5	69.2 / 86.2	-	134	0.000	0.000	15
Zone 8	4.3	69.1 / 85.7	-	243	0.000	0.000	55
Zone 9	2.4	69.1 / 85.4	-	133	0.000	0.000	15
Zone 10	3.0	69.4 / 86.1	-	165	0.000	0.000	45

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	25.7	2.1	26.3
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	25.7	2.1	26.3

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

	Zone Cooling	Time of	Zone Heating	Zone Floor
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Zone Sizing Summary for ERU-7 (Admin Area A4)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Sensible (MBH)	Peak Sensible Cooling Load	Load (MBH)	Area (ft²)
Zone 1	1.8	Jul 1400	2.9	158.0
Zone 2	1.2	Jul 1400	0.7	400.7
Zone 3	3.8	Jul 1400	3.3	298.0
Zone 4	1.8	Jul 1400	2.4	129.9
Zone 5	1.9	Jul 1400	2.5	146.8
Zone 6	1.9	Jul 1400	2.5	146.8
Zone 7	1.9	Jul 1400	2.5	146.8
Zone 8	4.1	Jul 1400	4.5	252.2
Zone 9	1.8	Jul 1400	2.4	123.3
Zone 10	3.2	Jul 1400	3.0	260.2

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
A404 SUPT ASSIST	1	1.8	Jul 1400	159	2.9	158.0	1.01
Zone 2							
A404A CORRIDOR	1	0.1	Jul 1400	6	0.1	47.6	0.14
A411 CORRIDOR	1	0.6	Jul 1400	26	0.4	195.4	0.14
A415 CORRIDOR	1	0.5	Jul 1400	21	0.3	157.7	0.14
Zone 3							
A404C ACCT INTERN	1	3.8	Jul 1400	182	3.3	298.0	0.61
Zone 4							
A407 ACCT REC	1	1.8	Jul 1400	133	2.4	129.9	1.02
Zone 5							
A408 TREAS OFF	1	1.9	Jul 1400	134	2.5	146.8	0.91
Zone 6							
A409 HR OFF	1	1.9	Jul 1400	134	2.5	146.8	0.91
Zone 7							
A410 BUS MGR OFF	1	1.9	Jul 1400	134	2.5	146.8	0.91
Zone 8							
A412 CONF	1	4.1	Jul 1400	243	4.5	252.2	0.97
Zone 9							
A413 SUPT ASSIST	1	1.8	Jul 1400	133	2.4	123.3	1.08
Zone 10							
A414 SUPT OFF	1	3.2	Jul 1400	165	3.0	260.2	0.64

Dedicated Outdoor Air System (DOAS) Sizing Summary for HRU-1 Classrooms A/B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **HRU-1 Classrooms A/B**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **38**
Floor Area **42848.0** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **13.4** Tons
Total coil load **160.5** MBH
Total coil load **1469.7** CFM/Ton
Sensible coil load **160.5** MBH
Coil CFM at Jul 1400 **19660** CFM
Max coil CFM **19660** CFM
Sensible heat ratio **1.000**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **80.0 / 72.0** °F
Leaving DB / WB **72.4 / 69.8** °F
Bypass Factor **0.100**

Heating Coil Sizing Data

Max coil load **273.8** MBH
Coil CFM at Des Htg **19660** CFM
Max coil CFM **19660** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **54.5 / 67.4** °F

Ventilation Fan Sizing Data

Actual max CFM **19660** CFM
Standard CFM **19639** CFM
Actual max CFM/ft² **0.46** CFM/ft²

Fan motor BHP **20.28** BHP
Fan motor kW **16.09** kW
Fan static **3.00** in wg

Exhaust Fan Sizing Data

Actual max CFM **19660** CFM
Standard CFM **19639** CFM
Actual max CFM/ft² **0.46** CFM/ft²

Fan motor BHP **13.52** BHP
Fan motor kW **10.73** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **19660** CFM
CFM/ft² **0.46** CFM/ft²

CFM/person **33.45** CFM/person

Zone Sizing Summary for HRU-1 Classrooms A/B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name HRU-1 Classrooms A/B
Equipment Class TERM
Air System Type VRF

Number of zones 38
Floor Area 42848.0 ft²
Location Boston, Massachusetts

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Sum of space airflow rates
Space CFM Sizing Individual peak space loads

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	10.8	6.0	75.0 / 70.6	66.1 / 65.7	-	Jul 0700	0.54
Zone 2	15.4	9.0	75.8 / 67.1	55.0 / 54.3	-	Jul 1000	0.46
Zone 3	29.9	17.9	75.6 / 66.8	55.6 / 54.9	-	Jul 1300	0.81
Zone 4	4.1	2.0	75.5 / 69.7	55.0 / 54.7	-	Jul 1000	0.11
Zone 5	3.5	2.1	76.0 / 66.7	55.0 / 54.3	-	Aug 1000	0.29
Zone 6	10.0	7.7	75.0 / 69.8	67.1 / 66.6	-	Jul 1100	1.49
Zone 7	18.3	8.0	75.0 / 70.6	55.0 / 54.9	-	Aug 1200	0.40
Zone 8	39.2	18.6	75.0 / 70.6	62.9 / 62.6	-	Jul 0900	0.96
Zone 9	15.2	6.7	75.0 / 70.6	58.6 / 58.4	-	Jul 0900	1.03
Zone 10	37.7	18.1	75.0 / 70.6	63.3 / 62.9	-	Jul 0900	0.96
Zone 11	10.1	4.5	75.2 / 70.5	55.0 / 54.8	-	Aug 1200	0.10
Zone 12	26.6	15.1	75.9 / 67.5	55.0 / 54.4	-	Jul 1000	0.78
Zone 13	26.5	14.9	75.8 / 67.5	55.0 / 54.4	-	Aug 1000	0.78
Zone 14	26.5	15.0	75.9 / 67.5	55.0 / 54.4	-	Jul 1000	0.78
Zone 15	20.3	11.3	75.3 / 68.3	58.9 / 58.3	-	Jul 1400	0.73
Zone 16	55.8	33.1	76.5 / 67.2	55.0 / 54.3	-	Jul 1000	0.19
Zone 17	19.0	8.9	75.2 / 69.7	55.0 / 54.7	-	Jul 1200	0.55
Zone 18	10.7	5.8	75.6 / 67.9	55.0 / 54.5	-	Jul 1000	0.49
Zone 19	11.6	6.4	75.8 / 67.7	55.0 / 54.4	-	Jul 1000	0.44
Zone 20	20.3	10.1	75.3 / 68.9	55.5 / 55.1	-	Jul 0900	0.60
Zone 21	20.9	11.5	75.0 / 70.6	66.0 / 65.6	-	Jul 0800	0.47
Zone 22	26.9	15.4	75.8 / 67.4	55.0 / 54.4	-	Aug 1000	0.79
Zone 23	2.5	1.4	76.2 / 67.5	55.0 / 54.4	-	Aug 1000	0.41
Zone 24	39.2	18.6	75.0 / 70.6	62.9 / 62.6	-	Jul 0900	0.96
Zone 25	11.2	5.3	75.0 / 70.6	63.0 / 62.7	-	Jul 1100	1.00
Zone 26	39.2	18.6	75.0 / 70.6	62.9 / 62.6	-	Jul 0900	0.96
Zone 27	26.6	15.1	75.9 / 67.5	55.0 / 54.4	-	Jul 1000	0.77
Zone 28	26.8	15.2	75.9 / 67.5	55.0 / 54.4	-	Jul 1000	0.75
Zone 29	26.5	15.0	75.9 / 67.5	55.0 / 54.4	-	Jul 1000	0.77
Zone 30	10.3	7.1	75.2 / 68.1	63.1 / 62.4	-	Jul 1200	1.11
Zone 31	42.0	20.5	75.1 / 70.3	62.5 / 62.1	-	Jul 1400	0.59
Zone 32	2.7	1.5	75.8 / 67.5	55.0 / 54.4	-	Jul 1000	0.46
Zone 33	4.0	1.8	75.0 / 70.6	58.6 / 58.4	-	Jul 1400	0.20
Zone 34	40.1	19.0	75.0 / 70.6	62.9 / 62.5	-	Jul 1000	0.97
Zone 35	10.9	5.1	75.0 / 70.6	62.3 / 62.0	-	Jul 1100	1.00
Zone 36	40.8	19.3	75.0 / 70.6	62.7 / 62.3	-	Jul 0900	0.97
Zone 37	27.0	15.5	75.8 / 67.3	55.0 / 54.4	-	Jul 1000	0.80
Zone 38	26.9	15.3	75.8 / 67.4	55.0 / 54.4	-	Jul 1000	0.80

Terminal Unit Sizing Data - Heating, Fan, Ventilation

	Heating Coil	Heating Coil Ent/Lvg	Htg Coil Water Flow	Fan Design	Fan	Fan	OA Vent Design
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Zone Sizing Summary for HRU-1 Classrooms A/B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Load (MBH)	DB (°F)	@20.0 °F (gpm)	Airflow (CFM)	Motor (BHP)	Motor (kW)	Airflow (CFM)
Zone 1	2.2	70.0 / 73.3	-	625	0.000	0.000	625
Zone 2	1.8	69.9 / 74.0	-	401	0.000	0.000	180
Zone 3	8.5	69.7 / 79.2	-	832	0.000	0.000	375
Zone 4	0.7	69.8 / 77.4	-	88	0.000	0.000	50
Zone 5	0.0	0.0 / 0.0	0.00	94	0.000	0.000	30
Zone 6	15.8	69.3 / 85.5	-	905	0.000	0.000	270
Zone 7	0.0	0.0 / 0.0	0.00	369	0.000	0.000	360
Zone 8	16.1	70.0 / 80.4	-	1430	0.000	0.000	1430
Zone 9	0.0	0.0 / 0.0	0.00	380	0.000	0.000	380
Zone 10	14.8	70.0 / 79.6	-	1430	0.000	0.000	1430
Zone 11	0.0	0.0 / 0.0	0.00	204	0.000	0.000	180
Zone 12	7.6	69.7 / 80.2	-	670	0.000	0.000	360
Zone 13	6.5	69.7 / 78.8	-	665	0.000	0.000	360
Zone 14	6.7	69.8 / 79.1	-	666	0.000	0.000	360
Zone 15	11.1	69.6 / 85.7	-	634	0.000	0.000	360
Zone 16	4.2	69.8 / 72.6	-	1426	0.000	0.000	340
Zone 17	4.4	69.9 / 80.0	-	407	0.000	0.000	340
Zone 18	4.6	69.6 / 86.1	-	260	0.000	0.000	150
Zone 19	4.5	69.5 / 84.2	-	286	0.000	0.000	150
Zone 20	7.3	69.7 / 84.0	-	476	0.000	0.000	345
Zone 21	0.0	0.0 / 0.0	0.00	1190	0.000	0.000	1190
Zone 22	8.1	69.7 / 80.6	-	685	0.000	0.000	360
Zone 23	0.0	0.0 / 0.0	0.00	62	0.000	0.000	30
Zone 24	16.1	70.0 / 80.4	-	1430	0.000	0.000	1430
Zone 25	0.0	0.0 / 0.0	0.00	410	0.000	0.000	410
Zone 26	15.8	70.0 / 80.2	-	1430	0.000	0.000	1430
Zone 27	7.6	69.7 / 80.1	-	671	0.000	0.000	360
Zone 28	6.6	69.8 / 78.9	-	673	0.000	0.000	360
Zone 29	6.7	69.8 / 79.2	-	667	0.000	0.000	360
Zone 30	9.8	69.4 / 86.0	-	546	0.000	0.000	160
Zone 31	13.9	70.0 / 78.5	-	1510	0.000	0.000	1370
Zone 32	0.3	69.9 / 73.5	-	69	0.000	0.000	35
Zone 33	1.1	70.0 / 80.2	-	100	0.000	0.000	100
Zone 34	24.4	70.0 / 85.6	-	1450	0.000	0.000	1450
Zone 35	1.3	70.0 / 73.2	-	370	0.000	0.000	370
Zone 36	25.2	70.0 / 86.1	-	1450	0.000	0.000	1450
Zone 37	9.2	69.6 / 82.0	-	688	0.000	0.000	360
Zone 38	8.0	69.6 / 80.5	-	683	0.000	0.000	360

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	432.1	36.0	270.9
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	432.1	36.0	270.9

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
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Zone Sizing Summary for HRU-1 Classrooms A/B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	2.5	Jul 1400	0.4	1167.2
Zone 2	8.6	Jul 1400	1.6	870.0
Zone 3	17.9	Jul 1400	8.6	1031.8
Zone 4	1.9	Jul 1400	0.8	769.3
Zone 5	2.0	Jan 1400	0.0	326.7
Zone 6	6.4	Jul 1400	16.6	608.8
Zone 7	8.0	Jan 1400	0.0	918.5
Zone 8	11.8	Jul 1400	6.5	1490.2
Zone 9	5.7	Jan 1400	0.0	367.4
Zone 10	11.1	Jul 1400	5.7	1490.2
Zone 11	4.4	Jan 1100	0.0	1965.6
Zone 12	14.5	Aug 1100	7.9	862.2
Zone 13	14.3	Aug 1100	6.8	849.4
Zone 14	14.4	Aug 1100	6.8	859.6
Zone 15	10.3	Jul 1400	11.6	864.7
Zone 16	30.8	Jul 1100	4.9	7322.8
Zone 17	8.8	Jul 1400	4.9	741.1
Zone 18	5.6	Jul 1400	4.8	531.6
Zone 19	6.2	Jul 1400	4.8	656.1
Zone 20	10.3	Nov 1400	7.9	790.3
Zone 21	5.6	Jan 1100	0.0	2539.3
Zone 22	14.8	Aug 1100	8.5	862.1
Zone 23	1.3	Jan 1400	0.0	149.9
Zone 24	11.8	Jul 1400	6.5	1490.3
Zone 25	3.6	Jan 1100	0.0	410.2
Zone 26	11.8	Jul 1400	6.5	1490.2
Zone 27	14.5	Aug 1100	7.9	866.7
Zone 28	14.5	Aug 1100	6.8	901.3
Zone 29	14.4	Aug 1100	6.8	864.1
Zone 30	6.5	Jul 1400	10.0	493.5
Zone 31	15.0	Jul 1400	7.2	2570.1
Zone 32	1.5	Jul 1400	0.3	149.9
Zone 33	1.6	Jul 1400	0.9	496.8
Zone 34	13.2	Jul 1400	11.4	1496.5
Zone 35	3.7	Jul 1400	0.7	370.3
Zone 36	13.2	Jul 1400	11.5	1496.5
Zone 37	14.8	Aug 1100	9.6	864.7
Zone 38	14.7	Aug 1100	8.5	852.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
A146 CORRIDOR	1	2.5	Jul 1400	625	0.4	1167.2	0.54
Zone 2							
A141C RELATED CR	1	8.6	Jul 1400	401	1.6	870.0	0.46
Zone 3							
B101E RELATED CR	1	17.9	Jul 1400	832	8.6	1031.8	0.81
Zone 4							
B111A CORRIDOR	1	1.9	Jul 1400	88	0.8	769.3	0.11
Zone 5							
B115 SCHOOL STORE	1	2.0	Jan 1400	94	0.0	326.7	0.29

