VAN ZELM ENGINEERS

Oliver Ellsworth Elementary School

HVAC System / Humidity Study

DRAFT
November 14, 2023

vZ #2023127.00

VAN ZELM HEYWOOD & SHADFORD, INC.

1200 CONVERSE STREET
LONGMEADOW, MA 01106
P: 617.218.9976

10 TALCOTT NOTCH
FARMINGTON, CT 06032
P: 860.284.5064
www.vanzelm.com

862 BRAWLEY SCHOOL ROAD, SUITE 207
MOORESVILLE, NC 28117
P: 704-799-7275

VANZELM ENGINEERS

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APPENDIX

Oliver Ellsworth School

HVAC System/Humidity Study

HUMIDITY / MOLD HISTORY

According to the facilities technician that has maintained the building for 20+ years, high humidity and mold have always been a concern and sporadic issue. In recent years the humidity/mold problems have increased, most likely due to increased rainfall and outdoor relative humidity.

In 2022, Eagle Environmental was hired to perform a mold and moisture assessment of the school. Mold was found in a variety of spaces including classrooms and cafeteria. Other observations of mold include the intake/storage room at the gym and the storage room in the kitchen. Although no visible mold was found in the office areas, the main office sampling resulted in the highest spore concentration.

HUMIDITY / MOLD PROBABLE CAUSES

High humidity and the resulting mold growth can happen for a variety of reasons including lack of proper dehumidification, outdoor air infiltration, poorly sealed walls and windows, cooling coil condensate, piping condensation and lack of internal gains during unoccupied periods. In buildings that have slab on grade construction, water can seep or wick up through the cement floor, causing mold to grow on carpet pads or carpet backing. The condensate drains have recently been sealed for all unit ventilators. Piping condensation issues have been taken care of by the recent replacement of insulation on some sections of piping.

Enviro-Med, a testing firm, is currently evaluating the floor slab moisture and we are waiting for the final results. For this building we see the main source of high humidity as infiltration due to negative pressure and lack of internal gains during un-occupied or semi-occupied periods.

Infiltration has been a known issue due to negative pressure in the space, which can be witnessed by opening any outside door. Negative pressure is caused by an imbalance between exhaust air and corresponding make-up air by the existing HVAC systems. There has been a temporary fix for this issue by disabling the exhaust fans that serve the spaces. The current arrangement of the classrooms requires a negative pressure in the classroom to facilitate bringing in fresh air through the unit ventilators. Most of the unit ventilators get their fresh air from a duct that contains an internal lining. Fresh air ductwork and duct lining are contributing to negative pressure issues due to static pressure drop. The lining also presents a problem from a mold growth standpoint, as it is directly exposed to humid outdoor air conditions. Finally, the unit ventilator intake louver is just inches above the roof and in close proximity to the roof drains, which can cause wetting of the intake duct during snow or rain conditions.

Some windows in the school are single pane and significant condensation can be witnessed on the outside of the windows when it is humid outside. This condensation in conjunction with negative building air pressure may be contributing to the problem since the main path for infiltration is around the window casings.

The occupancy of schools tends to be very low in the summertime, and this results in the internal heat gains being very low. The reduced loads during unoccupied periods require the cooling systems to do less work which results in reduced dehumidification and higher humidity levels in the space. The formula of reduced cooling load with constant ventilation rates is problematic for humidity control.

During October 2023, sub slab moisture testing was performed by Enviro-Med. The report indicated higher than recommended relative humidity within the concrete slab floors in about 25 areas of the school. We believe the sub slab moisture is not the main source of mold in the building, however. There are recommendations in the report, such as replacing the gym floor within the next 5 years and fixing any site drainage issues, which the Town should consider.

Envelope Testing

During October and November 2023, Gale Associates performed a review of the envelope with infra-red and blower door testing. Our review of their report indicates that the envelope quality is not the primary source of the mold problem, however.

EXISTING CONDITIONS – HVAC SYSTEMS

The building's heating and cooling plant consists of a 225-ton Carrier 23 XRV screw chiller, three Aerco Benchmark 2,000 mbh condensing boilers, and a 675 GPM BAC cooling tower mounted on grade. The piping system is 2-pipe with variable speed pumps. The plant equipment and piping was installed in 2018.

Classrooms are heated, cooled, and ventilated with unit ventilators that are fed by the 2-pipe chilled water/hot water system. Many of the unit ventilator's fresh air intakes are via lined ductwork that is routed within wall cavity to louvers at roof level. The unit ventilators (1500 cfm) are equipped with economizer controls for free cooling. Constant volume roof mounted exhaust fans (525 cfm per classroom) provide exhaust air to the classrooms. Corridors and miscellaneous spaces are served by 2-pipe fan coil units and hot water fin tube radiation. All unit ventilators and fan coil units were replaced in 2018.

The Gymnasium, Cafeteria, and Kitchen are served by air handlers located in a mezzanine mechanical room. The air handlers are equipped with 2-pipe heating/cooling coils and separate exhaust fans. The units are sized for 0-100% O.A. but the control sequence is unknown. The controls for these AHUs are using older Honeywell Spyder controllers with no outputs or trending for analysis.

The kitchen contains an exhaust hood with make-up air provided by air handling unit AHU-6.

The Office area is served by a DX rooftop unit with VAV zone control. The return duct is located under the floor slab.

EXISTING CONDITIONS – ELECTRICAL SYSTEM

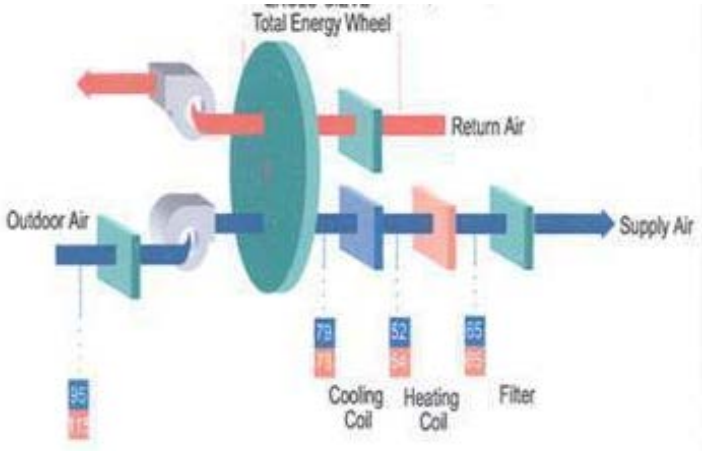
The main electrical service was installed in 1968 and includes a utility-owned 750 kVA (actual size is pending confirmation) 13.2kV – 480/277, 3 phase, 4W pad-mounted transformer and a 1200A, 480/277V, 3-phase, 4W main service switchboard manufacturer by GE. This service provides power for the entire building.
The existing GE switchboard comprises two sections. The main section houses a 1200A main circuit breaker. The second section serve as the distribution section. This section houses ten (10) feeder circuit breakers. The switchboard is located in the Main Electrical room

The electrical system also includes 480V-208/120V, 3 phase, dry type transformers. There are several electrical panels located throughout the facility, which are original to the building. There does not appear to be any spare circuit breakers available to add any electrical circuits. The condition of the panelboards is poor. The original panelboards are manufactured by GE.

RECOMMENDATIONS

Classrooms

To alleviate the negative pressure and corresponding high humidity issues in the classrooms, we recommend capping the fresh air duct to the unit ventilators and providing new dedicated outside air supply (DOAS) air handling units located on the roof or on grade. These units can provide cooling and dehumidification through the use of direct expansion refrigerant (DX) or chilled water coils, but must provide some form of reheat for true dehumidification control or the spaces may over-cool. DOAS units bring in 100% outside air in quantities required for proper ventilation (based on Code), delivering it directly to the occupied areas, and provide balanced exhaust to eliminate negative pressure in the building. A heat recovery device (heat wheel) is utilized to transfer energy between the two airstreams, preheating in the winter and precooling/dehumidifying in the summer. DOAS units will solve both the infiltration problem due to negative pressure and the lack of internal gains during unoccupied periods, while saving energy and operating costs. The capping of the fresh air duct will eliminate the economizer cycle, but the DOAS units may be used during the shoulder periods to cool the classrooms in lieu of the unit ventilators.



Gymnasium

The Gymnasium air handling unit and associated exhaust fan are currently outfitted with variable frequency drives (VFDs) for volume control. The control of this unit shall be updated to operate under a single zone VAV sequence. A carbon dioxide (CO2) sensor shall be added to the space or return ductwork and a demand control ventilation sequence of operation added to the control system. This will closely match the quantity of outside air provided to the occupancy of the space. The return/exhaust air for the gym is transferred back to the unit through louver doors in the storage room. The grille situation should be improved if possible by ducting return air directly to the Gymnasium.

Option 1: Provide new hot water reheat coil in the existing air handling unit. This option requires a new hot water piping loop and modifications to the existing condensing boiler plant to allow it to operate year-round, and will increase energy use/cost.

Option 2 (recommended): Provide a new DOAS roof mounted air handling unit with chilled water cooling to satisfy only the gym's outdoor air requirements during normal occupancy. Unit shall be located on lower roof and connect into AHU-4 return duct. AHU-4 control sequence shall be revised to operate in sequence with the new DOAS unit.

Locker Rooms

The boy's locker room has been converted to storage. The girl's locker room status is unknown. Both locker room air handling units are located in the mezzanine mechanical room, are in poor condition, and are in need of replacement. Locker rooms have significant outside air and exhaust requirements. If the spaces are to be used as locker rooms a heat recovery unit is both recommended and required by Code.

Option 1: Provide new indoor air handling units to match existing and update controls to the building standard system (Distech). This option is valid only if not used as locker room program space.

***Option* 2 *(recommended)*:** Provide one new roof mounted DOAS unit to serve both locker rooms.

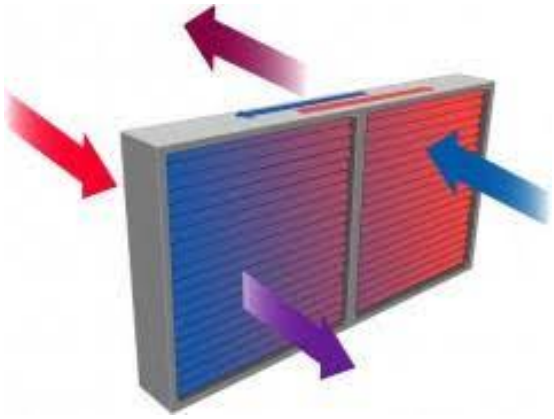
Option 3: Provide two new ERV indoor units with chilled water coil. Space constraints may be an issue for this option. This option would allow for better zoning, and recirculation damper could be added to satisfy the current space use and minimize energy cost.

Cafeteria

For the existing system, the control sequence should be reviewed and updated. Field observations during site visit showed the supply fan VFD at 33% and the exhaust fan VFD at 100%, indicating a negative pressure condition. Adding transfer grilles between kitchen and cafeteria will help reduce the negative pressure in the building. The existing cafeteria exhaust fan can be modulated to maintain positive pressure in the cafeteria which will allow for changes in kitchen exhaust and fresh air being supplied to the cafeteria. A demand control ventilation sequence of operation should be added to the DDC control system to minimize fresh air introduced to the space.

Option 1: Provide new hot water reheat coil. This option requires a new hot water piping loop and modification to the existing condensing boiler plant to allow it to operate year-round, increasing energy cost..

Option 2 (recommended): Install a heat pipe type heat recovery unit between return and supply duct for reheat. This option will save significant energy.



Storage Room

This room was originally a dishwash room that required significant exhaust (2,000 cfm) and supply (1,600 cfm). The room is now a storage room and should be re-balanced to code-required fresh air flow (25 cfm). The fresh air currently being supplied to the storage room can be redirected to the cafeteria which will contribute to the kitchen make-up.

Stage

The stage area is walled off and currently used as a music room. The return air path needs to be reviewed more closely to ensure proper airflow is provided to the space.

Kitchen

An air balancing firm shall run tests with kitchen hood on after the completion of this project. Test should include AHU supply CFM, return CFM, exhaust CFM, Kitchen hood exhaust CFM, and space pressure. The system should then be properly balanced.

Kitchen Storage

The kitchen storage room contains just one exhaust which is drawing in moist kitchen air and creating mold problems. A supply duct should be added to the storage room to keep the space under positive pressure. The exhaust rate also seems to exceed code requirements, so the fan airflow should be rebalanced.

Offices

The office area high spore concentration should be addressed after further testing is completed. It is possible that the source of the mold growth is coming from the under-slab return duct system. The sub-slab moisture testing indicated elevated moisture levels in the office area.

Option 1: Eliminate the under-slab duct and replace it with ceiling return duct system if space allows. This option requires further investigation.

Option 2: Install a Rawal APR control valve in the packaged DX rooftop unit for better capacity control, resulting in a more consistent humidity control. Additionally, upgrade unit to demand control ventilation if possible.

Option 3 (recommended): Replace existing 5 ton Trane unit with a similar DX rooftop that has hot gas reheat capability and CO2-based demand control ventilation.

Controls

The Gym, Cafeteria, and Kitchen are controlled by an older DDC system that may lack expandability. These unit controls should be updated to Distech, and demand control ventilation should be added. The control sequences for the existing unit ventilators will be revised for recirculation while heating and cooling. The unit ventilator economizer sequence will be disabled. The new DOAS units will require an expansion of the existing Distech controls. Normally, the DOAS units would be equipped with on-board controls, but the use of the chilled water coil for cooling and heating may require field-mounted Distech control. Control requirements may differ depending on the chosen manufacturer of the unit.

Adjusting and Balancing

Since the DOAS units will be reducing the load on the unit ventilators the fan speed may be reduced, resulting in a quieter air delivery. This project will require a building-wide complete air balance of all diffusers, registers, fans, coils and dampers.

Structural Modification

We have reviewed the option of installing roof-mounted DOAS units with a structural engineer, Girard Associates, in order to determine the extent of structural reinforcement required. Based on the DOAS unit sizes and weights, their review indicated that no major structural modifications would be required, only modest reinforcements.

DOAS UNIT CONFIGURATION

DOAS units are available with myriad options including heat pumps, chilled water coils, hot water reheat, Energy Recovery (ERV) wheels and plates, gas primary heat, gas reheat, electric reheat, hot gas bypass, etc. The goal of our unit selection is to select a product that will dehumidify under all conditions and be available for summer 2024 installation.

Option A: DOAS Chilled Water/Gas

Since chilled water is available on site, this is our preferred option from an energy standpoint. Using chilled water for primary cooling will also require reheat to satisfy humidity requirements during lightly loaded periods. If units are mounted on grade, the chilled water unit option will require heat trace on the exposed piping. Available reheat options are natural gas and hot water.

Option A1: DOAS Chilled Water/Hot Water

The second choice for the DAS units would be chilled water with hot water reheat. The current lead time for a Valent VXE112 with chilled water cooling, hot water reheat and ERV is roughly 18 weeks (as of 10/24/23). Running a new hot water piping loop in the corridor ceiling may be a challenge due to existing conditions and the addition of chilled water piping required to support the new units. Distech may need to fully control this unit due to using the chilled water coil for cooling and heating. This option will carry a significantly higher first cost than Option A, since gas piping on the roof is more cost effective than hot water piping run in existing congested ceiling. Both Option A and Option A1 utilize the existing condensing boilers for pre-heat. Option A1 utilizes the condensing boilers for pre-heat and re-heat.

Pros:

- Will add load to a lightly loaded chiller, improving performance.
- Much lower electrical power usage than heat pump option.
- Unit is lighter than heat pump DOAS unit by approximately 900 lbs.
- Less maintenance than heat pump unit.
- Better discharge

Cons:

- Grade mounted units will require electric heat trace to prevent freezing.
- Requires piping to be installed in corridor ceiling.
- Using chilled water coil for heating may require field mounted controls.
- Required roof mounted gas piping or hot water piping in corridor.

Option B: DOAS DX option

The DOAS units with heat pumps are a good option to consider for dehumidification. The air source heat pump is utilized for heating and cooling while hot gas reheat is used when internal space gains are low. This option does require supplemental electric heat when outdoor temperatures are below 10°F. A hot water reheat coil would be preferred, but the unit configuration will not allow roof mounted ductwork if that option is chosen.

Pros:

- Hot gas bypass for reheat and heat pump for heating down to 10°F.
- No potential freezing issues.
- Onboard controls can be used with BACnet interface.
- Does not use natural gas for heat from an electrification standpoint.

Cons:

- More unit weight than chilled water unit, which may have structural implications.
- DX unit has higher first cost.
- Requires significantly more electrical power than chilled water unit, with associated electrical system upgrades.
- Increase in electrical usage and demand charges.
- This option reduces the load on the chiller plant which may be a problem due to limited turn-down of the conservatively loaded chiller.
- Increased maintenance cost due to compressors in unit.

DOAS RECOMMENDATIONS

DOAS recommendation Option A

We recommend the chilled water DOAS unit configuration with natural gas for reheat. The only factor that would make us consider the DX heat pump unit is a difference in lead time, or if the units need to be mounted on grade due to structural implications. The current lead time for a Valent VXE112 with Chilled water cooling, natural gas reheat and ERV is roughly 18 weeks (as of 10/24/23). Structural support confirmation, final CFM of supply/exhaust, and unit voltage shall be confirmed prior to ordering unit. Distech may need to fully control this unit due to using the chilled water coil for cooling and heating.

New unit zoning

- DOAS-1 serves Classrooms 1,2,3,4,5,6,7,8, Teacher's Lounge, Family center, Media center, Lobby (3,500 cfm)
- DOAS-2 serves Classrooms 12,13,16,17,21,22,25,26, (2) Special Ed classrooms, Corridors (3,100 cfm)
- DOAS-3 serves Classrooms 10,11,14,15,19,20,23,24, Corridors (2,500 cfm)
- DOAS-4 serves Classrooms 27,28,29,30, work room, Reading, Media Center, Corridor (2,500 cfm)
- DOAS-5 serves Gym unit AHU-4 minimum outside air (1600 cfm)
- DOAS-6 serves Boys and Girls Locker room (1300 cfm) – Unit will be used for ventilation, cooling and heating. Discharge air temperatures will be calculated for heating and cooling loads. Additional hot water coil added for Boys room due to skin load.

PROPOSED ELECTRICAL SYSTEMS

DOAS Option A: Six chilled water DOAS units with natural gas for reheat or hot water reheat.

Based on the analysis of the new electrical loads for the proposed mechanical equipment, it appears that the existing 1200A, 480/277V, 3-phase, 4W can accommodate the new recommended mechanical systems. No major upgrade to the electrical system is required.

We recommend adding a new 200A, 3P feeder circuit breaker in the existing distribution section located in the main electrical room to serve a new 200A, 3 phase, 480/277VAC, 65 kAIC power panel to be located in the Mezzanine room. This power panel will feed the six (6) new DOAS units located throughout the roof.
A new 4#4/0, 1#4G, 2 1/2"C feeder from the switchboard to the new power panel location should be installed.

Each of the new DOAS roof units should be fed from a new 25A-3P circuit breaker located in the new power panel. Provided a new 3#10, 1#10G, 3/4"C feeder from the new panel to each unit.

A new waterproof 30A, 3P fused disconnect switch, with 20A fuses should be located adjacent to each DOAS unit.

DOAS Option B*:* Six DOAS heat pump units with electric heat (if the heat pump units with electric heat is chosen by the Mechanical trade)

Based on the analysis of the existing historical electric bill in the past 12-month period and the new electrical loads for the proposed mechanical equipment, it appears that the existing utility-owned 750 kVA pad-mounted transformer (actual size is pending confirmation) can accommodate the new recommended mechanical systems, but this needs to be reviewed further.

If the pad-mounted transformer has the spare capacity, we recommend the existing 1200A distribution section located in the Main Electrical room be replaced in its entirety with a new 1200A switchboard, arranged to accommodate a new 600A, 3P feeder circuit breaker, along with the existing to remain ten (10) feeder circuit breakers.

A new 600A, 3 phase, 480/277VAC, 65 kAIC power panel should be added in the Mezzanine room. This power panel will feed the six (6) new DOAS heat pump units located throughout the roof.

A new two sets of 4#350 KCM, 1#1G, 3"C feeder from the switchboard to the new power panel location should be installed.

Each of the new DOAS heat pump units should be fed from a new 100A-3P circuit breaker located in the new power panel. Provide a new 3#2, 1#8G, 1 1/2 "C feeder from the new panel to each unit.

A new waterproof 100A, 3P fused disconnect switch, with 100A fuses should be located adjacent to each DOAS heat pump unit.

ORDER OF MAGNITUDE ESTIMATE OF PROBABLE COSTS

- This provides a rough estimate of the MEP construction costs involved with Option B (average case). Costs of the project will vary greatly based on material costs, labor, schedule, etc. Construction costs have been very volatile since 2020, and the after-effects of the COVID pandemic are still being felt.

- This project will have significant non-MEP scope including general construction, rigging, cutting and patching, ceiling work, etc. We strongly recommend retaining a construction manager for accurate pricing, scheduling and bidding work.

- This estimate includes hard construction costs only, and does not include "below the line" costs such as design fees, permits, contingencies, O&P, etc.

SCOPE	COST
DOAS Units	$ 750,000
Ductwork	450,000
Heat Pipe ER Unit	80,000
Piping	395,000
Insulation	95,000
Controls	266,000
Pumps and Valves	85,000
Electrical	140,000
General Construction	375,000
Structural Work	78,000
TOTAL	**$ 2,714,000**

SUMMARY

The new equipment and modifications to the building described in this report will drastically improve humidity control in the building. To expedite the installation of the systems, long lead time items need to be identified and pre-ordered.

Action items include the following for the next phase of project (Design Phase):

- Decision on unit configuration (Heat pump vs Chilled water).
- If heat pump type unit is selected, provide more detailed review of electrical distribution required to serve units. Overall, electrical service appears adequate.
- More detailed structural analysis.
- Scheduling of DOAS units for Pre-Purchase.
- Bid leveling if multiple unit manufacturers are considered.

Miscellaneous Items Outside Scope

The boiler room still has one atmospheric-type gas fired hot water heater that requires combustion air, but there are no combustion air louvers. Boiler room is very large so it most likely is operating adequately with infiltration to satisfy combustion air.

The chiller room does not have a refrigerant monitor or refrigerant exhaust fan & intake. With 802 lbs of 134a refrigerant, a 2,850 cfm exhaust fan with high/low grilles is required in addition to fresh air louver or penthouse (ASHRAE 15).

Electrification

When considering significant upgrades to a building's HVAC system it is always a good idea to invest in equipment that will reduce carbon emissions if possible. The HVAC systems in the building were recently upgraded in 2018 and include high efficiency condensing boilers and a high efficiency chiller. Our recommended option in this report utilizes these existing components and also reduces energy use further due to added energy recovery on all outdoor air that is introduced in the classrooms.

The electrification option of using DOAS heat pump units with electric heat is a viable option to solve the high humidity issues but does come with some added direct and indirect costs. The electrical energy costs will go up for the school due to the combination of using the existing chiller and the heat pump during the cooling season. Part of this increased utility cost may also be due to increased electrical demand charge. If heat pumps are selected this will reduce thermal load on the chiller, which may require it to be replaced as part of this project.

If the Town desires to reduce substantial reduce carbon emissions, a more direct path would be to install a central air source heat pump to replace the chiller and also provide heating capacity while the gas fired boilers are used for backup. This major upgrade should be handled separately from the humidity mold project and will not alter our DOAS equipment recommendation.

-END-

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APPENDIX A

Photos

APPENDIX A
Photos

Condensing boilers - recently replaced

Boiler & Chiller plant feeding 2-pipe system

Existing Cafeteria unit
Where heat pipe will be installed

Boy's Locker Room unit
(not functional)

Packaged rooftop unit serving Office area

Roof view

Lower roof where new DOA units will be placed

Typical fresh air louver serving Unit Ventilators

Typical Classroom showing Unit Ventilator

Ceiling cavity where new ductwork from DOAS units will be run

Ceiling space in Corridor area

Louvered door in Gym storage room

VANZELM ENGINEERS

APPENDIX B

Heat Pipe
Equipment Cutsheets

SelectPlus™ Design Software

Project Submittal

Prepared For:	Jon Peterson	Prepared By:	Eric Cormier (ecormier)
			Flow Tech Inc.
Project:	Windsor Public Schools	Date:	10/25/2023 6:59 AM
		HPT Project:	223626
	Windsor Connecticut		

Qty:	Model:	Tag:	Order Code:
1	HRM	Cafeteria	HO-AMG-10812A-07125-04500-3200F-04500-XMX

The attached information describes the equipment we propose to furnish for this project and is submitted for your approval

SelectPlus™ Design Software

Project Name:	Windsor Public Schools
Prepared For:	Jon Peterson
Prepared By:	Eric Cormier (ecormier)
	Flow Tech Inc.
Date:	10/25/2023 6:59 AM HPT Project: 223626

HRM Order Code

EC150212
Rev4 2/21/2019

Model	Materials	Coil Configuration	Geometry									Option		
H	H	- A	M	G	- 1	01	08	A	- 07625	- 12038	- 2038	X - 12038	- E	D	X

Example order code used for demonstration only

Custom Options
X - None, S - Unique option

Damper
X - None, D - Damper

Fin Coating
X - None, E - ECoat, H - Heresite P-413

Exhaust Fin Length (for HRM-H and HRM-Z), Upper Face Height (for HRM-O)
XXX.XX in

Gap Fill Material
X - None, F - Foam

Gap Length
XX.XX in

Supply Fin Length (for HRM-H and HRM-Z), Lower Face Height (for HRM-O)
XXX.XX in

Fin Height (for HRM-H and HRM-Z), Face Length (for HRM-O)
XXX.XX in

Pipe Diameter
A - 1/2"

Fins Per Inch
10, 12, 14

No. of Rows
01, 02, 03, 04, 05, 06, 07, 08

No. of Stacked Sections
1 - 1 Section, 2 - 2 Sections, 3 - 3 Sections

Sheet Metal
S - 304 Stainless Steel, G - G90 Galvanized

Refrigerant
M - R410A, N - R134A

Fin Material
A - Aluminum .006", C - Copper .005"

Type
H - HRM-H Horizontal, A - HRM-Z Optimized For Heating, B - HRM-Z Optimized For Cooling, O - HRM-O Over-Under

HRM
H - Heat Recovery

SelectPlus™ Design Software

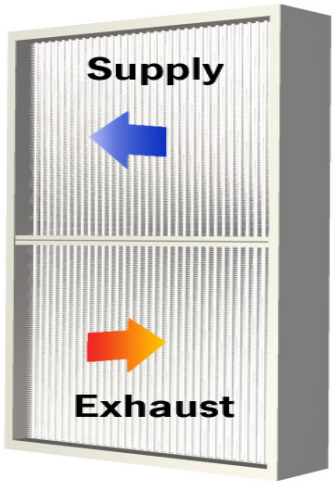
Project Name: Windsor Public Schools
Prepared For: Jon Peterson
Prepared By: Eric Cormier (ecormier)
Flow Tech Inc.
Date: 10/25/2023 6:59 AM HPT Project: 223626

Qty:	Model:	Tag:	Order Code:
1	HRM	Cafeteria	HO-AMG-10812A-07125-04500-3200F-04500-XMX

HRM Design Performance

Elevation: 0 ft.

Air Type: Standard



OACF 1.00	EATR % 0.0
11,500 SCFM	
55.00 ÁF DB	61.09 ÁF DB
45.11 ÁF WB	57.47 ÁF WB
45.0 %RH	80.7 %RH
Supply	Exhaust
64.34 ÁF DB	7,650 SCFM
49.44 ÁF WB	75.00 ÁF DB
32.2 %RH	62.54 ÁF WB
	50.0 %RH

SCFM1=SCFM2=Net Supply Airflow

Coil Performance

Pressure Drop (in. H2O)	0.85	0.5
Face Velocity (SFPM)	516.50	343.60
Temperature Gain/Loss(ÁF)	9.30	13.90
Sensible Effectiveness %	70.2	
Latent Effectiveness %	0.0	
Total Effectiveness %	48.7	
Heat Transferred (BTU/h)	116,920	
Condensation (lbs/hr)	0.0	0

Coil Design

Face Height (in.)	45.00	45.00
Face Length (in.)	71.25	71.25
Face Area (SF)	22.27	22.27
No. of Rows	8	8
Tube OD (in.)	1/2	1/2
Fins per inch	12	12
Fin Type	Standard	Standard
Fin Material	Aluminum	Aluminum
Tilt Angle degree	90	

Refrigerant: R410a

Application Rating is outside the scope of the AHRI ERV Certification Program but is rated in accordance with AHRI Standard 1060.

Performance is based on counterflow conditions.

