omega
HEAT PUMP

PRODUCT GUIDE

OMEGA VSHP SERIES

VERTICAL STACKED WATER SOURCE HEAT PUMPS

MODEL: VSHP.H (R-454B)

DOCUMENT RELEASE: OMEGA-VSHP.H-PGD-2504

SUPERSEDES: OMEGA-VSHP.H-PGD-2411

Document Release April 7, 2025

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OMEGA Heat Pump
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1. PRODUCT OVERVIEW

Product Features

Reliability

Omega Vertical Stack Water-Source Heat Pump systems are installed across the United States and Canada. Omega units are designed and built for durability, quiet and reliable operation, and energy efficient heating and cooling comfort.

Serviceability

Omega VSHP units with slide-out chassis offer an unmatched service friendly design. Quick connect molex plugs and water connections provide easy installation and maintenance for minimal interruption to occupants. The drop-down blower assembly provides easy service access of fan motor, and removable drain pan for cleaning out and checking condensate trap and connection.

Quiet Operation

Omega units are 3rd party sound tested and recognized as the quietest units on the market. All Omega units come standard with the deluxe sound package for optimized noise attenuation.

Energy Efficient

A water source heat pump system transfers energy to different zones within a system. Conservation of energy within the building system allows for optimization of energy input requirements from a centralized heating system. Omega units are designed with high efficiency coaxial heat exchangers, compressors and coils.

Customizable

Omega units feature customizable options to meet the specific requirements of any project including variable cabinet heights and supply discharge air sizes.

Shipping Option Flexibility

Omega offers a variety of flexible shipping options to meet the requirements on site. Fan cabinets can be shipped horizontally with risers mounted or vertically with risers shipped loose. Chassis can also be shipped inside fan cabinets to minimize storage and handling.

Quality

To maintain the highest level of quality control, every single fan cabinet and refrigeration chassis is fully factory tested.

The chassis manufacturing process features a comprehensive 6-step quality control (QC) system to ensure the highest level of quality.

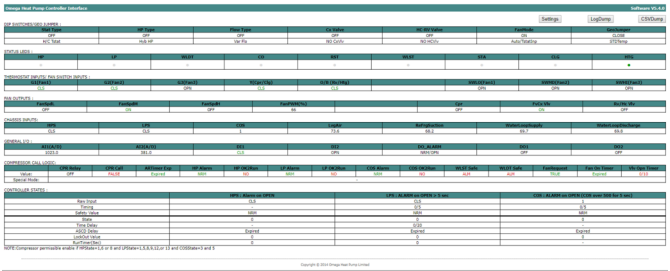
Tested and Certified

All units are internally tested within our own state of the art R&D psychometric facility for operation, min and max conditions, and ensuring units operate within our published design operating ranges.

Omega products are proudly certified and tested by AHRI and ETL listed. Testing information and certificates are posted online for viewing.

Diagnostics & Data Logging

Each unit features Omega's latest heat pump control technology. The on-board LED display provides quick troubleshooting. With optional webpage technicians have access to Omega's diagnostic and data log page to track past performance and current operations in order to make informed decisions. Webpage tool is easily accessed through a smartphone, tablet or laptop.



Product Features

Energy Efficient Design

- High efficiency compressors and blower motors
- High Efficient R-454B DX refrigerant coils
- Thermal expansion valves
- High efficient coaxial heat exchanger coils
- Exceeds ASHRAE 90.1 EER and COP Energy Efficiency Requirements

Quiet Operation

- 1-inch 3-1/2 lb sound density insulated cabinet
- Noise attenuating sound baffle
- Double isolated chassis base to isolate the refrigeration chassis from the cabinet
- Fan motor vibration isolators
- Acoustically optimized chassis design

IAQ Space Considerations

- Fire and mould resistant insulation
- 20-gauge cabinet construction
- Removable stainless steel drain
- Optional MERV 13 Filters
- Optional Electrostatic/Dynamic Filters

Reliability

- 3rd Party Tested and in-house life cycle tested to minimum & maximum operating limits.
- Six Step Quality Control Manufacturing process
- Factory Tested and charged with R-454B
- Premium components
- Microprocessor controlled safety protection devices

Environment

- Low GWP refrigerant R-454B
- Recyclable materials
- Energy efficient EC fan motors
- Local North American Steel

Service

- Slide-out chassis for easy removal and servicing
- Plug-n-play harnesses
- Easy disconnecting water connections
- Refrigerant service access ports
- Simple on-board LED diagnostics
- Optional wireless webpage diagnostics
- Optional data logging for troubleshooting

Certification

All Omega products are listed by ETL (Intertek) and conform to UL-60335-2-40.

VSHP Series units are AHRI certified as per ANSI/ ASHRAE/ISO 13256 and conform to CAN/CSA-C13256-1.

2. DESIGN

2.1 Design Considerations

Energy Conservation

Heat pump systems within the building allow for transfer of waste energy to other areas resulting in energy conservation. North exposure will have higher heating requirements and southern exposure more cooling demand. Waste heat from south side of building is transferred into heating the north side.

Standard Water Loop

Loop temperature for standard condenser loop range typically from as low as 60°F to 100°F entering water. Benefits include: no requirement for pipe insulation of condenser loop thereby reducing installation costs and eliminate condensation risk on risers; less requirements for expansion compensators; wide margin of condenser loop operation safety even as loads change throughout the building.

Geothermal

Geothermal applications condenser loops range from 20°F to 60°F entering fluid in heating season and up to 100°F typically in cooling season. Geothermal loops with bore hole fields require consideration in sizing to determine if fields can support the entire cooling load or if a hybrid system is required with additional heat rejection equipment. This is to ensure the ground does not become subject to thermal drift. Sizing of systems will require more cooling than heating.

Low Temperature Water

For applications where water only non-glycol based geothermal is being considered for water loop heating temperatures between 50°F and 60°F in the heating season using a water condenser loop without glycol. Omega units are specially fitted with coaxial freeze protection safeties on the water circuit.

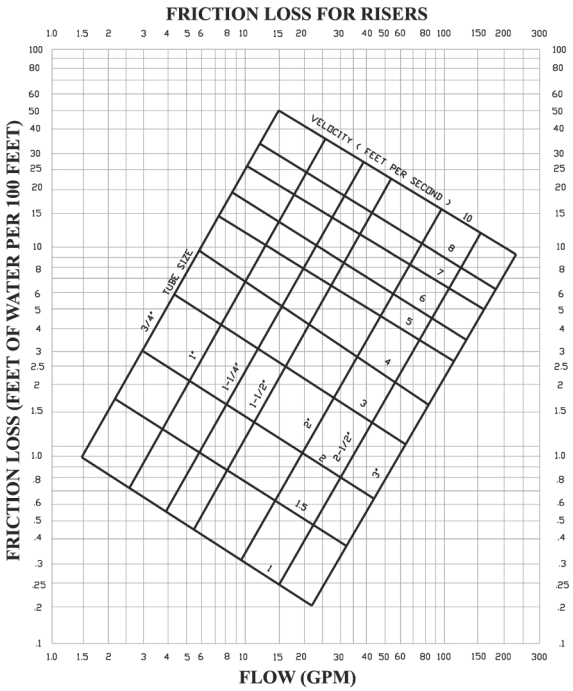
Vertical Stacking Serviceability

The slide-out chassis design allows for quick servicing and maintenance with minimal disruption to occupant. Quick connect electrical and water connections facilitate the process. On site spare chassis (attic stock) will eliminate down time during any maintenance and servicing.

Riser Design Criteria

Refer to ASHRAE 2001 Fundamentals 35.3 Table 6 for Riser Sizing. Friction Loss chart shows riser size diameter versus flow (in GPM), friction loss and fluid velocity (water).

Riser sizes range from 3/4” to 4” in either Type M or Type L copper. Condensate risers do not typically require insulation as condensation is not likely to occur. Check and verify with local codes and design requirements. Insulation on condensate risers is optional and available in 3/8” closed cell. For water loop conditions supply and return riser insulation is not required. In Geothermal applications riser insulation is recommended and available in 3/8” and 1/2” closed cell.



Condensate Riser Trap

The p-trap provided with the cabinets in most applications will act as a dry trap and only during the cooling season some priming of the p-trap occur. Therefore over sizing the condensate riser can introduce un-wanted odors from other areas into the occupant space.

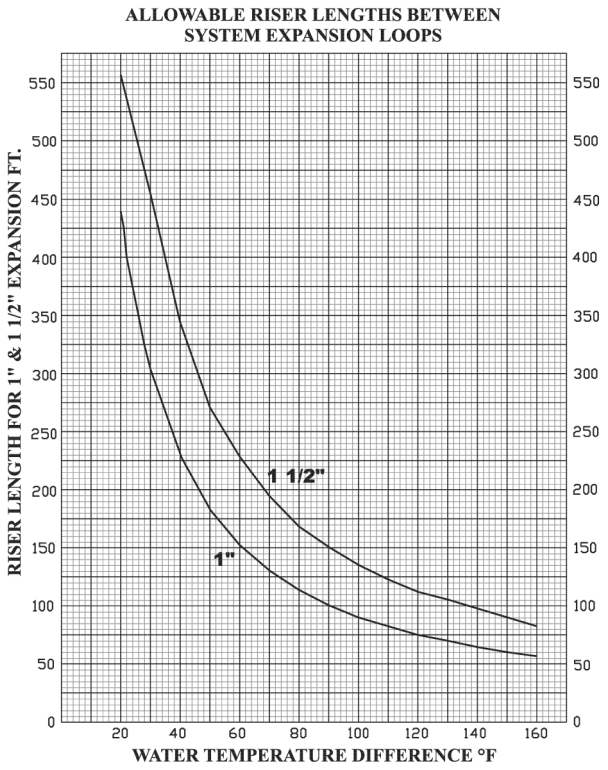
Refer to local building codes on requirements on terminating condensate risers and venting condensate risers. Typically when terminating condensate risers to a sanitary drain, a self priming p-trap is required between condensate riser and drain connection.

When terminating condensate risers to a storm drain, an air gap is required between condensate riser and drain connection.

Riser Expansion

Refer to ASHRAE HVAC Systems and Equipment Handbook and other publications and technical documents for technical information on riser expansion, contraction, and anchoring. Riser stub-outs must be centered in the unit riser knockout openings to allow for +/- 1-1/2 inches of riser expansion and contraction. Additional knockouts are provided for expansion beyond the 1-1/2 inches. The chart below indicates the expansion properties of copper risers compared to water temperature difference.

Sound Considerations



For sound mitigation in a suite several factors need to be considered: unit location, size of equipment, location of supply discharges, duct layout, and room size and furnishings.

Recommend closet construction to include insulated stud cavities with sound rated insulation, minimum 1/2” thick sheetrock, avoid hard connections between unit and closet frame or ductwork.

Ideally locate first supply discharges minimum 6 FT from unit supply opening with a minimum 1, 90 degree elbow. Recommend duct layout and quantity of supply discharges allow for face velocities from 300-500 FPM. High face velocities will result in elevated noise levels from supply grilles.

Size units for approx. 1 Ton of cooling for 600 sqft of living space. Ideal equipment locations include hallways, laundry and bathroom areas.

2.2 Standard & Optional Features

STANDARD FEATURES

Cabinet
The galvanized 20-gauge sheet metal cabinet is designed for structural rigidity, installation flexibility, and serviceability. Cabinet interior is lined with 1" thick acoustic, thermal, mould and fire resistant insulation rated to meet NFPA 90.

Standard Efficiency (SE) Chassis
Standard efficiency chassis balances cost with efficiency requirements. Unit meets or exceeds ASHRAE 90.1 minimum efficiency requirements.

Standard Control Board
Control board and contactors are mounted in the electrical box connected with quick connect plugs. Standard control board detects any alarms on High Pressure (HPS), Low pressure (LPS), Condensate Overflow and Refrigerant Suction temperature (RST).

Deluxe Sound Package
All units come with Omega's deluxe sound package as standard including the double isolated chassis base, isolated fan motor, and base isolation pads.

Blower Fan
A centrifugal forward curved double width double inlet (DWDI) blower with a direct drive motor assembly with easy removal and servicing provides air delivery.

ECM Fan Motor
High-efficient EC motors (ECM) for improved fan operating efficiency and fan performance across a wider operating range over traditional PSC motors. Unit comes with 3 fan speeds.

Field Selectable Supply Air Discharge
Cabinets feature our standard "Knockout" style supply discharge openings for field selectable supply air openings in Left, Right, Front, Back, and/or Top configurations.

DX Coil
High efficient air to refrigerant coils are multi-row with copper tubes and enhanced aluminum fins. Coil fins are mechanically bonded to the tubes.

Compressors
High efficient R-454B compressors are standard, rotary type 1/2 to 1.5 Ton (VSHP 020-060) and scroll type 2 to 3 Ton (VSHP 080-120).

Double Isolated Chassis Base
Compressors are mounted to the chassis frame with elastomer vibration isolators to minimize vibration transmission. Compressor chassis is further mounted on a double isolated base for enhanced noise attenuation to prevent vibration transmission into the cabinet and occupied space.

Coaxial Heat Exchanger Coil
The water to refrigerant coaxial coil is tube in tube with a convoluted inner copper tube design. The coaxial coil is selected for minimum water pressure drop and low fouling characteristics. The coils are optimized for heat pump operation.

Stainless Steel Drain Pan
Unit cabinet stainless steel drain pan provides corrosion resistance. Drain pan is positively sloped, externally insulated with a 7/8 inch O.D. connection and factory mounted p-trap condensate hose. Drain pan is fully removable for servicing of p-trap and checking connection to condensate riser.

Energize to Cool Reversing Valve (ECOOL)
A 4-way reversing valve, pilot operated, sliding piston type with solenoid coil is installed in each heat pump chassis to change refrigerant flow. Reversing valve is installed in "Energized to Cool" mode and "Fails to Heating" mode.

Thermostatic Expansion Valve (TXV)
All units come with a bi-flow thermostatic expansion valve (TXV). TXV is precision machined brass assembly providing precise refrigerant flow metering for R-454B refrigerant.

Condensate Overflow Sensor (COS)
Condensate overflow sensor (electronic) is mounted to the unit drain pan for detecting overflow conditions such as a clogged condensate drain. If condensate switch is tripped compressor operation is stopped.

Air Filter
Standard 1-inch disposable MERV 8 pleated filter is available as standard.

OPTIONAL FEATURES

Premium High Efficiency (HE) Chassis
Upgraded chassis with higher operating efficiency than our standard chassis. Chassis features larger heat exchangers for improved performance. Ideal for geothermal applications.

Deluxe Control Board
Omega Deluxe Microprocessor control board features embedded webpage with unit live status, temperature readings, data logging with stored alarm states, and supply & leaving water temperature readings. Connection through standard ethernet port using router tool for easy access to webpage using a smart phone device, tablet or laptop. Control board provides live readings of water in and out (EWT, LWT), leaving supply air (SAT) and refrigerant temperature (RST).

SmartOne® Communication Board
A RS-485 add-on communication board is supplied to communicate with SmartONE® building automation systems. Includes remote temperature sensor (RTS) that is field mounted in the space.

Gold Series Cabinet
Cabinet comes with integrated canvas duct collar to prevent noise transmission into duct system. The upper section is a supply discharge plenum lined with 1-inch thick acoustic insulation connected to lower cabinet using a flexible duct canvas collar.

MERV 13 Filter
Unit comes with 2-inch filter rack and MERV 13 rated pleated filter for enhanced air filtration.

Auto Shut-Off Control Valve
Optional factory installed 2-way automatic shut-off control valves shut off water flow to the unit when compressor is not operating.

Automatic Balancing Valve
Optional automatic balancing valves are factory installed for automatically limiting water flow through the unit to the nominal rated flow rate (±10% of rated GPM) over a large differential pressure range.

Y-Strainer (HE Chassis)
Optional 20 mesh y-strainer installed on the water circuit inside the chassis.

Y-Strainer (SE Chassis)
Optional 20 mesh y-strainer field installed inside the fan cabinet at the riser supply shut-off valve.

Fresh Outside Air
Fresh Outside Air Duct take-off is installed at the top of the cabinet for providing fresh air into the occupied space. Ideal for designs with a remote mounted ERV specified. Comes with Omega's "Whisper Mode" ultra-low fan speed continuous fan-on operation.

Supply, Return & Condensate Risers
Risers are available in Type M and Type L copper. Factory supplied risers come standard with manual shut-off isolation ball valves soldered to the riser tee. Risers can be ordered swaged or as straight pipe and with optional closed cell insulation.

Geothermal (GEO)
A geothermal option (GEO) package includes an insulated water circuit and condenser coil to prevent condensation. Geothermal option is only intended for fluid loops containing a glycol mixture for freeze protection. If a water only loop is being utilized, it is recommended to select the Low Temperature Water option.

Coaxial Freeze Protection (LTW)
Coaxial freeze protection option to protect the water circuit from freezing. This Low Temp Water (LTW) option package is recommended for low temperature heating water loops between 50°F and 60°F EWT. Chassis inlet and outlet water pipes are fitted with high pressure water safety switches to shut compressor operation in the event of a high water pressure condition above 450 PSIG.

Return Air Panel
Available in two standard styles: **Acoustic with Sound Baffle** is a stamped louver blade style, designed as a narrow, removable door panel. **Perimeter**, enhanced aesthetic, is an insulated swing door style panel. Cylinder key-locks are available for both Acoustic and Perimeter panels.