Zone Sizing Summary for HRU-1 Classrooms A/B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 6							
B114 CORRIDOR	1	6.4	Jul 1400	905	16.6	608.8	1.49
Zone 7							
A208 LANGUAGE LEARNING	1	8.0	Jan 1400	369	0.0	918.5	0.40
Zone 8							
A209 SCI LAB	1	11.8	Jul 1400	1430	6.5	1490.2	0.96
Zone 9							
A210 SCI PREP	1	5.7	Jan 1400	380	0.0	367.4	1.03
Zone 10							
A211 SCI LAB	1	11.1	Jul 1400	1430	5.7	1490.2	0.96
Zone 11							
A212 CORRIDOR	1	4.4	Jan 1100	204	0.0	1965.6	0.10
Zone 12							
A224 CR	1	14.5	Aug 1100	670	7.9	862.2	0.78
Zone 13							
A225 CR	1	14.3	Aug 1100	665	6.8	849.4	0.78
Zone 14							
A226 CR	1	14.4	Aug 1100	666	6.8	859.6	0.78
Zone 15							
A301 SPED LEARNING CENTE	1	10.3	Jul 1400	634	11.6	864.7	0.73
Zone 16							
A302 BIO RELATED CR	1	30.8	Jul 1100	1426	4.9	7322.8	0.19
Zone 17							
A305 HEALTH ASSIST RELAT	1	8.8	Jul 1400	407	4.9	741.1	0.55
Zone 18							
A306 SPED SMALL GROUP	1	5.6	Jul 1400	260	4.8	531.6	0.49
Zone 19							
A307 SPED SMALL GROUP	1	6.2	Jul 1400	286	4.8	656.1	0.44
Zone 20							
A308 DIGITAL LEARNING	1	10.3	Nov 1400	476	7.9	790.3	0.60
Zone 21							
A309 CORRIDOR	1	5.6	Jan 1100	1190	0.0	2539.3	0.47
Zone 22							
A431 CR	1	14.8	Aug 1100	685	8.5	862.1	0.79
Zone 23							
A317 SPED RESOURCE	1	1.3	Jan 1400	62	0.0	149.9	0.41
Zone 24							
A318 SCI LAB	1	11.8	Jul 1400	1430	6.5	1490.3	0.96
Zone 25							
A319 SCI PREP	1	3.6	Jan 1100	410	0.0	410.2	1.00
Zone 26							
A320 SCI LAB	1	11.8	Jul 1400	1430	6.5	1490.2	0.96
Zone 27							
A322 CR	1	14.5	Aug 1100	671	7.9	866.7	0.77
Zone 28							
A323 CR	1	14.5	Aug 1100	673	6.8	901.3	0.75
Zone 29							
A324 CR	1	14.4	Aug 1100	667	6.8	864.1	0.77
Zone 30							
A401 SPED SMALL GROUP	1	6.5	Jul 1400	546	10.0	493.5	1.11
Zone 31							
A416 CORRIDOR	1	9.8	Jul 1400	1200	2.5	1398.5	0.86
A416a CORRIDOR Ext	1	2.0	Jul 1400	160	2.9	249.6	0.64
A416b CORRIDOR	1	3.2	Jul 1400	150	1.7	922.0	0.16

Zone Sizing Summary for HRU-1 Classrooms A/B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 32							
A424 SPED RESOURCE	1	1.5	Jul 1400	69	0.3	149.9	0.46
Zone 33							
A421 STOR	1	1.6	Jul 1400	100	0.9	496.8	0.20
Zone 34							
A425 SCI LAB	1	13.2	Jul 1400	1450	11.4	1496.5	0.97
Zone 35							
A426 SCI PREP	1	3.7	Jul 1400	370	0.7	370.3	1.00
Zone 36							
A427 SCI LAB	1	13.2	Jul 1400	1450	11.5	1496.5	0.97
Zone 37							
A429 CR	1	14.8	Aug 1100	688	9.6	864.7	0.80
Zone 38							
A430 CR	1	14.7	Aug 1100	683	8.5	852.0	0.80

Dedicated Outdoor Air System (DOAS) Sizing Summary for HRU-2 Classrooms B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **HRU-2 Classrooms B**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **58**
Floor Area **58585.8** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **13.3** Tons
Total coil load **159.0** MBH
Total coil load **1442.0** CFM/Ton
Sensible coil load **159.0** MBH
Coil CFM at Jul 1400 **19108** CFM
Max coil CFM **19108** CFM
Sensible heat ratio **1.000**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **80.1 / 72.1** °F
Leaving DB / WB **72.4 / 69.8** °F
Bypass Factor **0.100**

Heating Coil Sizing Data

Max coil load **266.1** MBH
Coil CFM at Des Htg **19108** CFM
Max coil CFM **19108** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **54.5 / 67.4** °F

Ventilation Fan Sizing Data

Actual max CFM **19108** CFM
Standard CFM **19087** CFM
Actual max CFM/ft² **0.33** CFM/ft²

Fan motor BHP **19.72** BHP
Fan motor kW **15.64** kW
Fan static **3.00** in wg

Exhaust Fan Sizing Data

Actual max CFM **19108** CFM
Standard CFM **19087** CFM
Actual max CFM/ft² **0.33** CFM/ft²

Fan motor BHP **13.14** BHP
Fan motor kW **10.43** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **19108** CFM
CFM/ft² **0.33** CFM/ft²

CFM/person **19.88** CFM/person

Zone Sizing Summary for HRU-2 Classrooms B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **HRU-2 Classrooms B**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **58**
Floor Area **58585.8** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	20.1	9.3	75.2 / 69.9	55.0 / 54.8	-	Jul 1200	0.44
Zone 2	0.9	0.4	75.5 / 69.3	55.0 / 54.7	-	Jul 1300	0.14
Zone 3	9.4	4.1	75.1 / 70.6	55.0 / 54.9	-	Jul 1200	0.11
Zone 4	5.3	3.0	76.0 / 67.5	55.0 / 54.4	-	Aug 1000	0.33
Zone 5	1.7	0.9	75.8 / 68.3	55.0 / 54.5	-	Aug 1000	0.50
Zone 6	2.5	1.1	75.5 / 70.1	55.0 / 54.8	-	Jul 1000	0.13
Zone 7	24.6	12.9	75.5 / 68.2	55.0 / 54.5	-	Aug 1000	0.60
Zone 8	20.5	9.1	75.1 / 70.3	55.0 / 54.8	-	Aug 1200	0.34
Zone 9	26.5	15.0	75.9 / 67.5	55.0 / 54.4	-	Jul 1000	0.78
Zone 10	41.3	37.0	75.4 / 64.5	59.1 / 58.0	-	Jul 1800	2.05
Zone 11	26.6	15.0	75.8 / 67.6	55.0 / 54.4	-	Aug 1000	0.78
Zone 12	11.3	5.5	75.0 / 70.6	63.8 / 63.5	-	Jul 0900	0.51
Zone 13	8.3	3.8	75.3 / 70.0	55.0 / 54.8	-	Aug 1200	0.35
Zone 14	7.0	3.0	75.1 / 70.5	55.0 / 54.9	-	Aug 1200	0.41
Zone 15	22.1	11.4	75.3 / 68.5	55.9 / 55.5	-	Aug 1400	0.65
Zone 16	27.3	19.3	76.3 / 65.1	55.0 / 54.0	-	Aug 1000	0.84
Zone 17	31.2	13.6	75.0 / 70.6	56.2 / 56.0	-	Jul 0900	0.18
Zone 18	22.9	11.9	75.4 / 68.4	55.5 / 55.1	-	Aug 1400	0.62
Zone 19	19.2	11.8	75.6 / 66.5	55.6 / 54.8	-	Aug 1400	0.65
Zone 20	26.9	15.2	75.8 / 67.5	55.0 / 54.4	-	Jul 1000	0.81
Zone 21	26.6	15.0	75.9 / 67.6	55.0 / 54.4	-	Aug 1000	0.78
Zone 22	26.6	15.0	75.9 / 67.6	55.0 / 54.4	-	Aug 1000	0.78
Zone 23	26.6	15.0	75.9 / 67.6	55.0 / 54.4	-	Aug 1000	0.78
Zone 24	26.9	15.2	75.9 / 67.5	55.0 / 54.4	-	Jul 1000	0.79
Zone 25	2.5	1.4	76.2 / 67.7	55.0 / 54.4	-	Aug 1000	0.42
Zone 26	26.0	11.7	75.2 / 70.2	55.0 / 54.8	-	Jul 0900	0.13
Zone 27	13.7	6.2	75.7 / 70.4	55.0 / 54.8	-	Jul 1000	0.11
Zone 28	39.2	34.1	75.6 / 63.1	55.7 / 54.6	-	Jul 1800	2.39
Zone 29	26.7	15.0	75.9 / 67.6	55.0 / 54.4	-	Jul 1000	0.78
Zone 30	26.7	15.0	75.8 / 67.6	55.0 / 54.4	-	Jul 1000	0.78
Zone 31	22.1	11.5	75.4 / 68.5	55.9 / 55.4	-	Aug 1400	0.65
Zone 32	22.9	11.9	75.4 / 68.4	55.5 / 55.0	-	Aug 1400	0.62
Zone 33	22.2	11.5	75.4 / 68.5	55.9 / 55.4	-	Aug 1400	0.65
Zone 34	35.3	17.3	75.0 / 70.6	63.8 / 63.4	-	Jul 1400	0.92
Zone 35	12.8	6.2	75.0 / 70.6	63.5 / 63.1	-	Jul 1100	1.07
Zone 36	2.8	1.2	75.0 / 70.7	59.6 / 59.4	-	Jul 1300	0.24
Zone 37	34.8	17.1	75.0 / 70.6	63.9 / 63.6	-	Jul 1100	0.92
Zone 38	27.0	18.8	75.9 / 65.1	55.0 / 54.1	-	Jul 1000	0.84
Zone 39	2.5	1.4	76.2 / 67.7	55.0 / 54.4	-	Aug 1000	0.42
Zone 40	26.7	15.0	75.9 / 67.6	55.0 / 54.4	-	Jul 1000	0.78
Zone 41	26.6	15.0	75.9 / 67.6	55.0 / 54.4	-	Aug 1000	0.78
Zone 42	26.6	15.0	75.9 / 67.6	55.0 / 54.4	-	Aug 1000	0.78
Zone 43	27.4	15.6	75.8 / 67.4	55.0 / 54.4	-	Aug 1000	0.82

Zone Sizing Summary for HRU-2 Classrooms B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 44	26.6	14.9	75.8 / 67.6	55.0 / 54.4	-	Aug 1000	0.79
Zone 45	27.1	15.3	75.8 / 67.4	55.0 / 54.4	-	Jul 1000	0.80
Zone 46	48.6	31.9	75.5 / 68.1	61.9 / 61.3	-	Jul 1400	0.41
Zone 47	43.0	34.7	75.7 / 63.8	55.7 / 54.7	-	Jun 1800	2.45
Zone 48	27.0	15.5	75.9 / 67.3	55.0 / 54.4	-	Jul 1000	0.81
Zone 49	26.2	19.8	76.3 / 64.4	55.0 / 53.9	-	Jul 1000	0.86
Zone 50	2.6	1.5	76.0 / 67.2	55.0 / 54.3	-	Jul 1000	0.46
Zone 51	27.1	15.4	75.8 / 67.4	55.0 / 54.4	-	Jul 1000	0.80
Zone 52	27.1	15.3	75.8 / 67.4	55.0 / 54.4	-	Jul 1000	0.80
Zone 53	27.1	15.3	75.8 / 67.4	55.0 / 54.4	-	Jul 1000	0.80
Zone 54	27.2	15.4	75.8 / 67.4	55.0 / 54.4	-	Jul 1000	0.81
Zone 55	27.3	15.5	75.8 / 67.4	55.0 / 54.4	-	Jul 1000	0.83
Zone 56	23.6	12.3	75.4 / 68.2	55.0 / 54.5	-	Aug 1400	0.66
Zone 57	23.9	12.6	75.4 / 68.2	55.0 / 54.5	-	Aug 1400	0.63
Zone 58	23.5	12.3	75.4 / 68.2	55.0 / 54.5	-	Aug 1400	0.67