Performance is single season based on airflow orientation

Final 2.1

SelectPlus™ Design Software

Project Name:	Windsor Public Schools
Prepared For:	Jon Peterson
Prepared By:	Eric Cormier (ecormier)
	Flow Tech Inc.
Date:	10/25/2023 6:59 AM HPT Project: 223626

Qty:	Model:	Tag:	Order Code:
1	HRM	Cafeteria	HO-AMG-10812A-07125-04500-3200F-04500-XMX

HRM Bin Analysis

	Supply	Exhaust	Heat pipe installed as retrofit	
Airflow (CFM)	11,500	7,650	Cooling	Electric
Face Height (in.)	45.00	45.00	Heating	Electric
Face Length (in.)	71.25	71.25	Cooling EER	15
Face Area (SQFT)	22.27	22.27	Electric Rate	$0.0800/kwh
Face Veloicty (SFPM)	516.5	343.6		
Max Pressure Drop (in. H2O)	0.85	0.5	Burner Efficiency	75%
No. of Rows	8	8	Motor Efficiency	90%
Fins Per Inch	12	12	Fan Efficiency	70%
Fin Material	Aluminum	Aluminum	Evaporative Cooling	No
Fin Type	Standard	Standard	Refrigerant	R410a
Desired Leaving Temps.	-	36ÁF(min)	RER	0.00
			Rate of Return	NA

BRIDGEPORT SIKORSKY MEMORIAL, CT @M-F: 0-24 Sat: 0-24 Sun: 0-24, Months: All.

Outside Air (Supply Entering)			Supply Air Leaving	Exhaust Air Entering	Exhaust Air Leaving	Heat Pipe Heat Recovery		RunTime	Savings	Fan Cost	Net Savings
Heat Pipe CFM	DB Bin ÁF	MCWB ÁF	DB/WB ÁF/ÁF	DB/WB ÁF/ÁF	DB/WB ÁF/ÁF	Eff %	BTU/h	h/Year	$/Year	$/Year	$/Year
							Totals:		**$0**		**$0**

Performance is single season based on airflow orientation

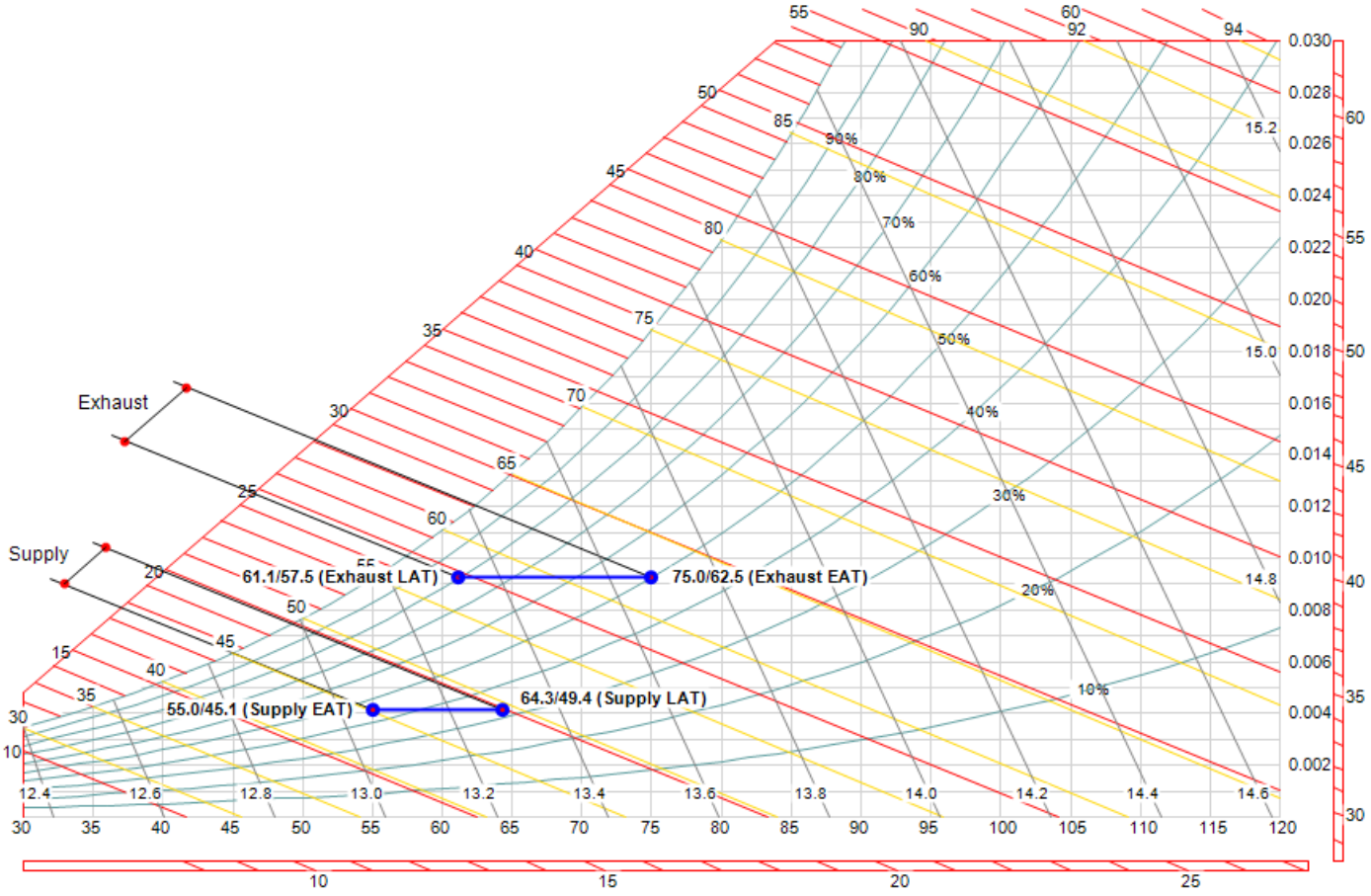
SelectPlus™ Design Software

Project Name:	Windsor Public Schools
Prepared For:	Jon Peterson
Prepared By:	Eric Cormier (ecormier)
	Flow Tech Inc.
Date:	10/25/2023 6:59 AM HPT Project: 223626

Qty:	Model:	Tag:	Order Code:
1	HRM	Cafeteria	HO-AMG-10812A-07125-04500-3200F-04500-XMX

Psychrometric Analysis

Supply Airflow:	11500 CFM	Exhaust Airflow:	7650 CFM
Supply Entering:	55.0/45.1 ÜF DB/ ÜF WB	Exhaust Entering:	75.0/62.5 ÜF DB/ ÜF WB
Supply Leaving:	64.3/49.4 ÜF DB/ ÜF WB	Exhaust Leaving:	61.1/57.5 ÜF DB/ ÜF WB



SelectPlus™ Design Software

Project Name:	Windsor Public Schools
Prepared For:	Jon Peterson
Prepared By:	Eric Cormier (ecormier)
	Flow Tech Inc.
Date:	10/25/2023 6:59 AM HPT Project: 223626

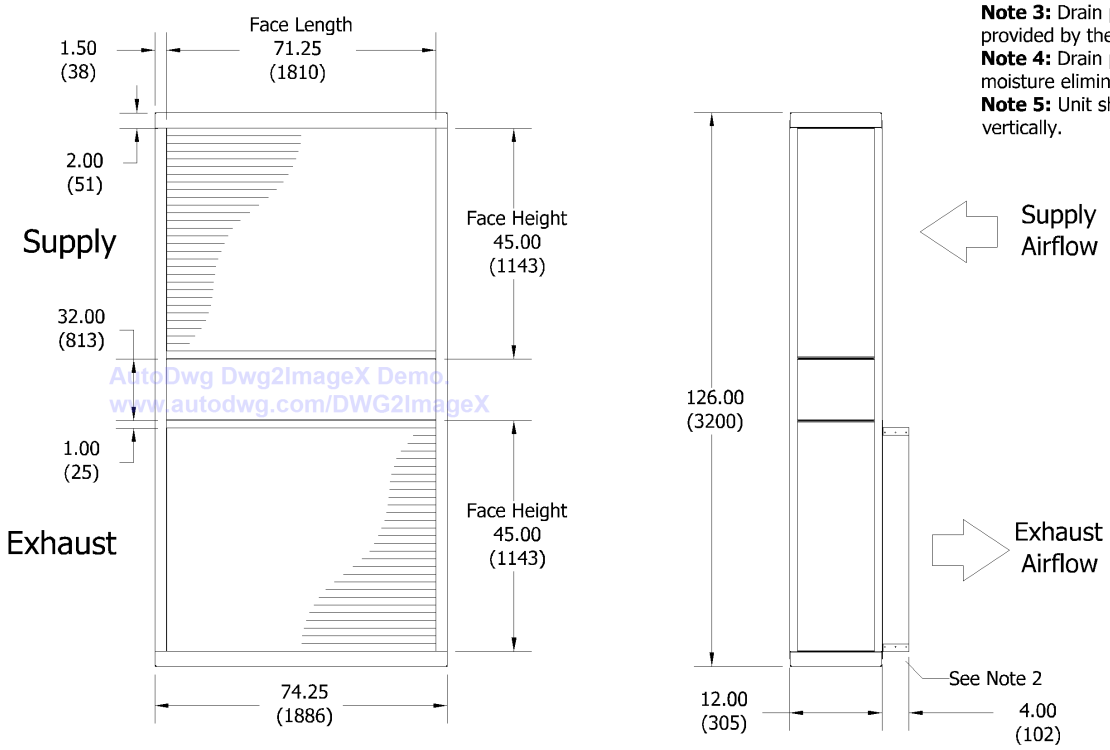
Qty:	Model:	Tag:	Order Code:
1	HRM	Cafeteria	HO-AMG-10812A-07125-04500-3200F-04500-XMX

Drawing

Tubes	Material: Copper	Fins	Coating: None	Unit:	Rows: 8	Refrigerant: R410a	FPI: 12	Approval	Name:	Date:
Diameter: 1/2	Surface: Rifled	Material: Aluminum	Geometry: Sine Wave	Sheet Metal: 16 GA G90 Galvanized Steel			Weight: 1478	Company:		Signature:

Order Code: HO-AMG-10812A-07125-04500-3200F-04500-XMX

Note 1: Heat Pipes used in this orientation have horizontal fins.
Note 2: Moisture Eliminator captures condensate droplets from airstream. Condensate drains from bottom of casing.
Note 3: Drain pans are required. They are not provided by the factory.
Note 4: Drain pan shall extend 2" beyond moisture eliminator.
Note 5: Unit ships horizontally and is installed vertically.



HS1MG 11/12/2018

Tolerances:
Unless specified
Fin Area: ±1/8 (3mm)
Sheet: ±3/16 (5mm)
Weight: ±10%
Length: inches (mm)
Weight: lbs

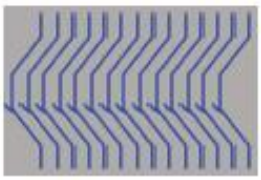
Project Name:	Project No:
Windsor Public Schools	223626
Unit Tag: Cafeteria	Created By: ecormier
Drawing No: XX23OCT1892	Date: 10/23/2023 10:48 AM
	Scale: Not To Scale

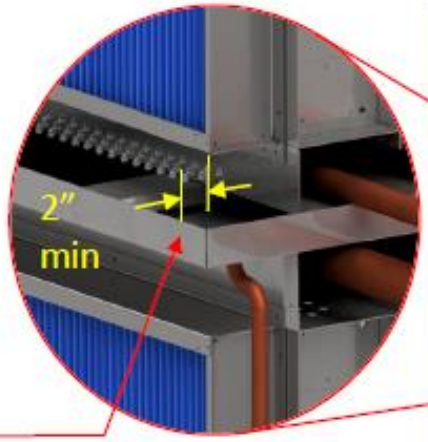
SelectPlus™ Design Software
6904 Parke East Blvd, Tampa FL 33610
P: (813) 470-4250 www.heatpipe.com

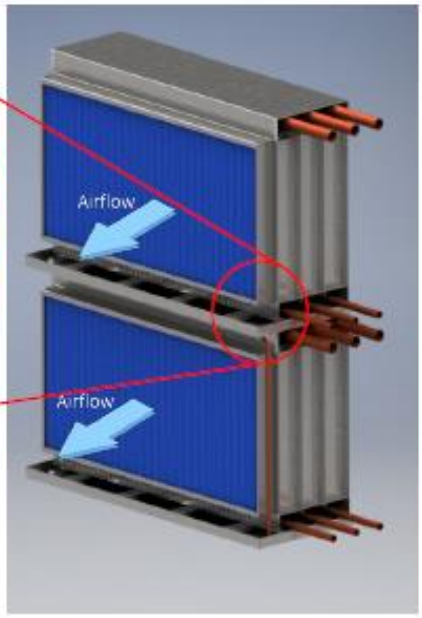
Moisture Eliminator

Description

Blades are designed to capture condensate that forms on, and spits from, horizontal coil fins. The moisture eliminator will sit over a drain pan and captured condensate will drain out of the bottom of the moisture eliminator into the pan.







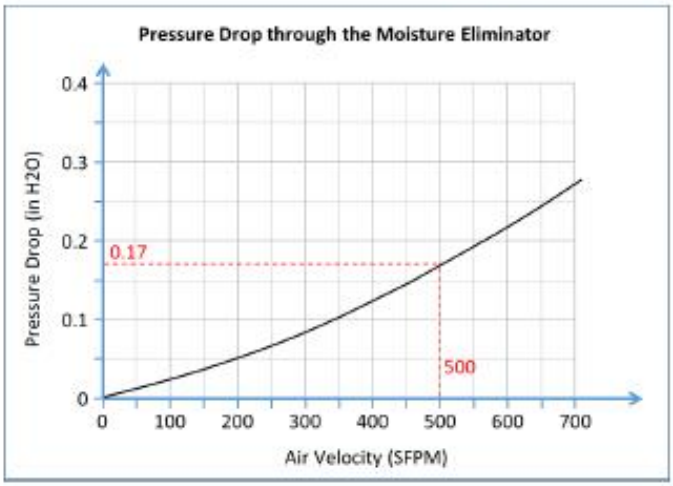
- Intermediate drain pans are required when multiple heat pipe sections are stacked vertically
- All drain pans to extend a minimum of 2" past the moisture eliminator casing

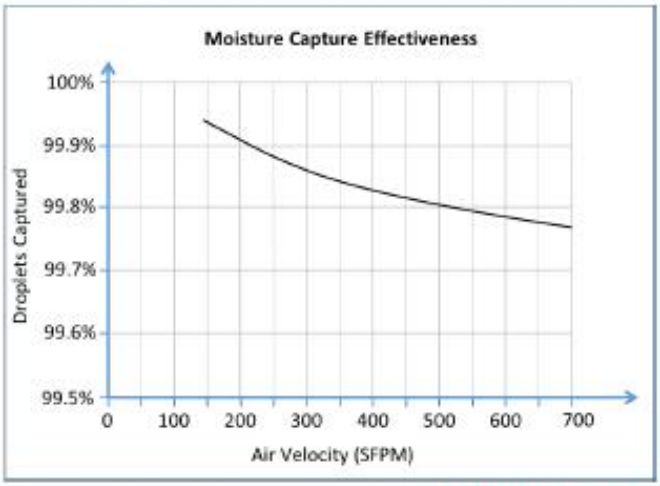
Materials of Construction

Moisture Eliminator Casing is either 16ga G90 Galvanized or 16ga 304 Stainless Steel. Moisture Eliminator Blades are made from extruded ABS plastic. Blade material is enhanced with UV resilient and anti-fungal additives. Blade material meets UL 94 V-0 Flammability requirements.

Performance

At least 99.75% of condensate will be captured by the moisture eliminator, when the coil is producing condensate at a rate of 0 to 15 lbs_{water} /sqft/hour and coil airflow is ≤ 700 SFPM





HRM warranty

Energy Recovery Heat Pipes (Module Only)
Five-Year Limited Warranty

Subject to the following conditions, **Heat Pipe Technology, Inc. (HPT)**, warrants this product to be free from defects in material and workmanship for a period of FIVE YEARS for the heat exchanger only from the date of installation not to exceed 90 days from date of shipment. Dampers and HPT provided controls carry a 12 month warranty. This warranty is in lieu of all other warrants not expressly set forth herein, whether expressed or implied by operation of law or otherwise. In the event this product fails under normal use and service within the applicable period, HPT will correct, repair or, at its sole discretion, replace the defective product or refund the purchase price of products which are returned freight prepaid to HPT for inspection, when accompanied by proof of purchase and written claims of defect, and which upon inspection by HPT, do comply with the terms of this warranty.

This warranty applies to the first retail buyer and extends to any subsequent owners of the systems.

The cost of replacement parts or components shall be determined by the price schedule in effect at the time of submission of warranty claim.

Repair or replacement parts will be furnished F.O.B. factory in all cases.

If HPT elects to replace or provide a refund, the defective product must be returned to HPT free and clear of liens or other encumbrances.

Limitations on Liability

This warranty does not cover and no warranty is made with respect to:

A. Failures not reported to HPT within the period specified above;
B. Failures or damage due to misapplication, misuse, abuse, improper storage or handling, abnormal conditions of temperature, water, dirt, corrosive substances or other contaminants;
C. Products which have been repaired with parts or materials not furnished or approved by HPT or by its authorized dealers or representatives, or products which have been in any way tampered with or altered;
D. Products damaged in shipment or storage or otherwise without fault of HPT;
E. Normal maintenance as outlined in the installation and servicing instructions or owners manual including coil cleaning, filter cleaning and periodic flushing of systems;
F. Damage or repairs required as a consequence of faulty installation or application by others;
G. Damage or repairs required as a consequence of any misapplication, abuse, improper servicing, unauthorized alteration or improper operation;
H. Damage as a result of floods, winds, fires, lightning, accidents, corrosive atmosphere or other conditions beyond the control of HPT;
I. Damage resulting from freezing of domestic water or condensate, inadequate or interrupted water supply, use of corrosive water, fouling or restriction of the water circuit by foreign material or like causes;
J. Damage resulting from operation with an inadequate supply of air or water;
K. Dampers or other mechanical options.

HPT total responsibility for any claims, damages, losses or liabilities related to the product covered hereunder shall not exceed the purchase price of such product. In no event shall HPT be liable for any special, indirect, incidental or consequential damages of any character, including but not limited to loss of use of productive facilities or equipment, lost profits, property damage, transportation, installation or removal, lost production, or personal injury whether suffered by Purchaser or any third party. HPT disclaims all liability for any and all costs, claims, demands, charges, expenses or other damages, either direct or indirect, incident to personal injury or property damage arising out of any cause of action based on strict liability.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the exclusion or limitation above of consequential damages or the limitation of time above on implied warranties may not apply to you.

This warranty gives you specific legal rights and you may have other rights which may vary from state to state.

APPENDIX C

DOAS Units
Equipment Cutsheets

VXE-112-36D-10A-1-D1

Unit Performance

Design Conditions

Elevation (ft)	Summer		Winter DB (F)	Supply (CFM)	Outdoor Air (CFM)	Exhaust Air (CFM)
	DB (F)	WB (F)				
180	91.0	73.0	0.0	3,200	3,200	3,200

Unit Specifications

Qty	Weight (lb)	Cooling Type	Primary Heating Type	Secondary Heating Type	Unit Installation	Unit ETL Listing
1	3,631 (+/- 5%)	Air-Source Heat Pump	Air-Source Heat Pump	Electric	Outdoor	UL\cUL 1995/ 60335-2-40

Configuration

Outdoor Air		Exhaust Air	
Intake	Discharge	Intake	Discharge
End	Side	Access Side	Side

ASHRAE 90.1 Compliance

	ASHRAE 90.1 Min. Efficiency	Calculated Efficiency	Compliance
ISMRE (ASHRAE 90.1-2019)	5.2	6.4	✓
ISMRE2 (ASHRAE 90.1-2022)	5	7.5	✓
ISCOP (ASHRAE 90.1-2019)	3.3	5	✓
ISCOP2 (ASHRAE 90.1-2022)	3.2	4.26	✓
Enthalpy Recovery Ratio (%)	50	60.4	✓

Energy Recovery Performance

Design Condition	Temperature (F)								Capacity Reduction (BTU/h)
	Outdoor Air		Supply Air		Return Air		Exhaust Air		
	DB	WB	DB	WB	DB	WB/RH	DB	WB	
Summer	91.0	73.0	81.0	67.0	75.0	62.5/50	85.0	69.2	73,440.0
Winter	0.0	-1.5	41.6	35.9	72.0	55.8/35	27.4	26.8	143,770.0

Cooling Specifications

Type	Total Capacity (MBH)	Sensible Capacity (MBH)	Coil (DB/WB)		Reheat	
			EAT (F)	LAT (F)	Capacity (MBH)	LAT (F)
Air-Source Heat Pump	134.6	96.5	81.0 / 67.0	53.6 / 53.3	62.8	71.7

Primary Heat Specifications

Type	Total Capacity (MBH)	Dry Bulb Temperatures		
		EAT (F)	LAT (F)	Ambient Outdoor Air (F)
Air-Source Heat Pump	58.5	46.2	63.1	10.0

Secondary Heat Specifications

Type	Capacity (kW)	Full Load Amps (FLA)	Capacity Control	Performance (w/ASHP)		Performance (w/o ASHP)	
				EAT (F)	LAT (F)	EAT (F)	LAT (F)
Electric	35.0	43.93	Modulating (SCR)	63.1	97.6	41.6	76.2

Air Performance

Type	Total Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	FRPM	Fan		
					Qty	Type	Drive-Type
Supply	3,200	1.5	3.843	2077	1	Plenum	Direct
Exhaust	3,200	1.25	3.09	2012	1	Plenum	Direct

Motor Specifications						
Motor	**Qty**	**Operating Power (hp)**	**Size (hp)**	**Enclosure**	**Efficiency**	**RPM**
Supply	1	3.08	5	ODP	PE	1750
Exhaust	1	2.82	5	ODP	PE	1750

Electrical Specifications					
Power Supply	**Rating (V/C/P)**	**MCA (A)**	**MOP (A)**	**FLA (A)**	**Fan Power (W/CFM)***
Unit	460/60/3	90.7	100.0	77.6	1.376

*Fan Power (W/CFM) = (Supply BHP + Exhaust BHP) / Supply CFM

Construction Features And Accessories

Unit	
Unit Installation - Outdoor	Std
Unit Construction - Double Wall	Std
Insulation - 2 inch 2.4# R13 foam	Std
Corrosion Resistant Fasteners	Std
Hinged Access	Std
Factory Wired Non-Fused Disconnect Switch	X
Direct Drive Plenum Blower & Motor Assemblies	Std
Factory Wired VFDs	Std
Unit Finish - Permatector, Concrete Gray (RAL 7023)	X
Stainless Steel Condensate Drain Pan and Connection	Std
Condensate Drain Trap	Std
Short Circuit Current - 5 kA	Std
Energy Recovery Device - Polymer Wheel w/ Silica Gel Desiccant	Std
Controls	
Unit Controls - Full Control	Std
Internally Mounted Control Center with 24 VAC control transformer(s) and control circuiting fusing	Std
BMS Protocol - BACNetMSTP	X
BMS Monitoring Points	
Supply Fan Control - Constant Volume-Adj. Setpoint	X
Exhaust Fan Control - Constant Volume-Adj. Setpoint	X
Economizer Control - Temp./Enthalpy	X
Exhaust Fan Only Power	
Web-Based User Interface	Std
Energy Wheel Economizer Control - Modulating Wheel, OA Temp Setpoint w/VFD Wheel	X
Energy Wheel Rotation Sensor	Std
Damper Control - Constant Volume-Adj. Setpoint	X
Unoccupied Recirc Mode	
Control Accessories	
Remote Display	
Dirty Filter Sensor(s)	
Airflow Monitor	
Room Thermostat	
Phase/Brownout Protection	Std
Economizer Fault Detection Diagnostics	

Accessories	
Frost Control - Modulating Wheel	X
Outdoor Air Damper - Low Leakage	X
Return Air Damper - Low Leakage	X
Roof Curb - GKD - 45.9/173.9-G14	X
Supply Air Filters - 2" Merv 8 And 2" Merv 13, 8-20x20x2	X
Service Outlet - Shipped loose and powered by others	X
Piping Vestibule	
Service Lights	
Condensate Overflow Switch	X
Spare Filters - Both, Qty: 1 set(s)	X
Exhaust Discharge Gravity Backdraft Damper	Std
ElectroFin Coil Coating	
Motor Shaft Grounding	X
Return Air Filters - 2" Merv 8, 2-20x25x2	Std
Outdoor Air Filters - 2" Merv 8, 2-20x25x2	Std
Furnace Control	
Spare Energy Wheel Belt	
Spare Energy Wheel Segments	
UV Lights	
Bipolar Ionization	
Smoke Detector(s)	
Barometric Relief Damper	
Energy Wheel Bypass Damper	
Hail Guards	X
Warranty Options	
Unit Warranty - 18 Months (Std.)	Std
Energy Wheel Warranty - 5 Yrs Less Motor	Std
Compressor Warranty - 5.5 Yrs. (4 Yrs. Extended)	X

Standard Option	Std
Not Included	
Included	X

Notes
Outdoor Air Damper supplied is low leakage, motorized VCD-23 (leakage rate of 3 CFM / ft^2 @ 1 in. wg), Class 1A
Return Air Damper supplied is low leakage, motorized VCD-23 (leakage rate of 3 CFM / ft^2 @ 1 in. wg), Class 1A
Air-Source Heat Pump heating is locked below 10°F (-12.2°C). Above 10°F (-12.2°C), unit may go into defrost or extended lock out (until weather pattern changes) during high humidity or precipitation events. Without supplemental heat, supply discharge temperature may be extremely low during defrost. To avoid this, consider selecting supplemental heat.