Line of Sight Baffle (LOSB)
Baffle is factory installed to prevent line of sight between adjacent rooms. Typically used when unit is directly supplying adjacent rooms (for example front and back discharge). Provides additional privacy between rooms.

Corrosion Protected DX Coils (HE Chassis)

DX evaporator coils are available with an epoxy coating (EC) meeting 1000 hours of Salt Spray ASTM B117 protection. Coated coils provide additional corrosion protection and extended life expectancy over traditional non-coated coils.

Cupro-Nickel Heat Exchanger

Optional cupro-nickel coaxial coil provides excellent corrosion resistance versus standard copper coaxial from loop water corrosion and fouling. Ideally suited for use with open loop systems or where corrosion might be an issue.

BTU Meter

Units can be configured to accept various BTU meters. BTU meter calculator is mounted inside the Fan cabinet and temperature probe is mounted to the chassis assembly. BTU meters can be wired to existing 24V controls if needed. Contact factory for more details.

Energize to Heat Reversing Valve (EHEAT)

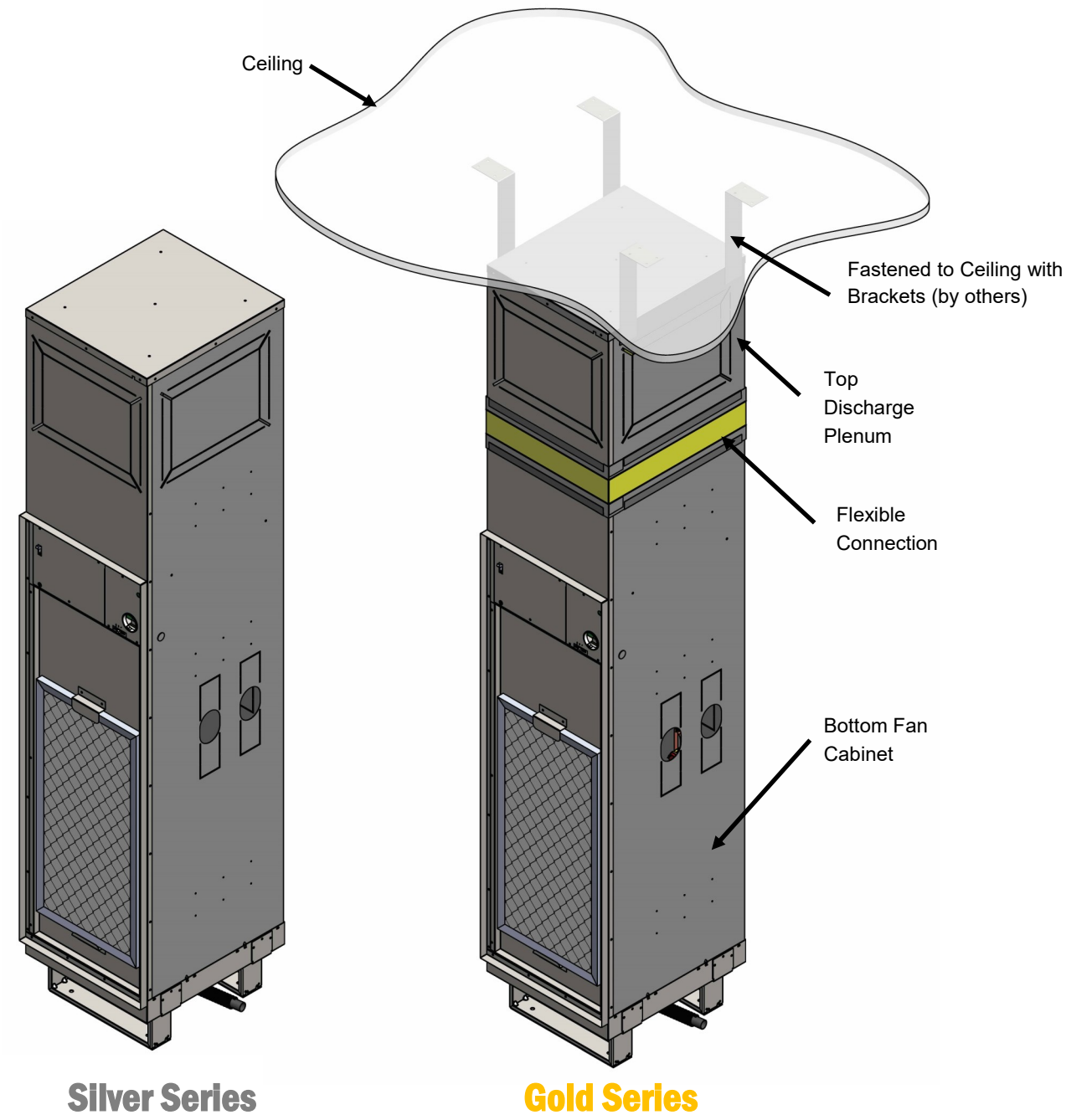
Chassis are built with the reversing valve energizing when in heating mode. In case of reversing valve failure unit will run in cooling mode.

Neoprene Base Pads

Base pads can be upgraded from standard 1/4” closed cell to neoprene.

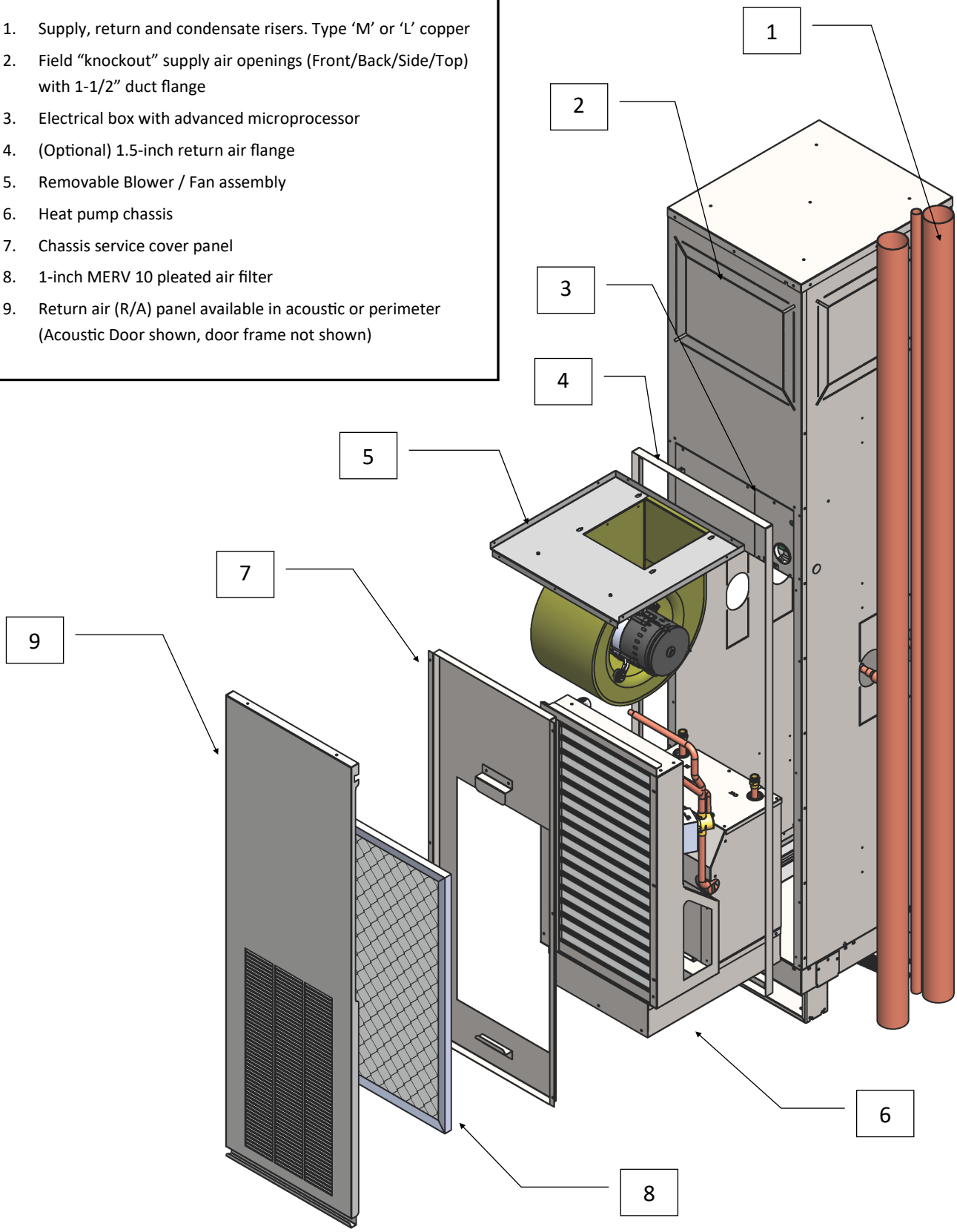
2.3 Cabinet Types—Silver & Gold Series

Omega offers two distinct cabinet options for VSHP units: the Silver and optional Gold series (see below). Silver series is the Omega standard product built as a free standing design. The optional Gold series cabinet includes a factory built-in canvas flex duct collar between the base chassis/blower section and upper discharge plenum. The upper discharge plenum is field mounted to the ceiling structure creating a non-rigid, acoustically isolated connection between the discharge plenum and the cabinet compressor and blower base section.



2.4 Assembly View

1. Supply, return and condensate risers. Type ‘M’ or ‘L’ copper
2. Field “knockout” supply air openings (Front/Back/Side/Top) with 1-1/2” duct flange
3. Electrical box with advanced microprocessor
4. (Optional) 1.5-inch return air flange
5. Removable Blower / Fan assembly
6. Heat pump chassis
7. Chassis service cover panel
8. 1-inch MERV 10 pleated air filter
9. Return air (R/A) panel available in acoustic or perimeter (Acoustic Door shown, door frame not shown)



2.5 Noise Attenuation Features

Omega Heat Pump units offer up to 5 separate methods of vibrational isolation.

Flex Duct Isolator

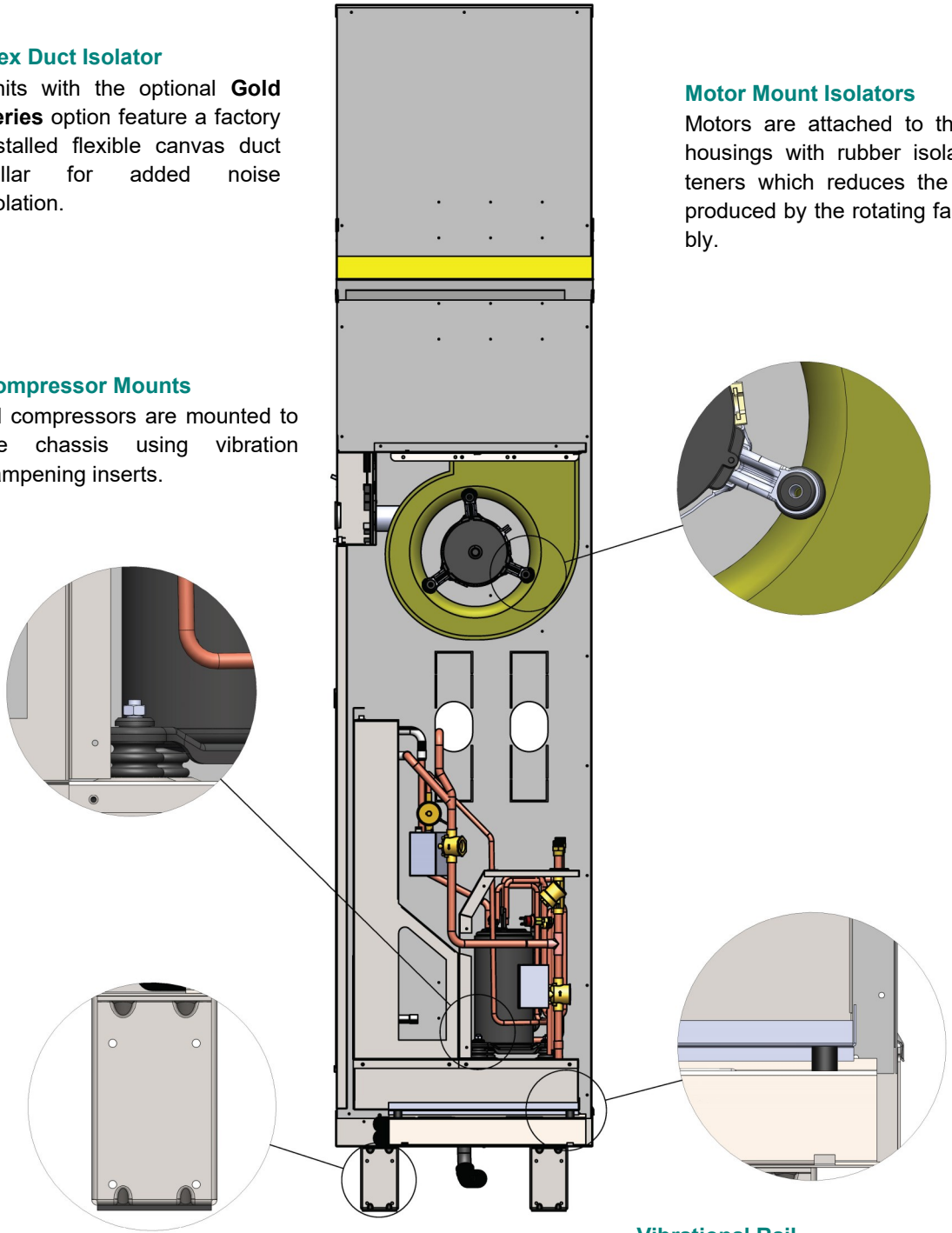
Units with the optional **Gold Series** option feature a factory installed flexible canvas duct collar for added noise isolation.

Motor Mount Isolators

Motors are attached to the blower housings with rubber isolation fasteners which reduces the vibration produced by the rotating fan assembly.

Compressor Mounts

All compressors are mounted to the chassis using vibration dampening inserts.



Unit Foot Insulation

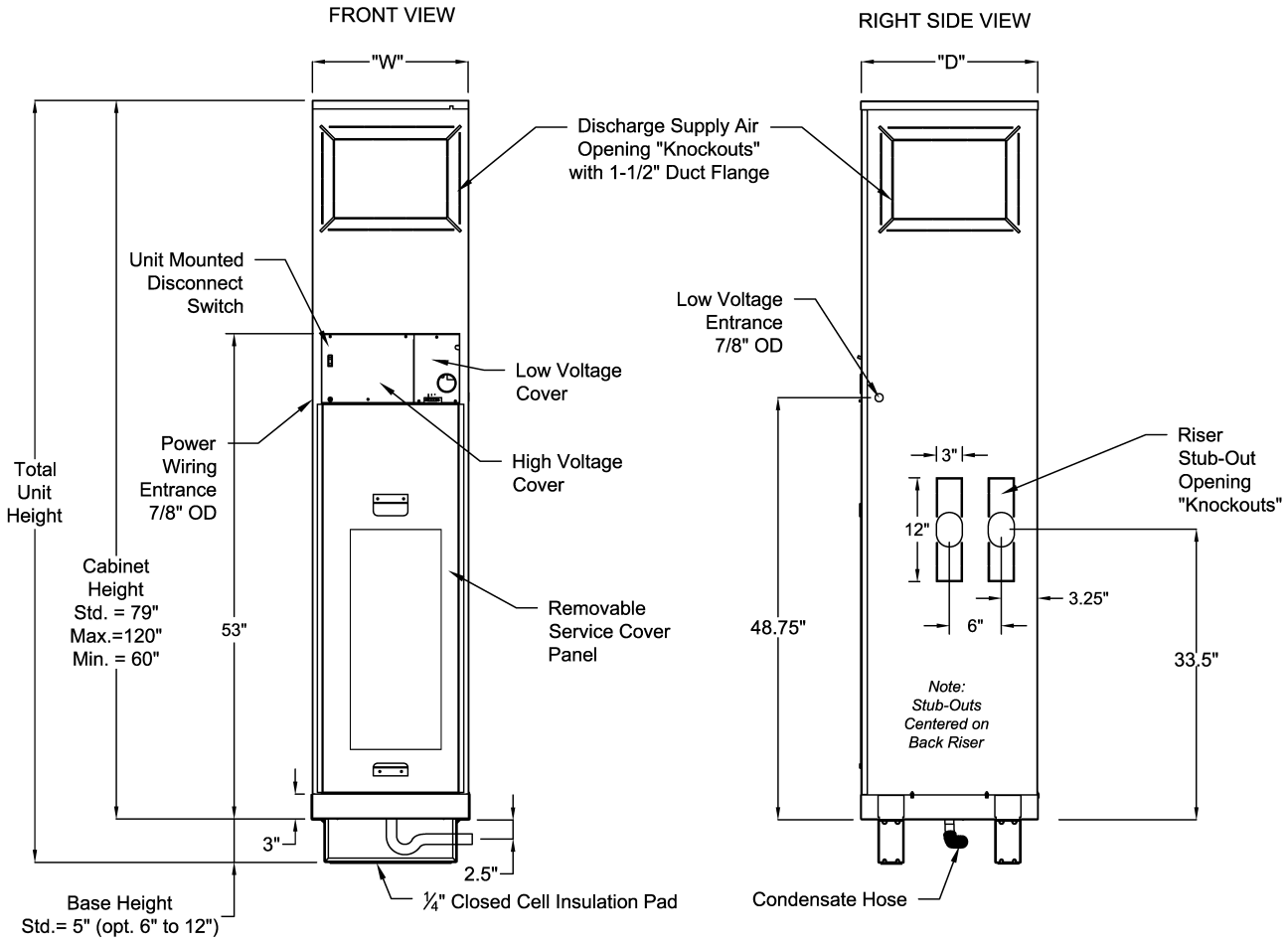
1/4” closed cell foam pads are factory installed under the cabinet base to isolate the unit from the floor surface.