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.7	70.0 / 73.7	-	425	0.000	0.000	365
Zone 2	0.3	69.7 / 81.9	-	20	0.000	0.000	10
Zone 3	0.8	70.0 / 73.9	-	188	0.000	0.000	178
Zone 4	0.0	0.0 / 0.0	0.00	133	0.000	0.000	55
Zone 5	0.0	0.0 / 0.0	0.00	41	0.000	0.000	25
Zone 6	0.0	0.0 / 0.0	0.00	51	0.000	0.000	35
Zone 7	10.4	69.7 / 86.2	-	585	0.000	0.000	365
Zone 8	0.0	0.0 / 0.0	0.00	419	0.000	0.000	390
Zone 9	9.8	69.7 / 83.4	-	666	0.000	0.000	352
Zone 10	38.3	69.4 / 86.3	-	2103	0.000	0.000	160
Zone 11	6.5	69.7 / 78.8	-	665	0.000	0.000	360
Zone 12	7.6	70.0 / 85.3	-	460	0.000	0.000	460
Zone 13	0.0	0.0 / 0.0	0.00	175	0.000	0.000	150
Zone 14	0.0	0.0 / 0.0	0.00	141	0.000	0.000	135
Zone 15	5.0	69.8 / 78.3	-	547	0.000	0.000	360
Zone 16	11.2	69.4 / 81.7	-	837	0.000	0.000	195
Zone 17	9.3	70.0 / 82.9	-	670	0.000	0.000	670
Zone 18	4.7	69.8 / 77.7	-	557	0.000	0.000	360
Zone 19	4.9	69.7 / 78.0	-	548	0.000	0.000	210
Zone 20	9.3	69.6 / 82.4	-	674	0.000	0.000	360
Zone 21	6.7	69.8 / 79.1	-	665	0.000	0.000	360
Zone 22	6.7	69.8 / 79.1	-	665	0.000	0.000	360
Zone 23	6.7	69.8 / 79.1	-	665	0.000	0.000	360
Zone 24	7.9	69.7 / 80.5	-	675	0.000	0.000	360
Zone 25	0.0	0.0 / 0.0	0.00	61	0.000	0.000	30
Zone 26	5.6	69.9 / 79.6	-	537	0.000	0.000	416
Zone 27	3.4	69.8 / 81.3	-	278	0.000	0.000	195
Zone 28	27.5	69.4 / 85.4	-	1594	0.000	0.000	160
Zone 29	6.7	69.8 / 79.1	-	665	0.000	0.000	360
Zone 30	7.2	69.7 / 79.7	-	666	0.000	0.000	360
Zone 31	4.6	69.8 / 77.6	-	546	0.000	0.000	360

Zone Sizing Summary for HRU-2 Classrooms B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 32	5.1	69.9 / 78.3	-	557	0.000	0.000	360
Zone 33	4.9	69.9 / 78.1	-	548	0.000	0.000	360
Zone 34	7.2	70.0 / 74.7	-	1430	0.000	0.000	1430
Zone 35	1.7	70.0 / 73.2	-	500	0.000	0.000	500
Zone 36	0.8	70.0 / 80.2	-	75	0.000	0.000	75
Zone 37	6.4	70.0 / 74.1	-	1430	0.000	0.000	1430
Zone 38	15.2	69.4 / 86.3	-	834	0.000	0.000	200
Zone 39	0.0	0.0 / 0.0	0.00	61	0.000	0.000	30
Zone 40	7.1	69.7 / 79.6	-	668	0.000	0.000	360
Zone 41	6.7	69.8 / 79.1	-	665	0.000	0.000	360
Zone 42	6.7	69.8 / 79.1	-	665	0.000	0.000	360
Zone 43	8.1	69.6 / 80.4	-	696	0.000	0.000	360
Zone 44	8.0	69.7 / 80.8	-	665	0.000	0.000	360
Zone 45	8.3	69.7 / 81.0	-	683	0.000	0.000	360
Zone 46	39.2	69.2 / 85.8	-	2183	0.000	0.000	330
Zone 47	28.9	69.5 / 86.1	-	1618	0.000	0.000	320
Zone 48	9.5	69.7 / 82.5	-	688	0.000	0.000	352
Zone 49	12.9	69.2 / 83.2	-	858	0.000	0.000	135
Zone 50	0.3	70.0 / 74.3	-	68	0.000	0.000	30
Zone 51	8.8	69.7 / 81.5	-	685	0.000	0.000	360
Zone 52	8.1	69.7 / 80.7	-	683	0.000	0.000	360
Zone 53	8.1	69.7 / 80.7	-	683	0.000	0.000	360
Zone 54	10.8	69.7 / 84.2	-	687	0.000	0.000	360
Zone 55	9.4	69.6 / 82.1	-	691	0.000	0.000	360
Zone 56	6.6	69.8 / 80.7	-	562	0.000	0.000	360
Zone 57	6.8	69.8 / 80.8	-	572	0.000	0.000	360
Zone 58	6.2	69.8 / 80.1	-	560	0.000	0.000	360

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	686.2	57.2	444.4
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	686.2	57.2	444.4

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	9.2	Jul 1400	1.8	964.7
Zone 2	0.4	Jul 1400	0.3	148.8
Zone 3	3.9	Jul 1400	0.8	1750.1
Zone 4	2.9	Jan 1100	0.0	400.3
Zone 5	0.9	Jan 1100	0.0	82.1
Zone 6	1.1	Jan 1400	0.0	400.3
Zone 7	11.5	Jul 1400	10.7	981.4
Zone 8	9.0	Jan 1400	0.0	1239.8

Zone Sizing Summary for HRU-2 Classrooms B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 9	14.4	Aug 1100	9.8	850.1
Zone 10	36.4	Jun 1800	38.6	1027.0
Zone 11	14.3	Aug 1100	6.8	848.5
Zone 12	2.9	Jul 1400	4.5	907.7
Zone 13	3.8	Jan 1400	0.0	500.2
Zone 14	3.0	Jan 1400	0.0	341.3
Zone 15	11.8	Oct 1400	5.4	837.7
Zone 16	18.1	Aug 1100	11.6	991.5
Zone 17	10.3	Jul 1500	7.6	3660.9
Zone 18	12.0	Oct 1400	5.2	904.5
Zone 19	11.8	Oct 1400	5.2	844.9
Zone 20	14.5	Aug 1100	9.7	836.8
Zone 21	14.4	Aug 1100	6.8	852.5
Zone 22	14.4	Aug 1100	6.8	852.5
Zone 23	14.4	Aug 1100	6.8	852.5
Zone 24	14.6	Aug 1100	8.3	858.4
Zone 25	1.3	Jan 1400	0.0	144.1
Zone 26	9.7	Jul 1100	5.0	4120.7
Zone 27	6.0	Jul 1100	3.6	2432.8
Zone 28	34.4	Jun 1800	27.7	665.8
Zone 29	14.4	Aug 1100	6.8	853.0
Zone 30	14.4	Aug 1100	7.6	850.1
Zone 31	11.8	Oct 1400	4.9	837.7
Zone 32	12.0	Oct 1400	5.1	904.5
Zone 33	11.8	Oct 1400	5.0	846.8
Zone 34	11.2	Jul 1400	2.8	1549.7
Zone 35	4.2	Jul 1400	0.9	468.8
Zone 36	1.1	Jul 1400	0.6	310.7
Zone 37	11.0	Jul 1400	2.4	1549.7
Zone 38	16.8	Aug 1100	15.3	993.4
Zone 39	1.3	Jan 1400	0.0	146.4
Zone 40	14.4	Aug 1100	7.5	858.4
Zone 41	14.4	Aug 1100	6.8	852.5
Zone 42	14.4	Aug 1100	6.8	852.5
Zone 43	15.0	Aug 1100	8.6	852.5
Zone 44	14.3	Aug 1100	8.1	836.8
Zone 45	14.7	Aug 1100	8.5	853.0
Zone 46	25.9	Jul 1400	39.5	5380.7
Zone 47	34.9	Jun 1800	29.3	659.1
Zone 48	14.9	Aug 1100	9.4	850.1
Zone 49	18.5	Aug 1100	13.6	993.2
Zone 50	1.5	Jul 1400	0.3	146.4
Zone 51	14.8	Aug 1100	9.2	858.4
Zone 52	14.7	Aug 1100	8.5	852.5
Zone 53	14.7	Aug 1100	8.5	852.5
Zone 54	14.8	Aug 1100	10.8	852.5
Zone 55	14.9	Aug 1100	9.9	836.8
Zone 56	12.1	Sep 1400	6.7	846.8
Zone 57	12.4	Sep 1400	6.9	904.8
Zone 58	12.1	Sep 1400	6.6	837.7

Zone Sizing Summary for HRU-2 Classrooms B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
B103E RELATED CR	1	9.2	Jul 1400	425	1.8	964.7	0.44
Zone 2							
B103D STOR	1	0.4	Jul 1400	20	0.3	148.8	0.14
Zone 3							
B111 CORRIDOR	1	3.3	Jul 1400	160	0.8	1452.1	0.11
B112 CORRIDOR	1	0.6	Jan 1100	28	0.0	298.0	0.09
Zone 4							
B118 BANK	1	2.9	Jan 1100	133	0.0	400.3	0.33
Zone 5							
B1 -2 Room - Bank Office	1	0.9	Jan 1100	41	0.0	82.1	0.50
Zone 6							
B121D STOR	1	0.6	Jan 1400	28	0.0	220.6	0.13
B121F WIG STOR	1	0.5	Jan 1400	24	0.0	179.7	0.13
Zone 7							
B121E THEORY CR	1	11.5	Jul 1400	585	10.7	981.4	0.60
Zone 8							
B104G RELATED CR	1	9.0	Jan 1400	419	0.0	1239.8	0.34
Zone 9							
B233 CR	1	14.4	Aug 1100	666	9.8	850.1	0.78
Zone 10							
B230 COLLAB	1	36.4	Jun 1800	2103	38.6	1027.0	2.05
Zone 11							
A227 CR	1	14.3	Aug 1100	665	6.8	848.5	0.78
Zone 12							
A223 CORRIDOR	1	2.9	Jul 1400	460	4.5	907.7	0.51
Zone 13							
B215 SPED SMALL GROUP	1	3.8	Jan 1400	175	0.0	500.2	0.35
Zone 14							
B216 IN-HOUSE SUSPENSION	1	3.0	Jan 1400	141	0.0	341.3	0.41
Zone 15							
B211 CR	1	11.8	Oct 1400	547	5.4	837.7	0.65
Zone 16							
B234 TEACHERS PLANNING	1	18.1	Aug 1100	837	11.6	991.5	0.84
Zone 17							
B214 CORRIDOR	1	2.3	Jan 1400	210	0.0	922.2	0.23
B231 CORRIDOR	1	8.5	Jul 1700	460	7.6	2738.7	0.17
Zone 18							
B212 CR	1	12.0	Oct 1400	557	5.2	904.5	0.62
Zone 19							
B213 SPED LEARNING CENTE	1	11.8	Oct 1400	548	5.2	844.9	0.65
Zone 20							
B239 CR	1	14.5	Aug 1100	674	9.7	836.8	0.81
Zone 21							
B238 CR	1	14.4	Aug 1100	665	6.8	852.5	0.78
Zone 22							
B237 CR	1	14.4	Aug 1100	665	6.8	852.5	0.78
Zone 23							
B236 CR	1	14.4	Aug 1100	665	6.8	852.5	0.78
Zone 24							
B235 CR	1	14.6	Aug 1100	675	8.3	858.4	0.79
Zone 25							
B234B HUDDLE	1	1.3	Jan 1400	61	0.0	144.1	0.42

Zone Sizing Summary for HRU-2 Classrooms B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 26							
D301 CORRIDOR	1	1.2	Jan 1400	55	0.0	438.3	0.13
B324 CORRIDOR	1	6.2	Jul 1100	287	5.0	2760.2	0.10
B312 CORRIDOR	1	2.3	Jan 1400	195	0.0	922.2	0.21
Zone 27							
A321 CORRIDOR	1	6.0	Jul 1100	278	3.6	2432.8	0.11
Zone 28							
B323 COLLAB	1	34.4	Jun 1800	1594	27.7	665.8	2.39
Zone 29							
B326 CR	1	14.4	Aug 1100	665	6.8	853.0	0.78
Zone 30							
B327 CR	1	14.4	Aug 1100	666	7.6	850.1	0.78
Zone 31							
B309 CR	1	11.8	Oct 1400	546	4.9	837.7	0.65
Zone 32							
B310 CR	1	12.0	Oct 1400	557	5.1	904.5	0.62
Zone 33							
B311 SPED LEARNING CENTE	1	11.8	Oct 1400	548	5.0	846.8	0.65
Zone 34							
B315 SCI LAB	1	11.2	Jul 1400	1430	2.8	1549.7	0.92
Zone 35							
B316 SCI PREP	1	4.2	Jul 1400	500	0.9	468.8	1.07
Zone 36							
B317 STOR	1	1.1	Jul 1400	75	0.6	310.7	0.24
Zone 37							
B322 SCI LAB	1	11.0	Jul 1400	1430	2.4	1549.7	0.92
Zone 38							
B328 TEACHERS PLANNING	1	16.8	Aug 1100	834	15.3	993.4	0.84
Zone 39							
B328B HUDDLE	1	1.3	Jan 1400	61	0.0	146.4	0.42
Zone 40							
B329 CR	1	14.4	Aug 1100	668	7.5	858.4	0.78
Zone 41							
B330 CR	1	14.4	Aug 1100	665	6.8	852.5	0.78
Zone 42							
B331 CR	1	14.4	Aug 1100	665	6.8	852.5	0.78
Zone 43							
B332 CR	1	15.0	Aug 1100	696	8.6	852.5	0.82
Zone 44							
B333 CR	1	14.3	Aug 1100	665	8.1	836.8	0.79
Zone 45							
A432 CR	1	14.7	Aug 1100	683	8.5	853.0	0.80
Zone 46							
A428 CORRIDOR	1	3.8	Jul 1400	292	5.4	901.3	0.32
B420 CORRIDOR	1	11.3	Jul 1400	804	14.7	3084.2	0.26
B421 CORRIDOR	1	2.1	Jul 1400	95	1.2	647.4	0.15
B412 CORRIDOR	1	8.7	Jul 1400	992	18.2	747.8	1.33
Zone 47							
B419 COLLAB	1	34.9	Jun 1800	1618	29.3	659.1	2.45
Zone 48							
B422 CR	1	14.9	Aug 1100	688	9.4	850.1	0.81
Zone 49							
B423 TEACHERS PLANNING	1	18.5	Aug 1100	858	13.6	993.2	0.86
Zone 50							

Zone Sizing Summary for HRU-2 Classrooms B

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
B423B HUDDLE	1	1.5	Jul 1400	68	0.3	146.4	0.46
Zone 51							
B424 CR	1	14.8	Aug 1100	685	9.2	858.4	0.80
Zone 52							
B425 CR	1	14.7	Aug 1100	683	8.5	852.5	0.80
Zone 53							
B426 CR	1	14.7	Aug 1100	683	8.5	852.5	0.80
Zone 54							
B427 CR	1	14.8	Aug 1100	687	10.8	852.5	0.81
Zone 55							
B428 CR	1	14.9	Aug 1100	691	9.9	836.8	0.83
Zone 56							
B411 SPED LEARNING CENTE	1	12.1	Sep 1400	562	6.7	846.8	0.66
Zone 57							
B410 CR	1	12.4	Sep 1400	572	6.9	904.8	0.63
Zone 58							
B409 CR	1	12.1	Sep 1400	560	6.6	837.7	0.67