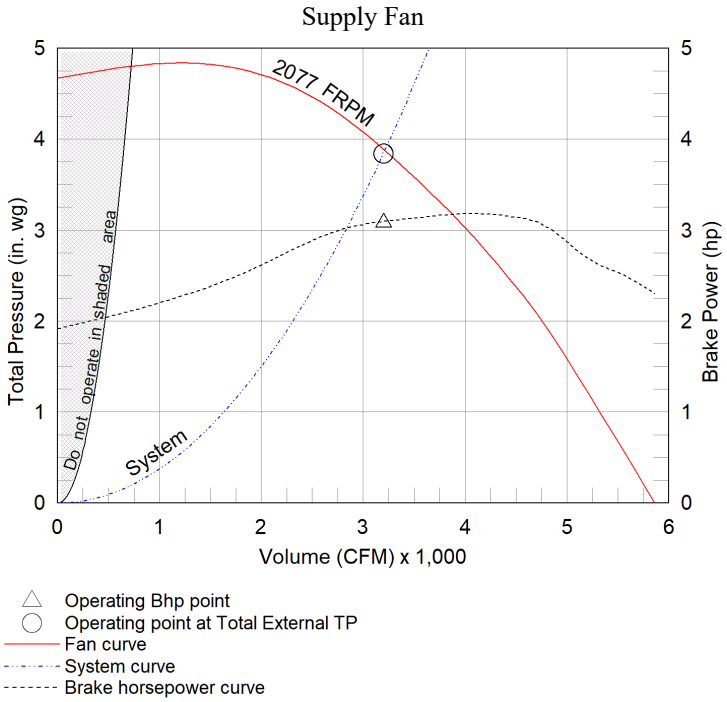
Supply Fan Charts And Performance

Supply Fan Performance									
Total Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	RPM	Operating Power (hp)	Motor		Fan		
					Qty	Size (hp)	Qty	Type	Drive-Type
3,200	1.5	3.843	2077	3.08	1	5	1	Plenum	Direct

Pressure Drop (in. wg)							
Weatherhood	Filter	Damper	Cooling	Heating	External	Energy Wheel	Total
0.08	0.304	0.04	0.304	0.304	1.5	1.28	3.843

Sound Performance in Accordance with AMCA										
Sound Power by Octave Band								Lwa	dBA	Sones
62.5	125	250	500	1000	2000	4000	8000			
76	82	85	76	71	67	73	63	81	69	17

*Energy Wheel pressure drop shown in above table also accounts for pressure drop across MERV8 OA filter



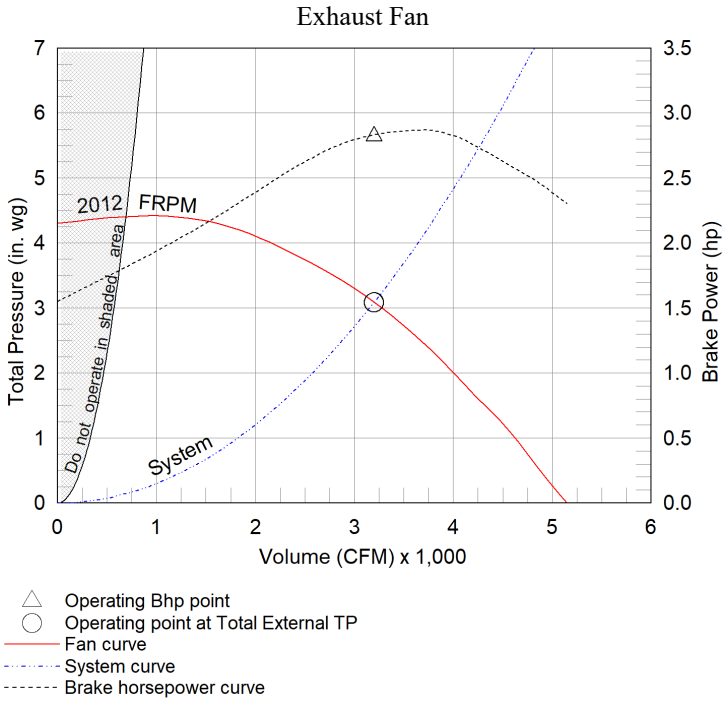
Exhaust Fan Charts And Performance

Exhaust Fan Performance									
Total Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	RPM	Operating Power (hp)	Motor		Fan		
					Qty	Size (hp)	Qty	Type	Drive-Type
3,200	1.25	3.09	2012	2.82	1	5	1	Plenum	Direct

Pressure Drop (in. wg)							
Weatherhood	Filter	Damper	Cooling	Heating	External	Energy Wheel	Total
0.13	-	-	-	-	1.25	1.71	3.09

Sound Performance in Accordance with AMCA										
Sound Power by Octave Band								Lwa	dBA	Sones
62.5	125	250	500	1000	2000	4000	8000			
81	72	80	73	69	67	67	61	77	65	14

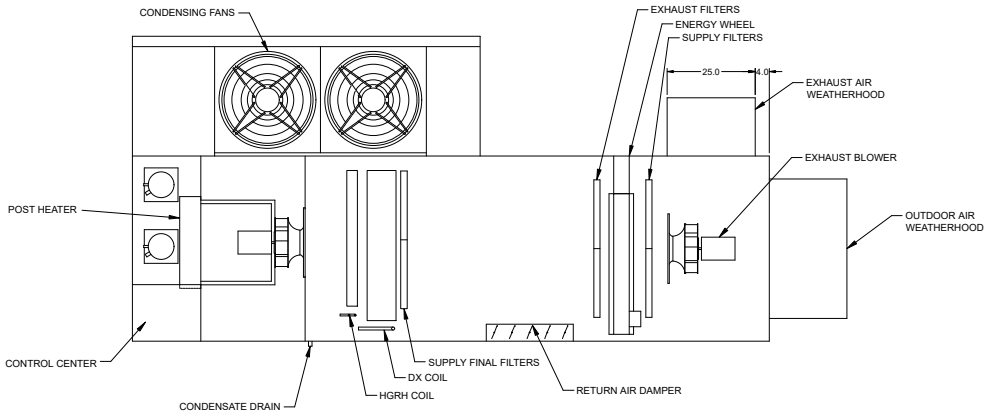
*Energy Wheel pressure drop shown in above table also accounts for pressure drop across MERV8 return air filter



Radiated Sound

Position A

Dimensional Overview



Plan

Position D

Position B

Position C

"E" is the Top Plane

Supply Air Flow Nominal, Largest Tonnage Condensing Section Available, PDX units only

Radiated Sound Levels										
Plane	Octave Bands (Lw)								Plane Lw	Plane LwA
	1	2	3	4	5	6	7	8		
A	73	86	81	79	77	73	69	63	89	82
B	71	79	77	71	69	64	63	55	82	75
C	79	76	69	66	64	59	53	46	81	69
D	74	77	72	72	69	62	58	51	81	74
E	77	84	80	76	76	70	66	60	87	80
Total	83	89	85	82	81	76	72	65	92	85

AMCA 320-07 - Laboratory Methods of Sound Testing of Fans Using Sound Intensity
Tests conducted in accordance with this standard.
Free field measurement plane created 1 foot from unit on all sides and top.
Sound Intensity measured in Watts/m^2.
Sound data converted to Sound Power (Lw) for the chart above.
A-Weighted Sound Power was determined using AMCA Standard 301-90 Clause 9.1.
Plane E sound data was measured above the top plane of the unit.

Air-Source Heat Pump Performance

Coil Information						
Indoor Coil Model	**Fins Per Inch**	**Rows Deep**	**Face Vel. (ft/min)**	**Coil PD (in. wg)**	**Refrigerant**	**Face Area (ft2)**
DX38S06S12-42x42.5-LH	12	6	258	0.304	R-410A	12

Compressor Details					
Lead Compressor Type	**Compressor Qty**	**Compressor RLA/MRC (A)**		**Compressor LRA (A)**	
		Comp. #1	**Comp. #2**	**Comp. #1**	**Comp. #2**
Inverter Scroll	2	8.3	7.8	NA	52

Cooling Specifications						
Type	**Total Capacity (MBH)**	**Sensible Capacity (MBH)**	**Coil (DB/WB)**		**Reheat**	
			EAT (F)	**LAT (F)**	**Capacity (MBH)**	**LAT (F)**
Air-Source Heat Pump	134.6	96.5	81.0 / 67.0	53.6 / 53.3	62.8	71.7

Primary Heat Specifications				
Type	**Total Capacity (MBH)**	**Dry Bulb Temperatures**		
		EAT (F)	**LAT (F)**	**Ambient Outdoor Air (F)**
Air-Source Heat Pump	58.5	46.2	63.1	10.0

Unit Details
Refrigerant charges provided by the factory are approximate and may require adjustment in the field
Hermetic scroll type compressors
Compressors mounted on neoprene vibration isolation
Crankcase heater on staged compressor
Electronic expansion valve on lead circuit, thermostatic expansion valve on staged circuit
Stainless steel double sloped drain pan
Moisture-indicating sight glass
Service/charging valves
Refrigerant high pressure switch (manual reset)
Liquid-Line filter drier
Multiple low sound outdoor fans with Lead ECM outdoor fan for modulating head pressure control
Inverter scroll compressor

Important Notes:
Air-Source Heat Pump heating is locked below 10°F (-12.2°C). Above 10°F (-12.2°C), unit may go into defrost or extended lock out (until weather pattern changes) during high humidity or precipitation events. Without supplemental heat, supply discharge temperature may be extremely low during defrost. To avoid this, consider selecting supplemental heat.

Secondary Heat Performance

Secondary Heat Specifications							
Type	Capacity (kW)	Full Load Amps (FLA)	Capacity Control	Performance (w/ASHP)		Performance (w/o ASHP)	
				EAT (F)	LAT (F)	EAT (F)	LAT (F)
Electric	35.0	43.93	Modulating (SCR)	63.1	97.6	41.6	76.2

Unit Details
Open coil heating elements
High grade Nickel-Chrome alloy coils
SCR controller
Unit controller maximum allowable supply discharge air set point is 100F (37.8C)
Heat pump and electric heater can operate simultaneously. Unit MCA/MOP will be sized for concurrent operation of all loads

Energy Recovery Summer Performance

Outdoor Air		Supply Air	
Dry Bulb (F)	91.0	Dry Bulb (F)	81.0
Wet Bulb (F)	73.0	Wet Bulb (F)	67.0
Specific Humidity (gr/lb)	94	Specific Humidity (gr/lb)	77
Enthalpy (BTU/lb)	36.7	Enthalpy (BTU/lb)	31.6
Exhaust Air		**Return Air**	
Dry Bulb (F)	85.0	Dry Bulb (F)	75.0
Wet Bulb (F)	69.2	Rel. Humidity (%)	50
Specific Humidity (gr/lb)	82	Specific Humidity (gr/lb)	65
Enthalpy (BTU/lb)	33.2	Enthalpy (BTU/lb)	28.2

ENERGY WHEEL

Design Air Flow Conditions

OA Volume (CFM)	ASHRAE 90.1 OA Enthalpy Recovery Ratio	EA Volume (CFM)	EA Wheel Effectiveness
3,200	60.4	3,200	59.2

Outdoor Air Cooling Reduction

OA Load w/o Energy Recovery		OA Load with Energy Recovery		Equipment Reduction (tons)
(BTU/h)	(tons)	(BTU/h)	(tons)	
122,400.0	10.20	48,960.0	4.08	6.12

Summer Conditions

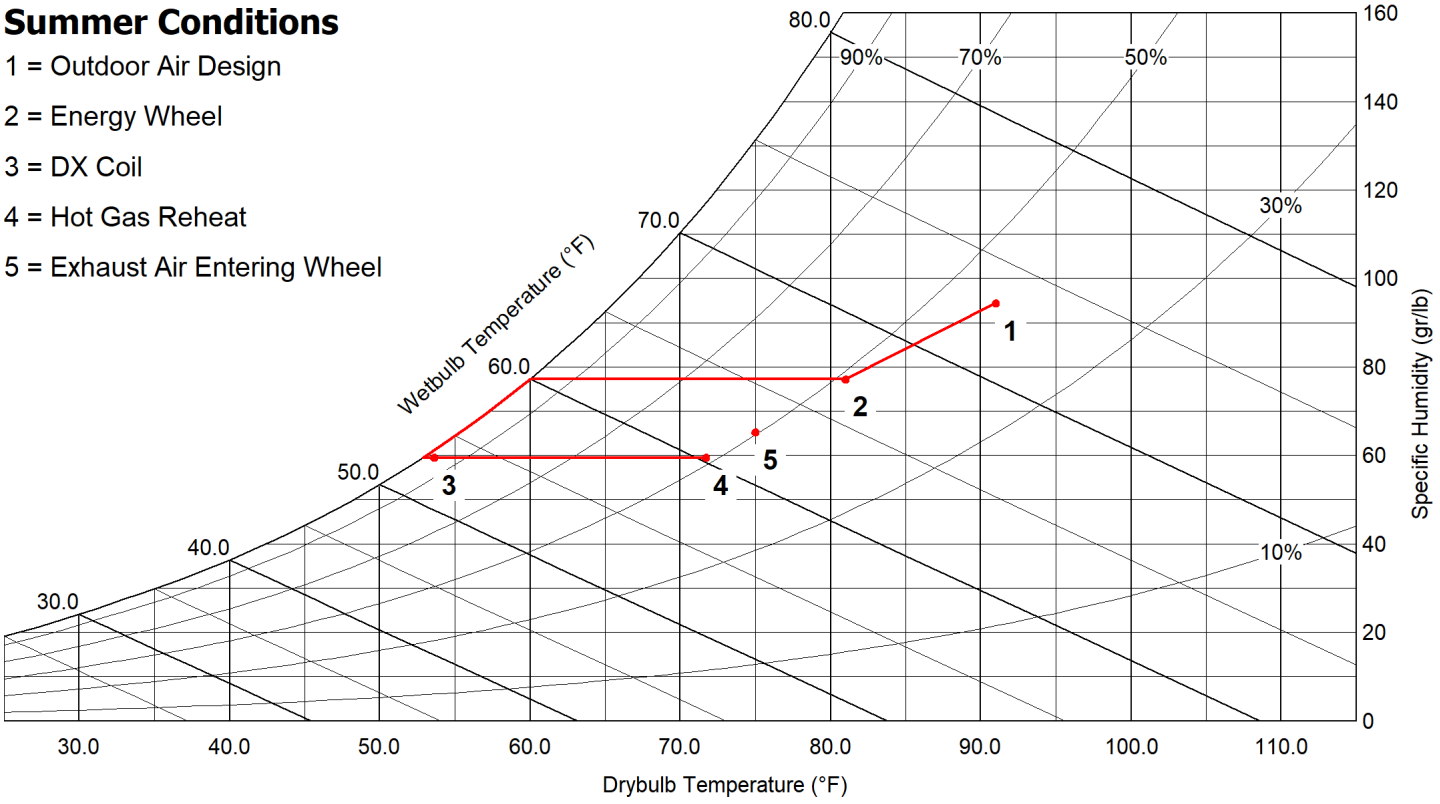
1 = Outdoor Air Design

2 = Energy Wheel

3 = DX Coil

4 = Hot Gas Reheat

5 = Exhaust Air Entering Wheel



Energy Recovery Winter Performance w/out Preheater

Outdoor Air		Supply Air	
Dry Bulb (F)	0.0	Dry Bulb (F)	41.6
Wet Bulb (F)	-1.5	Wet Bulb (F)	35.9
Specific Humidity (gr/lb)	3	Specific Humidity (gr/lb)	22
Enthalpy (BTU/lb)	0.4	Enthalpy (BTU/lb)	13.4
Exhaust Air		**Return Air**	
Dry Bulb (F)	27.4	Dry Bulb (F)	72.0
Wet Bulb (F)	26.8	Rel. Humidity (%)	35
Specific Humidity (gr/lb)	20	Specific Humidity (gr/lb)	41
Enthalpy (BTU/lb)	9.7	Enthalpy (BTU/lb)	23.7

ENERGY WHEEL

Design Air Flow Conditions

OA Volume (CFM)	ASHRAE 90.1 OA Enthalpy Recovery Ratio	EA Volume (CFM)	EA Wheel Effectiveness
3,200	55.8	3,200	59.3

Outdoor Air Heating Reduction

OA Load w/o Energy Recovery (BTU/h)	OA Load with Energy Recovery (BTU/h)	Equipment Reduction (BTU/h)	Sensible Effectiveness (%)
248,832.0	105,062.0	143,770.0	61.5

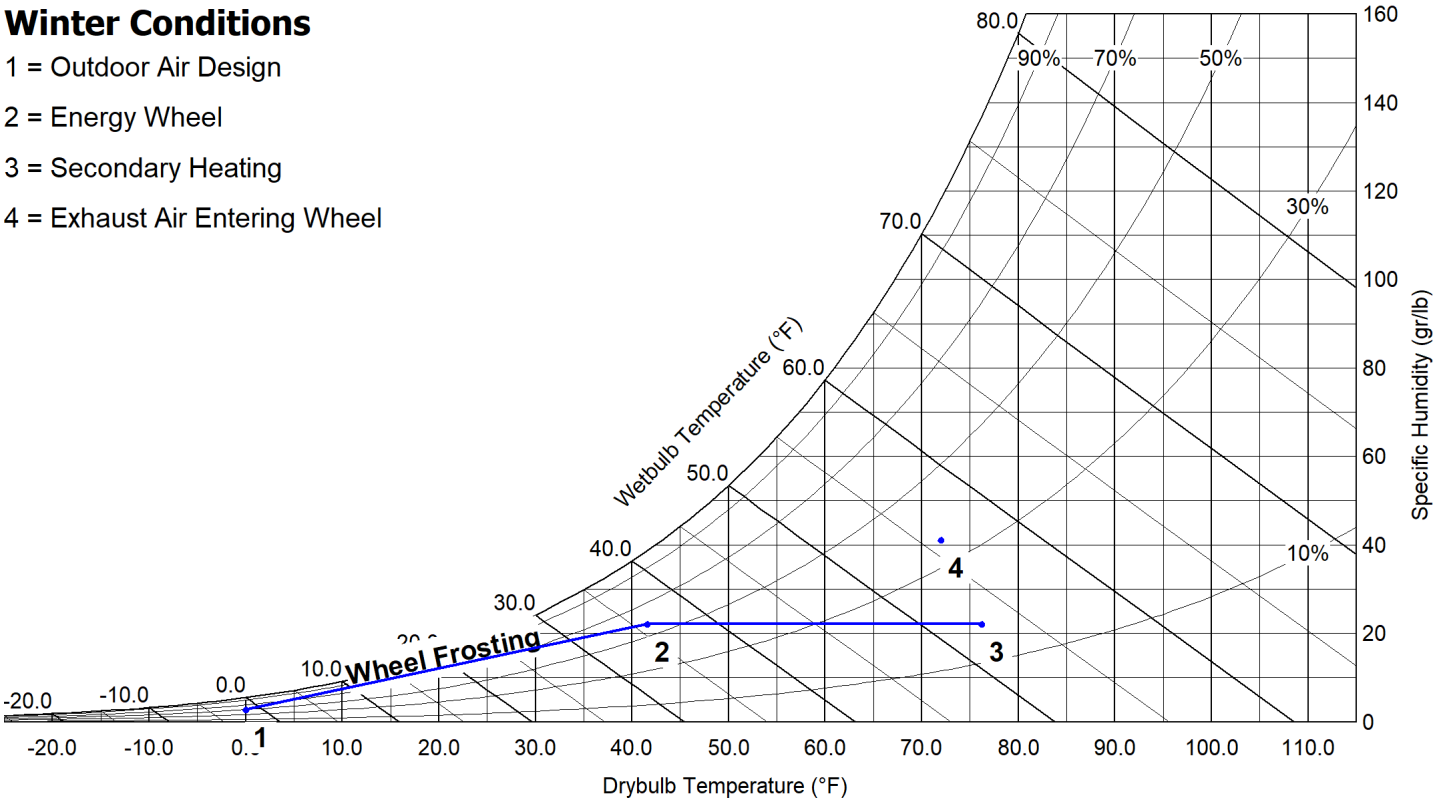
Winter Conditions

1 = Outdoor Air Design

2 = Energy Wheel

3 = Secondary Heating

4 = Exhaust Air Entering Wheel



AHRI Performance Ratings

Energy Recovery Performance Rating in accordance with AHRI Standard 1060 (I-P)							
Rated Airflow (SCFM)		Net Supply Airflow (SCFM)	EATR (%)	OACF	Pressure Drop (in. wg)		Purge Angle (degrees)
Leaving Supply	Entering Exhaust				Supply	Exhaust	
3245	3245	3200	1.4	1.05	1.00	0.99	0

Thermal Effectiveness Ratings							
Enthalpy Recovery		Sensible Effectiveness		Latent Effectiveness		Total Effectiveness	
Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
60.4	55.8	61.9	61.5	56.7	53.9	59.2	59.3

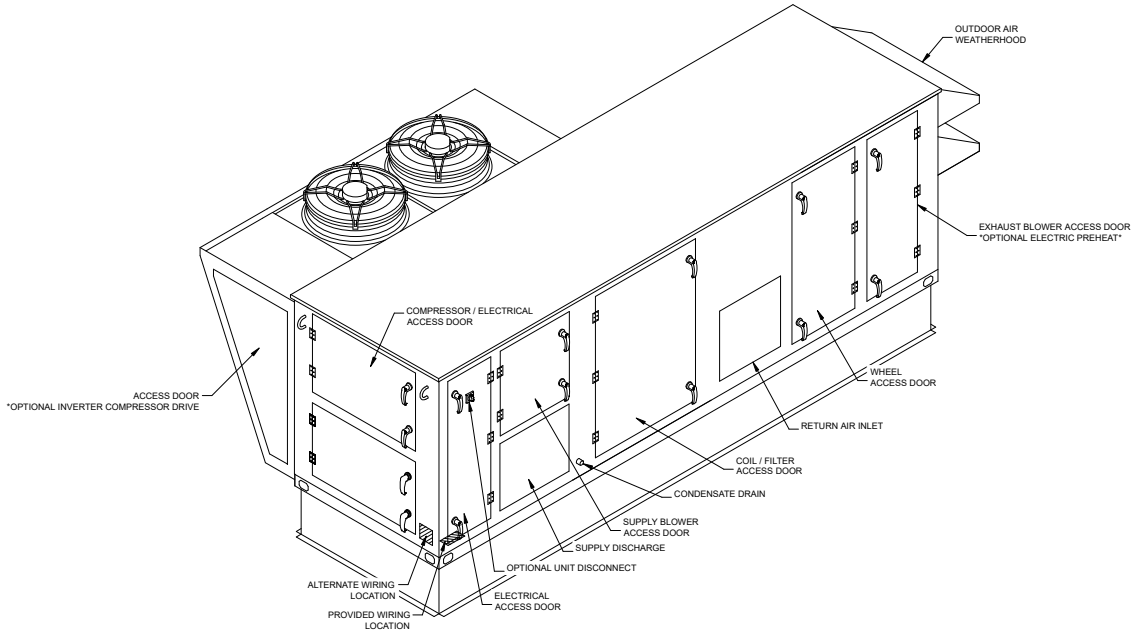
Note(s)

Summer Design Conditions:
Certified in accordance with the AHRI ERV Certification Program, which is based on AHRI Standard 1060. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Winter Design Conditions:
Application Rating is outside the scope of the AHRI ERV certification Program but is rated in accordance with AHRI Standard 1060.

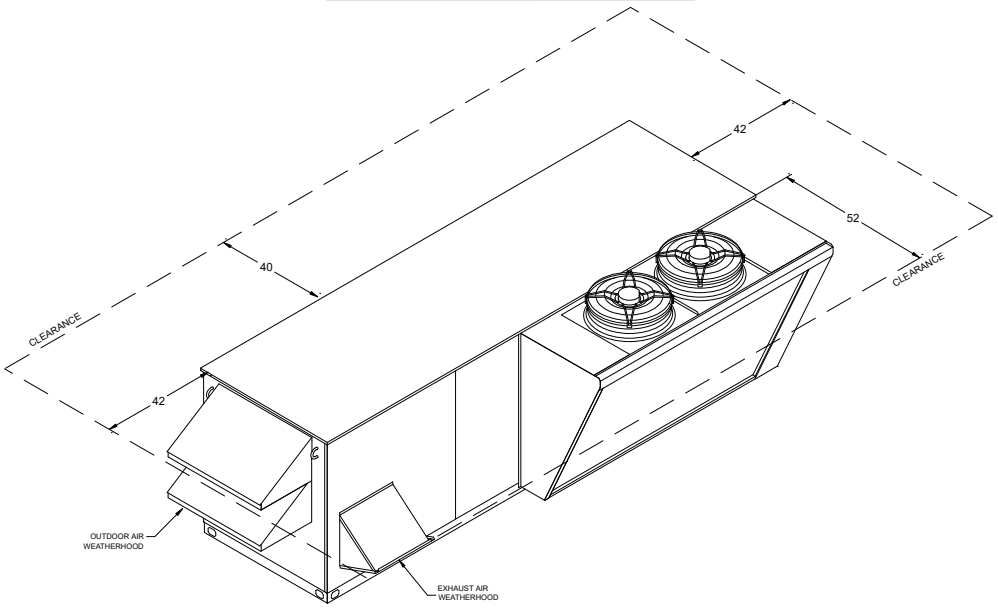
Isometric Drawings

Component Layout



Back Right Isometric

Service Clearances

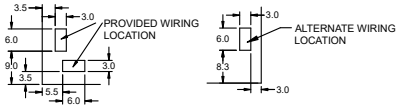


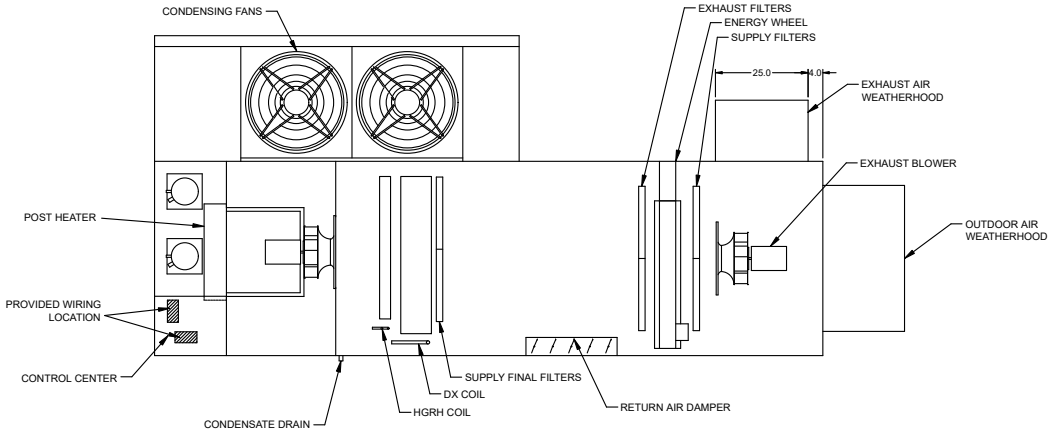
Front Left Isometric

Overview Drawings

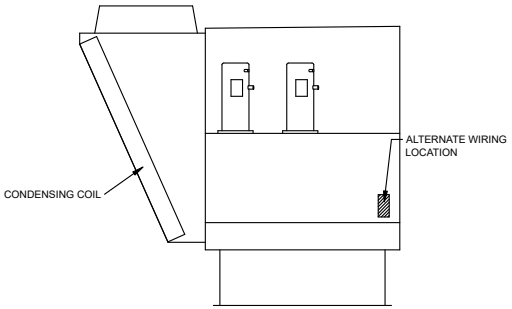
Dimensional Overview

Electrical Connections

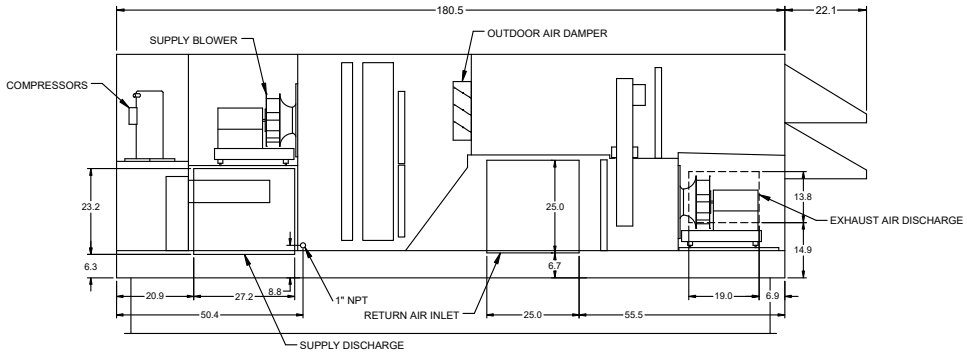




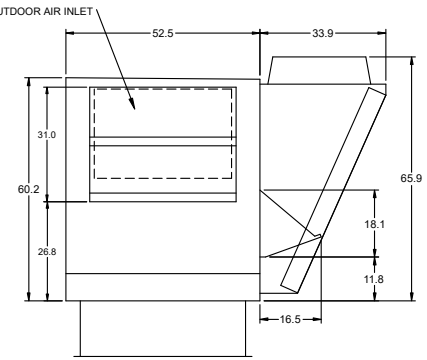
Plan



Left End



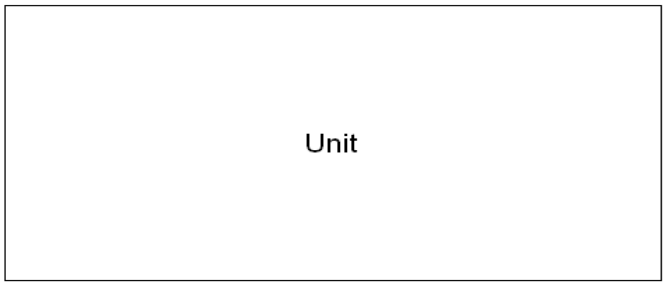
Elevation



Right End

Unit Corner Weights

1,332 lb 1,091 lb

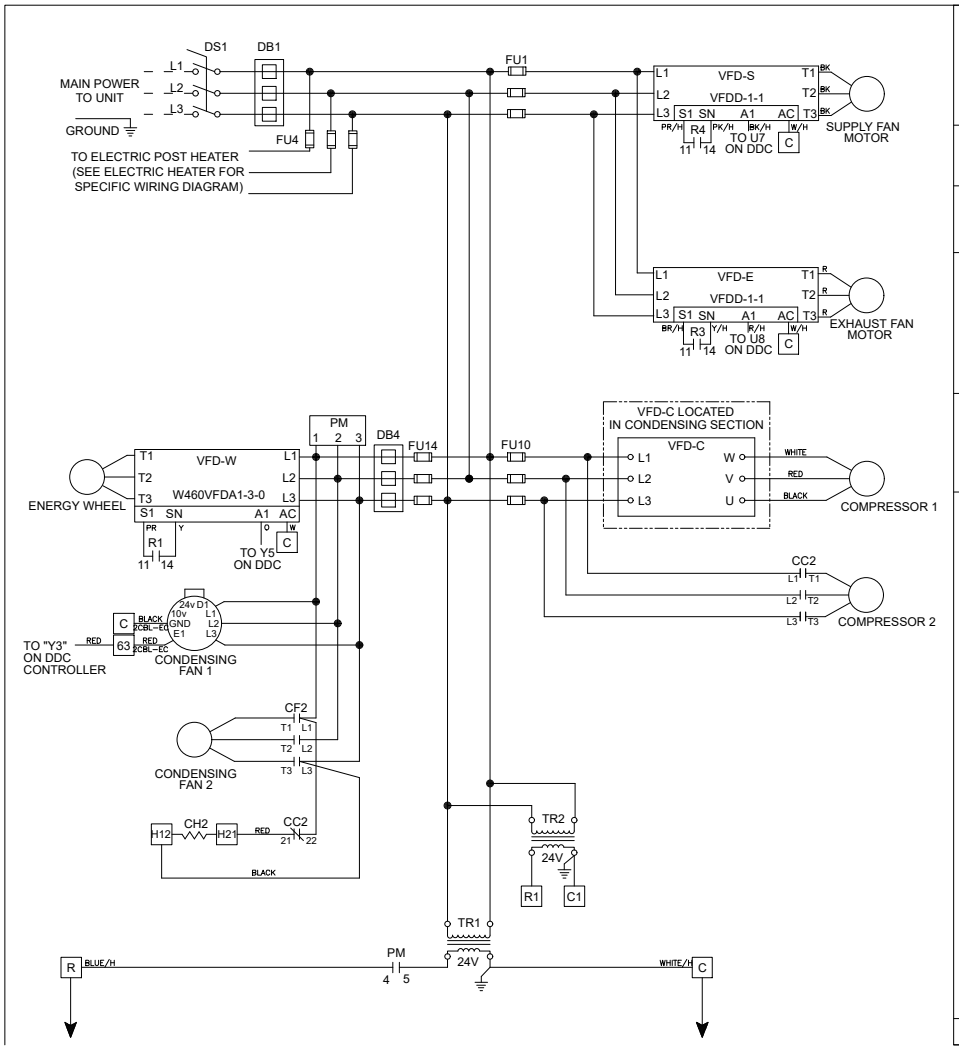


664 lb 544 lb

Note

Estimated corner weights are shown looking down on unit and the outside air intake will be on the right. Weights are applied at the base of the unit. Images not drawn to scale.