Vibrational Rail

The refrigeration chassis is mounted on a double isolated base with rubberized dampeners to isolate the chassis from the cabinet to minimize noise

3. CABINET DIMENSIONS & SUPPLY DISCHARGES

3.1 Standard Silver Series Cabinet

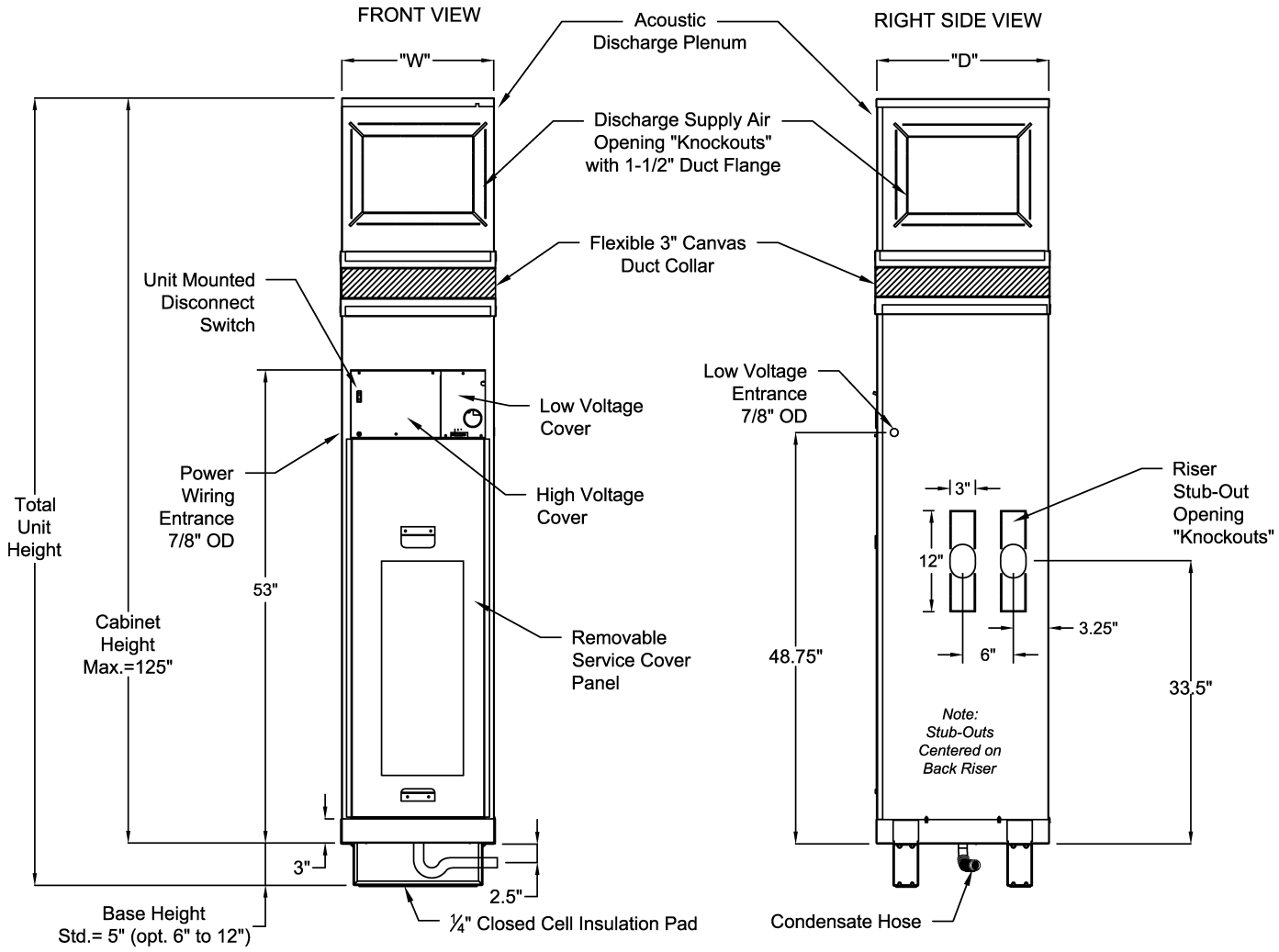


VSHP Cabinet Dimensions (Silver & Gold Series)

Model	Cabinet Size	Dimensions (in)		VSHP Supply Discharge Opening (W X H) inches	
		"W"	"D"	Horizontal	Top
VSHP 020	X	16	17.5	14 x 8	12 x 12
VSHP 030				14 x 8	12 x 12
VSHP 040				14 x 10	12 x 12
VSHP 050	Y	18	20.5	16 x 12	14 x 12
VSHP 060				16 x 12	14 x 12
VSHP 080	Z	22	24.5	18 x 14	14 x 14
VSHP 100				18 x 16	16 x 14
VSHP 120				18 x 16	16 x 16

Note: Discharge opening sizes are customer configurable. Published sizes shown are maximum factory default sizes. Customer to verify discharge opening sizes match design requirements for proper airflow and select appropriate discharge openings at time of order. Recommended face velocity between 300-500FPM at each supply discharge. Direct supply discharge will increase airflow noise into space. Ideally locate supply discharges min. 6ft from top of unit and minimum one 90 degree elbow.

3.2 Optional Gold Series Cabinet with Acoustic Plenum

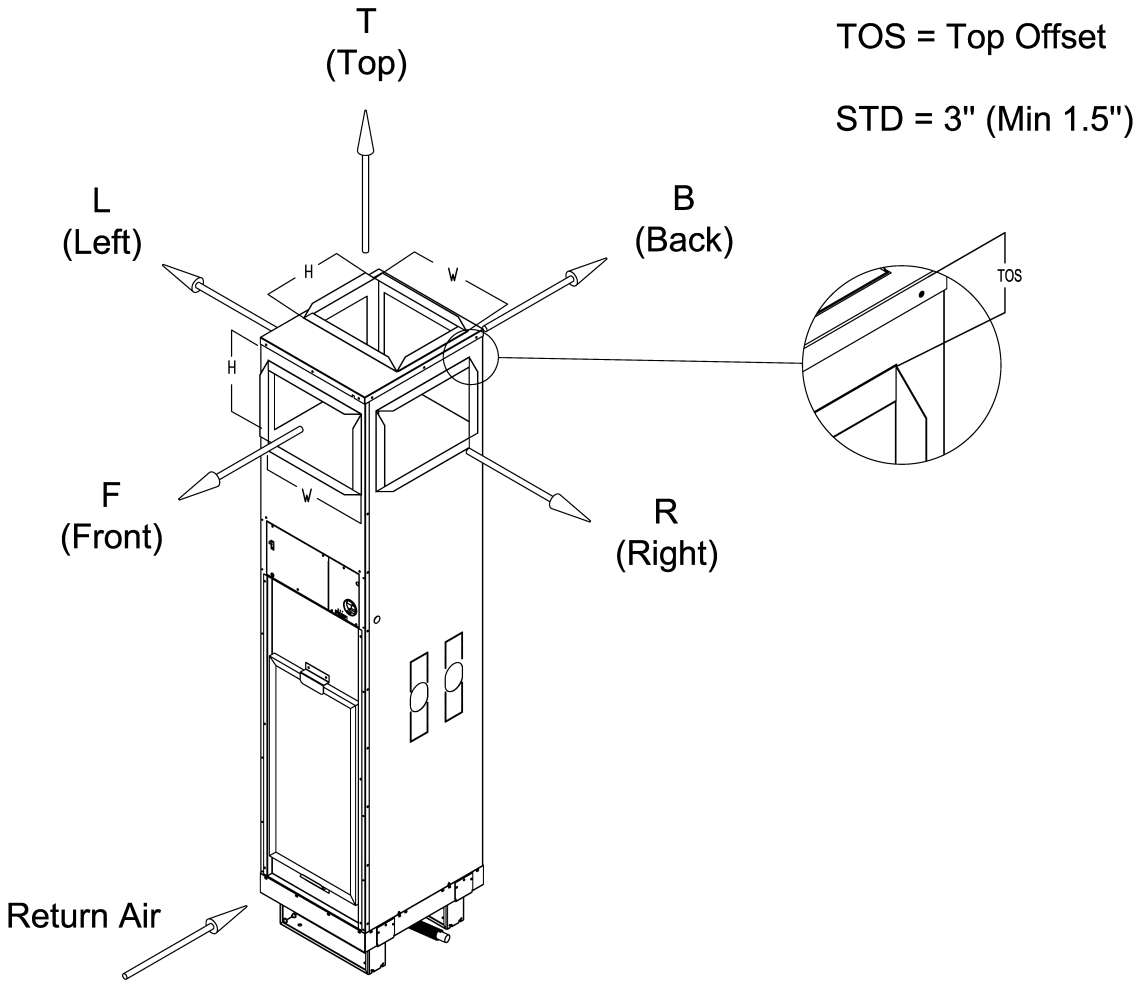


Model	Cabinet Size	Dimensions (in)		Minimum Cabinet Height (in)	
		"W"	"D"	Silver Series*	Gold Series
VSHP 020	X	16	17.5	60 / 72	80
VSHP 030					
VSHP 040					
VSHP 050	Y	18	20.5	60 / 74	82
VSHP 060					
VSHP 080	Z	22	24.5	60 / 74	86
VSHP 100					
VSHP 120					

* Short Cabinet - 60in without horizontal (side) discharges

3.3 Supply Discharge Openings

Units comes with standard "*Knockout"* style discharge openings on top and all sides for field configuration. This allows for custom discharge configurations based on site requirements. Discharge opening sizes are configurable to meet site design conditions.



Supply Air Opening Sizes

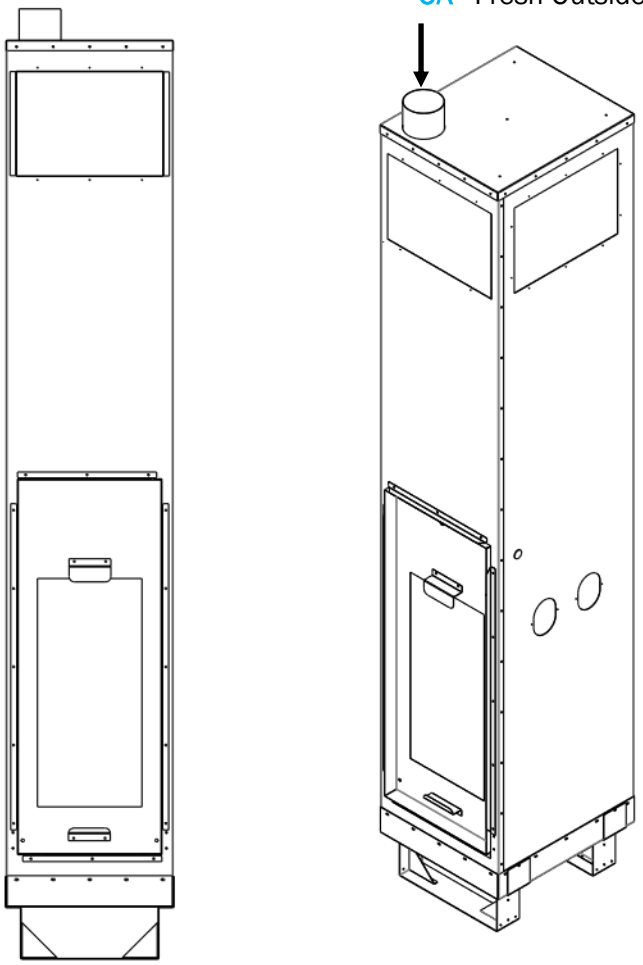
Model	VSHP Supply Discharge Opening (W X H) inches							
	020	030	040	050	060	080	100	120
Horizontal	14 x 8	14 x 8	14 x 10	16 x 12	16 x 12	18 x 14	18 x 16	18 x 16
Top	12 x 12	12 x 12	12 x 12	14 x 12	14 x 12	14 x 14	16 x 14	16 x 16

Notes:

- Discharge opening sizes are customer configurable. Published sizes shown are maximum factory default sizes. Customer to verify discharge opening sizes match design requirements for proper airflow and select appropriate discharge openings at time of order.
- Unit comes standard with field "knockout" style discharge openings on all sides. Discharge flanges are 1-1/2 inches.
- Line of Site Baffles (LOSB) are available where two or more horizontal discharge (Front, Left, Right and/or Back) openings are specified.
- All handing's determined by facing return air opening.
- Top Discharge is centered left and right, and offset 2 inches from the back.
- Recommend adding supply baffles when installing unit mounted discharges. Contact factory for information.

3.4 Optional Fresh Outside Air Duct

Optional built-in Fresh Air Duct is suited for applications where the Energy Recovery Ventilator (ERV) unit is remote mounted. The factory installed fresh air intake accepts fresh air connection from a remote mounted ERV. Refer to Section 3.5 to see different configurations available for location of fresh outside air duct.



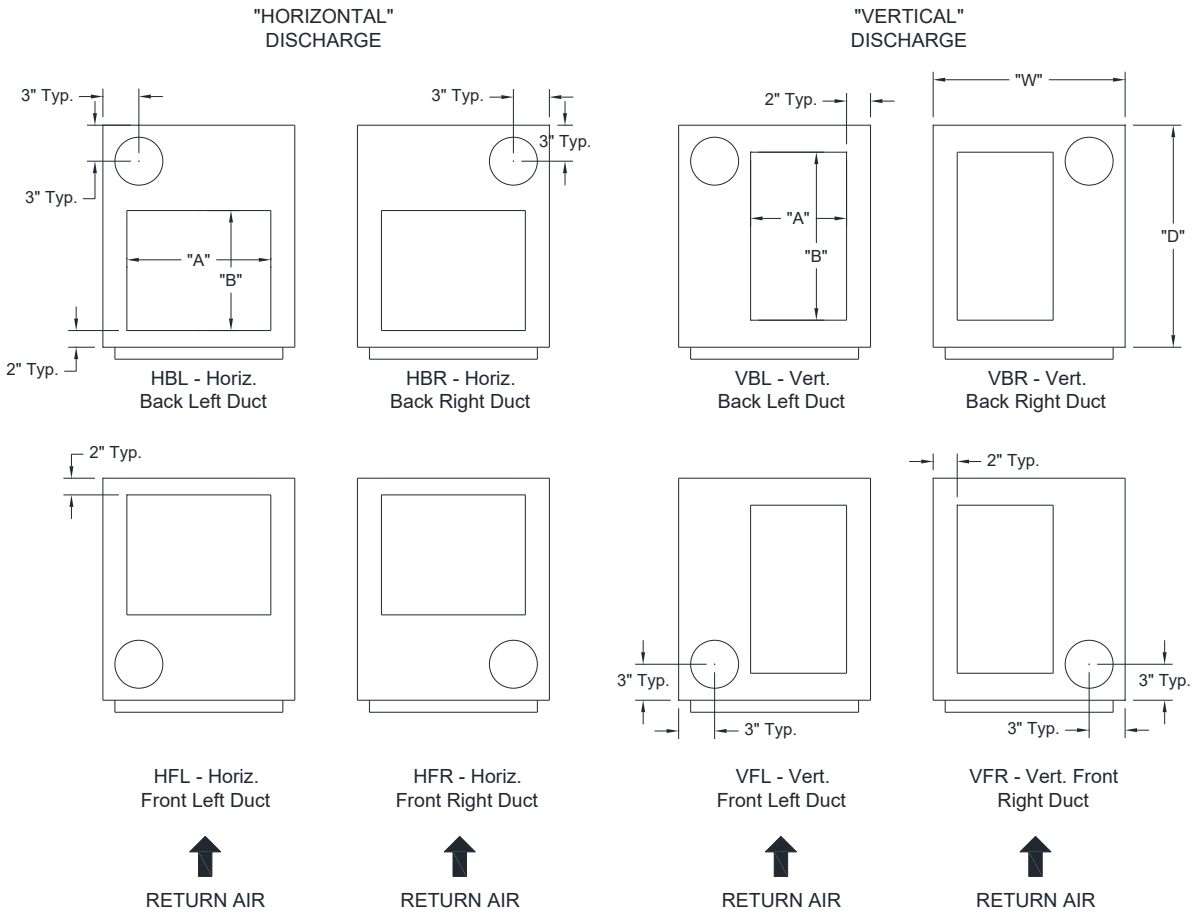
Note: Handing is referenced by facing the unit return air opening (front).

CAUTION

The introduction of cold conditioned outside air from a remote energy recovery ventilation device into the heat pump cabinet can result in potential freezing and bursting of mechanical components carrying water in the heat pump. Designer should take care to treat these considerations accordingly (e.g. utilize water glycol treatment or ensure ERV tempers Outside Air sufficiently above freezing point before entering the unit).