Dedicated Outdoor Air System (DOAS) Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name .. **HRU-3 Classrooms Plan North**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **87**
Floor Area **57878.7** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **15.3** Tons
Total coil load **183.8** MBH
Total coil load **1421.8** CFM/Ton
Sensible coil load **183.8** MBH
Coil CFM at Jul 1400 **21782** CFM
Max coil CFM **21782** CFM
Sensible heat ratio **1.000**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **80.2 / 72.1** °F
Leaving DB / WB **72.4 / 69.8** °F
Bypass Factor **0.100**

Heating Coil Sizing Data

Max coil load **302.7** MBH
Coil CFM at Des Htg **21782** CFM
Max coil CFM **21782** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **54.5 / 67.4** °F

Ventilation Fan Sizing Data

Actual max CFM **21782** CFM
Standard CFM **21759** CFM
Actual max CFM/ft² **0.38** CFM/ft²

Fan motor BHP **22.47** BHP
Fan motor kW **17.83** kW
Fan static **3.00** in wg

Exhaust Fan Sizing Data

Actual max CFM **21782** CFM
Standard CFM **21759** CFM
Actual max CFM/ft² **0.38** CFM/ft²

Fan motor BHP **14.98** BHP
Fan motor kW **11.89** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **21782** CFM
CFM/ft² **0.38** CFM/ft²

CFM/person **27.27** CFM/person

Zone Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name .. **HRU-3 Classrooms Plan North**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **87**
Floor Area **57878.7** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	33.2	20.8	76.0 / 66.3	55.0 / 54.2	-	Jul 1000	0.94
Zone 2	4.3	1.8	75.0 / 70.7	55.0 / 54.9	-	Jul 1200	0.30
Zone 3	4.3	3.1	76.4 / 64.9	55.0 / 54.0	-	Jul 1000	0.91
Zone 4	41.0	23.9	76.3 / 67.3	55.0 / 54.3	-	Jul 1000	0.51
Zone 5	16.5	7.1	75.0 / 70.7	55.0 / 54.9	-	Jul 1200	0.50
Zone 6	34.5	21.7	76.1 / 66.3	55.0 / 54.2	-	Jul 1000	0.88
Zone 7	39.7	19.8	75.4 / 68.9	55.0 / 54.6	-	Jul 1000	0.36
Zone 8	16.5	7.1	75.0 / 70.7	55.0 / 54.9	-	Jul 1200	0.50
Zone 9	16.5	7.1	75.0 / 70.7	55.0 / 54.9	-	Jul 1200	0.55
Zone 10	31.9	19.5	76.0 / 66.6	55.0 / 54.3	-	Jul 1000	0.85
Zone 11	5.5	4.8	75.7 / 64.8	59.1 / 58.1	-	Aug 1000	1.78
Zone 12	6.3	5.5	76.1 / 62.9	55.0 / 53.8	-	Aug 1000	1.52
Zone 13	52.5	27.8	75.7 / 68.2	55.0 / 54.5	-	Jul 1000	0.79
Zone 14	4.3	3.1	76.4 / 64.9	55.0 / 54.0	-	Jul 1000	0.93
Zone 15	3.2	1.6	75.9 / 69.0	55.0 / 54.6	-	Aug 1000	0.13
Zone 16	33.3	20.8	76.1 / 66.4	55.0 / 54.2	-	Jul 1000	0.91
Zone 17	19.9	12.3	75.4 / 66.2	55.0 / 54.2	-	Jul 1200	0.78
Zone 18	18.7	11.2	76.1 / 66.8	55.0 / 54.3	-	Jul 1000	0.68
Zone 19	3.5	2.5	76.6 / 65.2	55.0 / 54.0	-	Aug 1000	0.71
Zone 20	9.3	6.1	76.6 / 66.1	55.0 / 54.1	-	Aug 1000	0.51
Zone 21	16.0	6.9	75.0 / 70.7	55.0 / 54.9	-	Jul 1200	0.57
Zone 22	3.5	2.5	76.6 / 65.2	55.0 / 54.0	-	Aug 1000	0.71
Zone 23	18.7	11.2	76.0 / 66.8	55.0 / 54.3	-	Jul 1000	0.69
Zone 24	18.7	11.3	76.0 / 66.8	55.0 / 54.3	-	Jul 1000	0.72
Zone 25	7.8	3.6	75.3 / 69.8	55.0 / 54.8	-	Aug 1200	0.34
Zone 26	15.3	6.6	75.0 / 70.7	55.0 / 54.9	-	Jul 1200	0.60
Zone 27	27.7	16.5	76.2 / 67.1	55.0 / 54.3	-	Jul 1000	0.49
Zone 28	6.3	5.6	75.6 / 64.3	58.4 / 57.3	-	Jul 1000	1.99
Zone 29	5.6	4.8	75.9 / 63.3	55.6 / 54.4	-	Aug 1000	1.35
Zone 30	6.3	5.5	76.1 / 62.9	55.0 / 53.8	-	Aug 1000	1.52
Zone 31	1.2	0.6	75.9 / 69.4	55.0 / 54.6	-	Aug 1000	0.13
Zone 32	47.2	21.6	75.0 / 70.6	61.5 / 61.2	-	Jul 0800	1.00
Zone 33	4.3	2.0	75.0 / 70.6	62.6 / 62.3	-	Jul 1000	1.00
Zone 34	13.2	5.7	75.0 / 70.6	56.4 / 56.2	-	Jul 1100	1.05
Zone 35	12.1	5.4	75.0 / 70.6	59.8 / 59.6	-	Jul 1000	1.15
Zone 36	4.1	3.2	76.6 / 64.2	55.0 / 53.9	-	Aug 1000	0.87
Zone 37	3.6	1.8	75.7 / 69.0	55.0 / 54.6	-	Aug 1000	0.15
Zone 38	46.8	22.2	75.0 / 70.6	62.9 / 62.6	-	Jul 1100	1.16
Zone 39	35.6	21.4	75.6 / 66.6	55.0 / 54.3	-	Jul 1000	0.44
Zone 40	5.5	4.8	75.7 / 64.8	59.1 / 58.0	-	Jul 1000	1.77
Zone 41	3.4	2.9	75.4 / 67.0	62.8 / 62.0	-	Jul 1300	1.37
Zone 42	2.8	2.4	75.6 / 63.3	55.2 / 54.1	-	Jul 1800	1.11
Zone 43	3.8	2.8	75.4 / 66.2	59.2 / 58.4	-	Jul 1700	0.83

Zone Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 44	9.7	5.7	76.2 / 67.1	55.0 / 54.3	-	Aug 1000	0.55
Zone 45	5.3	4.0	76.6 / 64.5	55.0 / 53.9	-	Aug 1000	0.85
Zone 46	26.6	13.0	75.5 / 69.2	55.0 / 54.7	-	Jul 1200	0.39
Zone 47	26.3	12.5	75.4 / 69.5	55.0 / 54.7	-	Jul 1200	0.39
Zone 48	2.1	1.1	75.9 / 69.0	55.0 / 54.6	-	Aug 1000	0.13
Zone 49	2.1	0.9	75.1 / 70.4	55.0 / 54.8	-	Aug 1200	0.24
Zone 50	6.1	6.1	75.0 / 69.7	71.1 / 68.5	-	Sep 1100	4.20
Zone 51	3.4	2.4	76.9 / 65.3	55.0 / 54.0	-	Aug 1000	0.49
Zone 52	3.0	2.0	76.6 / 66.1	55.0 / 54.1	-	Aug 1000	0.47
Zone 53	18.6	8.2	75.0 / 70.6	58.3 / 58.1	-	Jul 1800	0.88
Zone 54	22.0	10.8	75.5 / 69.1	55.0 / 54.6	-	Jul 1200	0.42
Zone 55	35.8	20.6	75.5 / 67.3	55.7 / 55.1	-	Jul 0900	0.57
Zone 56	25.6	17.0	76.6 / 66.0	55.0 / 54.1	-	Jul 1000	0.48
Zone 57	3.4	2.9	75.5 / 67.1	63.0 / 62.2	-	Jul 1300	1.35
Zone 58	5.5	4.7	76.2 / 63.1	55.0 / 53.8	-	Aug 1000	1.27
Zone 59	6.4	5.7	75.5 / 63.7	57.3 / 56.2	-	Aug 1000	1.91
Zone 60	22.0	10.9	75.4 / 68.9	55.0 / 54.6	-	Jul 1200	0.51
Zone 61	5.7	2.7	75.3 / 69.6	55.0 / 54.7	-	Jul 1200	0.43
Zone 62	7.0	3.0	75.0 / 70.6	56.2 / 56.0	-	Aug 1000	1.05
Zone 63	38.0	17.2	75.1 / 70.1	55.0 / 54.8	-	Jul 1200	0.50
Zone 64	37.5	17.1	75.1 / 70.0	55.0 / 54.8	-	Jul 1200	0.50
Zone 65	2.8	1.6	75.4 / 67.6	57.4 / 56.8	-	Jul 0900	0.39
Zone 66	4.8	3.5	76.4 / 64.8	55.0 / 54.0	-	Jul 1000	0.75
Zone 67	4.8	2.2	75.0 / 70.6	61.5 / 61.1	-	Jul 1000	0.83
Zone 68	1.0	0.5	75.5 / 68.8	55.0 / 54.6	-	Jul 1000	0.26
Zone 69	38.5	21.2	75.6 / 67.7	55.0 / 54.4	-	Jul 1000	0.46
Zone 70	5.4	4.9	75.4 / 67.1	63.7 / 62.9	-	Aug 1000	2.58
Zone 71	6.3	5.6	75.8 / 64.2	58.2 / 57.1	-	Aug 1100	1.88
Zone 72	21.3	10.4	75.3 / 69.1	55.0 / 54.7	-	Jul 1200	0.54
Zone 73	4.4	2.3	75.6 / 68.5	55.0 / 54.5	-	Jul 1000	0.46
Zone 74	7.7	3.7	75.4 / 69.2	55.0 / 54.7	-	Jul 1300	0.16
Zone 75	35.2	20.4	75.8 / 67.1	55.0 / 54.3	-	Jul 1000	0.69
Zone 76	33.2	17.6	75.4 / 68.1	55.0 / 54.5	-	Jul 0900	0.59
Zone 77	35.0	19.6	75.7 / 67.5	55.0 / 54.4	-	Jul 1000	0.70
Zone 78	3.4	2.5	76.2 / 64.9	55.0 / 54.0	-	Jul 1000	0.88
Zone 79	21.2	12.0	75.3 / 68.2	59.1 / 58.5	-	Aug 1000	0.72
Zone 80	41.2	31.4	75.7 / 64.9	57.0 / 56.1	-	Jul 1000	1.08
Zone 81	6.3	5.5	76.0 / 62.9	55.0 / 53.8	-	Aug 1000	1.53
Zone 82	5.6	4.8	75.9 / 63.2	55.5 / 54.4	-	Aug 1000	1.36
Zone 83	6.5	5.6	75.6 / 64.6	58.7 / 57.7	-	Jul 1100	2.05
Zone 84	3.6	1.6	75.0 / 70.6	60.2 / 59.9	-	Jul 0900	0.20
Zone 85	30.0	15.4	75.7 / 68.7	55.0 / 54.6	-	Jul 1000	0.41
Zone 86	5.1	2.3	75.0 / 70.6	60.8 / 60.5	-	Jul 1400	1.05
Zone 87	20.6	11.5	75.4 / 67.4	55.0 / 54.4	-	Jul 1500	0.93

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	6.0	70.0 / 76.1	-	915	0.000	0.000	370
Zone 2	0.0	0.0 / 0.0	0.00	85	0.000	0.000	85

Zone Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 3	0.0	0.0 / 0.0	0.00	135	0.000	0.000	30
Zone 4	10.3	69.7 / 78.9	-	1043	0.000	0.000	490
Zone 5	0.0	0.0 / 0.0	0.00	330	0.000	0.000	330
Zone 6	10.3	69.6 / 79.6	-	953	0.000	0.000	380
Zone 7	12.6	69.8 / 82.8	-	897	0.000	0.000	635
Zone 8	0.0	0.0 / 0.0	0.00	330	0.000	0.000	330
Zone 9	0.0	0.0 / 0.0	0.00	330	0.000	0.000	330
Zone 10	7.4	69.8 / 77.7	-	862	0.000	0.000	371
Zone 11	4.9	69.4 / 86.2	-	268	0.000	0.000	15
Zone 12	3.9	69.3 / 84.5	-	240	0.000	0.000	15
Zone 13	6.7	69.9 / 74.9	-	1247	0.000	0.000	800
Zone 14	0.0	0.0 / 0.0	0.00	133	0.000	0.000	30
Zone 15	0.0	0.0 / 0.0	0.00	73	0.000	0.000	30
Zone 16	5.6	70.0 / 75.6	-	917	0.000	0.000	370
Zone 17	5.4	69.7 / 78.7	-	560	0.000	0.000	220
Zone 18	5.6	69.7 / 80.2	-	495	0.000	0.000	220
Zone 19	0.0	0.0 / 0.0	0.00	107	0.000	0.000	25
Zone 20	0.0	0.0 / 0.0	0.00	260	0.000	0.000	81
Zone 21	0.0	0.0 / 0.0	0.00	320	0.000	0.000	320
Zone 22	0.0	0.0 / 0.0	0.00	107	0.000	0.000	25
Zone 23	5.4	69.6 / 79.8	-	495	0.000	0.000	220
Zone 24	7.5	69.6 / 83.6	-	498	0.000	0.000	220
Zone 25	0.0	0.0 / 0.0	0.00	166	0.000	0.000	140
Zone 26	0.0	0.0 / 0.0	0.00	305	0.000	0.000	305
Zone 27	10.6	69.5 / 83.1	-	718	0.000	0.000	315
Zone 28	5.5	69.4 / 86.3	-	300	0.000	0.000	15
Zone 29	3.9	69.0 / 85.6	-	217	0.000	0.000	15
Zone 30	4.0	69.0 / 84.2	-	240	0.000	0.000	15
Zone 31	0.0	0.0 / 0.0	0.00	27	0.000	0.000	13
Zone 32	18.1	70.0 / 81.3	-	1485	0.000	0.000	1485
Zone 33	0.0	0.0 / 0.0	0.00	150	0.000	0.000	150
Zone 34	3.5	70.0 / 81.3	-	285	0.000	0.000	285
Zone 35	0.0	0.0 / 0.0	0.00	330	0.000	0.000	330
Zone 36	0.0	0.0 / 0.0	0.00	136	0.000	0.000	20
Zone 37	0.0	0.0 / 0.0	0.00	80	0.000	0.000	40
Zone 38	20.3	70.0 / 81.1	-	1705	0.000	0.000	1705
Zone 39	10.4	69.7 / 79.7	-	961	0.000	0.000	375
Zone 40	4.9	69.4 / 86.2	-	268	0.000	0.000	15
Zone 41	3.9	69.0 / 85.6	-	216	0.000	0.000	15
Zone 42	1.9	69.3 / 86.2	-	107	0.000	0.000	15
Zone 43	2.8	69.4 / 86.2	-	158	0.000	0.000	45
Zone 44	0.0	0.0 / 0.0	0.00	250	0.000	0.000	115
Zone 45	0.0	0.0 / 0.0	0.00	170	0.000	0.000	30
Zone 46	7.6	69.8 / 81.8	-	588	0.000	0.000	440
Zone 47	7.4	69.8 / 81.8	-	570	0.000	0.000	450
Zone 48	0.0	0.0 / 0.0	0.00	47	0.000	0.000	20
Zone 49	0.0	0.0 / 0.0	0.00	43	0.000	0.000	40
Zone 50	0.0	0.0 / 0.0	0.00	1441	0.000	0.000	1420
Zone 51	0.0	0.0 / 0.0	0.00	101	0.000	0.000	20
Zone 52	0.0	0.0 / 0.0	0.00	84	0.000	0.000	25
Zone 53	6.3	70.0 / 82.8	-	455	0.000	0.000	455
Zone 54	7.0	69.8 / 83.1	-	491	0.000	0.000	360
Zone 55	14.4	69.6 / 83.4	-	966	0.000	0.000	465