Wiring Diagram



Wiring Diagram Code:

V22Q2A1AF02G44X00NF23E0000BH29

CAUTION

UNIT SHALL BE GROUNDED IN ACCORDANCE WITH N.E.C.
POWER MUST BE OFF WHILE SERVICING.

NOTES

USE COPPER CONDUCTORS ONLY
60° C FOR TERMINALS RATED LESS THAN 100 AMPS.
75° C FOR TERMINALS RATED 100 AMPS OR MORE.

FIELD CONTROL WIRING RESISTANCE SHOULD NOT EXCEED 0.75 OHM.

FIELD WIRED – – – – –
FACTORY SUPPLIED AND WIRED ————

WIRE COLOR CODE

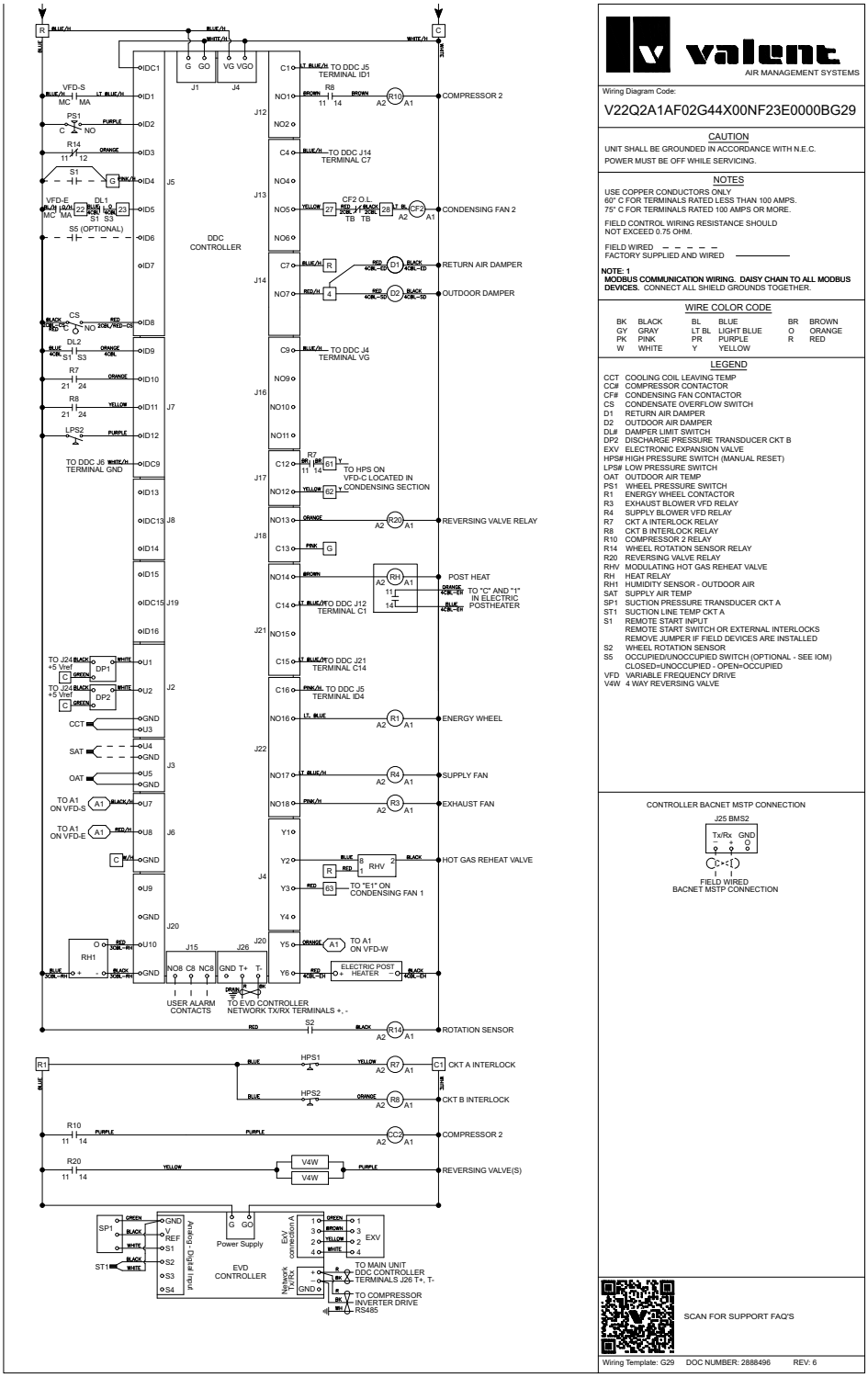
BK	BLACK	BL	BLUE	BR	BROWN
GY	GRAY	LT BL	LIGHT BLUE	O	ORANGE
PK	PINK	PR	PURPLE	R	RED
W	WHITE	Y	YELLOW		

LEGEND

CC#	COMPRESSOR CONTACTOR
CF#	CONDENSING FAN CONTACTOR
CH#	COMPRESSOR SUMP HEATER
DB#	POWER DISTRIBUTION BLOCK
DS	DISCONNECT SWITCH
FU#	FUSES
PM	PHASE VOLTAGE MONITOR
R1	ENERGY WHEEL CONTACTOR
R3	EXHAUST BLOWER VFD RELAY
R4	SUPPLY BLOWER VFD RELAY
TR#	TRANSFORMER
VFD	VARIABLE FREQUENCY DRIVE

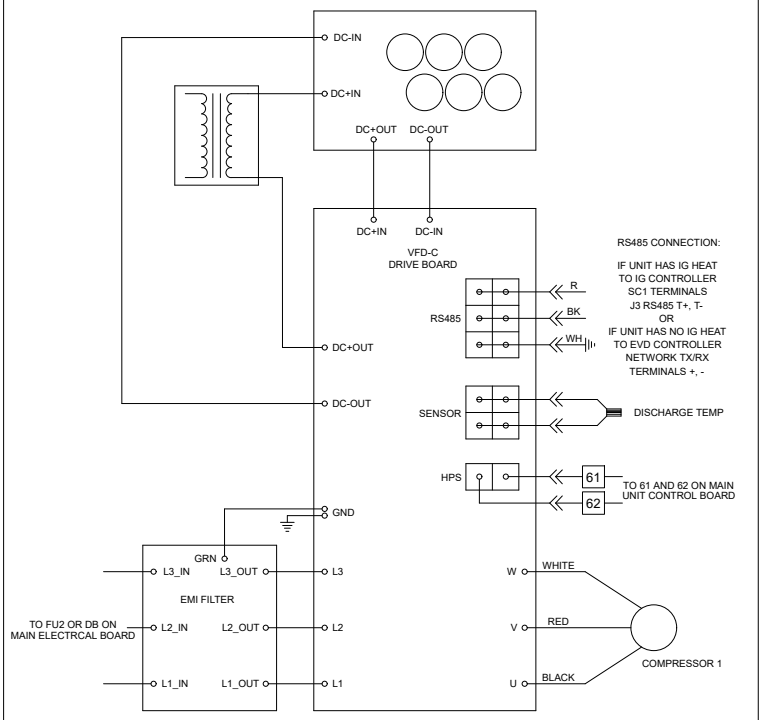
Wiring Template: H29 DOC NUMBER: 2888496 REV: 6

Wiring Diagram 2



Wiring Diagram 3

VFD-C
EV2 DIAGRAM



Wiring Diagram Code:
2937709-A

CAUTION

UNIT SHALL BE GROUNDED IN ACCORDANCE WITH N.E.C.
POWER MUST BE OFF WHILE SERVICING.

NOTES

USE COPPER CONDUCTORS ONLY
60° C FOR TERMINALS RATED LESS THAN 100 AMPS.
75° C FOR TERMINALS RATED 100 AMPS OR MORE.

FIELD CONTROL WIRING RESISTANCE SHOULD
NOT EXCEED 0.75 OHM.

FIELD WIRED – – – – –
FACTORY SUPPLIED AND WIRED ————

NOTE: 1
MODBUS COMMUNICATION WIRING. DAISY CHAIN TO ALL MODBUS DEVICES.

WIRE COLOR CODE

BK	BLACK	BL	BLUE	BR	BROWN
GY	GRAY	LT BL	LIGHT BLUE	O	ORANGE
PK	PINK	PR	PURPLE	R	RED
W	WHITE	Y	YELLOW		

LEGEND

Wiring Template: EV2 DOC NUMBER: 2888496 REV: 6

Valent Network Interface v8 Modbus/BACnet Points List

Variable	Description	BACnet Object	ModBus Object	Read or Write	Text or Unit of M		Included
					Active	Inactive	
Space_Temp_Analog_Input	Space Temperature	AI-1	30002	R	°F		
Supply_Temp_Analog_Input	Supply Temperature	AI-2	30004	R	°F		X
Outside_Air_Temp_Analog_Input	Outside Air Temperature	AI-3	30006	R	°F		X
Mixed_Temp_Analog_Input	Mixed Temperature	AI-4	30008	R	°F		
Cold_Coil_1_Temp_Analog_Input	Cold Coil 1 Temperature	AI-5	30010	R	°F		X
Return_Temp_Analog_Input	Return Temperature	AI-7	30014	R	°F		
Exhaust_Temp_Analog_Input	Exhaust Temperature	AI-8	30016	R	°F		
Space_RH_Analog_Input	Space % Relative Humidity	AI-9	30018	R	%		
Outside_RH_Analog_Input	Outside % Relative Humidity	AI-10	30020	R	%		X
Return_RH_Analog_Input	Return % Relative Humidity	AI-11	30022	R	%		
Return_Duct_Static_Pressure_Analog_Input	Return Duct Static Pressure	AI-12	30024	R	"wc		
Space_Static_Pressure_Analog_Input	Space Static Pressure	AI-13	30026	R	"wc		
Supply_Duct_Static_Pressure_Analog_Input	Supply Duct Static Pressure	AI-14	30028	R	"wc		
Space_CO2_1_Analog_Input	Space 1 CO2 ppm	AI-15	30030	R	ppm		
Return_CO2_Analog_Input	Return CO2 ppm	AI-17	30034	R	ppm		
Circuit_A_Discharge_Temp_Analog_Input	Circuit A Discharge Temperature	AI-20	30040	R	°F		X
Circuit_A_Suction_Temp_Analog_Input	Circuit A Suction Temperature	AI-21	30042	R	°F		X
Circuit_B_Discharge_Temp_Analog_Input	Circuit B Discharge Temperature	AI-22	30044	R	°F		X
Circuit_B_Suction_Temp_Analog_Input	Circuit B Suction Temperature	AI-23	30046	R	°F		X
Circuit_A_Discharge_Pressure_Analog_Input	Circuit A Discharge Pressure	AI-28	30056	R	psig		X
Circuit_A_Suction_Pressure_Analog_Input	Circuit A Suction Pressure	AI-29	30058	R	psig		X
Circuit_B_Discharge_Pressure_Analog_Input	Circuit B Discharge Pressure	AI-30	30060	R	psig		X
Circuit_B_Suction_Pressure_Analog_Input	Circuit B Suction Pressure	AI-31	30062	R	psig		X
Aux_In_Customer_1	Customer defined auxiliary input	AI-36	30072	R	selectable		
Aux_In_Customer_2	Customer defined auxiliary input	AI-37	30074	R	selectable		
Aux_In_Customer_3	Customer defined auxiliary input	AI-38	30076	R	selectable		
Aux_In_Customer_4	Customer defined auxiliary input	AI-39	30078	R	selectable		
Aux_In_Customer_5	Customer defined auxiliary input	AI-40	30080	R	selectable		
Aux_In_Customer_6	Customer defined auxiliary input	AI-41	30082	R	selectable		
Aux_In_Customer_7	Customer defined auxiliary input	AI-42	30084	R	selectable		
Aux_In_Customer_8	Customer defined auxiliary input	AI-43	30086	R	selectable		
Aux_In_Customer_9	Customer defined auxiliary input	AI-44	30088	R	selectable		
Aux_In_Customer_10	Customer defined auxiliary input	AI-45	30090	R	selectable		
Temperature_Setpoint	Main Temperature Set point Supply, Space, or Return target temperature	AV-1	40002	RW	°F		X
Temperature_Heat_Cool_Deadband	Heat/Cool Spt Deadband when Room or Return control is active Clg Spt = Deadband /2 + Temp Spt Htg Spt = Deadband /2 - Temp Spt	AV-2	40004	RW	Delta in °F		
Temperature_Setpoint_Unoccupied	Main Temperature Set point Supply, Space, or Return target temperature	AV-3	40006	RW	°F		
Temperature_Heat_Cool_Deadband_Unoccupied	Heat/Cool Spt Deadband when Room or Return control is active Clg Spt = Deadband /2 + Temp Spt Htg Spt = Deadband /2 - Temp Spt	AV-4	40008	RW	Delta in °F		
Cooling_Coil_Setpoint_Min	Cooling Coil Leaving Air Setpoint	AV-5	40010	RW	°F		X
Cooling_Coil_Setpoint_Max	Maximum Coil Leaving Setpoint	AV-6	40012	RW	°F		X
Dehumidification_Setpoint	Dehumidification Setpoint %RH for Space or Return control	AV-7	40014	RW	%		
Outside_Dewpoint_Setpoint	Outside Dewpoint Dehumidification Trigger	AV-8	40016	RW	°F		X
Indoor_Dewpoint_Setpoint	Indoor Dewpoint Dehumidification Trigger	AV-9	40018	RW	°F		
Unocc_Indoor_Dewpoint_Setpoint	Unoccupied Indoor Dewpoint Dehumidification Trigger	AV-10	40020	RW	°F		
Unoccupied_Dehumidification_Setpoint	Unoccupied Dehumidification %RH Setpoint	AV-11	40022	RW	°F		
Economizer_Temp_Enable_Setpoint	Economizer Ambient Temp Enable Setpoint Allow Econ when OAT is less than Setpoint	AV-12	40024	RW	°F		
Economizer_Enthalpy_Enable_Setpoint	Economizer Enthalpy Enable Setpoint Allow Econ when OA Enthalpy is less than Setpoint	AV-13	40026	RW	btu/lb		X
Cooling_Lockout_Setpoint	Cooling Ambient Lockout Setpoint	AV-17	40034	RW	°F		X
Heating_Lockout_Setpoint	Heating Ambient Lockout Setpoint	AV-18	40036	RW	°F		X
Preheat_Lockout_Setpoint	Preheat Ambient Lockout Setpoint	AV-19	40038	RW	°F		
Economizer_Lockout_Setpoint	Economizer Ambient Lockout Setpoint	AV-20	40040	RW	°F		X
Return_Duct_Static_Pressure_Setpoint	Return Duct Static Pressure Setpoint	AV-21	40042	R	"wc		
Space_Static_Pressure_Setpoint	Space Static Pressure Setpoint	AV-22	40044	RW	"wc		
Supply_Duct_Static_Pressure_Setpoint	Supply Duct Static Pressure Setpoint	AV-23	40046	RW	"wc		
Space_CO2_Setpoint	Space_CO2_Setpoint	AV-24	40048	RW	ppm		
Outside_Air_Damper_Minimum_Setpoint_Occ	Outside Air Damper Minimum Setpoint	AV-24	40050	RW	%		
Outside_RH_from_BMS	Outside RH from BMS Used when source selection is set to BMS	AV-26	40052	RW	%		X
Outside_Temp_from_BMS	Outside Temp from BMS Used when source selection is set to BMS	AV-27	40054	RW	°F		X
Return_RH_from_BMS	Return RH from BMS Used when source selection is set to BMS	AV-28	40056	RW	%		X
Return_Temp_from_BMS	Return Temp from BMS Used when source selection is set to BMS	AV-29	40058	RW	°F		X

Valent Network Interface v8 Modbus/BACnet Points List

Variable	Description	BACnet Object	ModBus Object	Read or Write	Text or Unit of M		Included
					Active	Inactive	
Space_1_CO2_from_BMS	Space 1 CO2 from BMS Used when source selection is set to BMS	AV-30	40060	RW	ppm		X
Return_CO2_from_BMS	Return CO2 from BMS Used when source selection is set to BMS	AV-32	40062	RW	ppm		X
Space_RH_from_BMS	Space RH from BMS Used when source selection is set to BMS	AV-33	40066	RW	%		X
Space_Static_from_BMS	Space Static from BMS Used when source selection is set to BMS	AV-34	40068	RW	"wc		X
Space_Temp_from_BMS	Space Temp from BMS Used when source selection is set to BMS	AV-35	40070	RW	°F		X
SF_Control_Signal_BMS	BMS to control signal for supply fan speed	AV-36	40072	RW	%		X
EF_Control_Signal_BMS	BMS to control signal for exhaust fan speed	AV-37	40074	RW	%		X
OAD_Control_Signal_BMS	Allows the BMS to control OAD position	AV-38	40076	RW	%		
Aux_BMS_Analog_Output_1	BMS Commanded auxilary analog output	AV-39	40078	RW	selectable		X
Unit_Status_Mode	Unit Status Mode - See Table	AV-40	30092	R	Real		X
Supply_Temperature_Calculated_Setpoint	Active Supply Temperature Setpoint	AV-41	30094	R	°F		X
Cooling_1_Ramp_Capacity	Cooling Ramp 1 Status Value	AV-42	30096	R	%		X
Defrost_Ramp	Defrost Ramp	AV-44	30100	R	%		X
Economizer_Ramp	Economizer Ramp	AV-45	30102	R	%		X
Head_Pressure_Control_Ramp_1_Ramp	Head Pressure Control Ramp 1	AV-46	30104	R	%		X
Head_Pressure_Control_Ramp_2_Ramp	Head Pressure Control Ramp 2	AV-47	30106	R	%		
HP_Ramp_Capacity	Heat Pump Heating Ramp	AV-50	30112	R	%		X
Heating_Capacity	Heating Ramp	AV-51	30114	R	%		X
Case_Heat_Control_Ramp	Case Heat Ramp	AV-52	30116	R	%		
Hot_Gas_Reheat_Ramp	Hot Gas Reheat Ramp	AV-53	30118	R	%		X
Outside_Dewpoint	Outside Dewpoint	AV-54	30120	R	°F		X
Outside_Enthalpy	Outside Enthalpy	AV-55	30122	R	btu/lb		X
Return_Dewpoint	Return Dewpoint	AV-56	30124	R	°F		
Return_Enthalpy	Return Enthalpy	AV-57	30126	R	btu/lb		
Space_Dewpoint	Space Dewpoint	AV-58	30128	R	°F		
Space_Enthalpy	Space Enthalpy	AV-59	30130	R	btu/lb		
Circuit_A_Superheat	Circuit A Superheat	AV-60	30132	R	°F		X
Circuit_B_Superheat	Circuit B Superheat	AV-61	30134	R	°F		X
Total_Exhaust_Fan_CFM_BMS	Total Exhaust Fan CFM	AV-64	30140	R	CFM		X
Total_Supply_Fan_CFM_BMS	Total Supply Fan CFM	AV-65	30142	R	CFM		X
OAD_CFM_BMS	OAD CFM	AV-66	30144	R	CFM		X
Active_Temperature_Setpoint	Active_Temperature_Setpoint	AV-67	30146	R	°F		X
Chilled_Water_1_Valve_Analog_Output	Chilled Water 1 Valve Analog Output	AV-68	30148	R	%		
Electric_Heater_1_Analog_Output	Electric Heater 1 Analog Output	AV-70	30152	R	%		
Energy_Recovery_Analog_Output	Energy Recovery Analog Output	AV-72	30156	R	%		X
Exhaust_Fan_Speed_Analog_Output	Exhaust Fan Speed Analog Output	AV-73	30158	R	%		X
Hot_Water_Valve_1_Analog_Output	Hot Water Valve 1 Analog Output	AV-74	30160	R	%		
Mod_Gas_Furnace_1_Analog_Output	Mod Gas Furnace 1 Analog Output	AV-76	30164	R	%		
Outside_Air_Damper_Analog_Output	Outside Air Damper Analog Output	AV-78	30168	R	%		
Supply_Fan_Speed_Analog_Output	Supply Fan Speed Analog Output	AV-79	30170	R	%		X
Modulating_Compressor_Analog_Output_BMS	First Modulating Compressor Analog Output - BMS	AV-80	30172	R	%		X
Circuit_A_Sat_Discharge_Temperature	Circuit A Saturated Discharge Temperature	AV-82	30176	R	°F		X
Circuit_B_Sat_Discharge_Temperature	Circuit B Saturated Discharge Temperature	AV-83	30178	R	°F		X
Circuit_A_Sat_Suction_Temperature	Circuit A Saturated Suciton Temperature	AV-86	30184	R	°F		X
Circuit_B_Sat_Suction_Temperature	Circuit B Saturated Suciton Temperature	AV-87	30186	R	°F		X
Coil_Temperature_Calculated_Setpoint	Calculated Coil Leaving Set point	AV-90	30192	R	°F		X
Unoccupied_Cooling_Setpoint	Active Cooling Setpoint - Unoccupied	AV-91	30194	R	°F		
Unoccupied_Heating_Setpoint	Active Heating Setpoint - Unoccupied	AV-92	30196	R	°F		
Temperature_Reset_Mode	Occupied Reset Type Setpoint 1-No Reset(Supply Temp Control) 2-Space 3-Return 4-Outside	IV-1	40080	RW	Integer		X
Temperature_Reset_Mode_Unoccupied	Unoccupied Reset Type Setpoint 1-No Reset(Supply Temp Control) 2-Space 3-Return 4-Outside	IV-2	40082	RW	Integer		
Active_Temperature_Reset_Mode	Active Occupied Reset Type Setpoint 1-No Reset(Supply Temp Control) 2-Space 3-Return 4-Outside	IV-3	30198	R	Integer		X
Active_Temperature_Reset_Mode_Unocc	Active Unoccupied Reset Type Setpoint 1-No Reset(Supply Temp Control) 2-Space 3-Return 4-Outside	IV-4	30200	R	Integer		
LatestAlm	Most recent alarm - See Alarm Table	IV-5	30202	R	Integer		X
Device_Enable_DO_Word	Device Enable DO Word - See Table	IV-6	30206	R	Bit Pack		X
Ref_Ckt_PressTemp_Alarm_Word	Refrigeration Circuit Word - See Table	IV-7	30210	R	Bit Pack		X
Device_Offline_Word	Device Offline Word - See Table	IV-8	30214	R	Bit Pack		X
Device_Alarm_Word	Device Alarm Word - See Table	IV-9	30218	R	Bit Pack		X
System_Word	System Word - See Table	IV-10	30222	R	Bit Pack		X
Unit_Status_Word	Unit Status Word - See Table	IV-11	30226	R	Bit Pack		X
Exhaust_Fan_1_Status_Digital_Inpu	Exhaust Fan Status	BI-1	10009	R	Active	Inactive	X
Supply_Fan_1_Status_Digital_Input	Supply Fan Status	B-2	10010	R	Active	Inactive	X

Valent Network Interface v8 Modbus/BACnet Points List

Variable	Description	BACnet Object	ModBus Object	Read or Write	Text or Unit of M		Included
					Active	Inactive	
Exhaust_Fan_1_Status_Digital_Input	Exhaust Fan Status	BI-1	10009	R	Active	Inactive	X
Supply_Fan_1_Status_Digital_Input	Supply Fan Status	B-2	10010	R	Active	Inactive	X
BMS_Watchdog	BMS Watchdog command Used to determine BMS comm status Must heartbeat within the watch dog timeout delay to detect comm status	BV-1	2	RW	Active	Inactive	X
System_Enable	Master system enable/disable point	BV-2	3	RW	Enable	Disable	X
BMS_Occupancy_Command	Occupancy Command	BV-3	4	RW	Unoccupied	Occupied	X
Reset_All_Alarms	Alarm Reset Command	BV-4	5	RW	Reset	Normal	X
Exhaust_Only_Mode_BMS_Cmd	Emergancy Exhaust Mode Command	BV-5	6	RW	Enable	Disable	
Pressurization_Only_Mode_BMS_Cmd	Emergancy Pressurization Mode Command	BV-6	7	RW	Enable	Disable	
Outside_RH_Source_BMS	Outside RH Source Selection	BV-7	8	RW	BMS	Local	X
Outside_Temp_Source_BMS	Outside Temp Source Selection	BV-8	9	RW	BMS	Local	X
Return_RH_Source_BMS	Return RH Source Selection	BV-9	10	RW	BMS	Local	X
Return_Temp_Source_BMS	Return Temp Source Selection	BV-10	11	RW	BMS	Local	X
Space_1_CO2_Source_BMS	Space 1 CO2 Source Selection	BV-11	12	RW	BMS	Local	X
Space_2_CO2_Source_BMS	Space 2 CO2 Source Selection	BV-12	13	RW	BMS	Local	X
Return_CO2_Source_BMS	Return CO2 Source Selection	BV-13	14	RW	BMS	Local	X
Space_RH_Source_BMS	Space RH Source Selection	BV-14	15	RW	BMS	Local	X
Space_Static_Source_BMS	Space Static Source Selection	BV-15	16	RW	BMS	Local	
Space_Temp_Source_BMS	Space Temp Source Selection	BV-16	17	RW	BMS	Local	X
SF_Control_Source_BMS	Allows the BMS to control supply fan speed	BV-17	18	RW	BMS	Local	X
EF_Control_Source_BMS	Allows the BMS to control exhaust fan speed	BV-18	19	RW	BMS	Local	X
OAD_Control_Source_BMS	Allows the BMS to control OAD position	BV-19	20	RW	BMS	Local	
Aux_BMS_Digital_Output_1	BMS Commanded auxilary digital output	BV-20	21	RW	Active	Inactive	
Aux_BMS_Digital_Output_2	BMS Commanded auxilary digital output	BV-21	22	RW	Active	Inactive	
Occupied	Occupancy	BV-22	10002	R	Occupied	Unoccupied	X
Global_Alarm	General alarm point Optionally set to indicate any alarm is active, or a shutdown alarm is active	BV-23	10003	R	Alarm	Normal	X
BMS_Watchdog_Active	Status of the BMS watchdog heartbeat	BV-24	10004	R	Active	Inactive	X
OAD_Feedback_Error_Not_Economizing.Active	Feedback indicates OAD is not opening during economizer	BV-25	10005	R	Alarm	Normal	
OAD_Feedback_Error_Economizing.Active	Feedback indicates OAD is open	BV-26	10006	R	Alarm	Normal	
OAD_Feedback_Error_OAD_Not_Modulating.Active	Feedback indicates the OAD is not modulating	BV-27	10007	R	Alarm	Normal	
OAD_Feedback_Error_Excess_OA.Active	Feedback indicates the OAD is not closing	BV-28	10008	R	Alarm	Normal	

System Word Table (IV-10)	
Bit	System_Word
0	Heat Wheel Enable
1	Preheat Enable
2	Reversing Valve (Cooling (0)/Heating(1))
3	
4	
5	
6	Supply Temp Low Limit Alarm
7	Supply Temp High Limit Alarm
8	Supply High Duct Static Alarm.Active
9	Supply Fan 1 Alarm
10	Exhaust Fan 1 Alarm
11	Drain Pan Alarm
12	Freeze Stat Alarm
13	Filter Alarm
14	Space High Static Alarm
15	Return Low Static Alarm
16	Shutdown Input Alarm
17	Energy Recovery Wheel High Diff Pressure
18	Energy Recovery Wheel Rotation Alarm
19	
20	Heat Pump Heating Lock Out Alarm
21	Permanent Memory - Too Many Writes
22	BMS Offline Alarm
23	
24	
25	
26	
27	
28	Heat-Cool Only - Dehumidification Request Active
29	Heat-Cool Only - Heating Request Active
30	Heat-Cool Only - Coil Setpoint Alarm Active
31	Heat-Cool Only - Supply Setpoint Alarm Active