3.4 Top Supply Discharge Openings with Optional Fresh Outside Air Duct

Top discharge for VSHP cabinet with Fresh Outside Air duct is available in two orientations: “Horizontal” and “Vertical”. Each orientation contains four possible configuration options for fresh air duct location. Discharge openings are field “knockout” style with 1.5” duct flange.



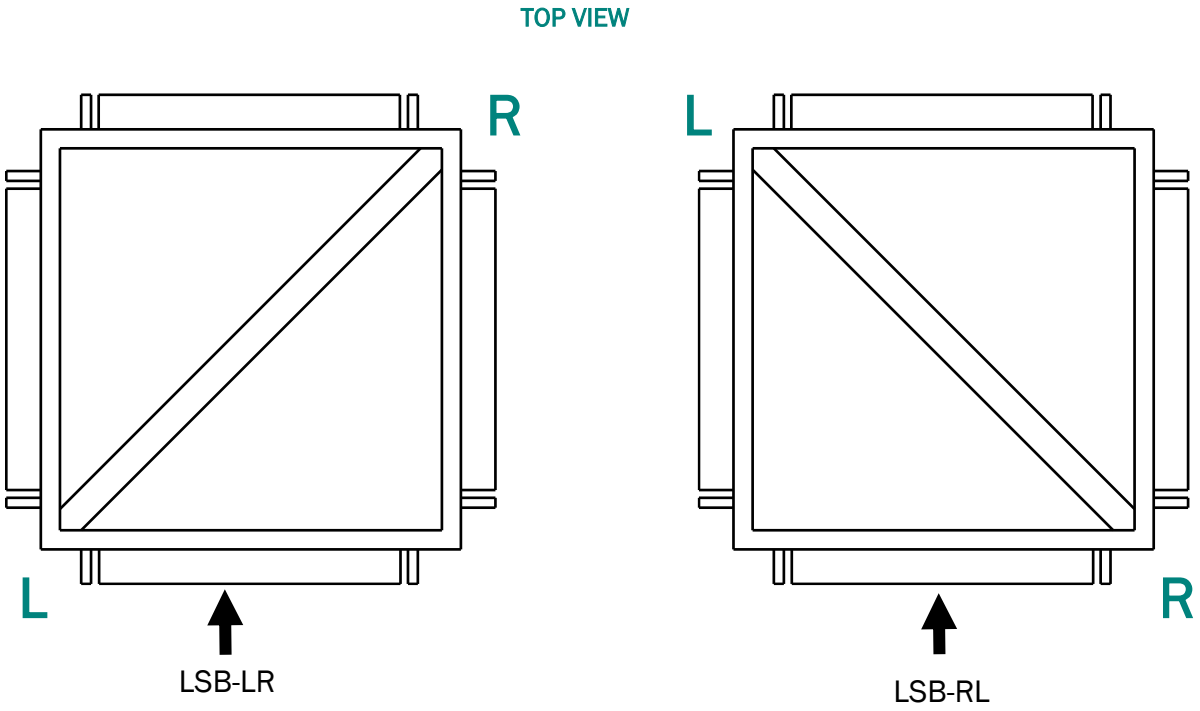
Supply Air Opening Sizes with OA in Horizontal & Vertical Configurations

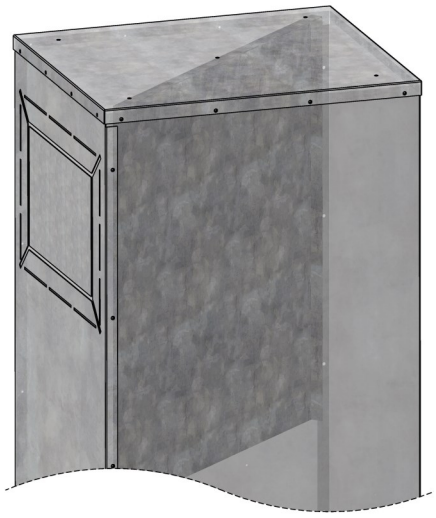
Supply Air Opening Sizes w/ Fresh Air Duct

Model	Cabinet Size	Dimensions (in)		Top Supply Opening w/ Fresh Air Duct (A x B) inches	
		"W"	"D"	"Horizontal"	"Vertical"
VSHP 020H	X	16	17.5	12 x 8	8 x 12
VSHP 030H				12 x 8	8 x 12
VSHP 040H				12 x 8	8 x 12
VSHP 050H	Y	18	20.5	14 x 12	10 x 16
VSHP 060H				14 x 12	10 x 16
VSHP 080H	Z	22	24.5	14 x 14	14 x 14
VSHP 100H				16 x 14	14 x 18
VSHP 120H				16 x 16	14 x 18

3.5 Optional Line of Sight Baffle

Optional Line of Sight Baffles (LOSB) are supplied inside discharge plenum. The LOSB provides occupant privacy between adjacent rooms. Two configurations (LSB-LR or LSB-RL) of LOSB are available based on the unit discharge arrangement. LOSB is not available with optional Fresh Outside Air Duct intake.

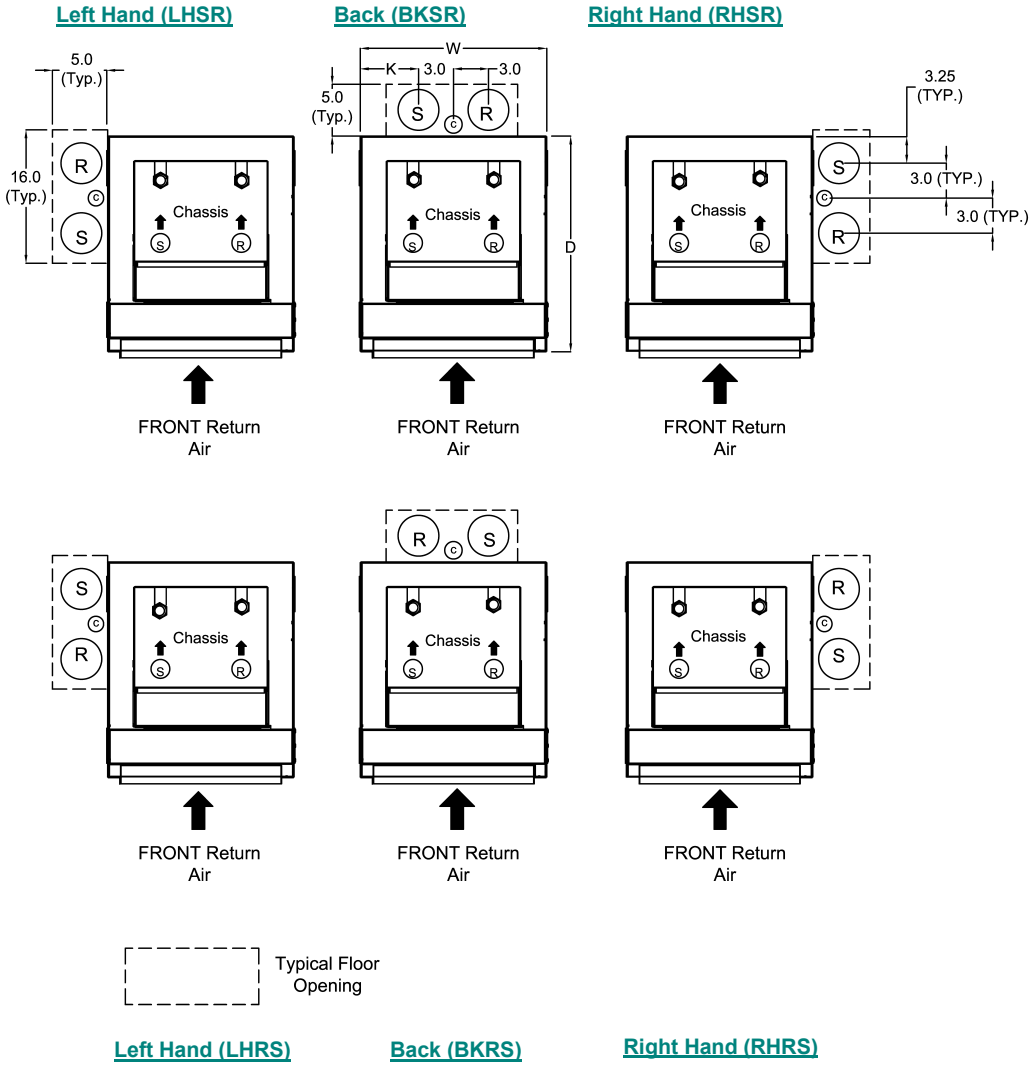




Line of Sight Baffle Configurations

4. RISERS & HOSE KITS

4.1 Riser Handing Conventions (Top View)



S = Supply Riser
C = Condensate Riser
R = Return Riser

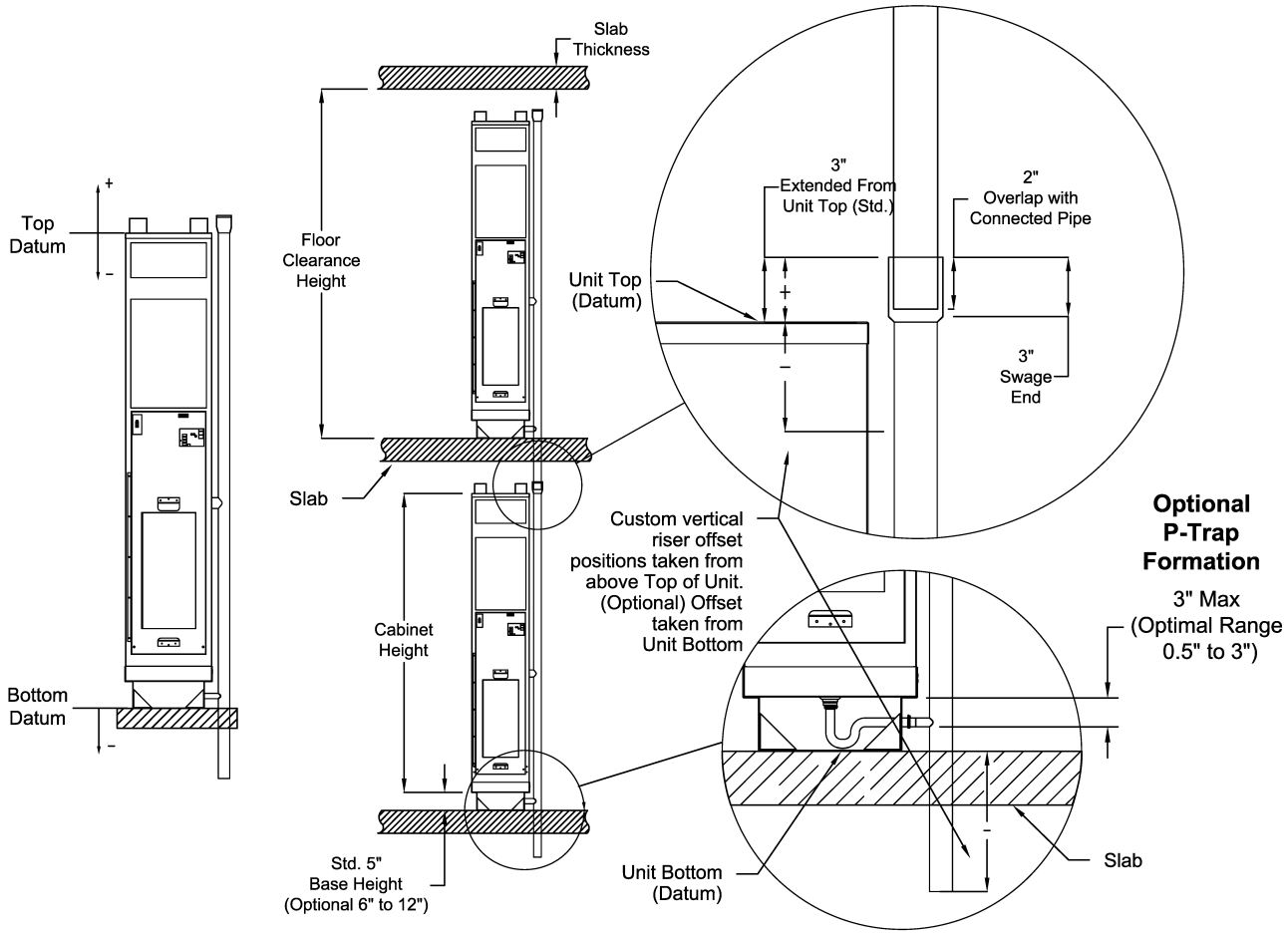
VSHP Cabinet Riser Dimensions

Unit Size	Cabinet Size	W	D	"K" (in)
020, 030, 040	X	16	17.5	5
050, 060	Y	18	20.5	6
080, 100, 120	Z	22	24.5	8

Notes:

- Units do not come with a riser chase or riser sleeve. Depiction shown indicates typical coring openings.
- Supply & Return risers shown are 3-inch. Condensate riser shown is 1.25-inch.
- Recommended riser shut-off valves protrude inside fan cabinet by 4.5-inches (not shown).

4.2 Riser Sizing Reference



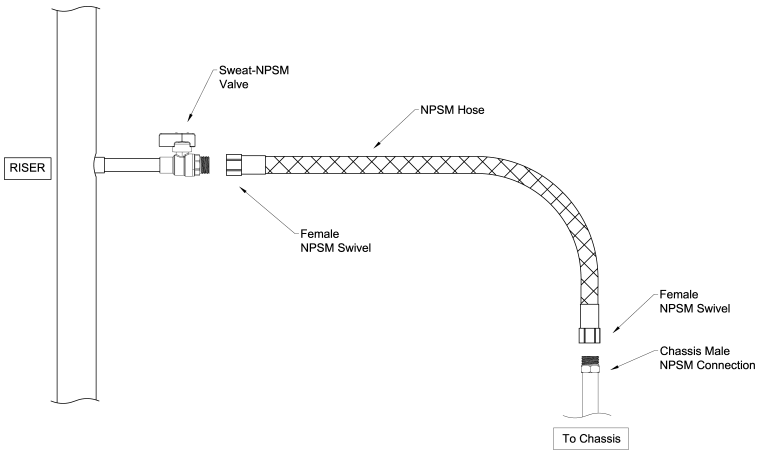
Notes:

- Risers are positioned relative to cabinet using a standard “Top” Datum reference (optional “Base” Datum). Top Datum Offset indicates where the top of riser will be located relative to top of cabinet. A Base Datum indicates where bottom of riser will be located below the base of cabinet.
- Upon request Omega will provide 3 inch deep swage on risers of same pipe size (optional for all risers) for connection to units on the floor below.
- Risers should insert 2 inches into the 3 inch deep swage connection (minimum 1 inch insertion is required)
- Riser Length = Floor Clearance Height + Slab Thickness + 2 inch (overlap) (Rounded up to 120” or 144”).
- Omega supplies two standard riser lengths, 120” (10’) and 144” (12’).
- Supply extension tailpieces or reducers for joining dissimilar piping sizes are optional.
- Risers available in Type L and Type M copper.
- Condensate riser comes with optional 3/8-inch thick closed cell insulation to prevent condensation.
- Optional insulation on supply and return risers is available for 3/8-inch and 1/2-inch closed cell insulation.