Zone Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 56	10.3	69.5 / 82.6	-	728	0.000	0.000	205
Zone 57	3.9	69.0 / 85.6	-	214	0.000	0.000	15
Zone 58	3.6	69.1 / 85.6	-	205	0.000	0.000	15
Zone 59	5.2	69.4 / 86.2	-	288	0.000	0.000	15
Zone 60	6.6	69.8 / 82.2	-	496	0.000	0.000	360
Zone 61	0.5	70.0 / 73.8	-	122	0.000	0.000	100
Zone 62	0.5	70.0 / 73.1	-	150	0.000	0.000	150
Zone 63	12.6	69.9 / 84.7	-	793	0.000	0.000	710
Zone 64	12.0	69.9 / 84.0	-	787	0.000	0.000	695
Zone 65	1.5	69.4 / 86.0	-	84	0.000	0.000	36
Zone 66	0.4	70.1 / 72.5	-	151	0.000	0.000	30
Zone 67	0.5	70.0 / 73.4	-	150	0.000	0.000	150
Zone 68	0.2	69.9 / 75.9	-	24	0.000	0.000	15
Zone 69	13.8	69.7 / 83.1	-	953	0.000	0.000	516
Zone 70	7.1	69.3 / 86.3	-	388	0.000	0.000	15
Zone 71	5.4	69.4 / 86.3	-	295	0.000	0.000	15
Zone 72	6.7	69.8 / 83.0	-	474	0.000	0.000	360
Zone 73	0.4	70.0 / 74.0	-	102	0.000	0.000	67
Zone 74	1.8	69.8 / 79.7	-	170	0.000	0.000	110
Zone 75	10.4	69.7 / 80.3	-	911	0.000	0.000	445
Zone 76	14.1	69.7 / 86.1	-	798	0.000	0.000	495
Zone 77	9.9	69.7 / 80.1	-	880	0.000	0.000	475
Zone 78	0.2	69.8 / 71.3	-	108	0.000	0.000	25
Zone 79	12.2	69.6 / 86.0	-	690	0.000	0.000	360
Zone 80	27.5	69.1 / 85.4	-	1562	0.000	0.000	260
Zone 81	4.1	68.9 / 84.7	-	243	0.000	0.000	15
Zone 82	3.9	69.0 / 85.6	-	218	0.000	0.000	15
Zone 83	5.6	69.4 / 86.2	-	309	0.000	0.000	24
Zone 84	0.0	0.0 / 0.0	0.00	100	0.000	0.000	100
Zone 85	8.3	69.8 / 81.1	-	687	0.000	0.000	460
Zone 86	0.5	70.0 / 73.0	-	150	0.000	0.000	150
Zone 87	5.8	69.6 / 80.0	-	524	0.000	0.000	300

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	765.0	63.7	419.4
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	765.0	63.7	419.4

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	19.7	Jul 1100	6.0	978.4
Zone 2	1.7	Jan 1400	0.0	278.9
Zone 3	2.9	Jan 1100	0.0	148.0

Zone Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 4	22.5	Jul 1100	10.8	2058.3
Zone 5	6.8	Jan 1400	0.0	659.3
Zone 6	20.6	Jul 1400	10.8	1082.5
Zone 7	17.6	Aug 1100	12.1	2459.7
Zone 8	6.8	Jan 1400	0.0	659.3
Zone 9	6.6	Jan 1400	0.0	601.1
Zone 10	18.6	Jul 1400	7.4	1009.1
Zone 11	4.4	Aug 1100	4.9	150.5
Zone 12	5.2	Aug 1100	4.0	157.3
Zone 13	26.9	Jul 1100	6.5	1572.3
Zone 14	2.9	Jan 1100	0.0	143.7
Zone 15	1.6	Jan 1400	0.0	550.9
Zone 16	19.8	Jul 1100	5.6	1007.7
Zone 17	12.1	Jul 1600	5.7	713.4
Zone 18	10.7	Jul 1400	5.7	727.3
Zone 19	2.3	Jan 1100	0.0	151.0
Zone 20	5.6	Jan 1100	0.0	510.5
Zone 21	6.5	Jan 1400	0.0	560.7
Zone 22	2.3	Jan 1100	0.0	151.0
Zone 23	10.7	Jul 1400	5.7	721.7
Zone 24	10.8	Jul 1400	7.7	696.6
Zone 25	3.6	Jan 1100	0.0	490.1
Zone 26	6.3	Jan 1400	0.0	509.6
Zone 27	15.5	Aug 1100	11.3	1452.8
Zone 28	5.2	Aug 1100	5.5	150.5
Zone 29	4.4	Aug 1100	4.0	160.7
Zone 30	5.2	Aug 1100	4.1	158.7
Zone 31	0.6	Jan 1400	0.0	216.0
Zone 32	13.9	Jul 1400	8.5	1483.6
Zone 33	1.4	Jan 1400	0.0	150.1
Zone 34	5.6	Jul 1500	3.6	270.2
Zone 35	4.8	Jan 1100	0.0	287.9
Zone 36	2.9	Jan 1100	0.0	156.5
Zone 37	1.7	Jan 1400	0.0	554.6
Zone 38	13.8	Jul 1400	7.8	1466.3
Zone 39	17.6	Aug 1100	9.1	2197.9
Zone 40	4.4	Aug 1100	4.9	151.3
Zone 41	2.7	Jul 1400	4.0	157.2
Zone 42	2.3	Jun 1800	2.0	96.4
Zone 43	2.7	Jun 1800	2.9	189.2
Zone 44	5.4	Jan 1100	0.0	452.1
Zone 45	3.7	Jan 1100	0.0	199.9
Zone 46	12.7	Jul 1400	8.3	1501.1
Zone 47	12.3	Jul 1400	7.7	1470.5
Zone 48	1.0	Jan 1400	0.0	349.9
Zone 49	0.9	Jan 1400	0.0	181.1
Zone 50	1.2	Jan 1400	0.0	343.5
Zone 51	2.2	Jan 1100	0.0	205.3
Zone 52	1.8	Jan 1100	0.0	180.8
Zone 53	8.1	Jun 1800	5.5	514.8
Zone 54	10.6	Jul 1400	7.2	1159.5
Zone 55	20.8	Jun 1700	14.7	1701.6
Zone 56	15.7	Aug 1100	10.7	1502.1
Zone 57	2.7	Jul 1400	3.9	158.7

Zone Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 58	4.4	Aug 1100	3.6	160.7
Zone 59	5.2	Aug 1100	5.3	150.5
Zone 60	10.7	Jul 1400	7.3	981.9
Zone 61	2.6	Jul 1400	0.5	285.3
Zone 62	3.0	Jul 1400	0.3	142.9
Zone 63	17.1	Jul 1400	12.7	1584.5
Zone 64	17.0	Jul 1400	12.9	1558.1
Zone 65	1.3	Jul 1400	1.5	214.7
Zone 66	3.3	Jul 1100	0.4	200.9
Zone 67	1.6	Jul 1400	0.3	180.5
Zone 68	0.5	Jul 1400	0.2	90.5
Zone 69	18.8	Aug 1100	13.2	2085.2
Zone 70	4.5	Aug 1100	7.1	150.5
Zone 71	5.2	Aug 1100	5.4	157.2
Zone 72	10.2	Jul 1400	7.0	870.5
Zone 73	2.2	Jul 1400	0.4	223.8
Zone 74	3.7	Jul 1400	1.9	1059.4
Zone 75	19.7	Jul 1400	10.6	1327.5
Zone 76	14.9	Jul 1400	14.6	1360.5
Zone 77	19.0	Jul 1400	10.3	1258.4
Zone 78	2.3	Jul 1100	0.2	123.1
Zone 79	11.0	Jul 1400	12.6	961.2
Zone 80	27.7	Aug 1100	28.6	1440.4
Zone 81	5.3	Aug 1100	4.3	158.7
Zone 82	4.5	Aug 1100	4.0	160.7
Zone 83	5.3	Aug 1100	5.7	150.5
Zone 84	1.1	Jan 1100	0.0	496.8
Zone 85	14.8	Jul 1400	8.6	1668.3
Zone 86	2.1	Jul 1400	0.3	142.7
Zone 87	11.3	Jul 1600	6.3	563.4

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
A206F COMPUTER LAB	1	19.7	Jul 1100	915	6.0	978.4	0.94
Zone 2							
a206e photo stor	1	1.7	Jan 1400	85	0.0	278.9	0.30
Zone 3							
A148M (2nd flr. Voc. CR)	1	2.9	Jan 1100	135	0.0	148.0	0.91
Zone 4							
A206 DES. AND VIS. COMM.	1	22.5	Jul 1100	1043	10.8	2058.3	0.51
Zone 5							
A206A RELATED CR	1	6.8	Jan 1400	330	0.0	659.3	0.50
Zone 6							
A206B COMPUTER LAB	1	20.6	Jul 1400	953	10.8	1082.5	0.88
Zone 7							
A207A CORRIDOR	1	14.6	Aug 1100	677	12.1	1170.7	0.58
A207 CORRIDOR	1	3.0	Jan 1100	220	0.0	1289.0	0.17
Zone 8							
A206A RELATED CR	1	6.8	Jan 1400	330	0.0	659.3	0.50
Zone 9							

Zone Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
B201F RELATED CR	1	6.6	Jan 1400	330	0.0	601.1	0.55
Zone 10							
B201G COMPUTER LAB	1	18.6	Jul 1400	862	7.4	1009.1	0.85
Zone 11							
B206 GUID OFF	1	4.4	Aug 1100	268	4.9	150.5	1.78
Zone 12							
B207 GUID OFF	1	5.2	Aug 1100	240	4.0	157.3	1.52
Zone 13							
B201 DRAFTING - DESIGN	1	26.9	Jul 1100	1247	6.5	1572.3	0.79
Zone 14							
B201E OFF	1	2.9	Jan 1100	133	0.0	143.7	0.93
Zone 15							
B201B STOR	1	0.6	Jan 1400	28	0.0	225.3	0.12
B202E STOR	1	0.5	Jan 1400	22	0.0	162.5	0.14
B203A STORAGE	1	0.5	Jan 1400	22	0.0	163.1	0.14
Zone 16							
B201D COMPUTER LAB	1	19.8	Jul 1100	917	5.6	1007.7	0.91
Zone 17							
B202C COMPUTER LAB	1	12.1	Jul 1600	560	5.7	713.4	0.78
Zone 18							
B202B COMPUTER LAB	1	10.7	Jul 1400	495	5.7	727.3	0.68
Zone 19							
B202D OFF	1	2.3	Jan 1100	107	0.0	151.0	0.71
Zone 20							
B202 BUSINESS OFFICE TEC	1	5.6	Jan 1100	260	0.0	510.5	0.51
Zone 21							
B202A RELATED CR	1	6.5	Jan 1400	320	0.0	560.7	0.57
Zone 22							
B203E OFF	1	2.3	Jan 1100	107	0.0	151.0	0.71
Zone 23							
B203D COMPUTER LAB	1	10.7	Jul 1400	495	5.7	721.7	0.69
Zone 24							
B203C COMPUTER LAB	1	10.8	Jul 1400	498	7.7	696.6	0.72
Zone 25							
B203 MARKETING	1	3.6	Jan 1100	166	0.0	490.1	0.34
Zone 26							
B203B RELATED CR	1	6.3	Jan 1400	305	0.0	509.6	0.60
Zone 27							
B204 CORRIDOR	1	15.5	Aug 1100	718	11.3	1452.8	0.49
Zone 28							
B210 SPED RESOURCE	1	5.2	Aug 1100	300	5.5	150.5	1.99
Zone 29							
B209 VOC DEAN	1	4.4	Aug 1100	217	4.0	160.7	1.35
Zone 30							
B208 GUID OFF	1	5.2	Aug 1100	240	4.1	158.7	1.52
Zone 31							
C301 CORRIDOR	1	0.6	Jan 1400	27	0.0	216.0	0.13
Zone 32							
A303-1 BIOTECHNOLOGY-1	1	13.9	Jul 1400	1485	8.5	1483.6	1.00
Zone 33							
A303A PREP	1	1.4	Jan 1400	150	0.0	150.1	1.00
Zone 34							
A303H LAB	1	5.6	Jul 1500	285	3.6	270.2	1.05
Zone 35							