Unit Status Word Table (IV-11)	
Bit	Unit_Status_Word
0	Off/Standby
1	Unoccupied Start
2	Occupied Start
3	Opening Dampers
4	Dampers Open
5	Fan Start Delay
6	Exhaust Fan On
7	Supply Fan On
8	System On
9	Soft Shutdown
10	System Disabled
11	Remote Off
12	System Shutdown Alarm
13	Supply Fan Only
14	Exhaust Fan Only
15	Purge Mode (Supply and Exhaust Only)
16	Case Heat Active
17	Fans Only
18	Economizing
19	Energy Recovery Active
20	Cooling
21	Heating
22	Dehumidifying
23	Hot Gas Reheat Active
24	HGRH Purging
25	Dehum w/Heat
26	Energy Recovery Defrost Active
27	Heat Pump Defrost Active
28	Morning Warm Up/Cool Down Active
29	Winter Ramp Active
30	
31	Overrides Active

Device Enable DO Word Table (IV-6)	
Bit	Device_Enable_DO_Word
0	Compressor 1 Start
1	Compressor 2 Start
2	Compressor 3 Start
3	Compressor 4 Start
4	
5	
6	
7	
8	Condenser Fan Ramp 1 Stage 1 Start
9	Condenser Fan Ramp 1 Stage 2 Start
10	Condenser Fan Ramp 1 Stage 3 Start
11	
12	Condenser Fan Ramp 2 Stage 1 Start
13	Condenser Fan Ramp 2 Stage 2 Start
14	Condenser Fan Ramp 2 Stage 3 Start
15	
16	Furnace 1 Start (External Furnace Controller Only)
17	Furnace 2 Start (External Furnace Controller Only)
18	
19	
20	Supply Fan Start
21	Exhaust Fan Start
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

Unit Status Word Table (IV-11)	
Bit	Ref_Ckt_PressTemp_Alarm_Word
0	Circuit A Discharge Pressure Sensor Alarm
1	Circuit A Discharge Temp Sensor Alarm
2	Circuit A Suction Pressure Sensor Alarm
3	Circuit A Suction Temp Sensor Alarm
4	Circuit B Discharge Pressure Sensor Alarm
5	Circuit B Discharge Temp Sensor Alarm
6	Circuit B Suction Pressure Sensor Alarm
7	Circuit B Suction Temp Sensor Alarm
8	Circuit A High Pressure Switch Alarm
9	Circuit A Low Pressure Switch Alarm
10	Circuit B High Pressure Switch Alarm
11	Circuit B Low Pressure Switch Alarm
12	Circuit A High Sat Discharge Temp Alarm
13	Circuit B High Sat Discharge Temp Alarm
14	
15	
16	
17	
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27	
28	
29	
30	
31	

Device Alarm Word Table (IV-9)	
Bit	Device_Alarm_Word -Ext
0	Cold Coil Temperature Sensor Alarm
1	
2	Mixed Temperature Sensor Alarm
3	Supply Duct Static Pressure Sensor Alarm
4	Supply Fan AFMS Alarm
5	Supply Air Temp Sensor Alarm
6	Exhaust Fan AFMS Alarm
7	Exhaust Temperature Sensor Alarm
8	Outside Air Temp Sensor Alarm
9	Outside RH Sensor Alarm
10	OAD AMD Alarm
11	Greentrol OAD AFMS Alarm
12	Return CO2 Sensor Alarm
13	Return Duct Static Pressure Sensor Alarm
14	Return Temperature Sensor Alarm
15	Return RH Sensor Alarm
16	Space CO2 Sensor Alarm
17	Space RH Sensor Alarm
18	Space Static Pressure Sensor Alarm
19	Space Temperature Sensor Alarm
20	IG Furnace Alarm
21	
22	Inverter Scroll 1 Alarm
23	
24	EVD Valve A Alarm
25	
26	SF VFD Alarm
27	
28	
29	
30	
31	

Device Offline Word Table (IV-8)	
Bit	Device_Offline_Word - Ext
0	Space TStat 1 Offline
1	Space TStat 2 Offline
2	Space TStat 3 Offline
3	Space TStat 4 Offline
4	VFD Offline Supply Fan
5	
6	
7	
8	Expansion Board 1 Alarm
9	Expansion Board 2 Alarm
10	Expansion Board 3 Alarm
11	Expansion Board 4 Alarm
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	Master Unit Offline Alarm
28	Slave Unit 1 Offline Alarm
29	Slave Unit 2 Offline Alarm
30	Slave Unit 3 Offline Alarm
31	Slave Unit 4 Offline Alarm

UNIT STATUS MODE TABLE (AV-40)			
0	Off/Standby	17	Fans Only Purge
1	Unoccupied Start	18	Case Heat Active
2	Occupied Start	19	Fans Only
3	Opening Dampers	20	Economizing
5	Dampers Open	21	Cooling
6	Fan Start Delay	22	Heating
7	Exhaust Fan Start	23	Dehumidifying
8	Supply Fan Start	25	HGRH Purging
9	Startup Delay	26	Energy Recovery Defrost Active
10	System On	29	Dehumifying w/Heat
11	Soft Shutdown	30	Overrides
12	System Disabled	31	Expansion Offline
13	Remote Off	33	Energy Recovery Active
14	System Shutdown Alarm	34	Hot Gas Reheat Active
15	Pressuization Only	35	Morning Warm Up/Cool Down Active (Sequence)
16	Exhaust Only	36	Heat Pump Defrost

Alarm Table (Latest Alarm IV-5)					
0	No Active Alarms	63	Supply Air Temperature - Low Limit Shutdown	117	High SDT Lockout - Circuit A
1	Supply Fan 1 Run - Status Not Proven	64	Heat Wheel Rotation - Not Detected	118	High SDT Lockout - Circuit B
2	Freeze Protection - Thermostat Tripped	65	Slave Unit 1 Offline -	121	Inverter 1 Alarm -
3	High Supply Duct - Static Pressure	66	Slave Unit 2 Offline -	123	Inverter 1 Lockout - Cycle Power to Unit
4	Low Return Duct - Static Pressure	67	Slave Unit 3 Offline -	125	High SDT Lockout - Circuit A
5	Outside Air Temp - Sensor Value Not Valid	68	Slave Unit 4 Offline -	126	Inverter 1 Foldback - Input Current
6	Supply Air Temperature - Sensor Value Not Valid	69	Master Unit Offline -	127	Inverter 1 Foldback - Inverter Temp
7	Cold Coil 1 Temp - Sensor Value Not Valid	70	Heat Pump Defrost - Mode is Active	131	Inverter 1 Comms Lost - Compressor Offline
9	Exhaust Air Temp - Sensor Value Not Valid	71	Multi Devices per Ch - Contact Tech Support	133	Space Thermostat 1 - Sensor Offline
10	Mixed Air Temperature - Sensor Value Not Valid	74	Shutdown Contact - In Alarm Position	134	Space Thermostat 2 - Sensor Offline
11	Return Air Temperature - Sensor Value Not Valid	75	Comp Maint Alarm - Run Hours Spt Reached	135	Space Thermostat 3 - Sensor Offline
12	Space Temperature - Sensor Value Not Valid	76	Supply Air Temperature - High Limit Shutdown	136	Space Thermostat 4 - Sensor Offline
13	Return Air RH - Sensor Value Not Valid	77	Space High Static Pres - Shutdown	137	IG Furnace 1. No flame - after 3 tries
14	Space RH - Sensor Value Not Valid	78	Internal Board Temp - Exceeds -40F or 158F	138	IG Furnace 1 Large - no flame after 3 tries
15	Outside RH - Sensor Value Not Valid	79	BMS Offline - Watchdog is FALSE	139	IG Furnace 1 combust - fan high pressure sw
16	Low Pressure Switch - Circuit A	80	Clg Coil Setpt Input - Value is not valid	140	IG Furnace 1 Ignition - controller alarm
17	Low Pressure Switch - Circuit B	81	Sup Air Setpt Input - Value is not valid	141	IG Furnace 1 pressure - switch fault alarm
20	High Pressure Switch - Circuit A	82	BACnet License - Not Installed	142	High SDT Lockout - Circuit B
21	High Pressure Switch - Circuit B	83	Low Suction SH ExV A - EVD 1 Alarm	143	IG Furnace 1 - Max retrys
24	Damper End Switch Fail - Dampers are not open	84	Low Suction SH ExV B - EVD 1 Alarm	144	IG Furnace 1 - High Limit Trip
25	Exhaust Fan 1 Run - Status Not Proven	85	LOP A EVD 1 - Low Operating Pressure	145	IG Furnace - pCOe 1 Offline
26	Filters are Dirty - Replace Filters	87	MOP A EVD 1 - Max Operating Pressure	146	IG Furnace 1 IC fault - Check Furnace Wiring
27	Cond Drain Pan Full - Check Drain	89	EEV A EVD 1 - Motor Alarm	147	IG Furnace 2 No flame - after 3 tries
28	Exp Board 1 Status - Board is Offline	91	LowSuct A EVD 1 - Refrigerant Temp	148	IG Furnace 2 Large - no flame after 3 tries
29	Exp Board 2 Status - Board is Offline	93	High Condensing Temp - EVD 1	149	IG Furnace 2 combust - fan high pressure sw
31	Exp Board 4 Status - Board is Offline	94	Sens S1 EVD 1 - Sensor Value Not Valid	150	IG Furnace 2 Ignition - controller alarm
32	Non-Volatile Memory Er - Contact Tech Support	95	Sens S2 EVD 1 - Sensor Value Not Valid	151	IG Furnace 2 pressure - switch fault alarm
33	Space 1 CO2 - Sensor Value Not Valid	96	Sens S3 EVD 1 - Sensor Value Not Valid	152	IG Furnace 2 combust - fan proving alarm
34	Space Static Pressure - Sensor Value Not Valid	97	Sens S4 EVD 1 - Sensor Value Not Valid	153	IG Furnace 2 - Max retrys
35	Supply Duct Stat Press - Sensor Value Not Valid	98	EVD 1 EEPROM Damaged - Call Tech Support	154	IG Furnace 2 - High Limit Trip
36	Return Duct Stat Press - Sensor Value Not Valid	99	Incomplete Closing - EVD 1	155	IG Furnace - pCOe 2 Offline
37	Sup Fan AFMS - Sensor Value Not Valid	101	Emergency Closing - EVD 1	156	IG Furnace 2 IC fault - Check Furnace Wiring
38	Exh Fan AFMS - Sensor Value Not Valid	101	EVD 1 Battery -	157	Outside Air Greentrol - Offline or Flow Error
39	Outside Damper AFMS - Sensor Value Not Valid	102	FW Incompatibility - EVD 1	158	Exhaust Air Greentrol - Offline or Flow Error
40	Space Setpt Adj Slider - Sensor Value Not Valid	106	EVD 1 Config Error -	159	Supply Air Greentrol - Offline or Flow Error
42	Return CO2 - Sensor Value Not Valid	105	High Discharge Temp - First Inverter	170	OA Damper Fault - Not Econ and should be
42	Discharge Press Ckt A - Sensor Value Not Valid	106	Low Discharge Pressure - First Inverter	171	OA Damper Fault - Econ and shouldn't be
43	Discharge Press Ckt A - Sensor Value Not Valid	106	Low Discharge Pressure - First Inverter	171	OA Damper Fault - Econ and shouldn't be
44	Discharge Press Ckt B - Sensor Value Not Valid	107	High Suction Pressure - First Inverter	172	OAD Fault - Damper not Modulating
47	Suction Press Ckt A - Sensor Value Not Valid	108	Low Suction Pressure - First Inverter	173	OAD Fault - Excess Outdoor Air
48	Suction Press Ckt B - Sensor Value Not Valid	109	High Current - First Inverter	174	IG Furnace 1 - Combustion Fan Alarm
51	Discharge Temp Ckt A - Sensor Value Not Valid	110	High Pressure Ratio - First Inverte	175	IG Furnace 2 - Combustion Fan Alarm
52	Discharge Temp Ckt B - Sensor Value Not Valid	111	Low Pressure Ratio - First Inverter	176	Supply Fan - VFD Offline
55	Suction Temp Ckt A - Sensor Value Not Valid	112	Low Delta P - First Inverter	177	OA Damper Fault - Not Econ and should be
56	Suction Temp Ckt B - Sensor Value Not Valid	113	High Discharge Press - First Inverter	178	Return Fan - VFD Offline
59	Ckt A High Saturated - Discharge Temperature	114	Compressor Staging - Order Skipped	179	Energy Recovery - VFD Offline
60	Ckt B High Saturated - Discharge Temperature	115	Heat Pump Heating - Locked Out	180	Embedded EVD Error
.		116	EVD 1 Error - Unexpected Position	181	SF VFD Alarm - Check VFD

Factory Controller Sequence of Operation

FACTORY CONTROLLER: Controller shall be provided with required sensors and programming for rooftop unit. Controller shall be factory programmed, mounted and tested. Controller shall have a LCD readout for changing set points and monitoring unit operation.

UNIT START COMMAND (Unit will be enabled to start once a jumper is placed between R to G):

- Factory mounted and wired outdoor air damper actuator is powered
- Return air damper actuator is powered.
- Exhaust fan starts after a (adj.) delay.
- Supply fan starts after a (adj.) delay.
- Tempering options and energy wheel option to function as described below.

UNIT STOP COMMAND (OR DE-ENERGIZED):

- Supply fan, exhaust fan, energy wheel and tempering options de-energized.
- Outdoor air damper actuator is spring return close.
- Return air damper is spring return close.

OCCUPIED/UNOCCUPIED MODES: Shall be based on a 7-day time clock internal to the controller. The schedule shall be set by the end user. When a user initiates an override input, the controller will switch from unoccupied to occupied mode. The controller will return to the scheduled occupied/unoccupied mode after the override time has expired. If internal time clock is disabled, a remote contact or a BMS can control the occupied/unoccupied mode.

Occupied Mode:

- Damper control per below.
- Energy wheel control per below.
- Exhaust fan ON.
- Supply fan ON.
- Heating per below.
- Cooling per below.

Unoccupied Mode (Unit Off): Unit remains off when in unoccupied mode.

- Supply fan OFF
- Exhaust fan OFF
- Tempering OFF
- Outdoor air damper closed.
- Return damper closed.

MORNING WARMUP/COOL DOWN: Prior to occupancy, the unit will run using the warmup or cool down sequence until the occupied set point is achieved. The heating or cooling mode must not be locked out and the space temperature is below or above set point by the unoccupied hysteresis (adj.) (This Sequence must be field configured.)

SUPPLY BLOWER SEQUENCE: The supply blower is provided with a factory mounted variable frequency drive. The supply blower speed will be controlled with the following sequence. Minimum supply fan turndown is 50% of the design maximum operation.

Constant Volume-Adj. Setpoint: The supply blower will operate at a constant speed set point (adj.) during operation.

OUTDOOR AIR DAMPER CONTROL: The outdoor air damper is factory mounted and wired with a non-modulating actuator. When the unit is enabled/occupied the outdoor air damper will open to 100%

EXHAUST BLOWER SEQUENCE: The exhaust blower is provided with a factory mounted variable frequency drive. The exhaust blower speed will be controlled with the following sequence.

Constant Volume-Adj. Setpoint: The exhaust blower will operate at a constant speed set point (adj.) during operation.

COOLING SEQUENCE: The cooling is controlled to maintain the supply temperature set point. The mechanical cooling will be locked out when the outside air is < 55 F (adj.).

Air-Source Heat Pump: The controller will provide a modulating signal for cooling. From 0-50%, the inverter scroll will be controlled to maintain discharge temperature. From 50-100% the second stage will be on in combination with the inverter scroll compressor to maintain the discharge temperature. The electronic expansion valve will modulate to maintain 10 F of superheat.

Modulating Hot Gas Reheat Sequence: During dehumidification the modulating HGRH is controlled to maintain the supply temperature set point.

Modulating Hot Gas Reheat: The controller will modulate the hot gas reheat reheat valve with a 0-10 V signal to maintain the supply temperature set point (adj.).

PRIMARY HEATING SEQUENCE: The air-source heat pump is controlled to maintain the supply temperature set point. Heating will be locked out when the outside air is > 80 F (adj.). The air-source heat pump will be locked out when outside temperatures are < 10 F.

Air-Source Heat Pump: The controller will provide a modulating signal for heating. From 0-50%, the inverter scroll will be controlled to maintain discharge temperature. From 50-100% the second stage will be on in combination with the inverter scroll compressor to maintain the discharge temperature. The electronic expansion valve will modulate to maintain 10 F of superheat.

SECONDARY HEATING SEQUENCE: If the air-source heat pump cannot meet the supply temperature set point, the secondary heating source will activate and work in conjunction with the air-source heat pump.

Electric Heater: The controller will modulate an electric heater to maintain the supply temperature set point (adj.).

TEMPERATURE CONTROL SEQUENCE: The unit will maintain the supply air discharge setpoint per the following. Adjustable locally or by BMS.

Supply Discharge Temperature Control: The supply setpoint will be a constant temperature setpoint from the controller (adj.). Adjustable locally or by BMS.

BUILDING FREEZE PROTECTION: If the supply air temperature drops below 35 F (adj.) for 300s (adj.), the controller will de-energize the unit and activate the alarm output.

TEMPERATURE PROTECTION: The controller will enable the supply fan to modulate down to help the unit keep up with heating demand in the event of wheel failure or the unit operating outside design conditions. (This can be enabled under the manufacturer menu in the controller)

ENERGY WHEEL FROST CONTROL: Frost control for the energy wheel is enabled when frost is present on the wheel; based on the outside air temperature and the pressure drop across the wheel. If the outdoor air temperature is below 5 F adj. and the differential pressure across the wheel is about 1.5", adj. frost control will enable.

Wheel VFD (Modulate Wheel): When frosting is occurring, the VFD modulates the wheel down to a slow rotational speed to defrost wheel. Once either the pressure drop decreases below the pressure switch set point, or the outdoor air temperature increases about the temperature set point, the unit will resume normal operation.

ECONOMIZER SEQUENCE: When the application requires cooling, and the outdoor air conditions are suitable for free cooling, the controller will modulate the energy wheel speed to maintain the discharge temperature set point. If the energy wheel speed modulates to the economizer set point and the supply air temperature is not met, the controller will increase the call for cooling to meet the supply air temperature and could engage mechanical cooling.

Temp./Enthalpy: The economizer will be locked out when: the outdoor air is < 40 F DB (adj.) or > 75 F DB (adj.) or > 55 F dew point (adj.) ; the unit is operating in dehumidification mode; or there is a call for heating.

ENERGY WHEEL SEQUENCE

Modulate Wheel: When economizer mode is enabled and there is a signal for cooling, the wheel VFD modulates wheel speed to maintain the supply air temperature set point.

ALARMS INDICATION: The controller will display alarms and have one digital output for remote indication of an alarm condition. Possible alarms include:

Building Management System: The controller will send all alarms to the BMS.

Dirty Wheel Alarm: The controller monitors pressure across the wheel and sends an alarm in the case of an increased pressure drop.

Wheel Rotation Alarm: The controller monitors wheel rotation, if the wheel does not rotate for a set period of time (adj.) an alarm will generate.

Supply and Exhaust Air Alarm: The controller monitors the proving switch on each blower and sends an alarm in the case of either blower proving switch not engaging.

Temperature Sensor Alarm: The controller sends an alarm in the case of a failed air temperature sensor.

Humidity Sensor Alarm: The controller sends an alarm in the case of a failed humidity sensor.

ACCESSORIES: The following accessories will be included with the unit to expand the functionality or usability of the controller.

BMS Interfacing: A BMS port or serial card is provided with the controller for field interfacing with a building management system. Each card is sent out with the default parameters, and the controls contractor must change the appropriate addresses to match the BMS settings.

Phase and Brownout Protection: Factory mounted and wired component which monitors the main power coming into the unit. If a phase drops out, or if the incoming voltage exceeds the acceptable range, the component will turn off the unit to help protect the electrical systems.

Condensate Overflow Unit Shutdown: Factory mounted condensate overflow switch wired to the unit controller. The controller monitors the condensate overflow switch. If the water level in the drain pan reaches a certain level, the unit will shutdown and send an alarm.

Damper End Switch: Damper end switched will be provided to ensure the supply and exhaust fans do not enable until the dampers are proven open.

Warranty Statement for Dedicated Outdoor Air Systems (DOAS)

Unit Warranty

Valent warrants the equipment to be free from defects in material and workmanship for a period of 18 months from ship date. Initial startup must be completed within six months of the shipment date, and a startup report must be submitted to Valent.

Energy Wheel Warranty

The energy recovery wheel is warranted to be free from defects in material and workmanship for a period of 5 years from the shipment date. This warranty applies to all parts and components in the energy recovery cassettes with the exception of the motor.

Compressor Extended Warranty

Valent warrants the refrigerant compressor(s) to be free from defects in material and workmanship for a period of 5.5 years from the shipment date.

Warranty Notes

Any component which proves defective during the warranty period will be repaired or replaced at Valent's sole option when returned to our factory, transportation prepaid. All warranties do not include labor costs associated with troubleshooting, removal, or installation. Valent will not be liable for any consequential, punitive, or incidental damages resulting from use, repair, or operation of any Valent product. These warranties are exclusive and are in lieu of all other warranties, whether written, oral, or implied, including the warranty of merchantability and the warranty of fitness for a particular purpose. No person (including any agent or salesperson) has authority to expand Seller's obligation beyond the terms of this warranty, or to state that the performance of the product is other than that published by Seller.

As a result of our commitment to continuous improvement, Valent reserves the right to change specifications without notice.

GKD Roof Curb

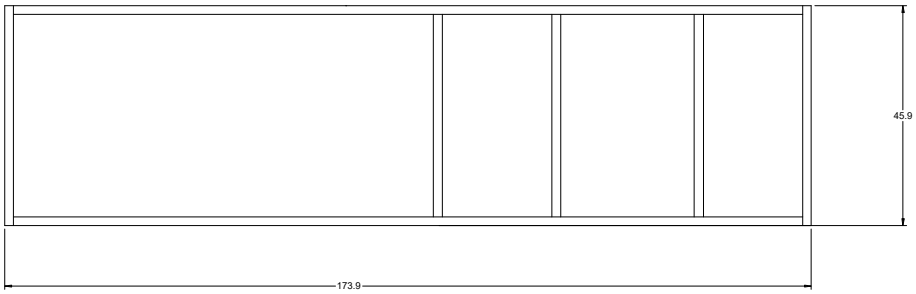
Model: GKD-45.9/173.9-G14

Curb Height (in.)	Curb Length (in.)	Curb Width (in.)	Material	Finish Type	Duct Adapter	Curb Weight (lb)
14	173.9	45.9	Galvanized	Galvanized	Yes	269

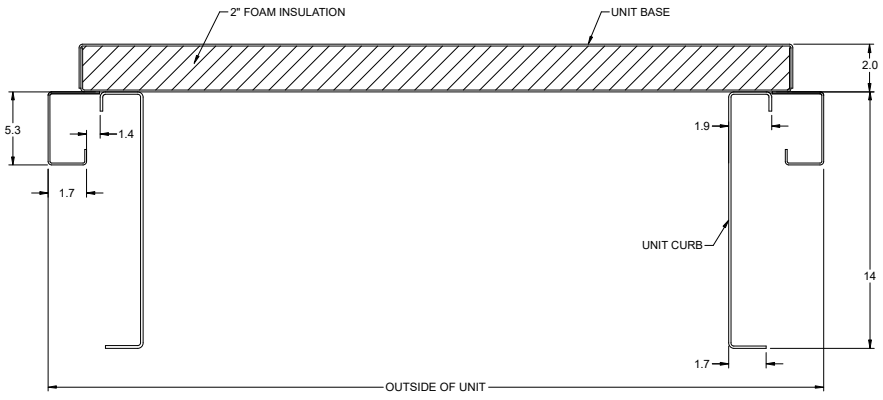
Standard Construction Features:
All dimensions shown are actual and in units of in.'s
If unit is selected with side or end discharge/return, there will not be bottom connections supplied with the curb.
14 gauge galvanized steel (perimeter channels).
14 gauge galvanized steel (interior channels).
Ships knocked down for field assembly.
Curb insulation to be provided by others.

Curb Detail

Top View of Curb



Cross-Section View of Unit on Curb



valent

Printed Date: 10/24/2023
Job: Oliver Ellsworth MS
Mark: DOAS-1 CW
Model: VXE-112-36D-CW-G-D1

VXE-112-36D-CW-G-D1

Unit Performance

Design Conditions

Elevation (ft)	Summer		Winter DB (F)	Supply (CFM)	Outdoor Air (CFM)	Exhaust Air (CFM)
	DB (F)	WB (F)				
180	91.0	73.0	0.0	3,200	3,200	3,200

Unit Specifications

Qty	Weight (lb)	Cooling Type	Heating Type	Unit Installation	Unit ETL Listing	Furnace ETL Listing
1	2,849 (+/- 5%)	Chilled Water	Indirect Gas	Outdoor	UL\cUL 1995/ 60335-2-40	ANSI Z83.8 / CSA 2.6

Configuration

Outdoor Air		Exhaust Air	
Intake	Discharge	Intake	Discharge
End	Side	Access Side	Side

Energy Recovery Performance

Design Condition	Temperature (F)								Capacity Reduction (BTU/h)
	Outdoor Air		Supply Air		Return Air		Exhaust Air		
	DB	WB	DB	WB	DB	WB/RH	DB	WB	
Summer	91.0	73.0	81.0	67.0	75.0	62.5/50	85.0	69.2	73,440.0
Winter	0.0	-1.5	41.6	35.9	72.0	55.8/35	27.4	26.8	143,770.0

Cooling Specifications

Type	Fluid Type		Flow Rate (GPM)	Fluid PD (ft wg)	Capacity (MBH)		Fluid Conditions		Performance (DB/WB)	
	Type	%			Total	Sensible	EWT (F)	LWT (F)	EAT (F)	LAT (F)
Chilled Water	Water	100	30.5	5	153.1	105.1	45.0	55.0	81.0 / 67.0	51.1 / 51.1

Heating Specifications

Type	Gas Type	Input (MBH)	Output (MBH)	Temperature Rise		Turndown	Performance	
				Min (F)	Max (F)		EAT (F)	LAT (F)
Indirect Gas	Natural	200.0	162.0	3.0	47.0	16:1	41.6	88.4

Air Performance

Type	Total Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	FRPM	Fan		
					Qty	Type	Drive-Type
Supply	3,200	1.5	3.998	2106	1	Plenum	Direct
Exhaust	3,200	1.25	3.09	2012	1	Plenum	Direct

Motor Specifications

Motor	Qty	Operating Power (hp)	Size (hp)	Enclosure	Efficiency	RPM
Supply	1	3.21	5	ODP	PE	1750
Exhaust	1	2.82	5	ODP	PE	1750

Electrical Specifications

Power Supply	Rating (V/C/P)	MCA (A)	MOP (A)	FLA (A)	Fan Power (W/CFM)*
Unit	~~208/60/3~~ 480/60/3	~~30.4~~ 15.9	~~45.0~~ 20	~~31.5~~ 14.2	1.405

*Fan Power (W/CFM) = (Supply BHP + Exhaust BHP) / Supply CFM

Construction Features And Accessories

Unit	
Unit Installation - Outdoor	Std
Unit Construction - Double Wall	Std
Insulation - 2 inch 2.4# R13 foam	Std
Corrosion Resistant Fasteners	Std
Hinged Access	Std
Factory Wired Non-Fused Disconnect Switch	X
Direct Drive Plenum Blower & Motor Assemblies	Std
Factory Wired VFDs	Std
Unit Finish - Permatector, Concrete Gray (RAL 7023)	X
Stainless Steel Condensate Drain Pan and Connection	Std
Condensate Drain Trap	Std
Energy Recovery Device - Polymer Wheel w/ Silica Gel Desiccant	Std
Controls	
Unit Controls - Heat-Cool Only Control	Std
Internally Mounted Control Center with 24 VAC control transformer(s)	Std
BMS Protocol - BACNetMSTP	X
BMS Monitoring Points	
Supply Fan Control - 0-10VDC By Others	X
Exhaust Fan Control - 0-10VDC By Others	X
Economizer Control	X
Exhaust Fan Only Power	
Web-Based User Interface	
Energy Wheel Economizer Control - VFD Signal By Others	X
Energy Wheel Rotation Sensor	Std
Damper Control - 0-10VDC By Others	X
Unoccupied Recirc Mode	
Control Accessories	
Remote Display	
Dirty Filter Sensor(s)	
Airflow Monitor	
Room Thermostat	
Phase/Brownout Protection	X
Economizer Fault Detection Diagnostics	