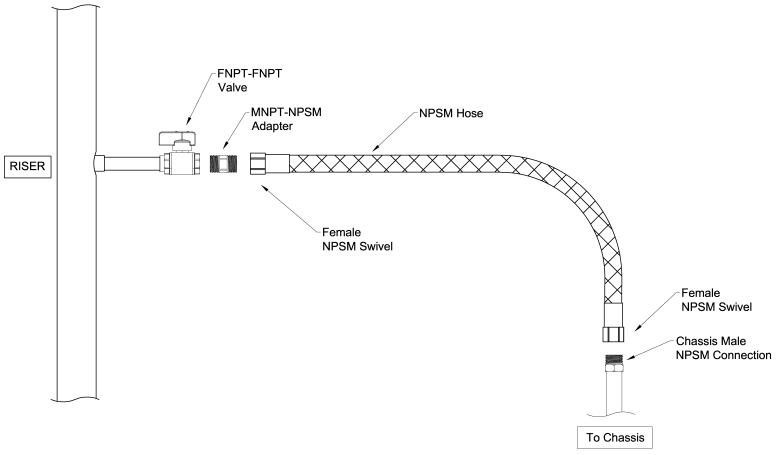
4.3 Hose Kit & Riser Stub-Out Details

Model	Hose Kit	
	Size (in)	Length (in)
VSHP 020	1/2	24
VSHP 030	1/2	24
VSHP 040	1/2	24
VSHP 050	1/2	24
VSHP 060	1/2	24
VSHP 080	3/4	30
VSHP 100	3/4	30
VSHP 120	3/4	30

STANDARD VALVE - SWEAT CONNECTED NPSM



OPTIONAL FPT VALVE - FPT to FPT

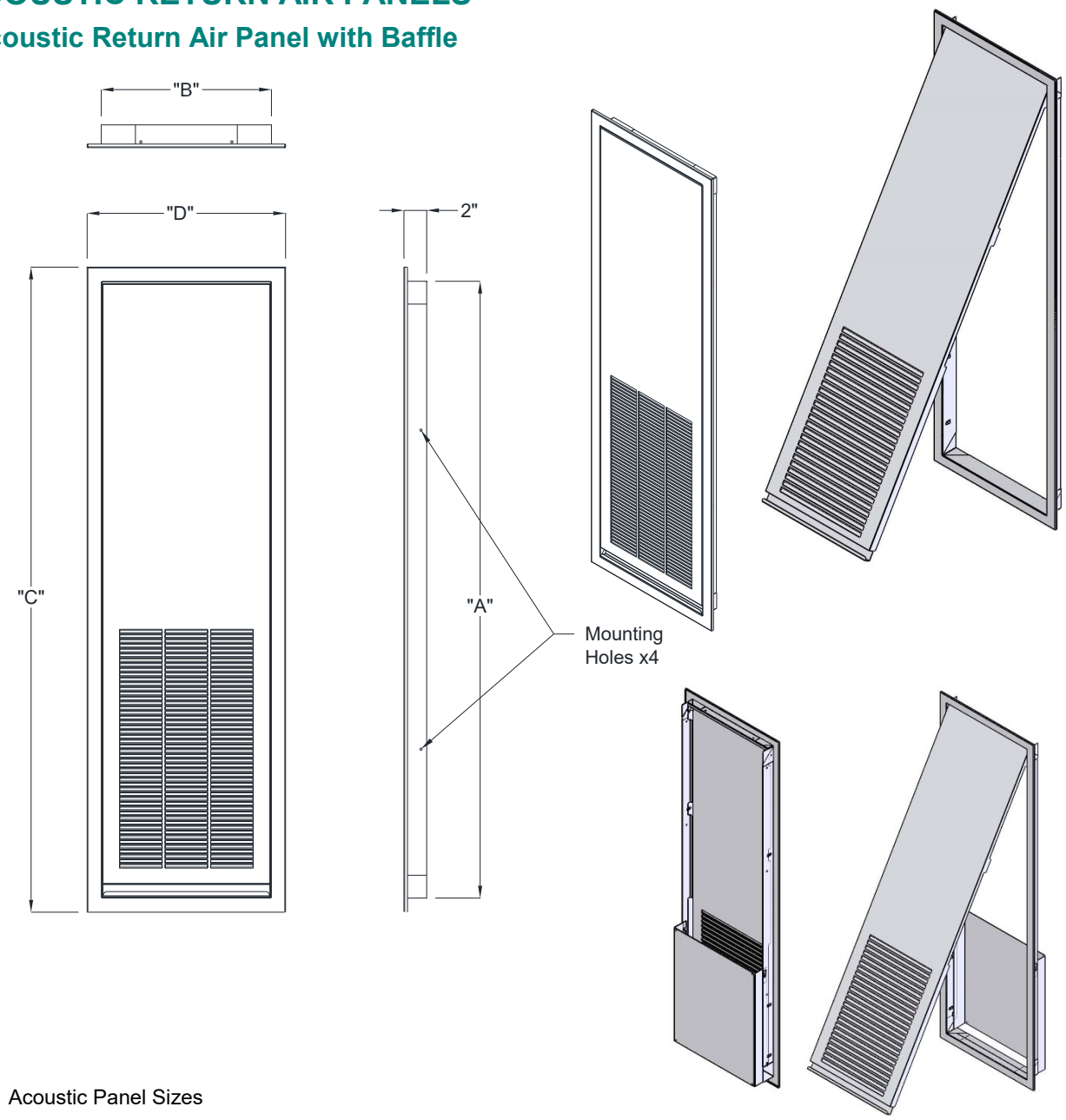


Isolation Valve Notes:

- Standard NPSM sweat connected isolation valves are provided for Factory or Field Supplied Copper Risers.
- Optional Female NPT valves for Field Supplied Risers only. Includes MNPT-MNPSM hose adaptors with hose kit.

5. ACOUSTIC RETURN AIR PANELS

5.1 Acoustic Return Air Panel with Baffle



Acoustic Panel Sizes

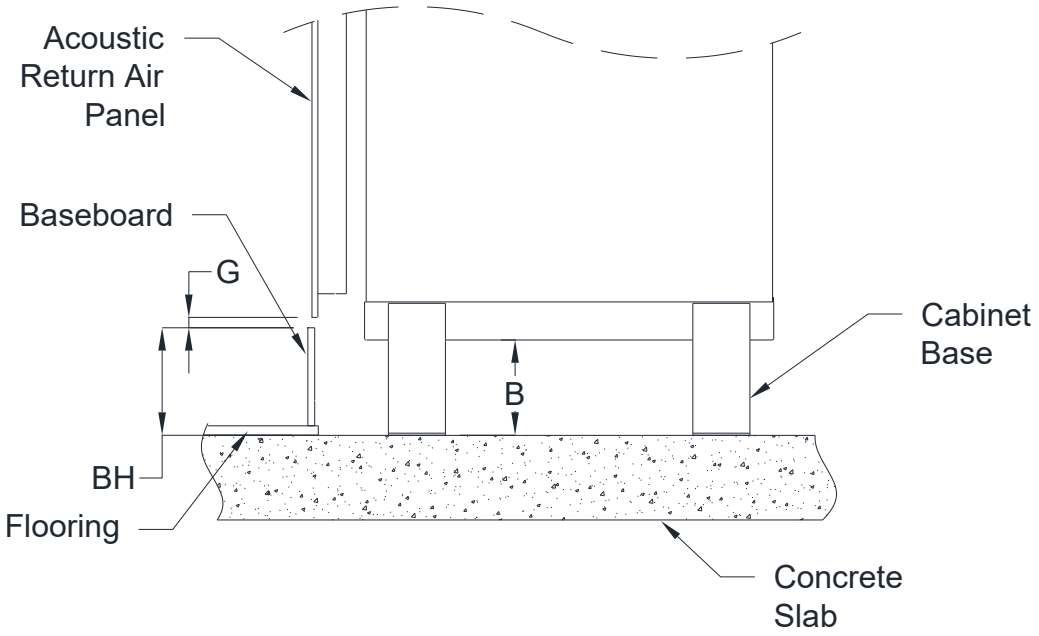
Model	Cabinet Size	Acoustic RA Panel Dimensions (inches)			
		A	B	C	D
VSHP 020	X	54	15 1/4	56 1/2	17 5/8
VSHP 030					
VSHP 040					
VSHP 050	Y	54	17 1/4	56 1/2	19 5/8
VSHP 060					
VSHP 080	Z	54	21 1/4	56 1/2	23 5/8
VSHP 100					
VSHP 120					

☐ Field Installed Baffle[1]

Notes:

1) Backside of RA Panel is insulated with 1/2 inch insulation.
2) Return air panel supplied in standard powder coat 'appliance white' finish.

5.2 Acoustic Panel Cabinet Base Height Calculation



Acoustic Panel Cabinet Base Height Calculation:

BH = Baseboard Height + Finish Floor Height*

G = Gap (min 0.5") between baseboard and panel.

B = Cabinet Base Height
(Min. 5", increases in 1" increments)

B = BH + G - 1.5"

Note: *Include flooring thickness, underlayment, and any concrete leveling as part of calculation.

Example:

If using a 5" baseboard, with 1" Finished Flooring height, and 0.5" gap:

B = (5" + 1") + (0.5") - 1.5"

B = 5"

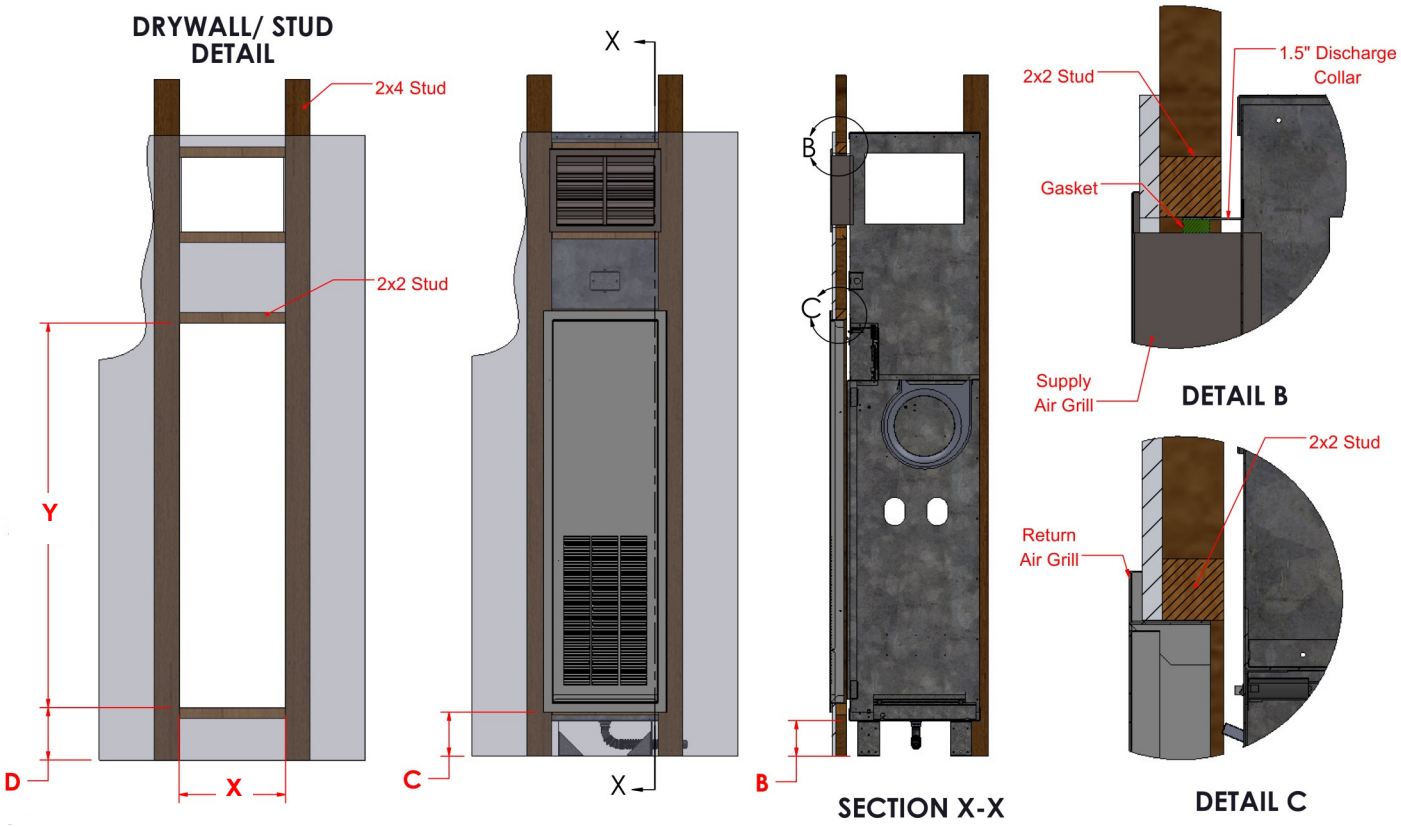
Therefore a 5" Cabinet Base is required.

Example: Baseboard to Base Height Table

Baseboard Height*	Cabinet Base Height
Up to 5"	5"
>5" to 6"	6"
>6" to 7"	7"
>7" to 8"	8"

*Includes 1" Total Flooring
*Using gap G= 0.5" (from top of baseboard to return panel flange)

5.3 Acoustic Return Air Panel Stud Furring Details



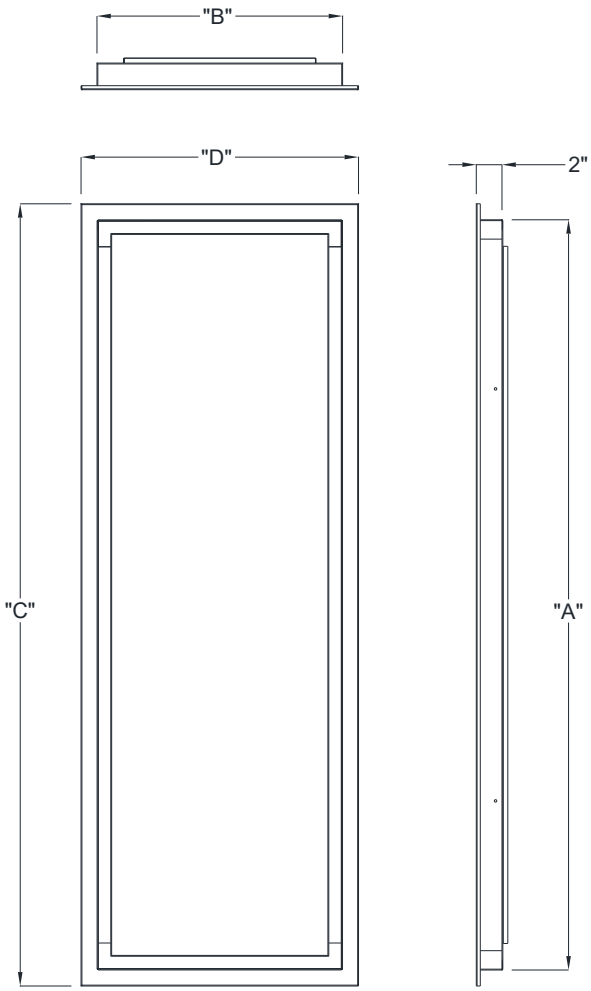
Acoustic Panel Furring Detail—Front & Side View

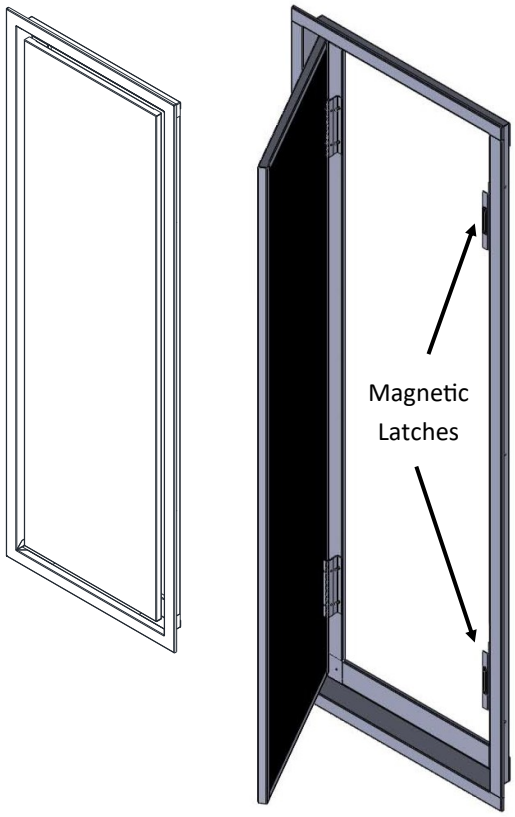
B = Cabinet Base Height (Min 5", increases in 1" increments)
C = Flange Height Above Floor (B + 1.25")
D = Rough-In Height Above Floor (B + 2.5")

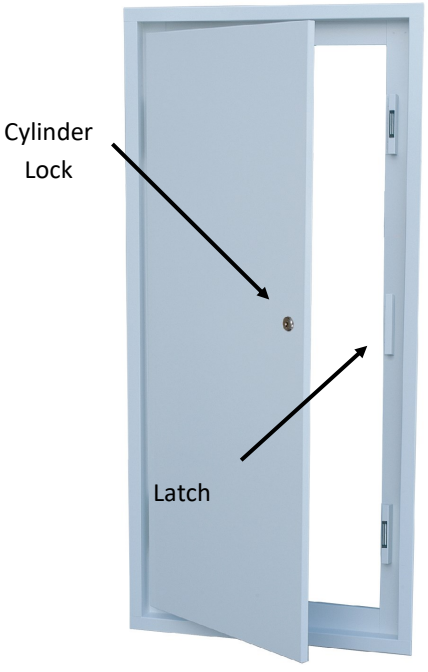
Acoustic Panel Rough-In Dimensions

Model	Cabinet Size	Cabinet Dimensions (in)		Rough-In (in)	
		W	D	"X"	"Y"
VSHP 020	X	16	17 1/2	15 3/4	54 1/2
VSHP 030					
VSHP 040					
VSHP 050	Y	18	20 1/2	17 3/4	54 1/2
VSHP 060					
VSHP 080	Z	22	24 1/2	21 3/4	54 1/2
VSHP 100					
VSHP 120					

5.4 Perimeter Return Air Panel







Perimeter Panel Sizes

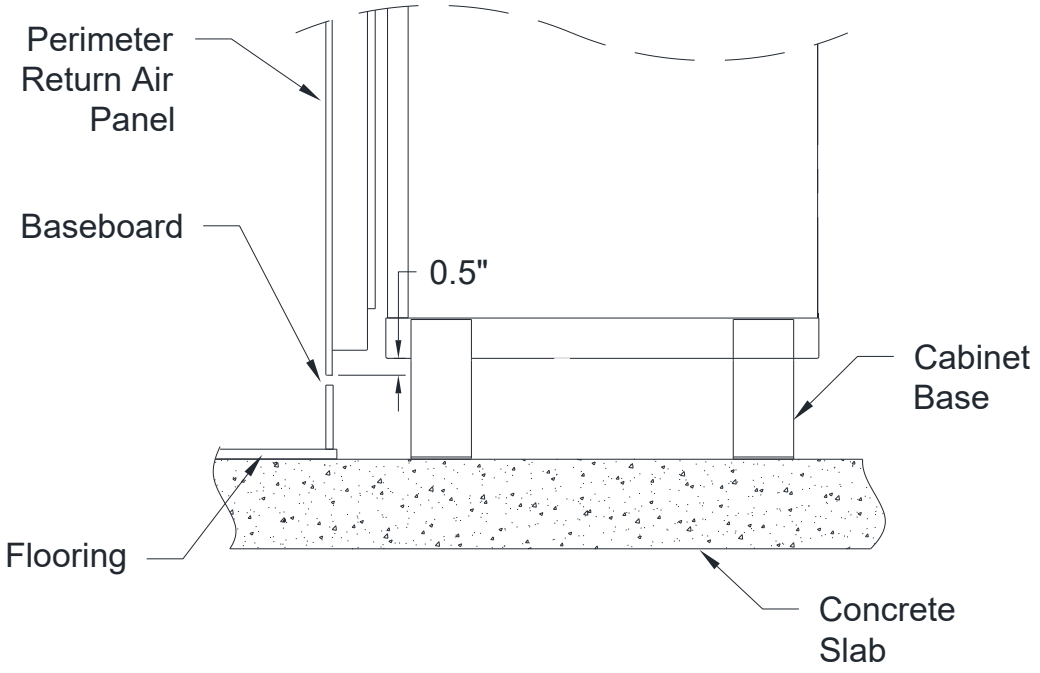
Model	Cabinet Size	Perimeter RA Panel Dimensions (inches)			
		A	B	C	D
VSHP 020	X	58 1/4	19 1/8	60 3/4	21 5/8
VSHP 030					
VSHP 040					
VSHP 050	Y	58 1/4	21 1/8	60 3/4	23 5/8
VSHP 060					
VSHP 080	Z	58 1/4	25 1/8	60 3/4	27 5/8
VSHP 100					
VSHP 120					

Notes:

- Return Panel interior is lined with 1/2 inch acoustic insulation
- Return air panel supplied in standard powder coat white finish.