Zone Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
A303J TISSUE CULTURE LAB	1	4.8	Jan 1100	330	0.0	287.9	1.15
Zone 36							
A303D OFF	1	2.9	Jan 1100	136	0.0	156.5	0.87
Zone 37							
A303C STOR	1	0.5	Jan 1400	22	0.0	157.7	0.14
B301A STOR	1	0.4	Jan 1400	20	0.0	136.9	0.15
B301B STOR	1	0.5	Jan 1400	21	0.0	151.4	0.14
B301C STOR	1	0.4	Jan 1400	17	0.0	108.6	0.16
Zone 38							
A303-3 BIOTECHNOLOGY-2	1	13.8	Jul 1400	1705	7.8	1466.3	1.16
Zone 39							
A304 CORRIDOR	1	2.1	Jan 1100	245	0.0	922.1	0.27
A303L CORRIDOR	1	0.3	Jan 1100	12	0.0	127.5	0.09
B303-1 CORRIDOR	1	15.2	Aug 1100	704	9.1	1148.3	0.61
Zone 40							
B304 ADJUST CNSLR	1	4.4	Aug 1100	268	4.9	151.3	1.77
Zone 41							
B305 GUID OFF	1	2.7	Jul 1400	216	4.0	157.2	1.37
Zone 42							
B301J Observ	1	2.3	Jun 1800	107	2.0	96.4	1.11
Zone 43							
B301H SIM	1	2.7	Jun 1800	158	2.9	189.2	0.83
Zone 44							
B301G MOCK APT	1	5.4	Jan 1100	250	0.0	452.1	0.55
Zone 45							
B301D OFF	1	3.7	Jan 1100	170	0.0	199.9	0.85
Zone 46							
B302-1 MEDICAL ASSISTING	1	12.7	Jul 1400	588	8.3	1501.1	0.39
Zone 47							
B302-2 MEDICAL ASSISTING	1	12.3	Jul 1400	570	7.7	1470.5	0.39
Zone 48							
B301K CORRIDOR	1	0.5	Jan 1400	21	0.0	147.9	0.14
B302L CORRIDOR	1	0.6	Jan 1400	26	0.0	202.0	0.13
Zone 49							
B302A OBSERV / STOR	1	0.9	Jan 1400	43	0.0	181.1	0.24
Zone 50							
B302C STOR	1	0.4	Jan 1400	17	0.0	108.0	0.16
B302G CLEAN	1	0.3	Jan 1400	1400	0.0	56.0	25.00
B302K STOR	1	0.5	Jan 1400	24	0.0	179.5	0.13
Zone 51							
B302D OFF	1	2.2	Jan 1100	101	0.0	205.3	0.49
Zone 52							
B302N OFF	1	1.8	Jan 1100	84	0.0	180.8	0.47
Zone 53							
B302H LAB	1	8.1	Jun 1800	455	5.5	514.8	0.88
Zone 54							
B302J RELATED CR	1	10.6	Jul 1400	491	7.2	1159.5	0.42
Zone 55							
B301-3 HEALTH ASSISTING-	1	20.8	Jun 1700	966	14.7	1701.6	0.57
Zone 56							
B303 - CORRIDOR	1	15.7	Aug 1100	728	10.7	1502.1	0.48
Zone 57							
B306 GUID OFF	1	2.7	Jul 1400	214	3.9	158.7	1.35
Zone 58							

Zone Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
B307 DEAN OFF	1	4.4	Aug 1100	205	3.6	160.7	1.27
Zone 59							
B308 SPED RESOURCE	1	5.2	Aug 1100	288	5.3	150.5	1.91
Zone 60							
A402A THEORY	1	10.7	Jul 1400	496	7.3	981.9	0.51
Zone 61							
A402B MODEL MAKING	1	2.6	Jul 1400	122	0.5	285.3	0.43
Zone 62							
A402D STERILIZATION	1	3.0	Jul 1400	150	0.3	142.9	1.05
Zone 63							
A402-1 DENTAL ASSISTING	1	17.1	Jul 1400	793	12.7	1584.5	0.50
Zone 64							
A402-2 DENTAL ASSISTING	1	17.0	Jul 1400	787	12.9	1558.1	0.50
Zone 65							
A402H STORAGE	1	1.3	Jul 1400	84	1.5	214.7	0.39
Zone 66							
A402G OFFICE	1	3.3	Jul 1100	151	0.4	200.9	0.75
Zone 67							
A402J X-RAY	1	1.6	Jul 1400	150	0.3	180.5	0.83
Zone 68							
A402K UTILITY	1	0.5	Jul 1400	24	0.2	90.5	0.26
Zone 69							
A403 CORRIDOR	1	3.1	Jul 1400	205	1.7	905.2	0.23
A403a CORRIDOR	1	16.1	Aug 1100	748	11.6	1180.0	0.63
Zone 70							
B404 ADJUST CNSLR	1	4.5	Aug 1100	388	7.1	150.5	2.58
Zone 71							
B405 GUID OFF	1	5.2	Aug 1100	295	5.4	157.2	1.88
Zone 72							
A402P THEORY	1	10.2	Jul 1400	474	7.0	870.5	0.54
Zone 73							
A402P MODEL MAKING	1	2.2	Jul 1400	102	0.4	223.8	0.46
Zone 74							
B401A STOR	1	0.2	Jul 1400	11	0.2	84.0	0.14
B402A STOR	1	0.5	Jul 1400	23	0.3	168.3	0.14
B402G STORAGE	1	0.8	Jul 1400	36	0.4	200.4	0.18
B402J STORAGE	1	1.0	Jul 1400	48	0.5	290.6	0.17
B402L CORRIDOR	1	0.6	Jul 1400	29	0.4	215.9	0.14
B402 Storage	1	0.5	Jul 1500	22	0.2	100.2	0.22
Zone 75							
B402-1 ROBOTICS & AUTOMA	1	19.7	Jul 1400	911	10.6	1327.5	0.69
Zone 76							
B401 PLTW / ENGINEERING	1	14.9	Jul 1400	798	14.6	1360.5	0.59
Zone 77							
B402-2 ROBOTICS & AUTMA	1	19.0	Jul 1400	880	10.3	1258.4	0.70
Zone 78							
B402C OFFICE	1	2.3	Jul 1100	108	0.2	123.1	0.88
Zone 79							
B402H RELATED CR	1	11.0	Jul 1400	690	12.6	961.2	0.72
Zone 80							
B403 CORRIDOR	1	27.7	Aug 1100	1562	28.6	1440.4	1.08
Zone 81							
B406 GUID OFF	1	5.3	Aug 1100	243	4.3	158.7	1.53
Zone 82							

Zone Sizing Summary for HRU-3 Classrooms Plan North

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
B407 GUID OFF	1	4.5	Aug 1100	218	4.0	160.7	1.36
Zone 83							
B408 DEAN OFF	1	5.3	Aug 1100	309	5.7	150.5	2.05
Zone 84							
A314 STOR	1	1.1	Jan 1100	100	0.0	496.8	0.20
Zone 85							
B301-1 HEALTH ASSISTING-	1	14.8	Jul 1400	687	8.6	1668.3	0.41
Zone 86							
A402M STERILIZATION	1	2.1	Jul 1400	150	0.3	142.7	1.05
Zone 87							
B402D FABRICATION LAB	1	11.3	Jul 1600	524	6.3	563.4	0.93

Dedicated Outdoor Air System (DOAS) Sizing Summary for HRU-4 (B+1 C/D)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **HRU-4 (B+1 C/D)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **38**
Floor Area **20793.9** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **5.6** Tons
Total coil load **66.7** MBH
Total coil load **1467.3** CFM/Ton
Sensible coil load **66.7** MBH
Coil CFM at Jul 1400 **8151** CFM
Max coil CFM **8151** CFM
Sensible heat ratio **1.000**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **80.0 / 72.0** °F
Leaving DB / WB **72.4 / 69.8** °F
Bypass Factor **0.100**

Heating Coil Sizing Data

Max coil load **111.7** MBH
Coil CFM at Des Htg **8151** CFM
Max coil CFM **8151** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **54.7 / 67.4** °F

Ventilation Fan Sizing Data

Actual max CFM **8151** CFM
Standard CFM **8142** CFM
Actual max CFM/ft² **0.39** CFM/ft²

Fan motor BHP **8.41** BHP
Fan motor kW **6.67** kW
Fan static **3.00** in wg

Exhaust Fan Sizing Data

Actual max CFM **8151** CFM
Standard CFM **8142** CFM
Actual max CFM/ft² **0.39** CFM/ft²

Fan motor BHP **5.61** BHP
Fan motor kW **4.45** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **8151** CFM
CFM/ft² **0.39** CFM/ft²

CFM/person **17.68** CFM/person

Zone Sizing Summary for HRU-4 (B+1 C/D)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name HRU-4 (B+1 C/D)
Equipment Class TERM
Air System Type VRF

Number of zones 38
Floor Area 20793.9 ft²
Location Boston, Massachusetts

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Sum of space airflow rates
Space CFM Sizing Individual peak space loads

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	1.4	0.6	75.0 / 70.6	58.6 / 58.4	-	Jul 0900	0.15
Zone 2	33.7	17.4	75.0 / 70.6	65.1 / 64.7	-	Jul 1100	0.37
Zone 3	1.7	0.9	75.4 / 69.2	59.9 / 59.4	-	Jul 1400	0.39
Zone 4	17.8	8.0	75.2 / 70.2	55.0 / 54.8	-	Aug 1200	0.42
Zone 5	3.5	1.4	75.6 / 72.5	55.0 / 55.0	-	Jul 1000	0.09
Zone 6	6.5	3.7	76.0 / 67.4	55.2 / 54.6	-	Aug 1000	0.35
Zone 7	0.0	0.0	0.0 / 0.0	0.0 / 0.0	0.00	Des 0000	0.80
Zone 8	2.0	1.1	75.9 / 68.5	55.0 / 54.5	-	Aug 1000	0.43
Zone 9	2.0	1.1	75.9 / 68.5	55.0 / 54.5	-	Aug 1000	0.43
Zone 10	17.0	7.4	75.1 / 70.5	55.0 / 54.9	-	Aug 1200	0.47
Zone 11	20.3	9.2	75.2 / 70.1	55.0 / 54.8	-	Jul 1200	0.35
Zone 12	0.0	0.0	0.0 / 0.0	0.0 / 0.0	0.00	Des 0000	0.35
Zone 13	4.3	1.9	75.4 / 71.2	61.5 / 61.2	-	Aug 0900	0.22
Zone 14	3.2	1.8	76.4 / 67.8	55.0 / 54.4	-	Aug 1000	0.42
Zone 15	2.4	1.3	76.3 / 68.2	55.0 / 54.4	-	Aug 1000	0.32
Zone 16	1.6	0.8	75.8 / 69.3	55.0 / 54.6	-	Aug 1000	0.28
Zone 17	2.5	1.3	76.3 / 68.2	55.0 / 54.4	-	Aug 1000	0.31
Zone 18	1.6	0.8	75.8 / 69.3	55.0 / 54.6	-	Aug 1000	0.28
Zone 19	1.5	0.7	75.7 / 69.4	55.0 / 54.6	-	Jul 1000	0.29
Zone 20	5.7	3.2	75.7 / 67.7	55.0 / 54.4	-	Aug 1000	0.37
Zone 21	17.0	7.3	75.0 / 70.7	55.0 / 54.9	-	Jul 1200	0.46
Zone 22	0.9	0.4	75.0 / 70.7	57.1 / 57.0	-	Jul 1300	0.30
Zone 23	59.0	40.7	75.8 / 65.3	55.5 / 54.6	-	Sep 1400	1.35
Zone 24	7.6	3.9	75.0 / 70.6	65.0 / 64.6	-	Jul 0700	0.38
Zone 25	2.1	1.1	75.8 / 69.1	55.0 / 54.6	-	Aug 1000	0.40
Zone 26	2.9	1.3	75.0 / 70.6	59.0 / 58.7	-	Jul 0900	0.74
Zone 27	43.9	19.5	75.0 / 70.6	59.2 / 59.0	-	Jul 1000	1.17
Zone 28	13.2	7.1	75.4 / 67.8	55.0 / 54.5	-	Aug 1300	0.95
Zone 29	8.7	5.1	75.6 / 66.8	55.0 / 54.3	-	Jul 1000	0.83
Zone 30	4.2	2.7	75.9 / 66.1	55.0 / 54.2	-	Aug 1000	0.60
Zone 31	8.7	5.2	75.7 / 66.9	55.0 / 54.3	-	Jul 1000	0.81
Zone 32	13.2	7.1	75.4 / 67.8	55.0 / 54.5	-	Aug 1300	0.94
Zone 33	45.3	20.0	75.0 / 70.6	58.8 / 58.5	-	Aug 1000	1.07
Zone 34	2.9	1.3	75.0 / 70.6	59.2 / 58.9	-	Jul 0900	0.74
Zone 35	1.7	1.0	76.2 / 68.0	55.0 / 54.4	-	Aug 1000	0.48
Zone 36	8.5	6.6	76.2 / 64.0	55.0 / 53.9	-	Dec 1400	0.60
Zone 37	53.7	33.8	75.4 / 66.4	56.7 / 55.9	-	Jul 0900	1.04
Zone 38	3.3	2.3	75.8 / 65.3	55.9 / 54.9	-	Aug 1000	0.60