Accessories	
Frost Control - VFD Signal By Others	X
Outdoor Air Damper - Low Leakage	X
Return Air Damper - Low Leakage	X
Roof Curb - GKD - 45.9/173.9-G14	X
Supply Air Filters - 2" Merv 8 And 2" Merv 13, 8-20x20x2	X
Service Outlet - Shipped loose and powered by others	X
Piping Vestibule	
Service Lights	
Condensate Overflow Switch	X
Spare Filters - Both, Qty: 1 set(s)	X
Exhaust Discharge Gravity Backdraft Damper	Std
ElectroFin Coil Coating	
Motor Shaft Grounding	X
Return Air Filters - 2" Merv 8, 2-20x25x2	Std
Outdoor Air Filters - 2" Merv 8, 2-20x25x2	Std
Furnace Control - 16:1 Modulating	X
Spare Energy Wheel Belt	
Spare Energy Wheel Segments	
UV Lights	
Bipolar Ionization	
Smoke Detector(s)	
Barometric Relief Damper	
Energy Wheel Bypass Damper	
Power Venting	Std
Warranty Options	
Unit Warranty - 18 Months (Std.)	Std
Energy Wheel Warranty - 5 Yrs Less Motor	Std
Furnace HX Warranty - 25 Yrs.	Std

Standard Option	Std
Not Included	
Included	X

Notes
Outdoor Air Damper supplied is low leakage, motorized VCD-23 (leakage rate of 3 CFM / ft^2 @ 1 in. wg), Class 1A
Return Air Damper supplied is low leakage, motorized VCD-23 (leakage rate of 3 CFM / ft^2 @ 1 in. wg), Class 1A

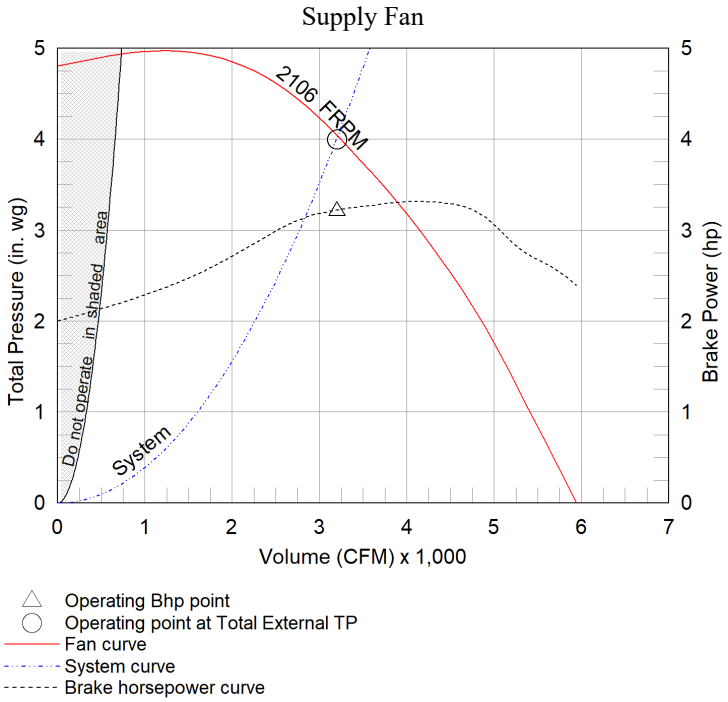
Supply Fan Charts And Performance

Supply Fan Performance									
Total Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	RPM	Operating Power (hp)	Motor		Fan		
					Qty	Size (hp)	Qty	Type	Drive-Type
3,200	1.5	3.998	2106	3.21	1	5	1	Plenum	Direct

Pressure Drop (in. wg)							
Weatherhood	Filter	Damper	Cooling	Heating	External	Energy Wheel	Total
0.08	0.304	0.04	0.444	0.354	1.5	1.28	3.998

Sound Performance in Accordance with AMCA										
Sound Power by Octave Band								Lwa	dBA	Sones
62.5	125	250	500	1000	2000	4000	8000			
77	82	85	77	71	67	74	64	81	69	18

*Energy Wheel pressure drop shown in above table also accounts for pressure drop across MERV8 OA filter



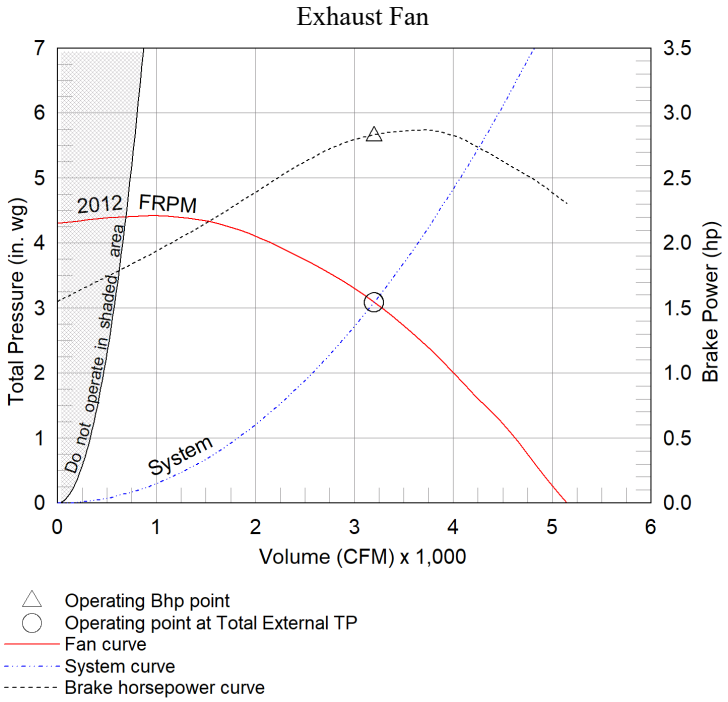
Exhaust Fan Charts And Performance

Exhaust Fan Performance									
Total Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	RPM	Operating Power (hp)	Motor		Fan		
					Qty	Size (hp)	Qty	Type	Drive-Type
3,200	1.25	3.09	2012	2.82	1	5	1	Plenum	Direct

Pressure Drop (in. wg)							
Weatherhood	Filter	Damper	Cooling	Heating	External	Energy Wheel	Total
0.13	-	-	-	-	1.25	1.71	3.09

Sound Performance in Accordance with AMCA										
Sound Power by Octave Band								Lwa	dBA	Sones
62.5	125	250	500	1000	2000	4000	8000			
81	72	80	73	69	67	67	61	77	65	14

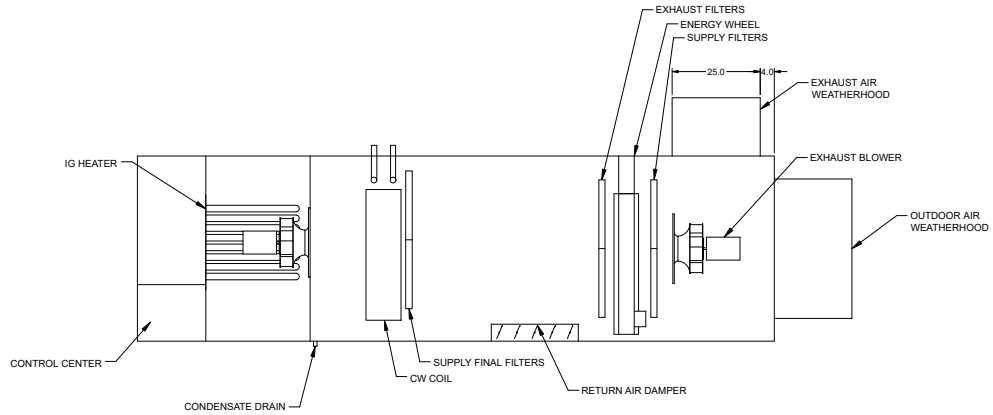
*Energy Wheel pressure drop shown in above table also accounts for pressure drop across MERV8 return air filter



Radiated Sound

Position C

Dimensional Overview



Plan

Position D

Position B

Position A

Supply Air Flow Nominal

Radiated Sound Levels										
Plane	Octave Bands (Lw)								Plane Lw	Plane LwA
	1	2	3	4	5	6	7	8		
A	73	86	81	79	77	73	69	63	89	92
B	71	79	77	71	69	64	63	55	82	75
C	79	76	69	66	64	59	53	46	81	69
D	74	77	72	72	69	62	58	51	81	74
E	77	84	80	76	76	70	66	60	87	80
Total	83	89	85	82	81	76	72	65	92	85

AMCA 320-07 - Laboratory Methods of Sound Testing of Fans Using Sound Intensity
Tests conducted in accordance with this standard.
Free field measurement plane created 1 foot from unit on all sides and top.
Sound Intensity measured in Watts/m^2.
Sound data converted to Sound Power (Lw) for the chart above.
A-Weighted Sound Power was determined using AMCA Standard 301-90 Clause 9.1.
Plane E sound data was measured above the top plane of the unit.

Cooling Performance

Cooling Specifications										
Type	Fluid Type		Flow Rate (GPM)	Fluid PD (ft wg)	Capacity (MBH)		Fluid Conditions		Performance (DB/WB)	
	Type	%			Total	Sensible	EWT (F)	LWT (F)	EAT (F)	LAT (F)
Chilled Water	Water	100	30.5	5	153.1	105.1	45.0	55.0	81.0 / 67.0	51.1 / 51.1

Coil Information					
CW Coil Model	Fins Per Inch	Rows Deep	Face Vel. (ft/min)	Coil PD (in. wg)	Connection Size (in.)
CW58S06H10-42x37-RH	10	6	297	0.444	1.5

Unit Details
Coil control valves must be field provided by others
Copper tube, aluminum fin coil construction
Coil freeze protection is to be provided by others
Stainless steel double sloped drain pan

Heating Performance

Heating Specifications								
Type	Gas Type	Input (MBH)	Output (MBH)	Temperature Rise		Turndown	Performance	
				Min (F)	Max (F)		EAT (F)	LAT (F)
Indirect Gas	Natural	200.0	162.0	3.0	47.0	16:1	41.6	88.4

Unit Details
ANSI standard Z83.8 and CSA 2.6
High Thermal efficiency
Direct spark ignition
3/4" Gas Connection
At least 6 in. wg of natural gas pressure (14 in. wg for LP) is required at the units gas connection in order to achieve maximum performance
Power Venting
24 Volt Control Power
Stainless Steel heat exchange tubes
Unit controller maximum allowable supply discharge air set point is 100F (37.8C)
Discharge temperature assumes proper energy wheel operation and maintenance.

Energy Recovery Summer Performance

Outdoor Air		Supply Air	
Dry Bulb (F)	91.0	Dry Bulb (F)	81.0
Wet Bulb (F)	73.0	Wet Bulb (F)	67.0
Specific Humidity (gr/lb)	94	Specific Humidity (gr/lb)	77
Enthalpy (BTU/lb)	36.7	Enthalpy (BTU/lb)	31.6
Exhaust Air		**Return Air**	
Dry Bulb (F)	85.0	Dry Bulb (F)	75.0
Wet Bulb (F)	69.2	Rel. Humidity (%)	50
Specific Humidity (gr/lb)	82	Specific Humidity (gr/lb)	65
Enthalpy (BTU/lb)	33.2	Enthalpy (BTU/lb)	28.2

ENERGY WHEEL

Design Air Flow Conditions

OA Volume (CFM)	ASHRAE 90.1 OA Enthalpy Recovery Ratio	EA Volume (CFM)	EA Wheel Effectiveness
3,200	60.4	3,200	59.2

Outdoor Air Cooling Reduction

OA Load w/o Energy Recovery		OA Load with Energy Recovery		Equipment Reduction (tons)
(BTU/h)	(tons)	(BTU/h)	(tons)	
122,400.0	10.20	48,960.0	4.08	6.12

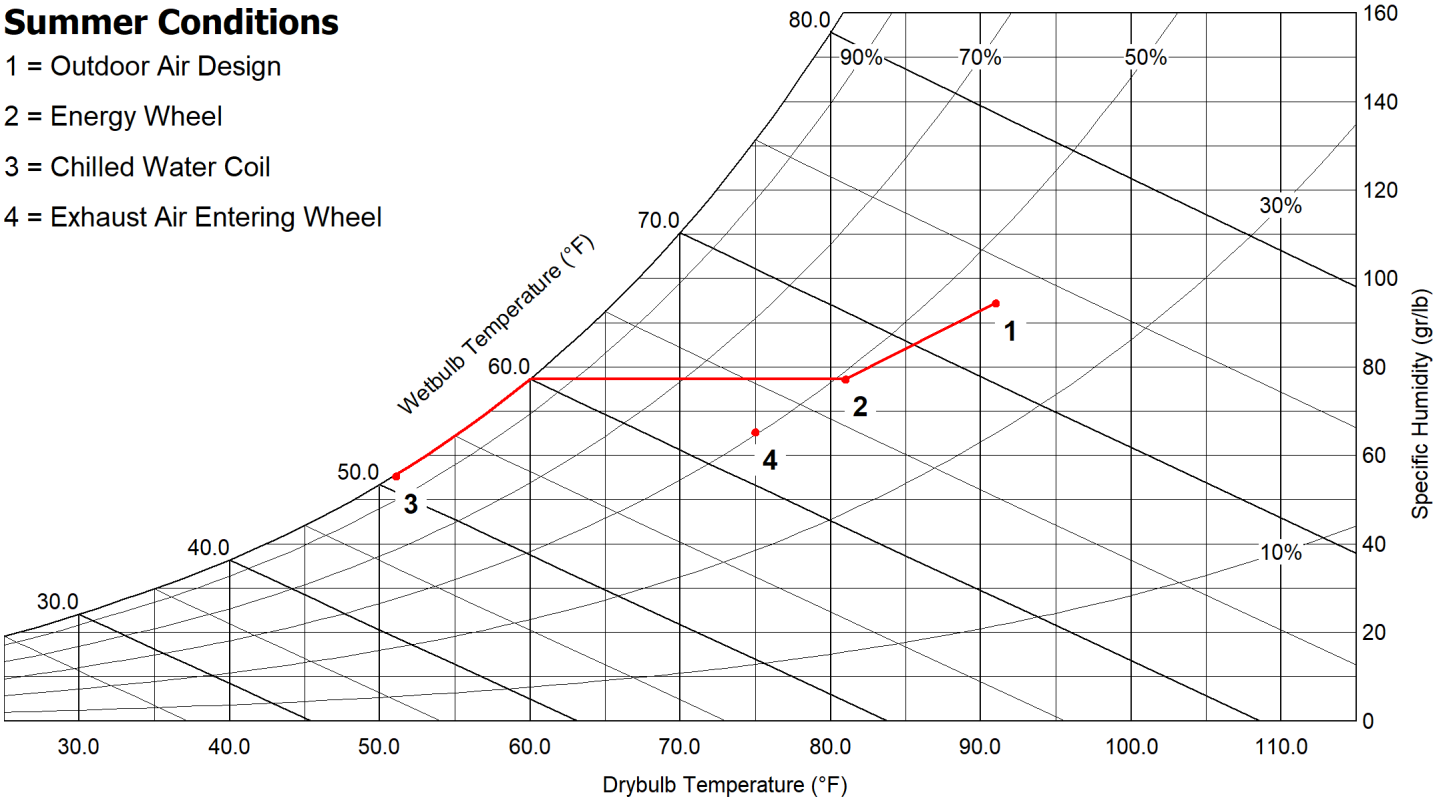
Summer Conditions

1 = Outdoor Air Design

2 = Energy Wheel

3 = Chilled Water Coil

4 = Exhaust Air Entering Wheel



Energy Recovery Winter Performance w/out Preheater

Outdoor Air		Supply Air	
Dry Bulb (F)	0.0	Dry Bulb (F)	41.6
Wet Bulb (F)	-1.5	Wet Bulb (F)	35.9
Specific Humidity (gr/lb)	3	Specific Humidity (gr/lb)	22
Enthalpy (BTU/lb)	0.4	Enthalpy (BTU/lb)	13.4
Exhaust Air		**Return Air**	
Dry Bulb (F)	27.4	Dry Bulb (F)	72.0
Wet Bulb (F)	26.8	Rel. Humidity (%)	35
Specific Humidity (gr/lb)	20	Specific Humidity (gr/lb)	41
Enthalpy (BTU/lb)	9.7	Enthalpy (BTU/lb)	23.7

ENERGY WHEEL

Design Air Flow Conditions

OA Volume (CFM)	ASHRAE 90.1 OA Enthalpy Recovery Ratio	EA Volume (CFM)	EA Wheel Effectiveness
3,200	55.8	3,200	59.3

Outdoor Air Heating Reduction

OA Load w/o Energy Recovery (BTU/h)	OA Load with Energy Recovery (BTU/h)	Equipment Reduction (BTU/h)	Sensible Effectiveness (%)
248,832.0	105,062.0	143,770.0	61.5

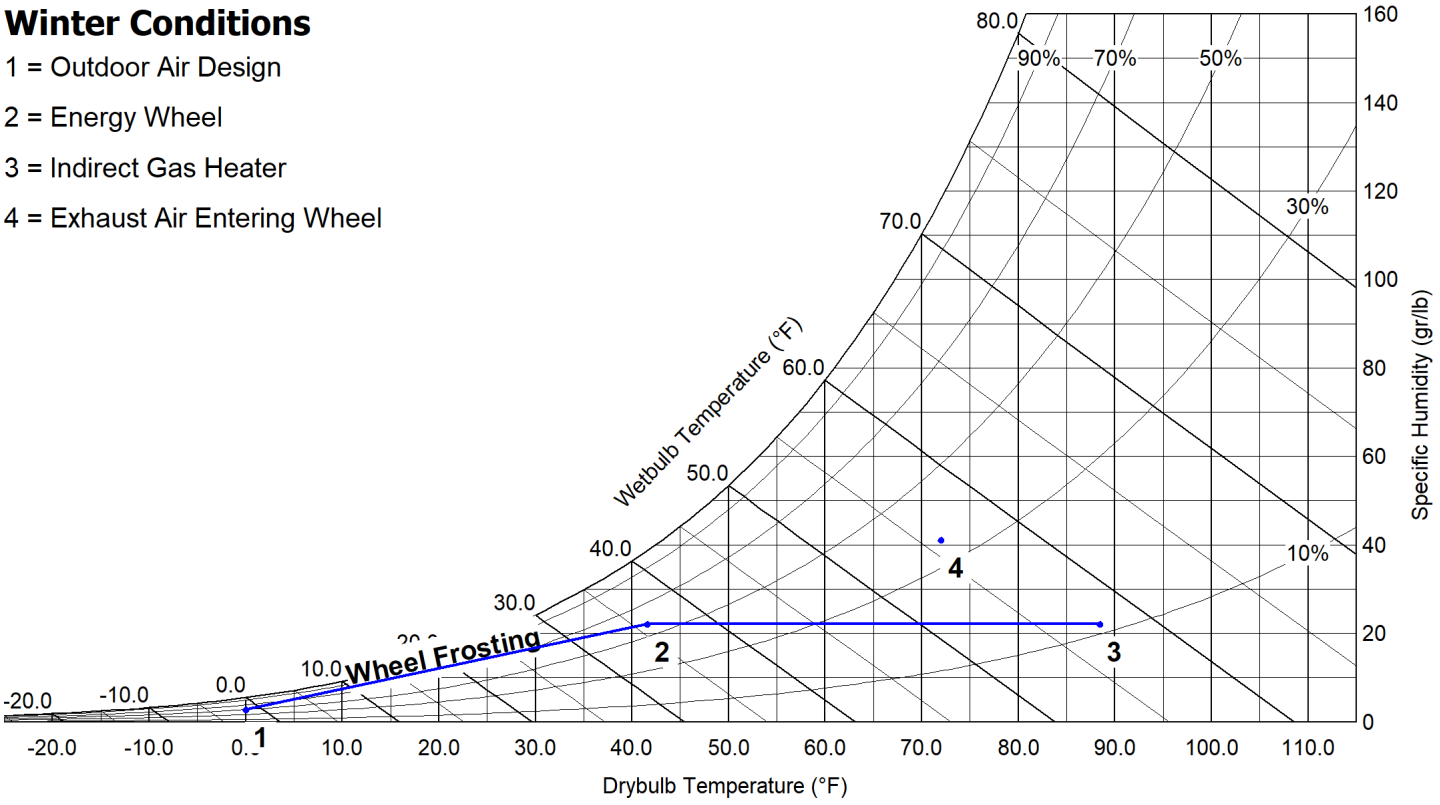
Winter Conditions

1 = Outdoor Air Design

2 = Energy Wheel

3 = Indirect Gas Heater

4 = Exhaust Air Entering Wheel



AHRI Performance Ratings

Energy Recovery Performance Rating in accordance with AHRI Standard 1060 (I-P)							
Rated Airflow (SCFM)		Net Supply Airflow (SCFM)	EATR (%)	OACF	Pressure Drop (in. wg)		Purge Angle (degrees)
Leaving Supply	Entering Exhaust				Supply	Exhaust	
3245	3245	3200	1.4	1.05	1.00	0.99	0

Thermal Effectiveness Ratings							
Enthalpy Recovery		Sensible Effectiveness		Latent Effectiveness		Total Effectiveness	
Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
60.4	55.8	61.9	61.5	56.7	53.9	59.2	59.3

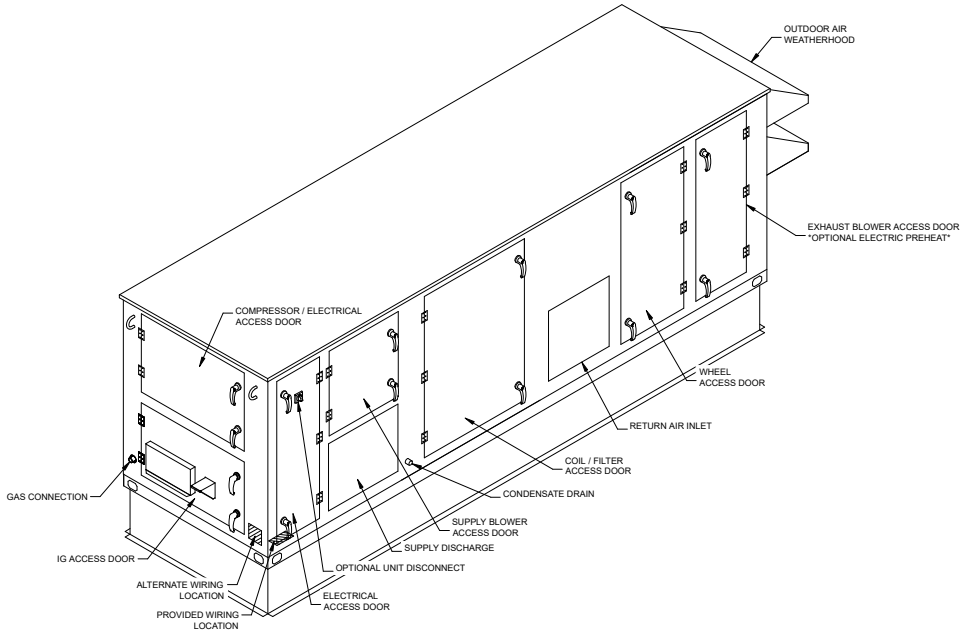
Note(s)

Summer Design Conditions:
Certified in accordance with the AHRI ERV Certification Program, which is based on AHRI Standard 1060. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Winter Design Conditions:
Application Rating is outside the scope of the AHRI ERV certification Program but is rated in accordance with AHRI Standard 1060.

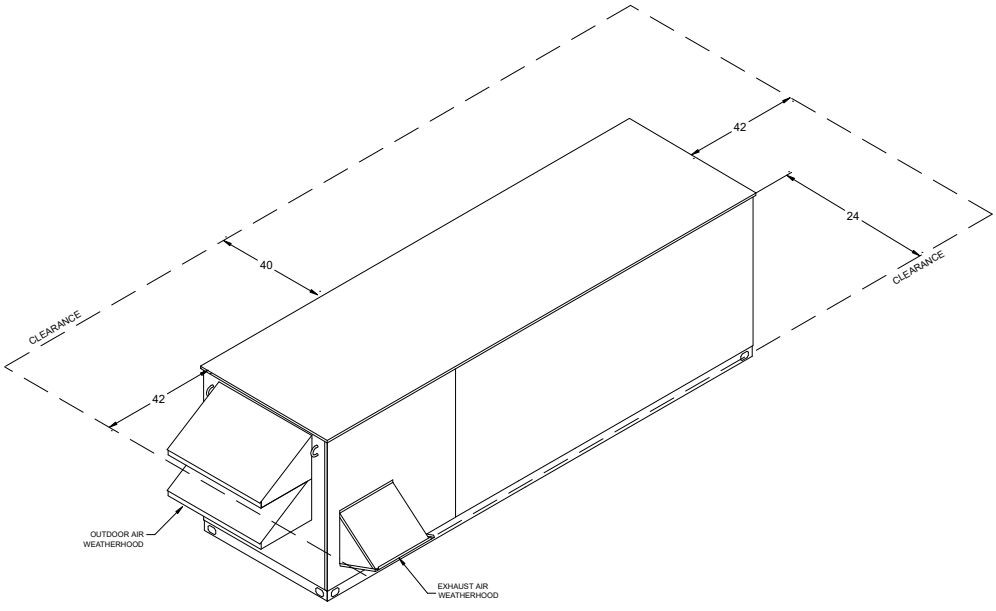
Isometric Drawings

Component Layout



Back Right Isometric

Service Clearances

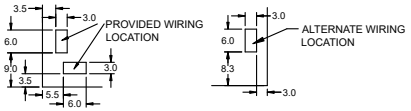


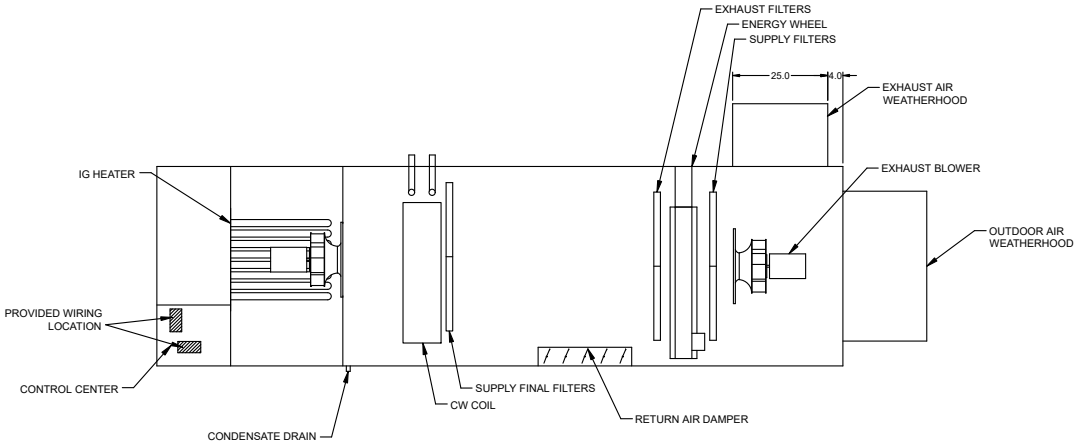
Front Left Isometric

Overview Drawings

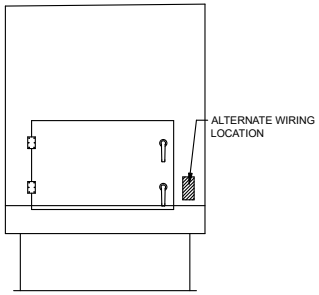
Dimensional Overview

Electrical Connections

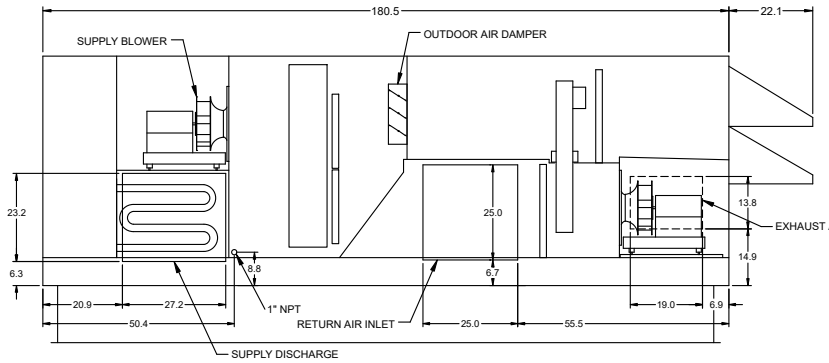




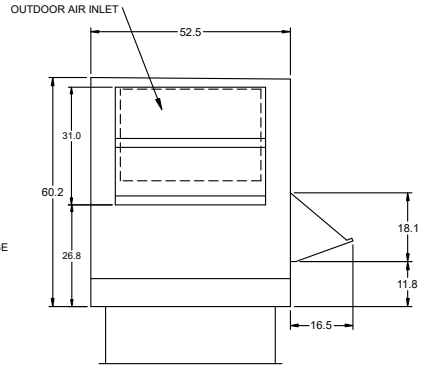
Plan



Left End



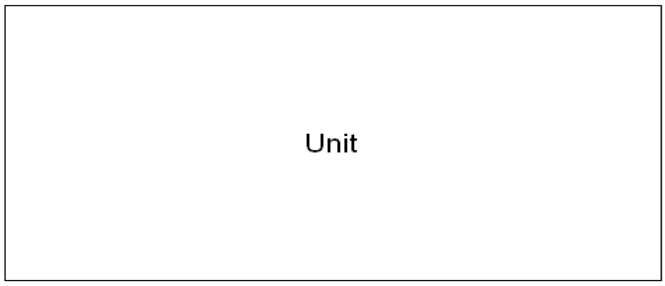
Elevation



Right End

Unit Corner Weights

688 lb 720 lb

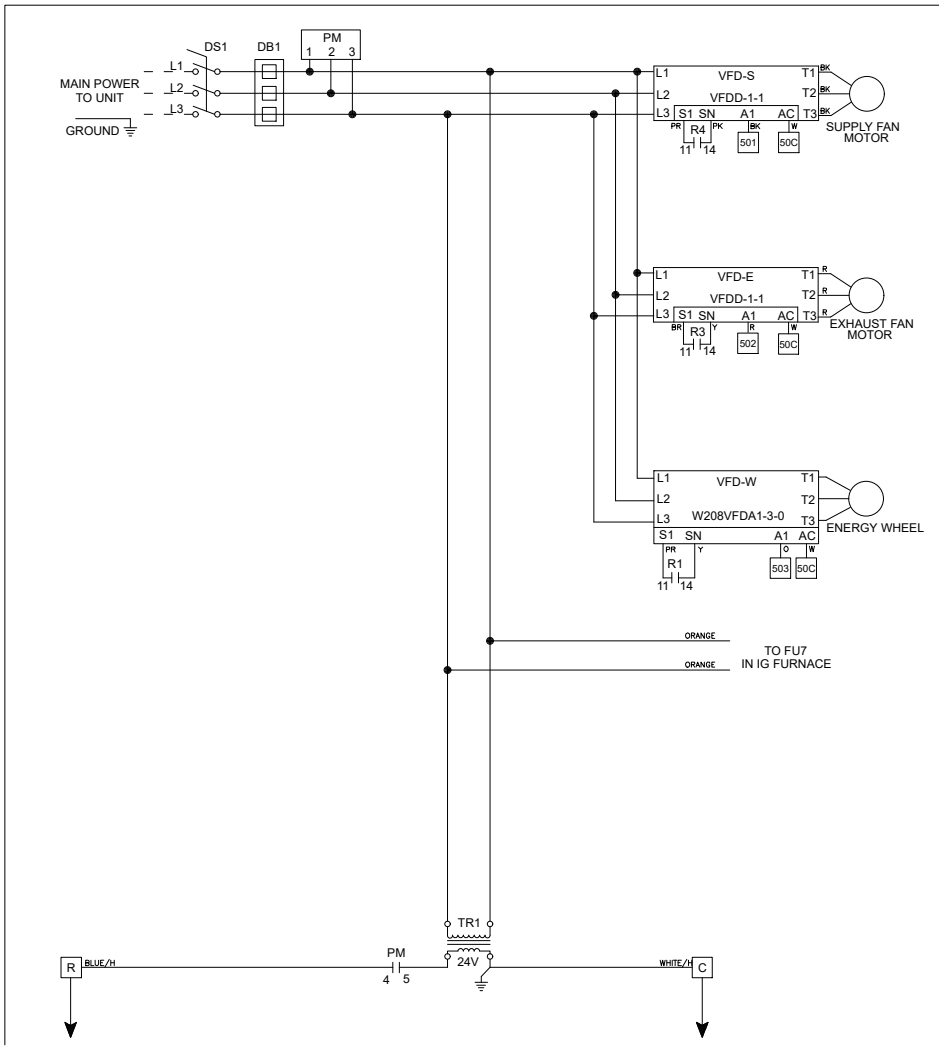


704 lb 738 lb

Note

Estimated corner weights are shown looking down on unit and the outside air intake will be on the right. Weights are applied at the base of the unit. Images not drawn to scale.