☐ Optional Perimeter Locking Panel

5.5 Perimeter Panel Cabinet Base Height Calculation



Perimeter Panel Cabinet Base Height Calculation

Perimeter Panel Cabinet Base Height Calculation:

BH = Baseboard Height + Finish Floor Height*
G = Gap (min 0.5")
B = Cabinet Base Height
(Min. 5", increases in 1" increments)

B = BH + G + 0.5"

Note: *Include flooring thickness, underlayment, and any concrete leveling as part of calculation.

Example:

If using a 5" baseboard, with 1" Finished Flooring height, and 0.5" gap:

B = (5" + 1") + (0.5") + 0.5"

B = 7"

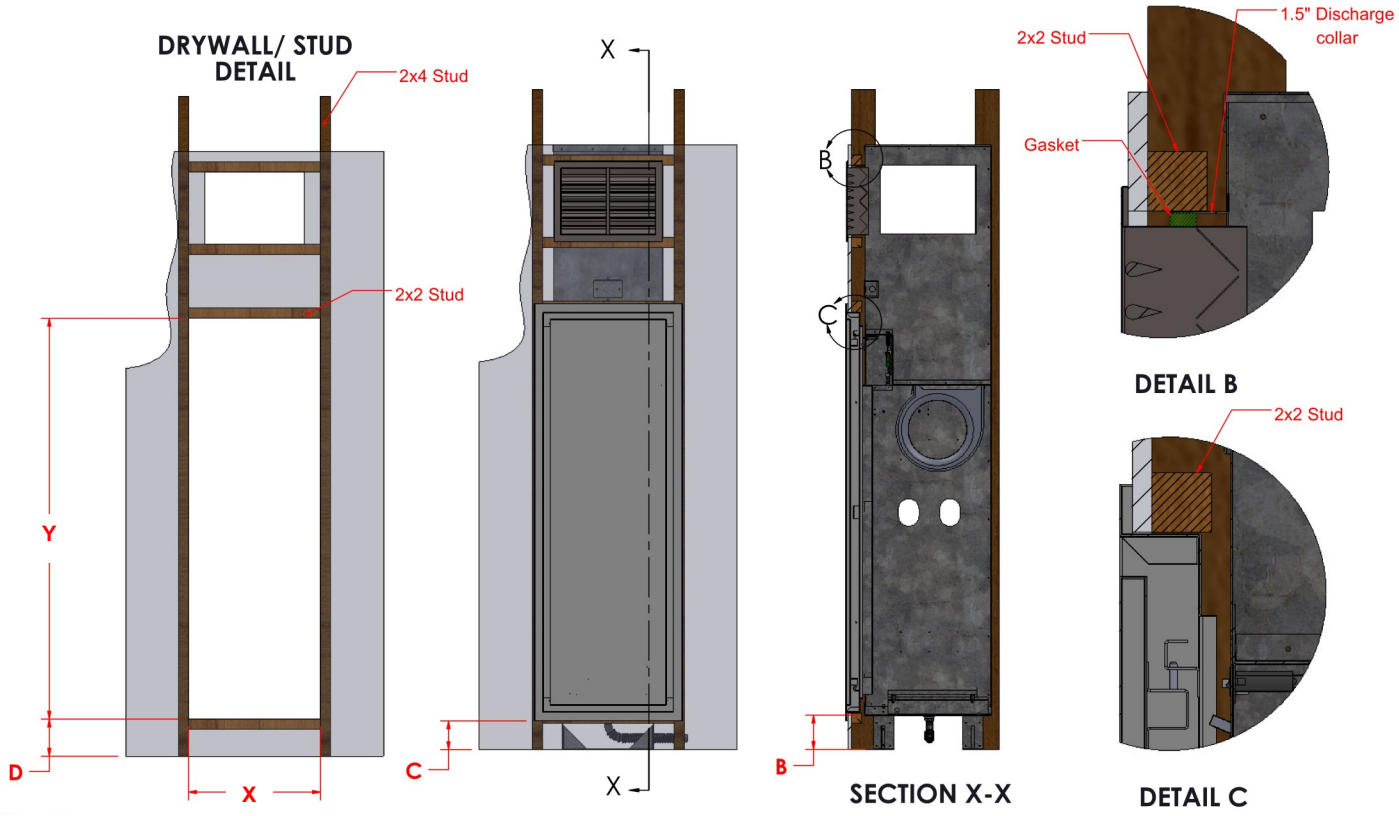
Therefore a 7" Cabinet Base is required.

Example: Baseboard to Base Height Table

Baseboard Height*	Cabinet Base Height
Up to 3"	5"
>3" to 4"	6"
>4" to 5"	7"
>5" to 6"	8"

*Includes 1" Total Flooring
*Using gap G= 0.5" (from top of baseboard to return panel flange)

5.6 Perimeter Return Air Panel Stud Furring Details

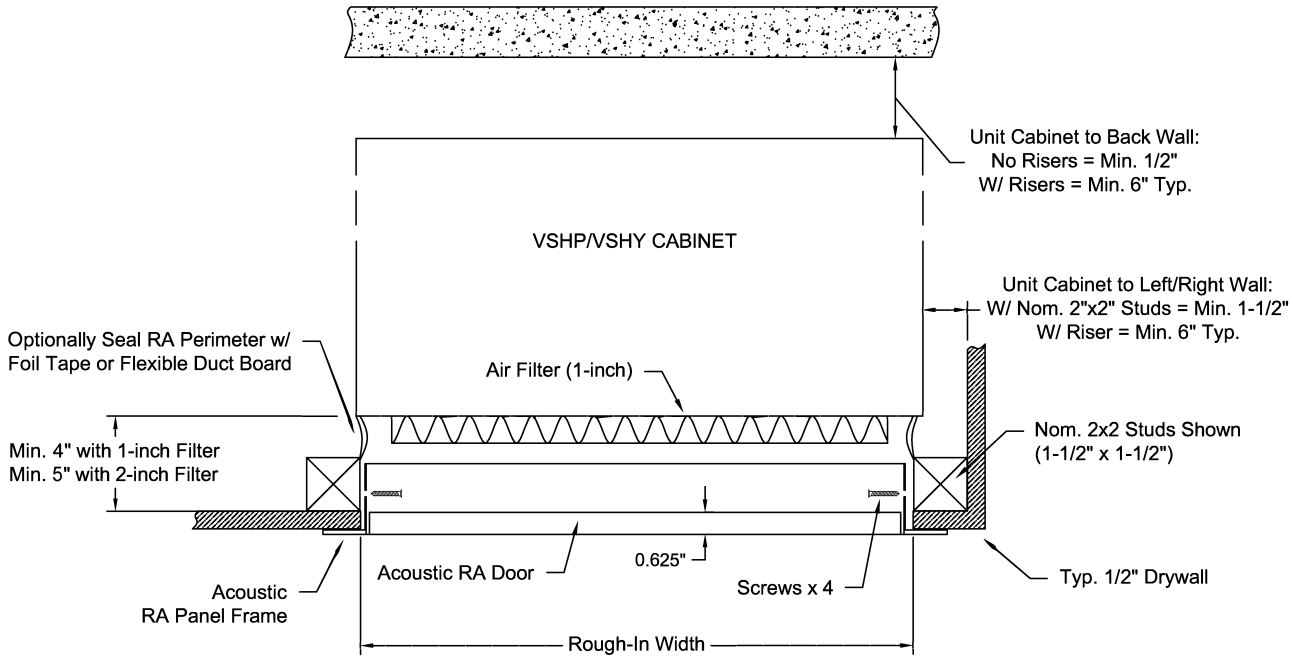


B = Cabinet Base Height (Min 5", increases in 1" increments)
C = Flange Height Above Floor (B - 0.5")
D = Rough-In Height Above Floor (B + 0.625")

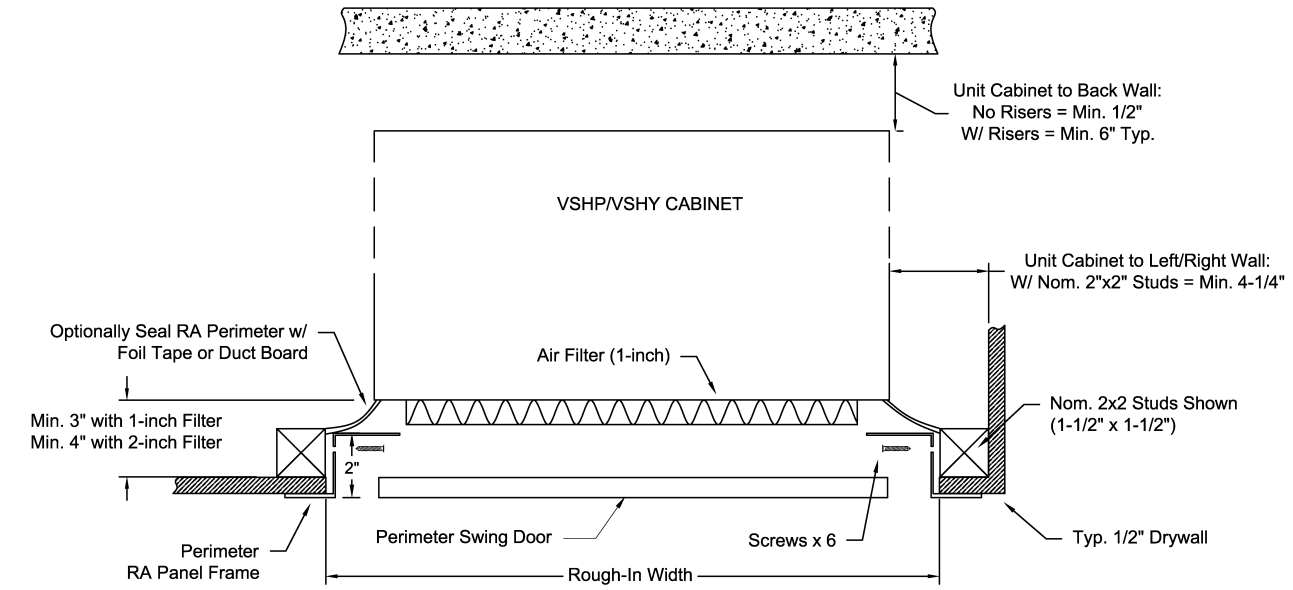
Perimeter Panel Rough-In Dimensions

Model	Cabinet Size	Cabinet Dimensions (in)		Rough-In (in)	
		W	D	"X"	"Y"
VSHP 020	X	16	17 1/2	19 1/2	58 3/4
VSHP 030					
VSHP 040					
VSHP 050	Y	18	20 1/2	21 1/2	58 3/4
VSHP 060					
VSHP 080	Z	22	24 1/2	25 1/2	58 3/4
VSHP 100					
VSHP 120					

5.7 Return Air Panel Closet Furring Details



Acoustic Panel Furring Detail—Typ. 2x2 Framing Plan View



Perimeter Panel Furring Detail—Typ. 2x2 Framing Plan View

Notes:

- Return air panel should be centered in front of the unit return air opening.
- With rear/side risers, allow for min. 6” typical clearance at the rear/side of the units.
- For additional sound attenuation insulate the closet cavity with acoustical insulation.
- Acoustic Sound Baffle not shown with Acoustic Panel. Min. clearance of 4” with 1-inch filter between unit and front of stud, as shown.

6. PERFORMANCE & ELECTRICAL DATA

6.1 VSHP (SE) Performance Data - Standard Efficiency

VSHP (SE) Performance Data

Unit Model	Refrig.	Air Flow (SCFM)		Water Flow (GPM)	WLHP Cooling[1]		WLHP Heating[1]		GLHP Cooling[2]		GLHP Heating[2]	
		Cooling	Heating		Capacity (BTUH)	EER	Capacity (BTUH)	COP	Capacity (BTUH)	EER	Capacity (BTUH)	COP
VSHP 020SE	**R-454B**	250	320	1.7	6,500	12.6	8,400	4.7	6,700	14.2	4,800	3.2
VSHP 030SE	**R-454B**	350	390	2.3	8,900	13.2	11,000	4.8	9,100	14.5	6,200	3.3
VSHP 040SE	**R-454B**	400	450	3.0	11,600	14.0	14,400	4.7	12,000	15.3	8,900	3.2
VSHP 050SE	**R-454B**	550	600	3.7	14,200	15.0	16,600	5.3	14,900	16.5	10,400	3.3
VSHP 060SE	**R-454B**	630	700	4.4	17,300	14.1	20,500	4.9	18,000	15.7	12,800	3.2
VSHP 080SE	**R-454B**	870	930	6.0	23,300	14.9	26,600	4.9	24,300	16.1	16,600	3.4
VSHP 100SE	**R-454B**	1100	1150	7.5	29,500	14.8	33,700	4.8	30,300	16.0	21,000	3.3
VSHP 120SE	**R-454B**	1200	1260	9.0	35,500	14.4	41,300	4.6	36,300	15.4	24,700	3.3

[1]Performance based on ARI/ISO 13256-1 Water Loop conditions at 86F EWT Cooling, 68F EWT Heating.
[2]Performance based on ARI/ISO 13256-1 Ground Loop conditions at 77F EWT Cooling, 32F EWT Heating.
Cooling performance shown is for 80.6F DB and 66.2F WB entering air. Heating performance shown based on 68F entering air.