Terminal Unit Sizing Data - Heating, Fan, Ventilation

	Heating Coil	Heating Coil Ent/Lvg	Htg Coil Water Flow	Fan Design	Fan	Fan	OA Vent Design
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Zone Sizing Summary for HRU-4 (B+1 C/D)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Load (MBH)	DB (°F)	@20.0 °F (gpm)	Airflow (CFM)	Motor (BHP)	Motor (kW)	Airflow (CFM)
Zone 1	0.0	0.0 / 0.0	0.00	35	0.000	0.000	35
Zone 2	7.8	70.0 / 74.4	-	1630	0.000	0.000	1630
Zone 3	0.8	69.5 / 83.5	-	54	0.000	0.000	25
Zone 4	0.0	0.0 / 0.0	0.00	367	0.000	0.000	330
Zone 5	0.0	0.0 / 0.0	0.00	61	0.000	0.000	40
Zone 6	0.0	0.0 / 0.0	0.00	166	0.000	0.000	40
Zone 7	4.5	69.2 / 85.5	-	259	0.000	0.000	50
Zone 8	0.0	0.0 / 0.0	0.00	47	0.000	0.000	25
Zone 9	0.0	0.0 / 0.0	0.00	47	0.000	0.000	25
Zone 10	0.0	0.0 / 0.0	0.00	344	0.000	0.000	330
Zone 11	0.0	0.0 / 0.0	0.00	422	0.000	0.000	360
Zone 12	1.9	70.0 / 85.3	-	115	0.000	0.000	115
Zone 13	2.3	69.3 / 85.9	-	128	0.000	0.000	35
Zone 14	0.0	0.0 / 0.0	0.00	78	0.000	0.000	30
Zone 15	0.0	0.0 / 0.0	0.00	58	0.000	0.000	20
Zone 16	0.0	0.0 / 0.0	0.00	34	0.000	0.000	20
Zone 17	0.0	0.0 / 0.0	0.00	59	0.000	0.000	20
Zone 18	0.0	0.0 / 0.0	0.00	35	0.000	0.000	20
Zone 19	0.0	0.0 / 0.0	0.00	33	0.000	0.000	20
Zone 20	0.0	0.0 / 0.0	0.00	141	0.000	0.000	50
Zone 21	0.0	0.0 / 0.0	0.00	340	0.000	0.000	340
Zone 22	0.0	0.0 / 0.0	0.00	20	0.000	0.000	20
Zone 23	26.7	69.6 / 82.9	-	1859	0.000	0.000	560
Zone 24	0.0	0.0 / 0.0	0.00	365	0.000	0.000	365
Zone 25	0.0	0.0 / 0.0	0.00	47	0.000	0.000	30
Zone 26	0.0	0.0 / 0.0	0.00	75	0.000	0.000	75
Zone 27	6.6	70.0 / 75.4	-	1145	0.000	0.000	1145
Zone 28	0.0	0.0 / 0.0	0.00	323	0.000	0.000	185
Zone 29	3.3	69.6 / 83.0	-	230	0.000	0.000	95
Zone 30	0.0	0.0 / 0.0	0.00	119	0.000	0.000	30
Zone 31	3.2	69.5 / 82.4	-	231	0.000	0.000	95
Zone 32	0.0	0.0 / 0.0	0.00	324	0.000	0.000	185
Zone 33	5.9	70.0 / 74.8	-	1145	0.000	0.000	1145
Zone 34	0.0	0.0 / 0.0	0.00	75	0.000	0.000	75
Zone 35	0.0	0.0 / 0.0	0.00	42	0.000	0.000	20
Zone 36	0.0	0.0 / 0.0	0.00	288	0.000	0.000	0
Zone 37	30.4	69.4 / 86.3	-	1676	0.000	0.000	555
Zone 38	0.0	0.0 / 0.0	0.00	107	0.000	0.000	11

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	218.0	18.2	93.5
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	218.0	18.2	93.5

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
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Zone Sizing Summary for HRU-4 (B+1 C/D)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	0.5	Jan 1100	0.0	226.7
Zone 2	9.1	Jul 1100	2.1	4430.8
Zone 3	1.2	Jan 1100	0.9	141.4
Zone 4	7.9	Jan 1400	0.0	872.0
Zone 5	1.3	Jan 1100	0.0	654.1
Zone 6	3.6	Jan 1400	0.0	474.1
Zone 7	0.0	Des Htg	4.8	325.5
Zone 8	1.0	Jan 1100	0.0	108.6
Zone 9	1.0	Jan 1100	0.0	108.6
Zone 10	7.4	Jan 1400	0.0	732.3
Zone 11	9.1	Jan 1400	0.0	1200.6
Zone 12	0.0	Des Htg	1.5	332.7
Zone 13	1.4	Jul 1400	2.4	578.4
Zone 14	1.7	Jan 1400	0.0	186.1
Zone 15	1.2	Jan 1100	0.0	181.3
Zone 16	0.7	Jan 1400	0.0	122.2
Zone 17	1.3	Jan 1100	0.0	186.2
Zone 18	0.8	Jan 1400	0.0	124.1
Zone 19	0.7	Jan 1400	0.0	110.8
Zone 20	3.0	Jan 1400	0.0	381.3
Zone 21	7.3	Jan 1400	0.0	739.5
Zone 22	0.4	Jan 1500	0.0	66.7
Zone 23	40.1	Sep 1400	26.6	1372.5
Zone 24	2.0	Jan 1100	0.0	972.3
Zone 25	1.0	Jan 1100	0.0	119.4
Zone 26	1.0	Jan 1100	0.0	101.4
Zone 27	17.1	Jul 1400	4.5	977.6
Zone 28	7.0	Jan 1400	0.0	340.5
Zone 29	5.0	Jul 1400	3.4	278.6
Zone 30	2.6	Jan 1100	0.0	197.8
Zone 31	5.0	Jul 1400	3.4	286.9
Zone 32	7.0	Jan 1400	0.0	344.0
Zone 33	17.2	Jul 1400	4.2	1068.9
Zone 34	1.0	Jan 1100	0.0	101.2
Zone 35	0.9	Jan 1100	0.0	86.7
Zone 36	6.2	Jan 1600	0.0	476.9
Zone 37	29.1	Jul 1100	30.7	1608.6
Zone 38	2.3	Jan 1100	0.0	176.6

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
C004B - STOR	1	0.5	Jan 1100	35	0.0	226.7	0.15
Zone 2							
C010 CORRIDOR	1	3.1	Jan 1100	540	0.0	1525.6	0.35
C017 CORRIDOR	1	2.1	Jan 1100	540	0.0	1020.3	0.53
D002 CORRIDOR	1	4.0	Jul 1100	550	2.1	1884.9	0.29
Zone 3							
C013 CUST OFF	1	1.2	Jan 1100	54	0.9	141.4	0.39
Zone 4							
C018 METAL FAB RELATED C	1	7.9	Jan 1400	367	0.0	872.0	0.42

Zone Sizing Summary for HRU-4 (B+1 C/D)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 5							
C019 GENERAL SUPPLY	1	1.3	Jan 1100	61	0.0	654.1	0.09
Zone 6							
C020 Cust Workshop	1	3.6	Jan 1400	166	0.0	474.1	0.35
Zone 7							
C015 GENERAL SUPPLY	1	0.0	Jan 0000	259	4.8	325.5	0.80
Zone 8							
C024 COACH OFF	1	1.0	Jan 1100	47	0.0	108.6	0.43
Zone 9							
C026 COACH OFF	1	1.0	Jan 1100	47	0.0	108.6	0.43
Zone 10							
C022D RELATED CR	1	7.4	Jan 1400	344	0.0	732.3	0.47
Zone 11							
D003D RELATED CR	1	9.1	Jan 1400	422	0.0	1200.6	0.35
Zone 12							
C011 CORRIDOR	1	0.0	Jan 0000	115	1.5	332.7	0.35
Zone 13							
C120 CORRIDOR	1	1.4	Jul 1400	128	2.4	578.4	0.22
Zone 14							
D102 NURSE WAIT	1	1.7	Jan 1400	78	0.0	186.1	0.42
Zone 15							
D103 NURSE OFF	1	1.2	Jan 1100	58	0.0	181.3	0.32
Zone 16							
D106 EXAM	1	0.7	Jan 1400	34	0.0	122.2	0.28
Zone 17							
D104 NURSE OFF	1	1.3	Jan 1100	59	0.0	186.2	0.31
Zone 18							
D109 EXAM	1	0.8	Jan 1400	35	0.0	124.1	0.28
Zone 19							
D110 EXAM	1	0.7	Jan 1400	33	0.0	110.8	0.29
Zone 20							
D105 RESTING	1	2.8	Jan 1400	130	0.0	258.1	0.50
D102A - CORRIDOR	1	0.2	Jan 1100	12	0.0	123.2	0.09
Zone 21							
D111 HEALTH CR	1	7.3	Jan 1400	340	0.0	739.5	0.46
Zone 22							
D113B FITNESS	1	0.4	Jan 1500	20	0.0	66.7	0.30
Zone 23							
D113 FITNESS	1	40.1	Sep 1400	1859	26.6	1372.5	1.35
Zone 24							
D114 CORRIDOR	1	2.0	Jan 1100	365	0.0	972.3	0.38
Zone 25							
D116 ATH DIR OFF	1	1.0	Jan 1100	47	0.0	119.4	0.40
Zone 26							
D117D PE INSTR OFF	1	1.0	Jan 1100	75	0.0	101.4	0.74
Zone 27							
D117 BOYS LOCKER	1	17.1	Jul 1400	1145	4.5	977.6	1.17
Zone 28							
D117B TEAM LOCKER	1	7.0	Jan 1400	323	0.0	340.5	0.95
Zone 29							
D117C TEAM LOCKER	1	5.0	Jul 1400	230	3.4	278.6	0.83
Zone 30							
D119 TRAINER	1	2.6	Jan 1100	119	0.0	197.8	0.60
Zone 31							

Zone Sizing Summary for HRU-4 (B+1 C/D)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
D122C TEAM LOCKER	1	5.0	Jul 1400	231	3.4	286.9	0.81
Zone 32							
D122B TEAM LOCKER	1	7.0	Jan 1400	324	0.0	344.0	0.94
Zone 33							
D122 GIRLS LOCKER	1	17.2	Jul 1400	1145	4.2	1068.9	1.07
Zone 34							
D122D PE INST OFF	1	1.0	Jan 1100	75	0.0	101.2	0.74
Zone 35							
D123 OFFICIALS	1	0.9	Jan 1100	42	0.0	86.7	0.48
Zone 36							
C023 TEAM LOCKER	1	6.2	Jan 1600	288	0.0	476.9	0.60
Zone 37							
D115 WEIGHTS	1	29.1	Jul 1100	1676	30.7	1608.6	1.04
Zone 38							
D120 PE STOR	1	2.3	Jan 1100	107	0.0	176.6	0.60

Dedicated Outdoor Air System (DOAS) Sizing Summary for HRU-5 (Cosmetology)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **HRU-5 (Cosmetology)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **6**
Floor Area **4455.6** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **10.7** Tons
Total coil load **127.9** MBH
Total coil load **258.9** CFM/Ton
Sensible coil load **88.9** MBH
Coil CFM at Aug 1400 **2759** CFM
Max coil CFM **2759** CFM
Sensible heat ratio **0.695**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Aug 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **81.4 / 66.5** °F
Leaving DB / WB **51.5 / 50.4** °F
Bypass Factor **0.100**

Heating Coil Sizing Data

Max coil load **44.6** MBH
Coil CFM at Jan 0700 **2759** CFM
Max coil CFM **2759** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Jan 0700**
Ent. DB / Lvg DB **51.5 / 66.5** °F

Ventilation Fan Sizing Data

Actual max CFM **2759** CFM
Standard CFM **2756** CFM
Actual max CFM/ft² **0.62** CFM/ft²

Fan motor BHP **3.80** BHP
Fan motor kW **3.01** kW
Fan static **4.00** in wg

Exhaust Fan Sizing Data

Actual max CFM **2759** CFM
Standard CFM **2756** CFM
Actual max CFM/ft² **0.62** CFM/ft²

Fan motor BHP **2.85** BHP
Fan motor kW **2.26** kW
Fan static **3.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **2759** CFM
CFM/ft² **0.62** CFM/ft²

CFM/person **30.96** CFM/person

Zone Sizing Summary for HRU-5 (Cosmetology)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name HRU-5 (Cosmetology)
Equipment Class TERM
Air System Type VRF

Number of zones 6
Floor Area 4455.6 ft²
Location Boston, Massachusetts

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Sum of space airflow rates
Space CFM Sizing Individual peak space loads

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	29.5	29.5	72.3 / 59.4	58.0 / 53.8	-	Jul 1400	0.95
Zone 2	1.9	1.7	75.8 / 64.1	58.0 / 56.9	-	Apr 1000	0.72
Zone 3	0.9	0.9	70.0 / 58.1	61.3 / 54.7	-	Jul 0900	0.61
Zone 4	21.9	21.9	71.7 / 59.1	58.2 / 53.8	-	Aug 1200	0.82
Zone 5	1.8	1.6	75.7 / 63.9	58.0 / 56.9	-	Apr 1000	0.81
Zone 6	0.4	0.4	70.0 / 58.1	68.8 / 57.6	-	Jul 1000	1.51

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	35.2	69.6 / 86.6	-	1918	0.000	0.000	1220
Zone 2	0.0	0.0 / 0.0	0.00	89	0.000	0.000	17
Zone 3	0.2	70.0 / 71.8	-	100	0.000	0.000	100
Zone 4	23.7	69.7 / 84.3	-	1509	0.000	0.000	1100
Zone 5	0.0	0.0 / 0.0	0.00	86	0.000	0.000	16
Zone 6	0.6	70.0 / 71.7	-	305	0.000	0.000	305

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	54.7	4.6	59.6
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	54.7	4.6	59.6

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	35.2	Jul 1400	36.8	2028.5
Zone 2	1.6	Jan 1100	0.0	123.8
Zone 3	1.3	Jul 1400	0.2	164.9
Zone 4	27.7	Aug 1400	25.2	1831.2
Zone 5	1.6	Jan 1100	0.0	105.6
Zone 6	0.9	Jul 1400	0.1	201.5

Zone Sizing Summary for HRU-5 (Cosmetology)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
B120 COSMETOLOGY	1	35.2	Jul 1400	1918	36.8	2028.5	0.95
Zone 2							
B120A OFF	1	1.6	Jan 1100	89	0.0	123.8	0.72
Zone 3							
B120C FACIAL	1	1.3	Jul 1400	100	0.2	164.9	0.61
Zone 4							
B121 COSMETOLOGY	1	27.7	Aug 1400	1509	25.2	1831.2	0.82
Zone 5							
B121C OFF	1	1.6	Jan 1100	86	0.0	105.6	0.81
Zone 6							
B120B DISP	1	0.9	Jul 1400	305	0.1	201.5	1.51