Wiring Diagram



AIR MANAGEMENT SYSTEMS

Wiring Diagram Code:

V22E1G1GF02A44X00CX02H0000BH29

CAUTION

UNIT SHALL BE GROUNDED IN ACCORDANCE WITH N.E.C.
POWER MUST BE OFF WHILE SERVICING.

NOTES

USE COPPER CONDUCTORS ONLY
60° C FOR TERMINALS RATED LESS THAN 100 AMPS.
75° C FOR TERMINALS RATED 100 AMPS OR MORE.

FIELD CONTROL WIRING RESISTANCE SHOULD NOT EXCEED 0.75 OHM.

FIELD WIRED – – – – –
FACTORY SUPPLIED AND WIRED ————

WIRE COLOR CODE

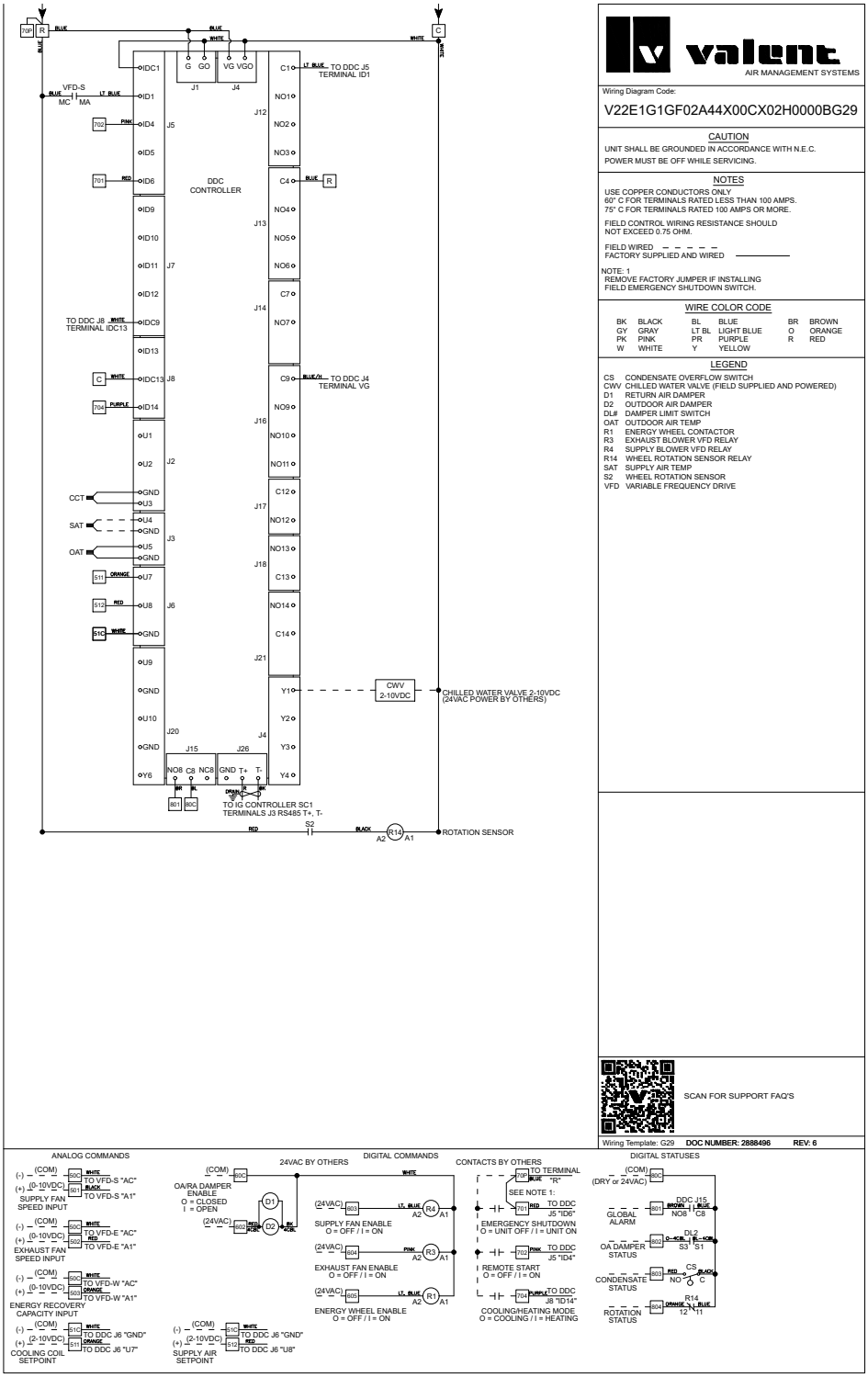
BK	BLACK	BL	BLUE	BR	BROWN
GY	GRAY	LT BL	LIGHT BLUE	O	ORANGE
PK	PINK	PR	PURPLE	R	RED
W	WHITE	Y	YELLOW		

LEGEND

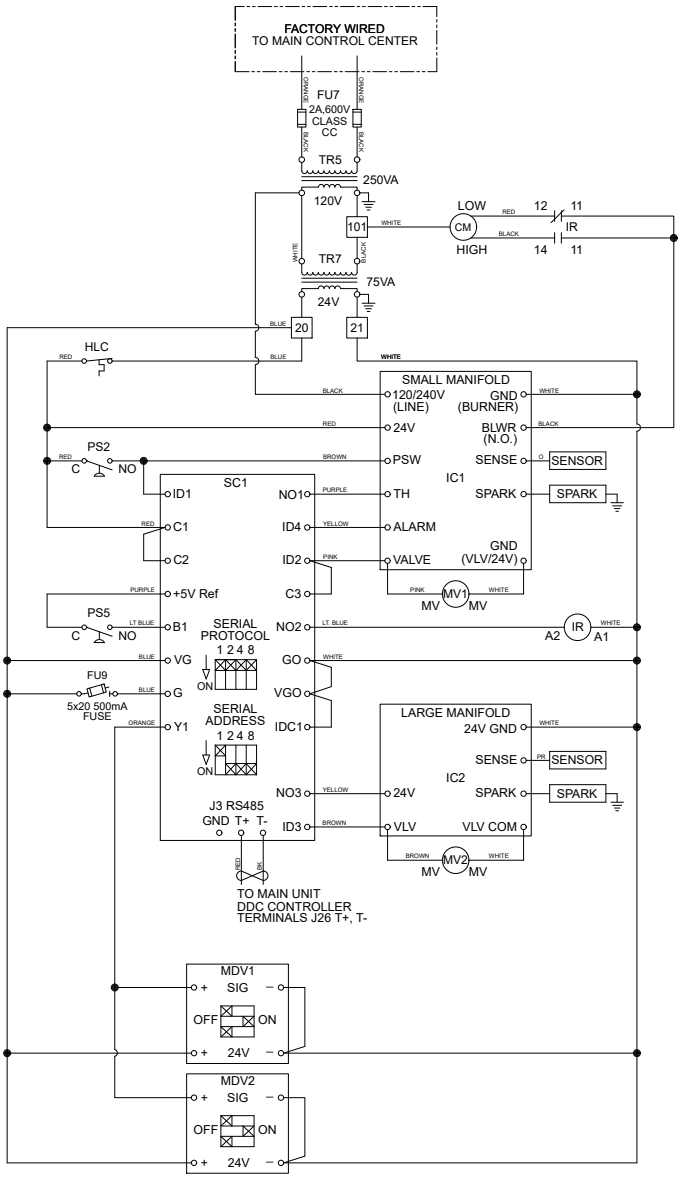
DB#	POWER DISTRIBUTION BLOCK
DS	DISCONNECT SWITCH
PM	PHASE VOLTAGE MONITOR
R1	ENERGY WHEEL CONTACTOR
R3	EXHAUST BLOWER VFD RELAY
R4	SUPPLY BLOWER VFD RELAY
TR#	TRANSFORMER
VFD	VARIABLE FREQUENCY DRIVE

Wiring Template: H29 DOC NUMBER: 2888496 REV: 6

Wiring Diagram 2



INDIRECT GAS WIRING DIAGRAM
FURNACE 1 - HTD MODULATING



valent
AIR MANAGEMENT SYSTEMS

Wiring Diagram Code:

V4N51X1RX0010GS22

CAUTION

UNIT SHALL BE GROUNDED IN ACCORDANCE WITH N.E.C.
POWER MUST BE OFF WHILE SERVICING.

NOTES

USE COPPER CONDUCTORS ONLY
60° C FOR TERMINALS RATED LESS THAN 100 AMPS.
75° C FOR TERMINALS RATED 100 AMPS OR MORE.

FIELD CONTROL WIRING RESISTANCE SHOULD NOT EXCEED 0.75 OHM.

FIELD WIRED – – – – –
FACTORY SUPPLIED AND WIRED ————

NOTE: 1
MODBUS COMMUNICATION WIRING. DAISY CHAIN TO ALL MODBUS DEVICES.

WIRE COLOR CODE

BK	BLACK	BL	BLUE	BR	BROWN
GY	GRAY	LT BL	LIGHT BLUE	O	ORANGE
PK	PINK	PR	PURPLE	R	RED
W	WHITE	Y	YELLOW		

LEGEND

CM	COMBUSTION BLOWER MOTOR
FU#	FUSE(S)
HLC	HIGH TEMPERATURE LIMIT CONTROL
IC1	IGNITION CONTROL - SMALL MANIFOLD
IC2	IGNITION CONTROL - LARGE MANIFOLD
IR	INDUCTION RELAY
MDV1	MODULATING VALVE - SMALL MANIFOLD
MDV2	MODULATING VALVE - LARGE MANIFOLD
MV1	MAIN GAS VALVE - SMALL MANIFOLD
MV2	MAIN GAS VALVE - LARGE MANIFOLD
PS2	COMBUSTION AIR PROVING SWITCH
PS5	HIGH SPEED PRESSURE SWITCH
SC1	STAGE CONTROLLER
TR#	TRANSFORMER(S)

Wiring Template: S22 DOC NUMBER: 2888496 REV: 6

Heat-Cool Only Controls - Sequence of Operation

1. Third-Party Controls Responsibilities and Limitations

The following information in this section are guidelines for the third-party controls contractor to follow when controlling a unit with Heat-Cool Only controls:

1.1 Airflow

Maintaining the proper airflow through the unit is the responsibility of the third-party.

A. Dampers
Ensure damper end switch, when installed, proves the damper position for airflow through the unit prior to starting the supply fan. (100% OA units)

i. Outside Air Damper
ii. Return Air Damper

B. Supply Fan Modulation
Proper fan modulation is the responsibility of the third-party. Enable and modulation of the supply fan within the following guidelines:

i. Compressor Operation
- Fan turn down limited to 50% of the designed airflow.

ii. Electric Heat
- Fan turndown limited to the requirements from the electric heater manufacturer.

iii. Gas Furnace Heat
- All gas furnaces must be limited to the greater of the following:
  - o minimum airflow in CFM; OR
  - o 50% of design airflow.

C. Exhaust Fan Modulation
Enable and modulation of the exhaust fan necessary to achieve the building requirements.

1.2 Energy Recovery

Controlling the energy recovery equipment is the responsibility of the third-party.

A. Enable of Energy recovery device and modulation signal, if installed.

B. Defrost of device located in the outside air stream.
All units with energy recovery options must provide a defrost sequence for the energy recovery section.

i. Energy Wheel
- Provide a difference pressure switch or transducer installed across the energy wheel; AND
- Maintain less than 1.5”wc when Outside Air Temp less than 10 F.

ii. Energy Core
- Provide an exhaust air temperature sensor; AND
- Maintain the exhaust air temperature >= 30 F.

i. Energy Wheel
- Provide an exhaust air temperature sensor; AND
- Maintain the exhaust air temperature >= 25 F.

iii. Pre-heat device, when installed, for energy recovery defrost.
- Outside Air Damper >= 30% open; AND
- Supply Fan enabled; AND
- Outdoor Air Temp less than 10 F.

Note: Please see manufacturer’s information for suggested minimum cfm for pre-heat.

1.3 Supply Air Temperature Control

Supply Air Temperature must be monitored and maintained by the third-party.

A. Supply Air Temperature Setpoint

i. A 2-10VDC analog input will be utilized by the third-party for setpoint control.

ii. Setpoint range between 50.0°F and 95.0°F for all modes of operation.
Note: A minimum setpoint of 60.0°F is advised in heating mode of a heat pump.

B. Supply Air Temperature Limits

The third-party must follow the supply air temp limits below.

i. Minimum Low Supply Temp Limit
- Supply Air Temperature less than 35 F.
- Cooling will shutdown and the unit will be disabled.

ii. Maximum High Supply Temp Limit
- Supply Air Temperature > 120 F.
- Heating will shutdown and the unit will be disabled.

1.4 Cooling and Dehumidification

Refrigeration control is requested by the third-party via two 2-10VDC inputs:

A. Cooling Mode

- Remote Enable Input: Closed
- Cooling/Dehumidification Input: Open
- Cooling/Heating Input: Open
- Cooling Coil Setpoint Request: 50 F - 75 F scaled from 2-10VDC (Compressor Staging)

B. Dehumidification Mode

- Remote Enable Input: Closed
- Cooling/Dehumidification Input: Closed
- Cooling/Heating Input: Open
- Supply Air Setpoint Request: 50 F - 95 F scaled from 2-10VDC (HGRH Valve Modulation)
- Cooling Coil Setpoint Request: 50 F - 75 F scaled from 2-10VDC (Compressor Staging)

1.5 Heating

Heating device control is requested by the third-party via a single 2-10VDC input. This input will control any heating devices installed in the unit.

A. Heating Mode
(IG Furnace, Electric Heat, Hot Water, Heat Pump Heating)

- Remote Enable Input: Closed
- Cooling/Dehumidification Input: Open
- Cooling/Heating Input: Closed
- Supply Air Setpoint Request: 50 F - 95 F scaled from 2-10VDC

Note: A minimum setpoint of 60.0 F is advised in heating mode of a heat pump.

2. Controls Availability

The following sequence is logic in the Heat-Cool Only Controller installed in the unit.

2.1 Unit Availability

The unit is available for operation when the following conditions are met:

A. Heat-Cool Only system alarms are not active.
B. Shutdown Input is closed.
C. Remote Start Input is closed.
D. Supply fan status indicates that the fan is running.
E. Outside Air Temperature sensor is reading a normal temperature.
F. Coil Leaving Air Temperature sensor is reading a normal temperature.
G. Supply Air Temperature sensor is reading a normal temperature.

2.2 Cooling Availability

The unit is available to operate in cooling mode when all the Unit Availability conditions, and the following conditions are met:

A. Outside Air Temp > Cooling Ambient Lockout.

B. Coil Leaving Air Temp > Cold Coil Low Limit Setpoint.
- If the coil leaving temp falls below 42.0 F, the compressors are not available to stage on until the cooling coil temp reaches 46.0 F.

C. Cooling/Heating Control Mode is open for cooling mode (third-party input).

D. Refrigeration alarms are not active.

2.3 Heating Availability

The unit is available to operate in heating mode when all the Unit Availability conditions, and the following conditions are met:

A. Outside Air Temp less than Heating Ambient Lockout.
B. Cooling/Heating Control Mode is closed for Heating Mode (third-party input).
C. Heat device alarms are not active.
D. Heat Pump Heating – Outside Air Temp > ASHP Low Ambient Lockout for ASHP.

3. Cooling Sequence

3.1 Cooling Control

The heat-cool only controller performs the following functions for compressor control.

A. The compressors stage and modulate to maintain the cooling coil temperature setpoint.

B. Modulating Inverter Scroll Compressor
If the unit is equipped with an inverter scroll compressor, the following control will also apply:

- Envelope Control: The Hear-Cool Only controller will monitor temperatures and pressures in the circuit and compare them to the compressor's operating envelope to ensure that the compressor is within safe operating conditions.
- Superheat Control: An Electronic Expansion Valve (ExV) and Electronic Valve Driver (EVD) will be utilized in the modulating circuit. The EVD will control the position of the ExV based on the Suction Superheat to maintain a setpoint of 10 F.

3.2 Dehumidification Control

Dehumidification mode is possible on units equipped with Hot Gas Reheat.

A. Enable Dehumidification
The Cooling/Dehumidification input is closed to initiate dehumidification mode, the following will occur:

- The hot gas reheat valve will modulate to maintain the supply air temperature setpoint.

- The compressors stage and modulate to maintain the cooling coil temperature setpoint.

B. Disable Dehumidification
The Cooling/Dehumidification input is open to initiate cooling mode, the following will occur:

- The HGRH valve modulates to the closed position when a compressor in the HGRH circuit is operating.
- The compressors stage and modulate to maintain the cooling coil temperature setpoint.

3.3 Pressure Control

Pressure control maintains a consistent condensing temperature in cooling and dehumidification modes by modulating coil fans to meet the pressure control setpoint.

4. Heating Sequence

4.1 Heat Control

The heat-cool only controller performs the following functions for control of gas furnaces, electric heat, or hot water devices installed in the unit.

A. Modulates the heating device to maintain the supply air temperature setpoint.

4.2 Heat Pump Heating

A. The compressors stage and modulate to maintain the supply air temperature setpoint.

B. Modulating Inverter Scroll Compressor

If the unit is equipped with an inverter scroll compressor, the following control will also apply:

- Envelope Control: The main controller will monitor temperatures and pressures in the circuit and compare them to the compressor's operating envelope to ensure that the compressor is within safe operating conditions.

- Superheat Control: An Electronic Expansion Valve (ExV) and Electronic Valve Driver (EVD) will be utilized in the modulating circuit. The EVD will control the position of the ExV based on the Suction Superheat to maintain a setpoint of 10 F.

C. Pressure Control

Pressure control maintains a consistent coil temperature in heating mode by modulating coil fans to meet the pressure control setpoint.

D. Secondary Heat

A secondary heating device may be installed in the unit. This device may be electric heat, gas furnace, or a hot water coil.

- Backup
  Secondary heat only operates when heat pump heating is not available.

- Supplemental
  Secondary heat will operate simultaneously with heat pump heating when the compressors are not producing enough heat to stay within 2 F of setpoint.

E. Outside Coil Defrost - ASHP

An Air-Source Heat Pump (ASHP) periodically initiates a defrost cycle of the outside coil to remove the accumulation of frost build-up when operating in heating mode.

- Supplemental Heat

If supplemental heat is installed in the unit, that heating device will maintain the Supply Air Temperature Setpoint.

- Backup Heat
  If backup heat is installed in the unit, that heating device will NOT start during defrost operation.

5. Switching Modes of Operation

The unit switches modes of operation based on an external input from a third-party device.

5.1 Switch from Cooling to Heating

When the Cooling/Heating contact is closed and all heating availability conditions are met, heating mode will initiate, and the following will occur:

A. All currently operating compressors are shut down.

B. The mode switch timer starts before completely switching to heating mode.

C. The reversing valve moves to the heating position, if the unit is a heat pump.

5.2 Switch from Heating to Cooling

When the Cooling/Heating contact is open and all cooling availability conditions are met, cooling mode will initiate, and the following will occur:

A. All heating devices are shut down.

B. The mode switch timer starts before completely switching to cooling mode.

C. The reversing valve moves to the cooling position, if the unit is a heat pump.

6. Digital Statuses

The Heat-Cool Only terminal strip provides the third-party controller with information from devices installed in the unit. The following information is available through those digital statuses.

6.1 Outside Air Damper Actuator End Switch

When installed, this status provides an indication that the outside air damper actuator has reached a specific open position.

6.2 Condensate Overflow Switch

This device, when installed, indicates when the condensate drain pan is full and further operation of the refrigeration system could cause an overflow of water in the pan.

6.3 Energy Recovery Status

When installed, the energy recovery device may have an indication back to the terminal strip that the device is rotating, or the bypass is open.

6.4 Filter Pressure Switch

If a filter pressure switch or switches are installed, an indication back to the third-party indicates that the filters are dirty.

6.5 Global Alarm Output

The global alarm output is available on all Heat-Cool Only units. This status indicates that there is an alarm condition in the Heat-Cool Only controller.

Warranty Statement for Dedicated Outdoor Air Systems (DOAS)

Unit Warranty

Valent warrants the equipment to be free from defects in material and workmanship for a period of 18 months from ship date. Initial startup must be completed within six months of the shipment date, and a startup report must be submitted to Valent.

Energy Wheel Warranty

The energy recovery wheel is warranted to be free from defects in material and workmanship for a period of 5 years from the shipment date. This warranty applies to all parts and components in the energy recovery cassettes with the exception of the motor.

Heat Exchanger Extended Warranty

Valent warrants the stainless steel heat exchanger to be free from defects in material and workmanship for a period of 25 years from the shipment date.

Warranty Notes

Any component which proves defective during the warranty period will be repaired or replaced at Valent's sole option when returned to our factory, transportation prepaid. All warranties do not include labor costs associated with troubleshooting, removal, or installation. Valent will not be liable for any consequential, punitive, or incidental damages resulting from use, repair, or operation of any Valent product. These warranties are exclusive and are in lieu of all other warranties, whether written, oral, or implied, including the warranty of merchantability and the warranty of fitness for a particular purpose. No person (including any agent or salesperson) has authority to expand Seller's obligation beyond the terms of this warranty, or to state that the performance of the product is other than that published by Seller.

As a result of our commitment to continuous improvement, Valent reserves the right to change specifications without notice.

GKD Roof Curb

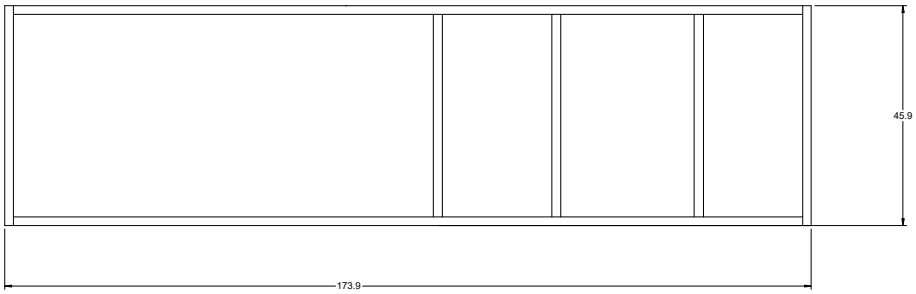
Model: GKD-45.9/173.9-G14

Curb Height (in.)	Curb Length (in.)	Curb Width (in.)	Material	Finish Type	Duct Adapter	Curb Weight (lb)
14	173.9	45.9	Galvanized	Galvanized	Yes	269

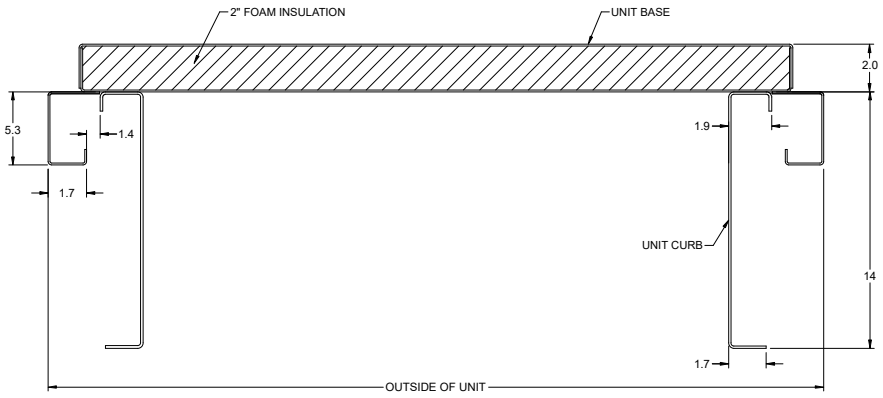
Standard Construction Features:
All dimensions shown are actual and in units of in.'s
If unit is selected with side or end discharge/return, there will not be bottom connections supplied with the curb.
14 gauge galvanized steel (perimeter channels).
14 gauge galvanized steel (interior channels).
Ships knocked down for field assembly.
Curb insulation to be provided by others.