VSHP (SE) Electrical Data

Model	Supply Voltage	Compressor				Blower		Total Unit FLA	MCA	MaxFuse/ Circuit Breaker
		Qty		RLA	LRA	HP	FLA			
VSHP 020SE	208-230/1/60	1	@	3.0	15.0	1/4	1.0	4.0	4.75	15
VSHP 030SE	208-230/1/60	1	@	3.7	22.0	1/4	1.1	4.8	5.73	15
VSHP 040SE	208-230/1/60	1	@	4.7	25.0	1/4	1.2	5.9	7.08	15
VSHP 050SE	208-230/1/60	1	@	5.6	29.0	1/3	2.1	7.7	9.10	15
VSHP 060SE	208-230/1/60	1	@	7.4	33.0	1/3	2.6	10.0	11.85	15
VSHP 080SE	208-230/1/60	1	@	10.9	62.9	1/2	2.4	13.3	16.03	25
VSHP 100SE	208-230/1/60	1	@	13.5	72.5	1/2	3.4	16.9	20.28	30
VSHP 120SE	208-230/1/60	1	@	15.4	83.9	1/2	3.4	18.8	22.65	35

Minimum voltage 200 V. Operating voltage 208-230 V, single phase. SCCR RATING: 5kA RMS, SYMMETRICAL, 300V MAX

VSHP (SE) Physical Data

Model Series	VSHP020SE	VSHP030SE	VSHP040SE	VSHP050SE	VSHP060SE	VSHP080SE	VSHP100SE	VSHP120SE
Nominal Cooling (Ton)[1]	0.50	0.75	1.0	1.25	1.50	2.0	2.5	3.0
Compressor-Type	High Efficiency Rotary					High Efficiency Scroll		
Water Coil-Type	High Efficiency Co-Axial							
Hose Size (in)	1/2"					3/4"		
Water Connections	1/2" NPSM					3/4" NPSM		
Total Chassis Fluid Volume (US gallons)[2]	0.13	0.15	0.22	0.25	0.27	0.58	0.61	0.63
Drain Connection Size	7/8" ID (Standard)							
Standard Blower / Motor	DWDI Forward-Curved Centrifugal / Direct-Drive							
Motor Type	ECM	ECM	ECM	ECM	ECM	ECM	ECM	ECM
Motor HP/Speeds	0.25/3	0.25/3	0.25/3	0.33/3	0.33/3	0.5/3	0.50/3	0.50/3
Standard 1" Filter MERV8	1-14x25x1			1-16x25x1		1-20x25x1		
Optional 2" Filter MERV13	1-14x25x2			1-16x25x2		1-20x25x2		
Chassis Weight (lb)	65	70	75	102	105	145	160	175
Cabinet Weight (lb)	153	153	153	158	158	223	230	230

6.2 Optional VSHP (HE) Performance Data - High Efficiency

VSHP (HE) ISO Performance Data

Unit Model	Refrig.	Air Flow (SCFM)		Water Flow (GPM)	WLHP Cooling[1]		WLHP Heating[1]		GLHP Cooling[2]		GLHP Heating[2]	
		Cooling	Heating		Capacity (BTUH)	EER	Capacity (BTUH)	COP	Capacity (BTUH)	EER	Capacity (BTUH)	COP
VSHP 020 HE	**R-454B**	200	250	1.75	7,100	13.5	8,800	5.1	7,200	15.4	5,500	3.4
VSHP 030 HE	**R-454B**	340	380	2.25	9,300	15.1	11,500	5.4	9,600	16.7	6,800	3.5
VSHP 040 HE	**R-454B**	400	450	3.2	12,000	15.5	14,500	5.3	12,300	17.2	9,000	3.5
VSHP 050 HE	**R-454B**	550	600	3.9	15,200	17.4	16,900	6.0	15,900	19.7	10,300	3.8
VSHP 060 HE	**R-454B**	630	700	4.7	17,900	15.5	20,600	5.7	18,500	17.7	13,300	3.7
VSHP 080 HE	**R-454B**	870	930	6.0	23,400	15.5	28,000	5.6	24,100	17.2	16,600	3.6
VSHP 100 HE	**R-454B**	1100	1150	7.5	29,700	15.4	34,200	5.5	30,200	17.1	20,900	3.6
VSHP 120 HE	**R-454B**	1200	1260	8.5	35,700	14.6	40,800	5.2	36,000	16.3	24,200	3.4

[1]Performance based on ARI/ISO 13256-1 Water Loop conditions at 86F EWT Cooling, 68F EWT Heating.
[2]Performance based on ARI/ISO 13256-1 Ground Loop conditions at 77F EWT Cooling, 32F EWT Heating.
Cooling performance shown is for 80.6F DB and 66.2F WB entering air. Heating performance shown based on 68F entering air.

VSHP (HE) Electrical Data (ECM Fan)

Model	Supply Voltage	Compressor				Blower		Total Unit FLA	MCA	MaxFuse/ Circuit Breaker
		Qty		RLA	LRA	HP	FLA			
VSHP 020 HE	208-230/1/60	1	@	3.0	15.0	1/4	1.0	4.0	4.75	15
VSHP 030 HE	208-230/1/60	1	@	3.7	22.0	1/4	1.1	4.8	5.73	15
VSHP 040 HE	208-230/1/60	1	@	4.7	26.0	1/4	1.2	5.9	7.08	15
VSHP 050 HE	208-230/1/60	1	@	5.5	26.0	1/3	2.1	7.6	9.10	15
VSHP 060 HE	208-230/1/60	1	@	7.0	38.0	1/3	2.6	9.6	11.85	15
VSHP 080 HE	208-230/1/60	1	@	10.9	62.9	1/2	2.4	13.3	16.03	25
VSHP 100 HE	208-230/1/60	1	@	13.5	72.5	1/2	3.4	16.9	20.28	30
VSHP 120 HE	208-230/1/60	1	@	15.4	83.9	1/2	3.4	18.8	22.65	35

Minimum voltage 200 V. Operating voltage 208-230 V, single phase. SCCR RATING: 5kA RMS, SYMMETRICAL, 300V MAX

VSHP (HE) Physical Data

Model Series	VSHP020HE	VSHP030HE	VSHP040HE	VSHP050HE	VSHP060HE	VSHP080HE	VSHP100HE	VSHP120HE
Nominal Cooling (Ton)[1]	0.50	0.75	1.0	1.25	1.50	2.0	2.5	3.0
Compressor-Type	High Efficiency Rotary					High Efficiency Scroll		
Water Coil-Type	High Efficiency Co-Axial							
Hose Size (in)	1/2"					3/4"		
Water Connections	1/2" NPSM					3/4" NPSM		
Total Chassis Fluid Volume (US gallons)[2]	0.13	0.15	0.22	0.25	0.27	0.58	0.61	0.63
Drain Connection Size	7/8" ID (Standard)							
Standard Blower / Motor	DWDI Forward-Curved Centrifugal / Direct-Drive							
Motor Type	ECM	ECM	ECM	ECM	ECM	ECM	ECM	ECM
Motor HP/Speeds	0.25/3	0.25/3	0.25/3	0.33/3	0.33/3	0.5/3	0.50/3	0.50/3
Standard 1" Filter MERV8	1-14x25x1			1-16x30x1		1-20x30x1		
Optional 2" Filter MERV13	1-14x25x2			1-16x30x2		1-20x30x2		
Chassis Weight (lb)	65	72	77	105	110	150	165	175
Cabinet Weight (lb)	153	153	153	158	158	223	230	230

1) Nominal Capacity calculated in accordance with ARI / ISO Standard 13256-1 for Water Loop Application.
2) Fluid volume includes chassis and hose sets.

6.3 EC Motor (ECM) Fan Data

Model	EC Motor Speed	Min. SCFM	Rated SCFM	External Static Pressure (in w.g.)												
				0	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6
				SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM	SCFM
020	WHISPER* MODE	N/A	N/A	110	100	95	85	75	70	60	55	40	30	-	-	-
	LOW	150	200	240	230	215	200	190	175	145	-	-	-	-	-	-
	MED			-	-	255	240	225	215	200	190	175	165	150	-	-
	HIGH			-	-	-	-	260	240	230	220	210	195	185	175	165
030	WHISPER* MODE	N/A	N/A	170	160	145	130	120	110	100	85	75	65	55	-	-
	LOW	220	350	315	305	295	285	275	265	250	240	225	-	-	-	-
	MED			350	340	335	325	315	305	295	285	275	265	255	245	235
	HIGH			-	-	365	355	350	340	330	320	310	305	295	285	275
040	WHISPER* MODE	N/A	N/A	190	175	170	155	135	120	110	95	85	70	75	-	-
	LOW	300	460	410	400	390	380	370	365	350	340	330	325	310	300	-
	MED			460	450	445	440	430	425	415	405	395	385	375	365	355
	HIGH			-	-	-	-	470	465	455	445	435	430	420	410	400
050	WHISPER* MODE	N/A	N/A	340	325	310	295	280	265	240	225	205	190	165	-	-
	LOW	375	530	520	510	490	470	450	430	410	390	375	-	-	-	-
	MED			-	-	550	540	520	505	485	470	450	430	410	390	375
	HIGH			-	-	-	-	-	-	555	540	525	510	490	475	460
060	WHISPER* MODE	N/A	N/A	340	325	310	295	280	265	240	225	205	190	165	-	-
	LOW	450	630	580	565	550	540	520	505	485	470	450	-	-	-	-
	MED			640	620	610	595	580	565	555	540	525	510	490	475	460
	HIGH			-	-	675	670	655	650	640	620	610	595	580	565	550
080	WHISPER* MODE	N/A	N/A	465	435	420	390	360	330	310	285	255	225	195	-	-
	LOW	600	820	800	760	740	720	695	660	640	620	-	-	-	-	-
	MED			880	860	840	820	800	780	750	720	700	670	650	625	600
	HIGH			-	-	-	-	895	880	860	820	805	795	780	770	760
100	WHISPER* MODE	N/A	N/A	465	435	420	390	360	330	310	285	255	225	195	-	-
	LOW	750	1010	960	940	920	890	860	840	820	800	775	750	-	-	-
	MED			1080	1060	1040	1010	990	970	950	930	900	880	860	840	820
	HIGH			-	-	-	-	1110	1090	1070	1060	1040	1020	990	980	960
120	WHISPER* MODE	N/A	N/A	465	435	420	390	360	330	310	285	255	225	195	-	-
	LOW	900	1200	1120	1100	1090	1070	1050	1025	1010	990	970	940	920	-	-
	MED			1230	1200	1185	1170	1150	1130	1110	1095	1080	1055	1040	1020	1000
	HIGH			1320	1290	1275	1260	1240	1225	1205	1190	1175	1160	1140	1120	1100

Note: All airflow ratings are taken at lowest voltage rating of dual rating (ie. 208 volt).
Airflow ratings include resistance of dry coil, Return Air panel and clean MERV10 air filters.
*Optional “Whisper” mode is Fan On, Compressor Off mode for constant fresh air circulation.
Due to a policy of continuous improvement, data is subject to change without notice.

7. CORRECTION FACTORS & DESIGN LIMITS

7.1 Correction Factor Tables

Entering Air Correction Factors for Cooling Performance											
EAT Wet Bulb (°F)	COOLING										
	Total Cooling Capacity (BTUh)	Watts (W)	THR (BTUh)	Sensible Cooling (BTUh) @ EAT Dry Bulb (°F)							
				65	70	75	80	80.6	85	90	95
55	0.770	0.989	0.878	0.838	1.038	S	S	S	S	S	S
60	0.873	0.995	0.924	0.609	0.842	1.053	1.247	1.283	S	S	S
65	0.976	0.998	0.984		0.636	0.844	1.054	1.085	1.260	S	S
66.2	1.000	1.000	1.000		0.590	0.798	1.008	1.000	1.215	1.477	S
67	1.016	1.000	1.013		0.553	0.762	0.971	1.010	1.177	1.365	S
70	1.077	1.003	1.058			0.639	0.845	0.883	1.051	1.257	1.440
75	1.180	1.006	1.145				0.639	0.680	0.839	1.039	1.252

S = Sensible Cooling capacity is equal to Total cooling at conditions shown
The cooling capacity based on 80.6ºF DB and 66.2ºF WB entering air.

Actual = Catalog Data x Correction Factor (CF)

EAT- Entering Air Temperature
EWT - Entering Water Temperature
DB - Dry Bulb
WB - Wet Bulb
THR - Total Heat of Rejection
THA - Total Heat of Absorption

Entering Air Correction Factors for Heating Performance			
EAT Dry Bulb (°F)	HEATING		
	Total Heating Capacity (BTUh)	Watts (W)	THA (BTUh)
45	1.077	0.768	1.155
50	1.061	0.818	1.123
55	1.044	0.868	1.088
60	1.027	0.918	1.055
65	1.010	0.968	1.021
68	1.000	1.000	1.000
70	0.993	1.023	0.987
75	0.978	1.071	0.955
80	0.958	1.124	0.915

The heating capacity based on 68ºF DB entering air.

Entering air correction factors table is used to correct the catalog values if the desired EAT is outside of rated EAT. Calculate desired EAT based on the "EAT Wet Bulb" and “EAT Dry Bulb” columns. Multiply the catalog results by the value corresponding to the design EAT and the desired output.

7.1 Correction Factor Tables (Cont'd)

Airflow Correction Factors							
Airflow	COOLING				HEATING		
% Rated CFM	Total Cooling (BTUh)	Sensible Cooling (BTUh)	Watts (W)	THR (BTUh)	Total Heating (BTUh)	Watts (W)	THA (BTUh)
70	0.93	0.82	0.97	0.94	0.94	1.08	0.93
75	0.94	0.85	0.98	0.95	0.95	1.06	0.94
80	0.95	0.88	0.98	0.96	0.96	1.05	0.96
85	0.97	0.91	0.99	0.97	0.97	1.03	0.97
90	0.98	0.94	0.99	0.98	0.98	1.02	0.98
95	0.99	0.97	1.00	0.99	0.99	1.01	0.99
100	1.00	1.00	1.00	1.00	1.00	1.00	1.00
105	1.01	1.03	1.00	1.01	1.01	0.99	1.01
110	1.02	1.06	1.01	1.02	1.02	0.98	1.02
115	1.03	1.09	1.01	1.03	1.02	0.98	1.03

Airflow correction factor table is used to correct the catalog values if the desired CFM is outside of rated CFM. Calculate desired CFM based on the "% Rated CFM" column. Multiply the catalog results by the value corresponding to the desired % Rated CFM and the desired output.

Antifreeze Correction Factors						
Glycol Type	% Glycol	COOLING			HEATING	
		Total Cooling (BTUh)	Sensible Cooling (BTUh)	Watts (W)	Total Heating (BTUh)	Watts (W)
Ethylene Glycol (E.G.)	0	1.000	1.000	1.000	1.000	1.000
	10	0.996	0.997	1.001	0.990	0.996
	20	0.991	0.992	1.004	0.980	0.992
	30	0.987	0.985	1.009	0.971	0.988
	40	0.982	0.976	1.016	0.961	0.984
	50	0.976	0.965	1.025	0.952	0.980
Propylene Glycol (P.G.)	0	1.000	1.000	1.000	1.000	1.000
	10	0.991	0.991	1.007	0.984	0.993
	20	0.983	0.982	1.012	0.968	0.986
	30	0.975	0.975	1.017	0.953	0.979
	40	0.968	0.968	1.020	0.938	0.972
	50	0.961	0.963	1.023	0.923	0.965

Antifreeze correction factor table is used to correct the catalog values if glycol is being utilized. Calculate the required "% Glycol". Based on desired glycol type. Multiply the catalog results by the value corresponding to the desired glycol type and glycol ratio.

7.2 Design Limits

Air Limits	Cooling		Heating
	DB	WB	DB
Std. Entering Air Temperature (EAT)	75°F	63°F	68°F
Min. Entering Air Temperature (EAT)	65°F	55°F	50°F
Max. Entering Air Temperature (EAT)	85°F	71°F	80°F

Fluid Limits	Standard Range		Low Temp Water Range		Geothermal Range	
	Cooling	Heating	Cooling	Heating	Cooling	Heating
Std. Entering Fluid Temperature (EFT)	85°F	70°F	85°F	55°F	85°F	35 - 50°F
Min. Entering Fluid Temperature (EFT)	50°F	60°F	50°F	50°F	30°F	20°F
Max. Entering Fluid Temperature (EFT)	110°F	90°F	110°F	90°F	110°F	90°F
Min. GPM/Ton	1.5		2.25		2.25	
Design GPM/Ton	3		3		3	
Max. GPM/Ton	4		4		4	

CFM Limits	
Min. CFM/Ton	300
Design CFM/Ton	400
Max. CFM/Ton	450

CAUTION

Design limits can not be combined. Combining maximum or minimum limits is not allowed. This could exceed the operation and design limits of the unit.

For example: It is not allowed to combine maximum entering air temperature (EAT) limits with maximum entering fluid temperature (EFT) limits.