Air System Sizing Summary for MAU-1 (Kitchen)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **MAU-1 (Kitchen)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **1675.8** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **10.3** Tons
Total coil load **123.4** MBH
Sensible coil load **116.4** MBH
Coil CFM at Jul 1600 **6510** CFM
Max block CFM **6510** CFM
Sum of peak zone CFM **6510** CFM
Sensible heat ratio **0.943**
CFM/Ton **633.0**
ft²/Ton **162.9**
BTU/(hr·ft²) **73.6**
Water flow @ 12.0 °F rise **N/A**

Load occurs at **Jul 1600**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **86.6 / 73.9** °F
Leaving DB / WB **70.1 / 68.8** °F
Coil ADP **68.2** °F
Bypass Factor **0.100**
Resulting RH **80** %
Design supply temp. **55.0** °F
Zone T-stat Check **1 of 1** OK
Max zone temperature deviation **0.0** °F

Central Heating Coil Sizing Data

Max coil load **141.7** MBH
Coil CFM at Feb 1100 **6510** CFM
Max coil CFM **6510** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Feb 1100**
BTU/(hr·ft²) **84.5**
Ent. DB / Lvg DB **50.0 / 70.2** °F

Preheat Coil Sizing Data

Max coil load **288.2** MBH
Coil CFM at Des Htg **6510** CFM
Max coil CFM **6510** CFM
Water flow @ 30.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **9.0 / 50.0** °F

Supply Fan Sizing Data

Actual max CFM **6510** CFM
Standard CFM **6503** CFM
Actual max CFM/ft² **3.88** CFM/ft²

Fan motor BHP **8.96** BHP
Fan motor kW **7.11** kW
Fan static **4.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **6315** CFM
CFM/ft² **3.77** CFM/ft²

CFM/person **637.88** CFM/person

Zone Sizing Summary for MAU-1 (Kitchen)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name MAU-1 (Kitchen)
Equipment Class SPLT AHU
Air System Type SZCAV

Number of zones 1
Floor Area 1675.8 ft²
Location Boston, Massachusetts

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Sum of space airflow rates
Space CFM Sizing Individual peak space loads

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	6315	6315	3.77	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	8.0	Jul 1400	2.1	1675.8

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
A108 KITCHEN	1	7.1	Jul 1400	5715	2.1	1441.3	3.97
A108A DISH WASHING	1	0.9	Jan 1400	600	0.0	234.5	2.56

Air System Sizing Summary for MAU-2 (Culinary Arts)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **MAU-2 (Culinary Arts)**
Equipment Class **SPLT AHU**
Air System Type **VAV**

Number of zones **4**
Floor Area **4231.8** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Peak zone sensible load**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **87.7** Tons
Total coil load **1053.0** MBH
Sensible coil load **556.5** MBH
Coil CFM at Jul 1600 **15144** CFM
Max block CFM at Jul 1400 **15144** CFM
Sum of peak zone CFM **15717** CFM
Sensible heat ratio **0.528**
CFM/Ton **172.6**
ft²/Ton **48.2**
BTU/(hr·ft²) **248.8**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1600**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **87.0 / 74.0** °F
Leaving DB / WB **52.9 / 52.3** °F
Coil ADP **49.2** °F
Bypass Factor **0.100**
Resulting RH **53** %
Design supply temp. **55.0** °F
Zone T-stat Check **4 of 4** OK
Max zone temperature deviation **0.0** °F

Preheat Coil Sizing Data

Max coil load **702.5** MBH
Coil CFM at Des Htg **15144** CFM
Max coil CFM **15144** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
Ent. DB / Lvg DB **7.0 / 50.0** °F

Supply Fan Sizing Data

Actual max CFM at Jul 1400 **15144** CFM
Standard CFM **15127** CFM
Actual max CFM/ft² **3.58** CFM/ft²

Fan motor BHP **12.44** BHP
Fan motor kW **9.87** kW
Fan static **3.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **15144** CFM
CFM/ft² **3.58** CFM/ft²

CFM/person **164.21** CFM/person

Zone Sizing Summary for MAU-2 (Culinary Arts)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name MAU-2 (Culinary Arts)
Equipment Class SPLT AHU
Air System Type VAV

Number of zones 4
Floor Area 4231.8 ft²
Location Boston, Massachusetts

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Peak zone sensible load
Space CFM Sizing Individual peak space loads

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	12655	12655	4.48	546.1	-	0.0	-	0
Zone 2	146	44	0.30	1.9	-	0.0	-	0
Zone 3	1845	1845	2.66	79.6	-	0.0	-	0
Zone 4	600	600	2.55	25.9	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	28.1	Jul 1400	17.9	2823.9
Zone 2	3.1	Jul 1100	0.1	478.1
Zone 3	10.4	Aug 1400	8.2	694.5
Zone 4	2.6	Jan 1100	0.0	235.3

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
A148 CULINARY ARTS	1	28.1	Jul 1400	12655	17.9	2823.9	4.48
Zone 2							
A148C OFF	1	0.9	Jan 1100	43	0.0	90.9	0.47
A148G OFF	1	1.7	Jan 1100	80	0.0	147.8	0.54
A148H DRY STOR	1	0.5	Jul 1100	23	0.1	239.4	0.10
Zone 3							
A148D THEORY CR	1	10.4	Aug 1400	1845	8.2	694.5	2.66
Zone 4							
A148K DISH	1	2.6	Jan 1100	600	0.0	235.3	2.55

Air System Sizing Summary for RTU-1 (Restaurant)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **RTU-1 (Restaurant)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **1400.0** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **3.4** Tons
Total coil load **41.3** MBH
Sensible coil load **31.7** MBH
Coil CFM at Jul 1400 **1263** CFM
Max block CFM **1263** CFM
Sum of peak zone CFM **1263** CFM
Sensible heat ratio **0.768**
CFM/Ton **367.0**
ft²/Ton **406.7**
BTU/(hr·ft²) **29.5**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **78.7 / 65.3** °F
Leaving DB / WB **55.4 / 54.2** °F
Coil ADP **52.8** °F
Bypass Factor **0.100**
Resulting RH **49** %
Design supply temp. **58.0** °F
Zone T-stat Check **0 of 1** OK
Max zone temperature deviation **0.2** °F

Central Heating Coil Sizing Data

Max coil load **31.5** MBH
Coil CFM at Des Htg **1263** CFM
Max coil CFM **1263** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **22.5**
Ent. DB / Lvg DB **62.7 / 85.8** °F

Preheat Coil Sizing Data

No heating coil loads occurred during this calculation.

Supply Fan Sizing Data

Actual max CFM **1263** CFM
Standard CFM **1262** CFM
Actual max CFM/ft² **0.90** CFM/ft²

Fan motor BHP **1.30** BHP
Fan motor kW **1.03** kW
Fan static **3.00** in wg

Return Fan Sizing Data

Actual max CFM **1263** CFM
Standard CFM **1262** CFM
Actual max CFM/ft² **0.90** CFM/ft²

Fan motor BHP **0.87** BHP
Fan motor kW **0.69** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **678** CFM
CFM/ft² **0.48** CFM/ft²

CFM/person **17.51** CFM/person

Zone Sizing Summary for RTU-1 (Restaurant)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name RTU-1 (Resteraunt)
Equipment Class SPLT AHU
Air System Type SZCAV

Number of zones 1
Floor Area 1400.0 ft²
Location Boston, Massachusetts

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Sum of space airflow rates
Space CFM Sizing Individual peak space loads

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	1225	1225	0.88	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	22.5	Jul 1400	24.9	1400.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
B113 RESTAURANT	1	22.5	Jul 1400	1225	24.9	1400.0	0.88

Air System Sizing Summary for RTU-2 (Gym)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **RTU-2 (Gym)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **12434.6** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load **35.2** Tons
Total coil load **422.4** MBH
Sensible coil load **286.7** MBH
Coil CFM at Jul 1400 **11622** CFM
Max block CFM **11622** CFM
Sum of peak zone CFM **11622** CFM
Sensible heat ratio **0.679**
CFM/Ton **330.2**
ft²/Ton **353.2**
BTU/(hr·ft²) **34.0**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Jul 1400**
OA DB / WB **87.0 / 74.0** °F
Entering DB / WB **78.3 / 66.5** °F
Leaving DB / WB **55.4 / 54.4** °F
Coil ADP **52.9** °F
Bypass Factor **0.100**
Resulting RH **57** %
Design supply temp. **58.0** °F
Zone T-stat Check **0 of 1** OK
Max zone temperature deviation **0.2** °F

Central Heating Coil Sizing Data

Max coil load **182.3** MBH
Coil CFM at Des Htg **11622** CFM
Max coil CFM **11622** CFM
Water flow @ 20.0 °F drop **N/A**

Load occurs at **Des Htg**
BTU/(hr·ft²) **14.7**
Ent. DB / Lvg DB **65.5 / 80.1** °F

Preheat Coil Sizing Data

No heating coil loads occurred during this calculation.

Supply Fan Sizing Data

Actual max CFM **11622** CFM
Standard CFM **11610** CFM
Actual max CFM/ft² **0.93** CFM/ft²

Fan motor BHP **11.99** BHP
Fan motor kW **9.51** kW
Fan static **3.00** in wg

Return Fan Sizing Data

Actual max CFM **11622** CFM
Standard CFM **11610** CFM
Actual max CFM/ft² **0.93** CFM/ft²

Fan motor BHP **7.99** BHP
Fan motor kW **6.34** kW
Fan static **2.00** in wg

Outdoor Ventilation Air Data

Design airflow CFM **4047** CFM
CFM/ft² **0.33** CFM/ft²

CFM/person **14.99** CFM/person

Zone Sizing Summary for RTU-2 (Gym)

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name RTU-2 (Gym)
Equipment Class SPLT AHU
Air System Type SZCAV

Number of zones 1
Floor Area 12434.6 ft²
Location Boston, Massachusetts

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Sum of space airflow rates
Space CFM Sizing Individual peak space loads

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	11274	11274	0.91	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	203.9	Jul 1400	169.7	12434.6

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
D202 GYMNASIUM	1	194.2	Jul 1400	10590	151.3	12009.8	0.88
D204 GYM STOR	1	10.4	Aug 1700	683	18.4	424.8	1.61

Zone Sizing Summary for VRF - Stair 1

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **VRF - Stair 1**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **1**
Floor Area **897.9** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	29.6	29.6	80.1 / 48.3	72.5 / 44.7	-	Aug 1100	4.05

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	66.9	69.2 / 86.2	-	3634	0.000	0.000	0

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	29.6	2.5	66.9
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	29.6	2.5	66.9

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	29.4	Aug 1100	66.7	897.9

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
S1 STAIR 1	1	29.4	Aug 1100	3634	66.7	897.9	4.05

Zone Sizing Summary for VRF - Stair 2

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **VRF - Stair 2**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **1**
Floor Area **359.2** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	13.6	13.6	80.5 / 48.5	71.5 / 44.2	-	Aug 1800	3.91

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	25.4	68.6 / 85.4	-	1405	0.000	0.000	0

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	13.6	1.1	25.4
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	13.6	1.1	25.4

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	13.8	Aug 1800	25.6	359.2

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
S2 STAIR 2	1	13.7	Aug 1800	1398	25.6	269.6	5.18
S2 STAIR 2 - Interior	1	0.2	Jan 1100	8	0.0	89.6	0.09

Zone Sizing Summary for VRF - Stair 3

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **VRF - Stair 3**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **1**
Floor Area **1271.2** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	23.4	23.4	80.3 / 48.4	71.8 / 44.4	-	Sep 1200	2.01

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	45.9	68.4 / 85.1	-	2549	0.000	0.000	0

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	23.4	2.0	45.9
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	23.4	2.0	45.9

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	23.6	Sep 1200	46.4	1271.2

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
S3 STAIR 3	1	23.2	Sep 1200	2531	46.4	1053.2	2.40
S3 STAIR 3 BASEMENT	1	0.4	Jan 1100	19	0.0	218.0	0.09

Zone Sizing Summary for VRF - Stair 4

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **VRF - Stair 4**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **1**
Floor Area **578.4** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	44.0	44.0	80.3 / 48.4	68.1 / 42.5	-	Jun 1800	5.76

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	60.8	69.2 / 86.1	-	3334	0.000	0.000	0

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	44.0	3.7	60.8
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	44.0	3.7	60.8

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	44.1	Jun 1800	61.1	578.4

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
S4 STAIR 4	1	44.1	Jun 1800	3334	61.1	578.4	5.76

Zone Sizing Summary for VRF - Stair 5

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **VRF - Stair 5**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **1**
Floor Area **350.9** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	6.7	6.7	80.0 / 48.3	76.3 / 46.5	-	Jul 1400	4.85

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	31.2	69.1 / 86.0	-	1703	0.000	0.000	0

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	6.7	0.6	31.2
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	6.7	0.6	31.2

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	6.6	Jul 1500	31.2	350.9

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
S5 STAIR 5	1	6.6	Jul 1500	1703	31.2	350.9	4.85

Zone Sizing Summary for VRF - Stair 6

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **VRF - Stair 6**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **1**
Floor Area **328.0** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	15.3	15.3	80.0 / 48.2	76.6 / 46.7	-	Jul 1500	12.73

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	76.3	69.0 / 85.9	-	4176	0.000	0.000	0

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	15.3	1.3	76.3
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	15.3	1.3	76.3

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	15.0	Jul 1500	76.6	328.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
S6 STAIR 6	1	15.0	Jul 1500	4176	76.6	328.0	12.73

Zone Sizing Summary for VRF - Stair 7

Project Name: Northeastern Metropolitan Regional Vocational High School
Prepared by: Bala Consulting Engineers, Inc.

Air System Information

Air System Name **VRF - Stair 7**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **1**
Floor Area **324.1** ft²
Location **Boston, Massachusetts**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft ²
Zone 1	7.6	7.6	80.2 / 48.3	75.4 / 46.1	-	Jul 1500	4.60

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	34.9	63.4 / 85.1	-	1491	0.000	0.000	0

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	7.6	0.6	34.9
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	7.6	0.6	34.9

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	7.6	Jul 1500	35.4	324.1

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
S7 STAIR 7	1	7.6	Jul 1500	1491	35.4	324.1	4.60