Curb Detail

Top View of Curb



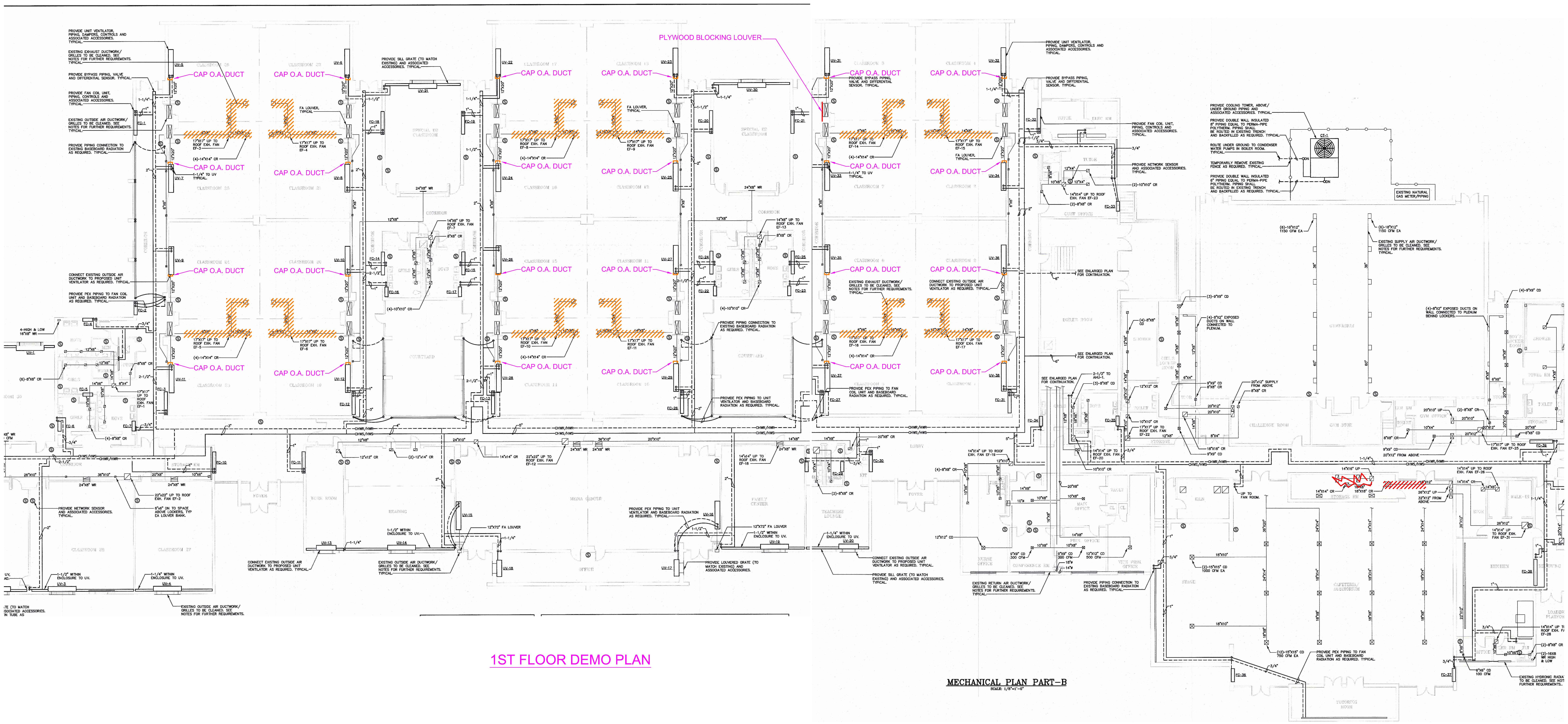
Cross-Section View of Unit on Curb



VANZELM ENGINEERS

APPENDIX D

Drawings



1 MECHANICAL DEMOLITION WORK
SCALE: 1/16"=1'

VANZELM ENGINEERS
VAN ZELM HEYWOOD & SHADFORD, INC.
CT: 860.284.5064 MA: 617.218.9976
10 TALCOTT NOTCH, FARMINGTON, CT 06032 - 1800
Connecticut | Massachusetts | North Carolina

PROJECT NAME:

HVAC Upgrades for Humidity Control
Oliver Ellsworth School
730 Kennedy Road
Windsor CT

KEYPLAN

N

100% SCEMATIC DESIGN

REVISIONS

REV. NO.	DATE	DESCRIPTION
X	XX/XX/XX	XXXXXXX

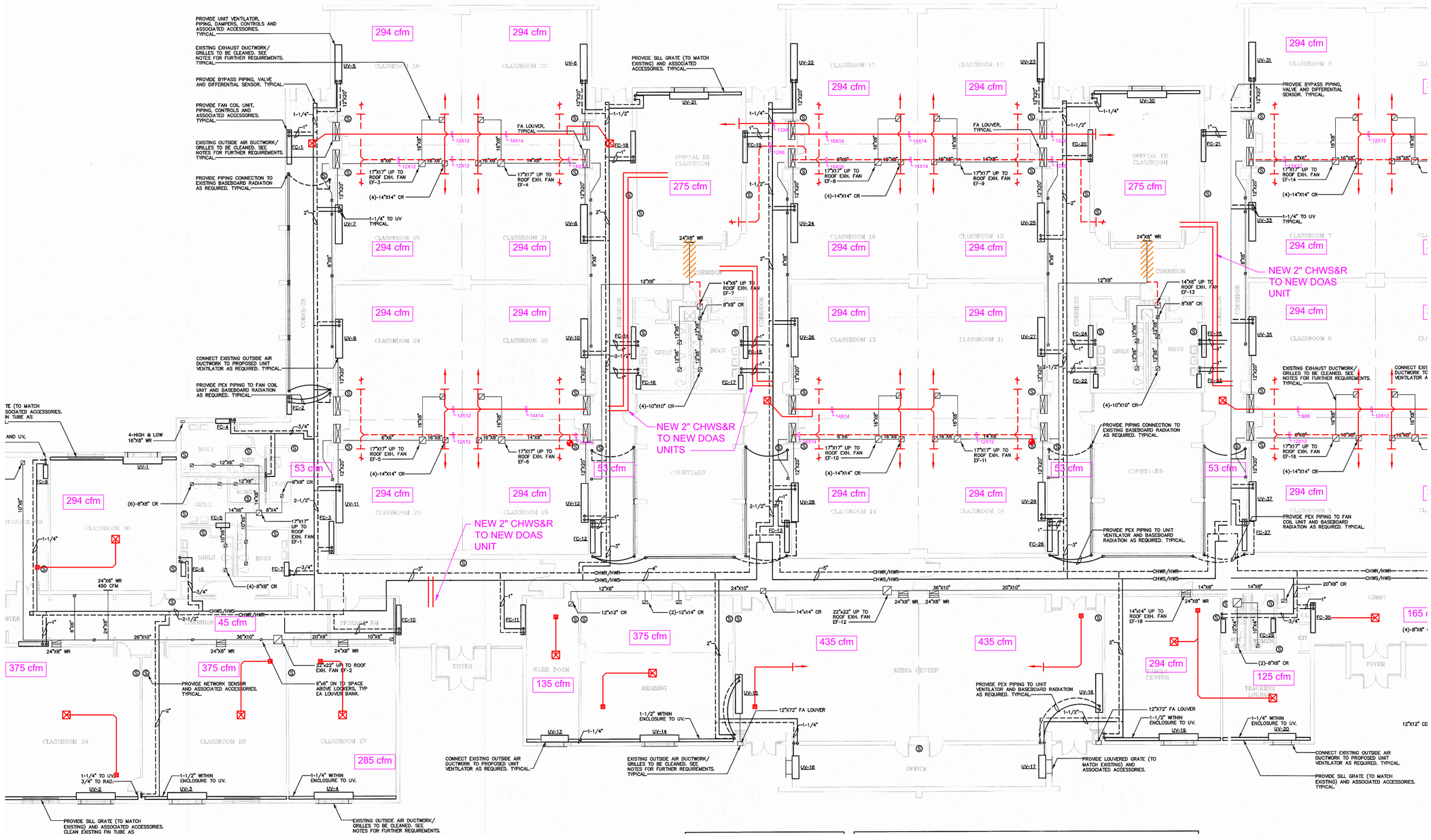
DRAWING TITLE:

MECHANICAL DEMOLITION PLAN.

DATE:	11/2/23
DRAWN BY:	JDP
CHECKED BY:	RDC
SCALE:	1/16"=1'
PROJ #:	2022110.00

DRAWING NUMBER:

MD1



1ST FLOOR PLAN

1 MECHANICAL 1ST FLOOR HVAC PLAN WEST
SCALE: 3/32"=1'-0"

VANZELM ENGINEERS
VAN ZELM HEYWOOD & SHADFORD, INC.
CT: 860.284.5064 MA: 617.218.9976
10 TALCOTT NOTCH, FARMINGTON, CT 06032 - 1800
Connecticut | Massachusetts | North Carolina

PROJECT NAME:

HVAC Upgrades for Humidity Control
Oliver Ellsworth School
730 Kennedy Road
Windsor CT

KEYPLAN

100% SCEMATIC DESIGN

REVISIONS

REV. NO.	DATE	DESCRIPTION
X	XX/XX/XX	XXXXXXX

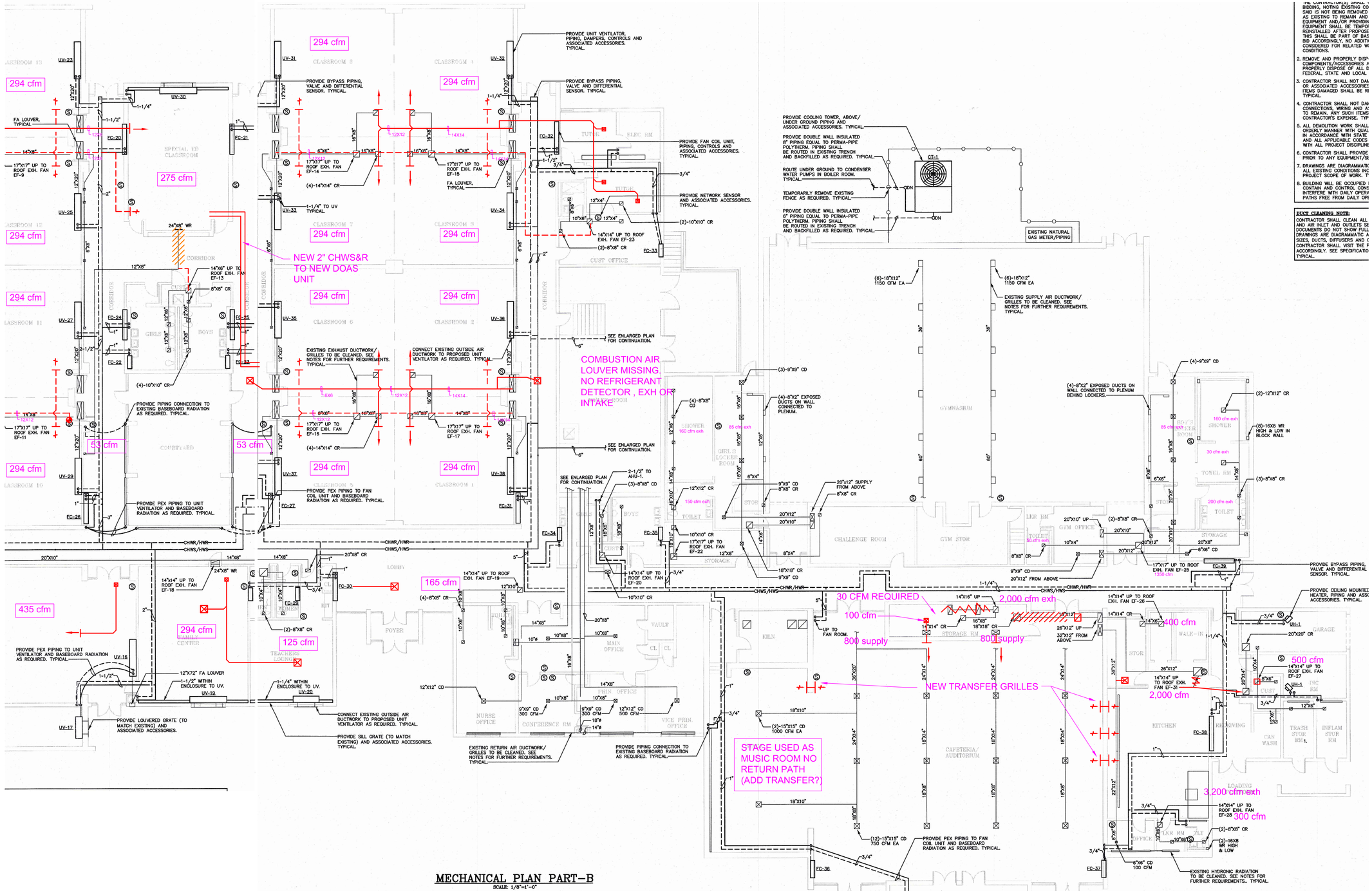
DRAWING TITLE:

MECHANICAL 1ST FLOOR HVAC PLAN WEST

DATE: 11/2/23
DRAWN BY: JDP
CHECKED BY: RDC
SCALE: 3/32"=1'-0"
PROJ #: 2022110.00

DRAWING NUMBER:

M1



MECHANICAL PLAN PART–B
SCALE: 1/8"=1'-0"

1 MECHANICAL 1ST FLOOR HVAC PLAN EAST
SCALE: 3/32"=1'-0"

1. THE CONTRACTOR(S) SHALL ... BIDDING, NOTING EXISTING CO... SAID IS NOT BEING REMOVED ... AS EXISTING TO REMAIN AND ... EQUIPMENT AND/OR PROVIDIN... EQUIPMENT SHALL BE TEMPO... REINSTALLED AFTER PROPOSE... THIS SHALL BE PART OF BAS... BID ACCORDINGLY. NO ADDITI... CONSIDERED FOR RELATED WO... CONDITIONS.
2. REMOVE AND PROPERLY DISP... COMPONENTS/ACCESSORIES A... PROPERLY DISPOSE OF ALL E... FEDERAL, STATE AND LOCAL.
3. CONTRACTOR SHALL NOT DAM... OR ASSOCIATED ACCESSORIES... ITEMS DAMAGED SHALL BE RE... TYPICAL.
4. CONTRACTOR SHALL NOT DAM... CONNECTIONS, WIRING AND A... TO REMAIN. ANY SUCH ITEMS ... CONTRACTOR'S EXPENSE. TYP...
5. ALL DEMOLITION WORK SHALL ... ORDERLY MANNER WITH QUAL... IN ACCORDANCE WITH STATE ... AND ALL APPLICABLE CODES ... WITH ALL PROJECT DISCIPLINE...
6. CONTRACTOR SHALL PROVIDE ... PRIOR TO ANY EQUIPMENT/SY...
7. DRAWINGS ARE DIAGRAMMATIC ... ALL EXISTING CONDITIONS INC... PROJECT SCOPE OF WORK. T...
8. BUILDING WILL BE OCCUPIED ... CONTAIN AND CONTROL CONS... INTERFERE WITH DAILY OPERA... PATHS FREE FROM DAILY OPE...

DUCT CLEANING NOTE:
CONTRACTOR SHALL CLEAN ALL ... AND AIR INLET AND OUTLETS SE... DOCUMENTS DO NOT SHOW FULL ... DRAWINGS ARE DIAGRAMMATIC A... SIZES, DUCTS, DIFFUSERS AND ... CONTRACTOR SHALL VISIT THE F... ACCORDINGLY. SEE SPECIFICATIO... TYPICAL.

VANZELM ENGINEERS
VAN ZELM HEYWOOD & SHADFORD, INC.
CT: 860.284.5064 MA: 617.218.9976
10 TALCOTT NOTCH, FARMINGTON, CT 06032 - 1800
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KEYPLAN

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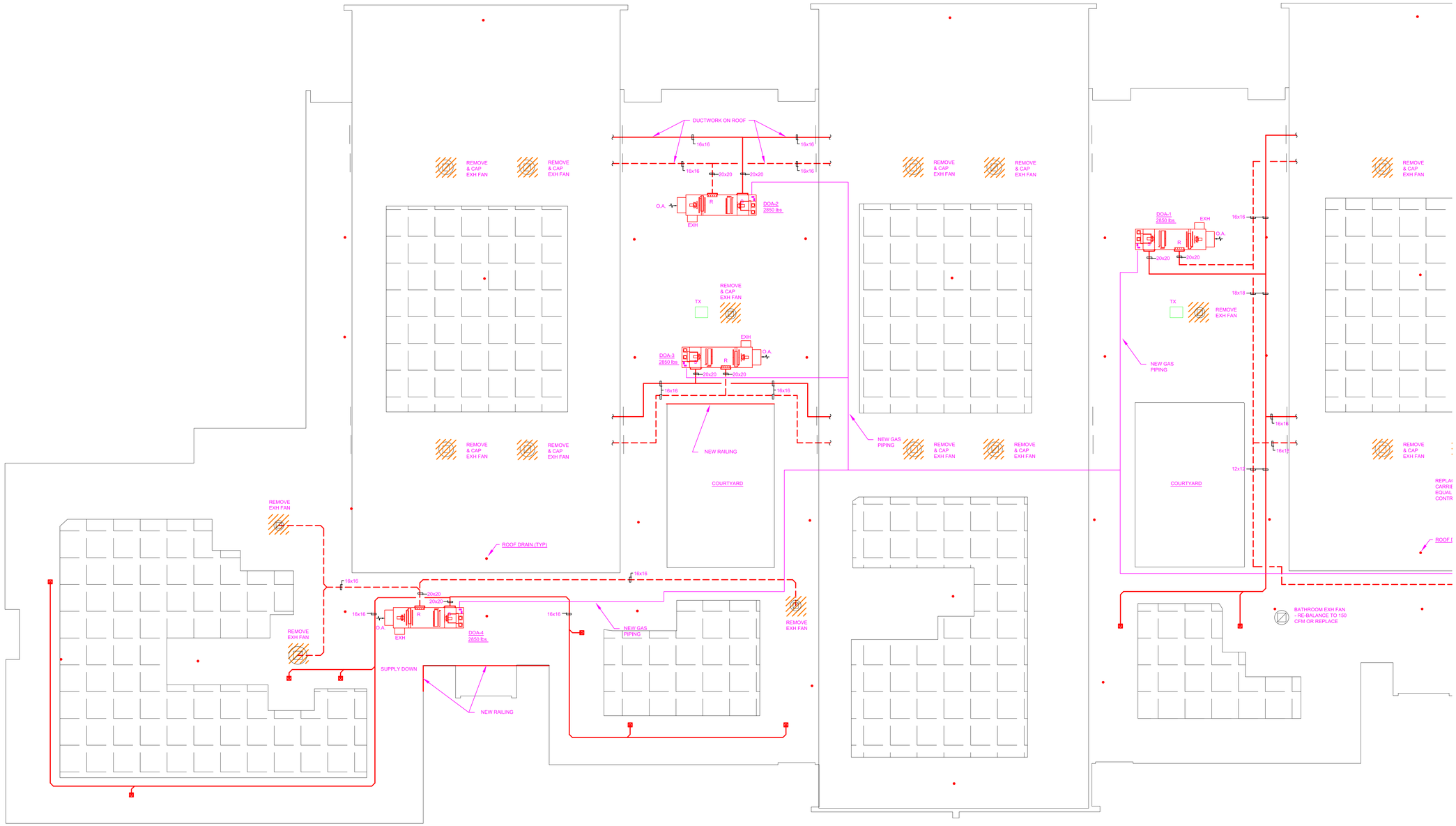
REVISIONS

REV. NO.	DATE	DESCRIPTION
X	XX/XX/XX	XXXXXXX

DRAWING TITLE:
MECHANICAL 1ST FLOOR HVAC PLAN EAST

DATE:	11/2/23
DRAWN BY:	JDP
CHECKED BY:	RDC
SCALE:	3/32"=1'-0"
PROJ #:	2022110.00

DRAWING NUMBER:
M2



ROOF PLAN

1 MECHANICAL ROOF HVAC PLAN WEST
SCALE: 3/32"=1'-0"

VANZELM ENGINEERS
VAN ZELM HEYWOOD & SHADFORD, INC.
CT: 860.284.5064 MA: 617.218.9976
10 TALCOTT NOTCH, FARMINGTON, CT 06032 - 1800
Connecticut | Massachusetts | North Carolina

PROJECT NAME:
HVAC Upgrades for Humidity Control
Oliver Ellsworth School
730 Kennedy Road
Windsor CT

KEYPLAN

100% SCEMATIC DESIGN

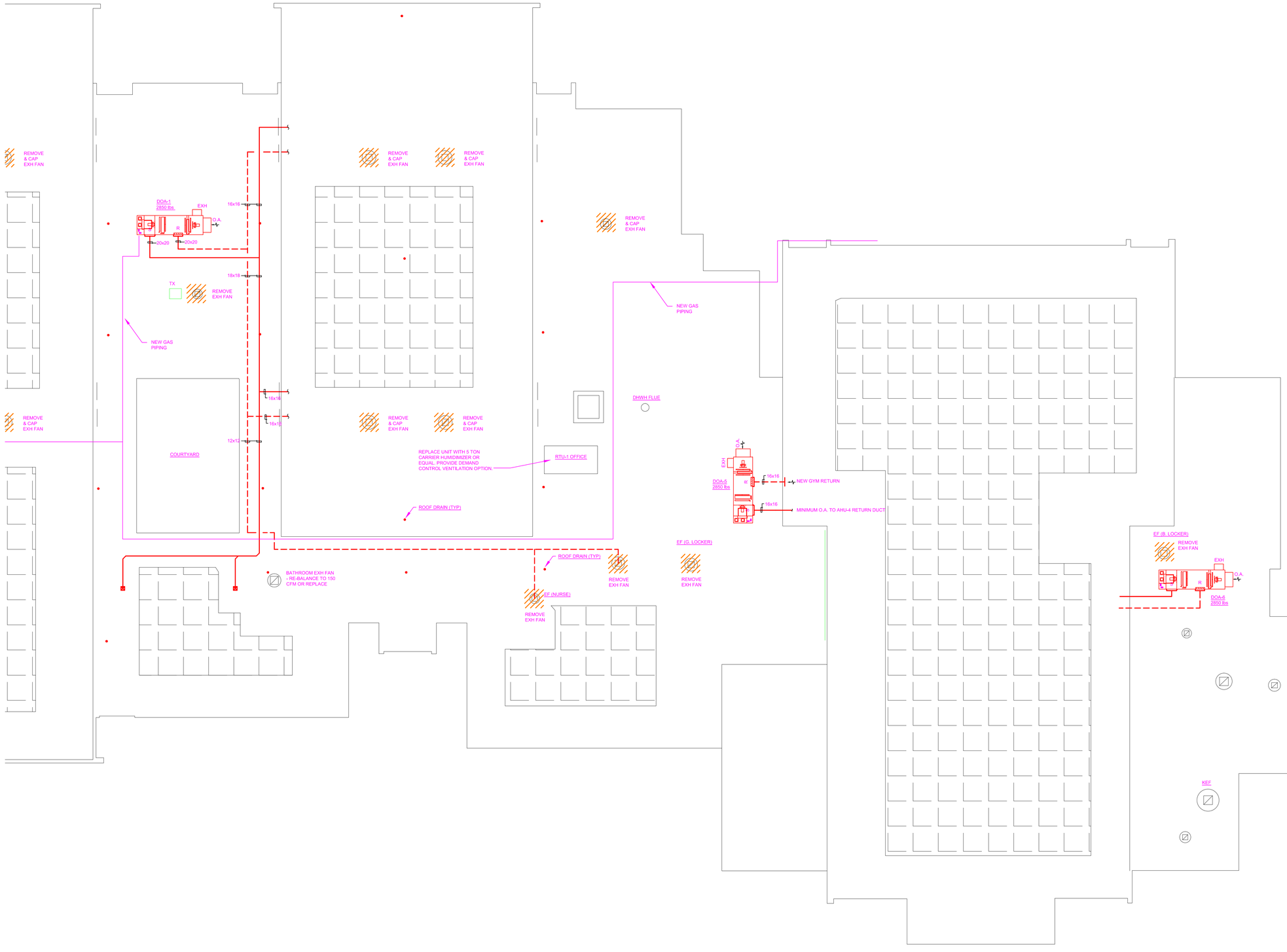
REVISIONS

REV. NO.	DATE	DESCRIPTION
X	XX/XX/XX	XXXXXXX

DRAWING TITLE:
MECHANICAL ROOF
HVAC PLAN WEST

DATE: 11/2/23
DRAWN BY: JDP
CHECKED BY: RDC
SCALE: 3/32"=1'-0"
PROJ #: 2022110.00

DRAWING NUMBER:
M3



1 MECHANICAL ROOF HVAC PLAN EAST
SCALE: 3/32"=1'-0"

VANZELM ENGINEERS
VAN ZELM HEYWOOD & SHADFORD, INC.
CT: 860.284.5064 MA: 617.218.9976
10 TALCOTT NOTCH, FARMINGTON, CT 06032 - 1800
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PROJECT NAME:

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Windsor CT

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100% SCEMATIC DESIGN

REVISIONS

REV. NO.	DATE	DESCRIPTION
X	XX/XX/XX	XXXXXXX

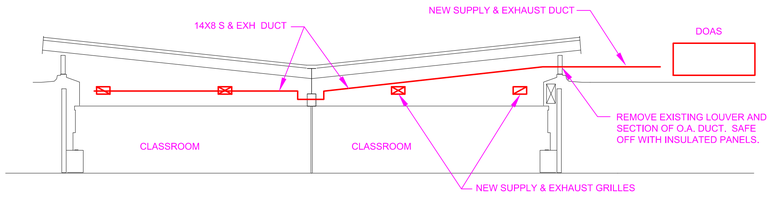
DRAWING TITLE:

MECHANICAL ROOF
HVAC PLAN EAST

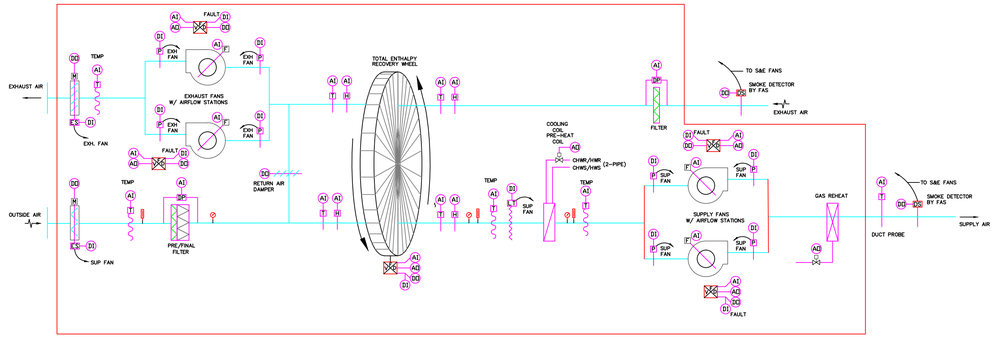
DATE: 11/2/23
DRAWN BY: JDP
CHECKED BY: RDC
SCALE: 3/32"=1'-0"
PROJ #: 2022110.00

DRAWING NUMBER:

M4

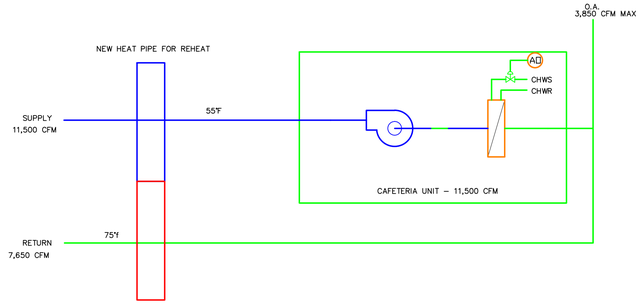


CLASSROOM SECTION

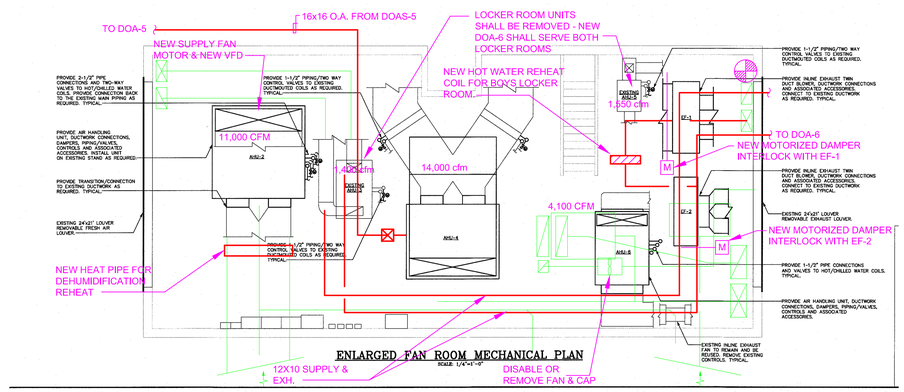


HEAT RECOVERY AIR HANDLING UNIT CONTROL DIAGRAM (DOA#)

NOT TO SCALE



CAFETERIA UNIT HEAT PIPE



ENLARGED FAN ROOM MECHANICAL PLAN

SCALE: 1/4"=1'-0"

MEZZANINE MECHANICAL ROOM

VANZELM ENGINEERS
VAN ZELM HEYWOOD & SHADFORD, INC.
CT: 860.284.5064 MA: 617.218.9976
10 TALCOTT NOTCH, FARMINGTON, CT 06032 - 1800
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PROJECT NAME:

HVAC Upgrades for Humidity Control
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730 Kennedy Road
Windsor CT

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REVISIONS

REV. NO.	DATE	DESCRIPTION
X	XX/XX/XX	XXXXXXX

DRAWING TITLE:

MECHANICAL DETAILS

DATE: 11/2/23
DRAWN BY: JDP
CHECKED BY: RDC
SCALE: 3/32"=1'-0"
PROJ #: 2022110.00

DRAWING NUMBER:

M5