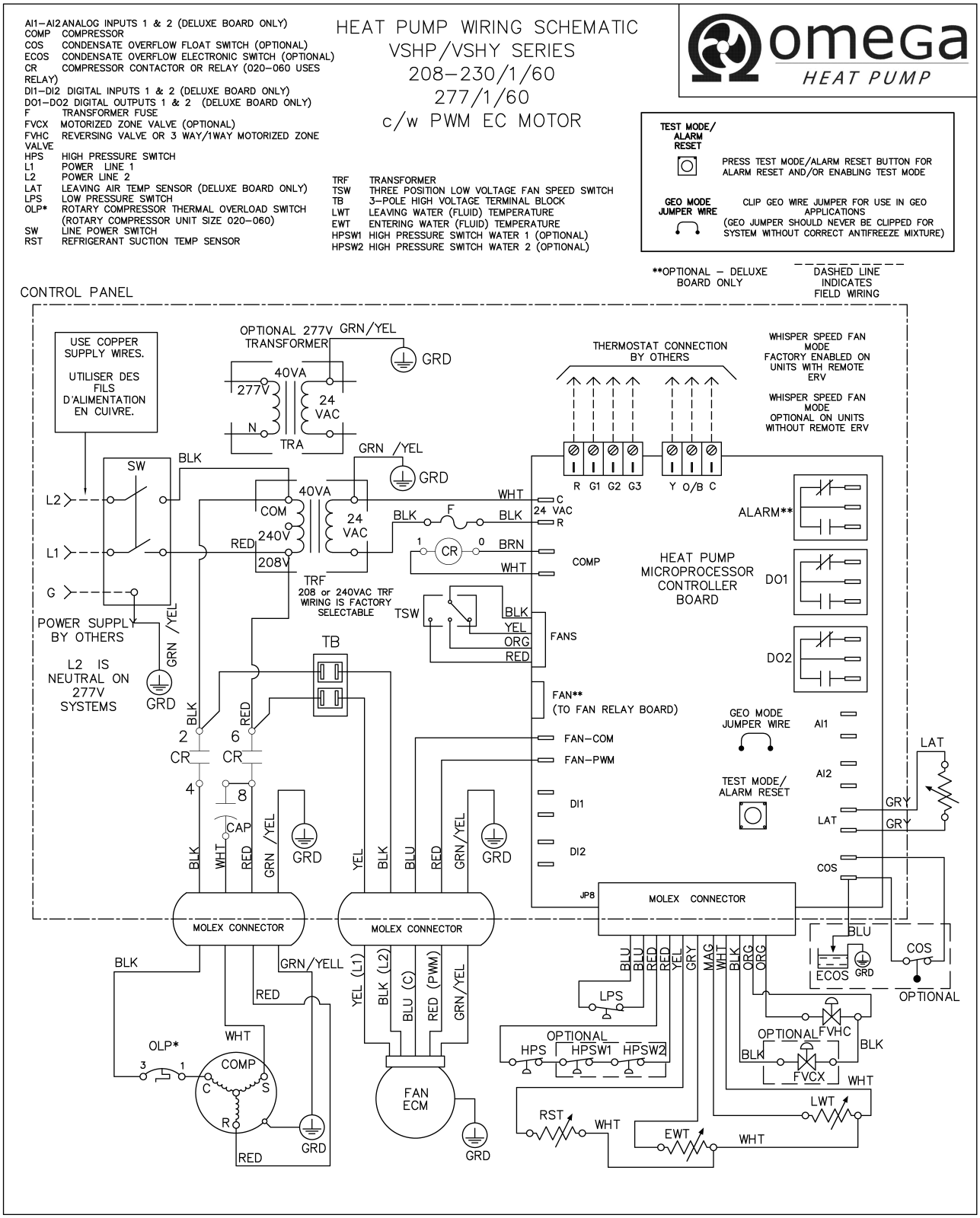
7.3 Antifreeze Percentages

ANTIFREEZE PERCENTAGE (by Volume)	Mininum Leaving Water Temperature F (°C)		
	25 F (-4°C)	30 F (-1°C)	35 F (1.5°C)
	Protects Fluid To:		
	10 F (-12°C)	15 F (-9°C)	20 F (-6.5°C)
Methanol	25%	22%	17%
Propylene Glycol	39%	25%	22%

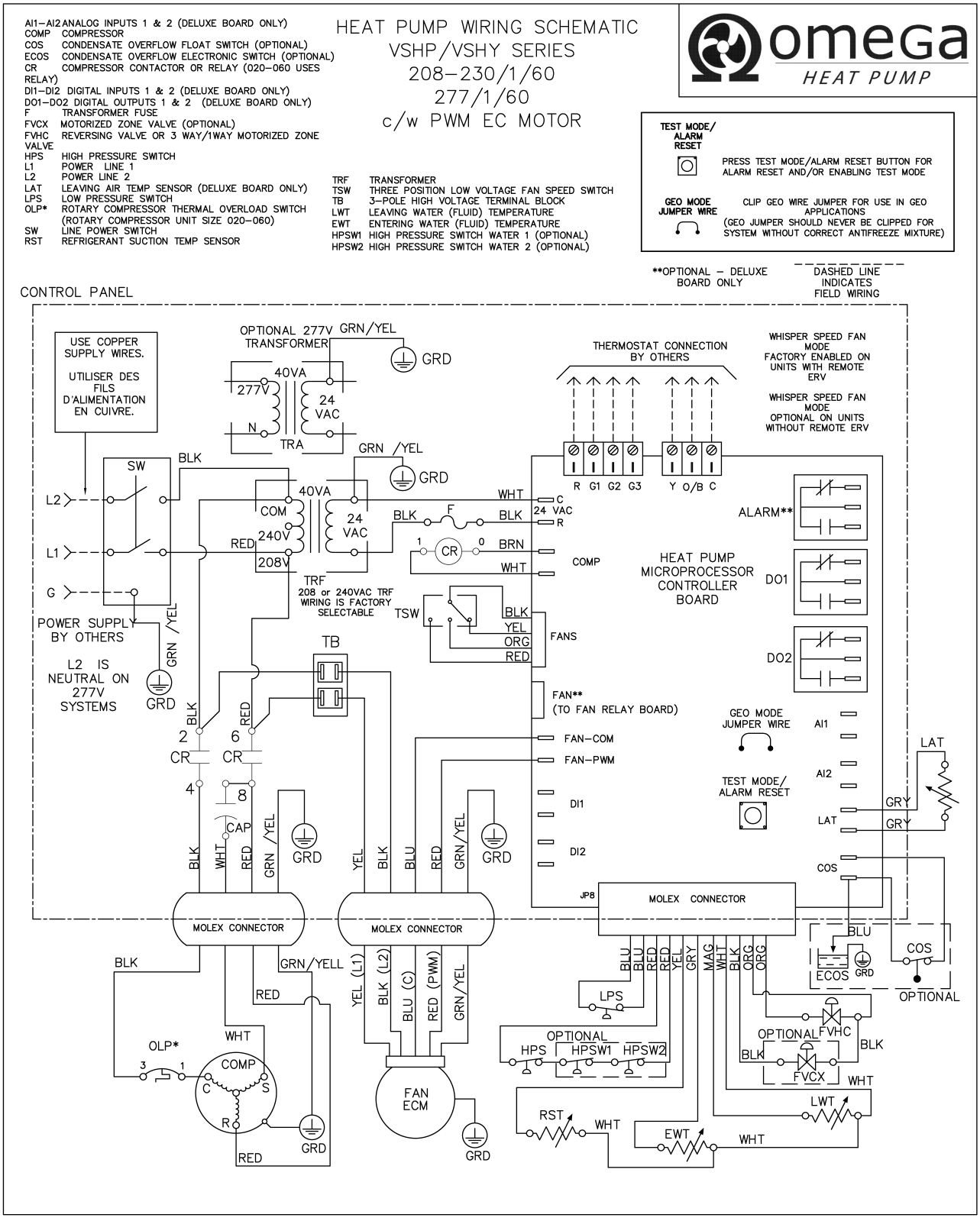
Note: Minimum glycol concentration of 20% is recommended.

8. ELECTRICAL SCHEMATICS & CONTROL WIRING

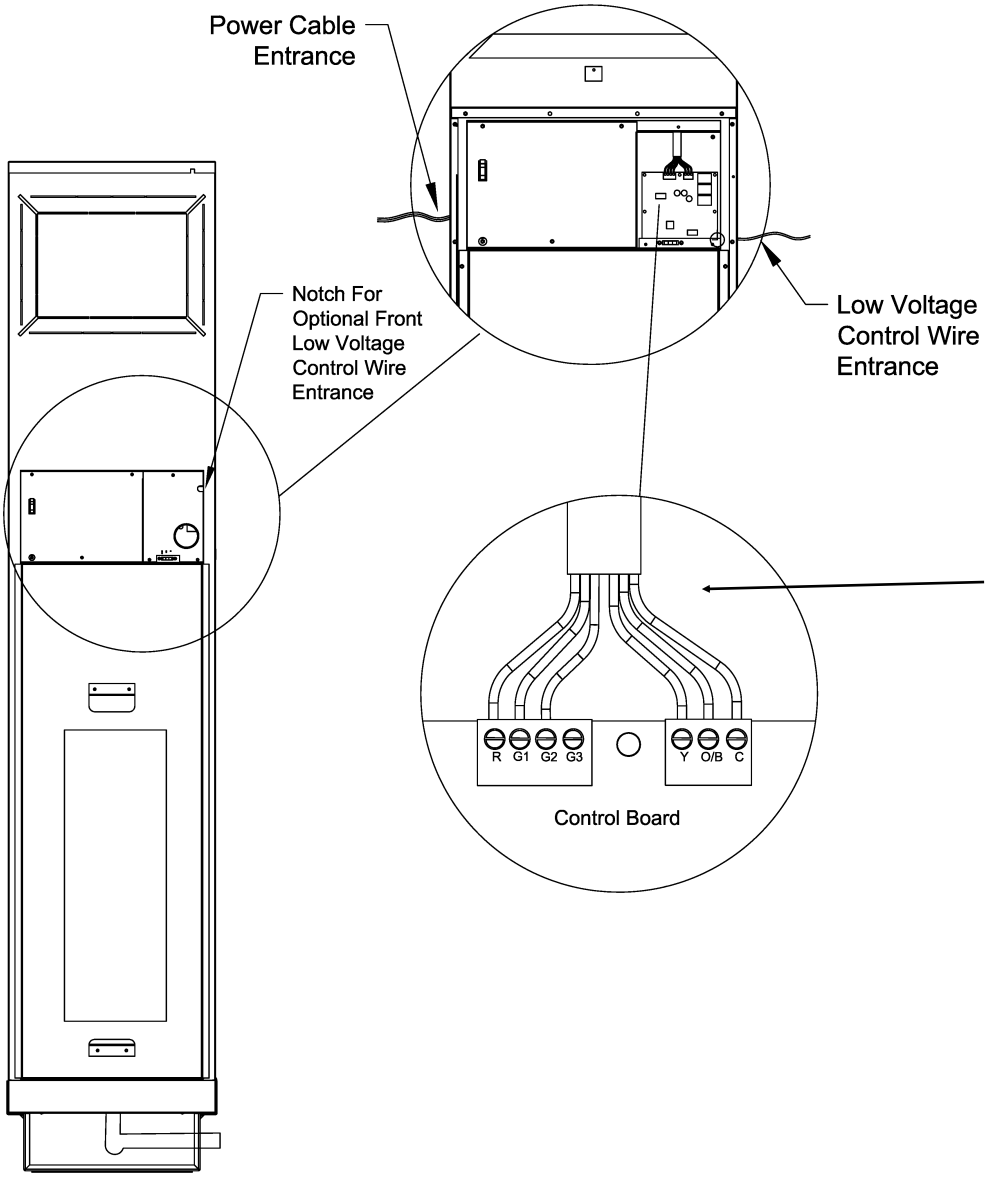
8.1 VSHP - ELECTRICAL SCHEMATIC - ECM Fan



8.2 VSHP - ELECTRICAL SCHEMATIC - ECM Fan with Optional SmartOne® Communication



8.3 Thermostat Wiring Details



Heat Pump Thermostat:
R = 24VAC
G1 = Low Fan Speed
G2 = Medium Fan Speed
G3 = High Fan Speed
Y = Compressor On
O/B = Reversing Valve
C = Common

Heat/Cool Thermostat:
R = 24VAC
G1 = Low Fan Speed
G2 = Medium Fan Speed
G3 = High Fan Speed
Y = Cooling
O/B = Heating
C = Common

Note: Thermostats may require a field installed jumper at the thermostat base to work in heat pump mode and/or field programming. Verify procedure in thermostat manual.

9. MECHANICAL SPECIFICATIONS

1 GENERAL

Vertical stacked heat pump units shall be Omega VSHP Series. Units shall provide scheduled capacities at the ampacity and voltage shown on the drawings. Specified airflow shall be at the scheduled external static pressure and shall include the effects of a wet coil and clean filter.

Each unit shall be factory tested and ship factory-charged with R-454B refrigerant. All units from 3/4 to 3 Tons shall be tested and certified to ASHRAE/ANSI/AHRI/ ISO 13256-1, UL60335-2-40, and ETL listed for United States and Canada. Each unit shall have factory affixed label showing ASHRAE/ANSI/AHRI/ISO and ETL logos. Cabinets and refrigeration chassis shall be factory wired and pre-piped.

2 CABINET

2.1 The vertical stacked heat pump units shall be **Omega VSHP Series**. Units shall provide scheduled capacities at the ampacity and voltage specified.

2.2 The cabinet shall be 20-gauge galvanized steel with riveted internal components for rigidity. Cabinet shall have internal surfaces insulated with 1 inch thick, 3.5 lbs. high-density, mold resistant, thermal and acoustic insulation. Insulation shall meet NFPA 90, UL-181, and ASTM-C1071 standards and insulation shall have a flame spread of less than 25, and a smoke developed classification of less than 50 per ASTM E-84 and UL 723.

2.3 Physical dimensions of each unit shall be accommodated within furring / ceiling-slab spaces provided as shown on the architectural drawings

2.4 (**Optional** GOLD Series) The cabinet shall be sectionalized using a factory installed canvas duct collar for acoustic and installation purposes. The lower section shall include the risers, blower and fan motor assembly, all controls, and removable refrigeration chassis. The upper section shall be an acoustic discharge plenum lined with 1 inch thick, 3.5 lbs. high-density, mold resistant, thermal and acoustic insulation. Final cabinet height shall be coordinated with the installing contractor and architect. The discharge plenum shall be designed to be fastened to the underside of the concrete slab with field cut ”Knockout” discharge openings. Rigid connections will not be accepted. A factory supplied flexible canvas connection shall be provided between the upper and lower sections. Heat pump manufacturer shall factory attach flexible connection to the plenum section.

2.5 Provide a minimum 5” (optional 6” to 12”) high stand factory installed to the bottom of the sheet metal cabinet to elevate the unit 5” above the floor.

2.6 A removable inner chassis service panel allowing service access to the fan and compressor compartment shall be provided with each unit.

2.7 The drain pan shall be minimum 18-gauge stainless steel. The drain pan shall have optional condensate overflow switch. The drain pan outlet shall be readily accessible for cleaning with a 7/8 inch OD copper drain connection. Unit shall be provided with a flexible p-trap condensate hose for connection to the condensate riser. Drain pan shall be removable to allow for access and inspection of p-trap and drain connection to riser.

2.8 Factory installed supply and return risers shall be (Type L) (Type M) copper, with (factory) (field) mounted shut-off ball valves on each supply and return riser. Valves shall be brass and rated for 400 psig. A (Type L) (Type M) condensate riser shall be (factory) (field) installed. Risers sizes shall be installed according to building plans.

2.7 Risers shall have a (field) (factory) provided 3-inch deep swage. Transition pieces & expansion joints shall be field supplied.

2.8 Unit cabinet shall come with supply discharge opening “knockouts”. An optional noise attenuating insulated privacy air baffle (LOSB) shall be provided, if available, for horizontal supply discharge openings. All cabinet discharge openings shall include 1-1/2 inch drywall flange around the full opening perimeter.

2.9 Supply ducts shall not be rigidly attached to the cabinet and shall be acoustically isolated from cabinet using flexible canvas connections. Contractor shall install flex connection on all discharge openings. There shall be no rigid connection to supply-air discharge grilles or supply ducts except on Gold Series units designed with split casing.

2.10 Each unit shall have an (Acoustic) (Perimeter) return air panel. The panels shall be insulated with 1/2 inch thick, lined fiberglass insulation. The panel shall be easily removable without tools to allow access to the filter, chassis compartment and service disconnect switch.

2.11 A field installed Return Air Baffle shall be provided with each Acoustic RA Panels for enhanced sound attenuation. Return Air Baffle contains 1/2” thick sound insulation. Installing contractor shall ensure there are adequate clearances when framing closet opening.

2.12 **(Optional)** Provide optional line of site baffles (LOSB) on all units with multiple horizontal unit outlets.

2.13 (**Optional)** Unit shall have an optional Fresh Outside Air Duct intake located at the top of the unit for introducing fresh outside air into the unit.

2.14 (**Optional)** Each unit shall be (field) (factory) supplied with double deflection supply grilles as shown on the plans. (Field) (Factory) provide opposed blade balancing dampers on units with multiple outlets as indicated on the plans.

2.15 (**Optional)** Unit shall have an optional 2-inch filter rack with MERV 13 rated pleated filter.

2.16 (**Optional)** Perimeter Return Air Panels shall have provision for a unit mounted thermostat to meet ADA requirements. Thermostat cable shall use a molex plug connector.

2.17 The drain pan shall come standard with an electronic condensate overflow switch to stop compressor operation if water is detected.

3 FAN & BLOWER

3.1 Each unit shall include a factory mounted forward curved, double inlet double width centrifugal direct drive fan and motor assembly with internal overload protection. The blower fan assembly shall be positioned horizontally from a sheet metal blower deck. Single inlet fans are not accepted.

3.2 Units shall be supplied with an ECM fan motor as standard. Fan motors speeds shall be field selectable by wiring thermostat to required fan speed terminals.

4 REFRIGERATION CHASSIS

9. MECHANICAL SPECIFICATIONS (CONT'D)

4.1. Provide high temperature and pressure rated water hoses for connection of the risers to the chassis. The hoses supplied shall be constructed with an inner core of rubber, a stainless-steel metal braid, and rubber outer covering. Fittings shall be brass construction. Hoses shall carry a pressure rating of 600 psig.

4.2. The compressor chassis shall be mounted and vibrationally isolated on 12-gauge slide rails using a double isolated base. Compressor shall have an acoustical enclosure ensuring compressor noise is isolated from air stream. Plug type electrical connections are provided for chassis control and power connections allowing for easy removal of the chassis from the front of the cabinet.

4.3 The refrigeration circuit shall have two service valves, for measuring high and low refrigerant pressure, in the chassis compartment enclosure. The refrigerant circuit shall contain a thermal expansion valve (TXV) refrigerant metering device, high and low safety pressure switches, a suction line freeze sensor, entering and leaving water temperature sensors, and a reversing valve.

4.4 Compressor shall be hermetically sealed type and protected with either compressor overload or internal thermal overload protection. Compressor shall be mounted on rubber vibration isolators.

4.5 Air side coils shall have copper tubes mechanically bonded to aluminum fins. Coil shall be sized to meet scheduled performance for cooling and heating. Provide 1" T/A filter on coil face.

4.6 Water side condenser heat exchanger shall be coaxial type with steel outer tube and copper inner tube. Condenser shall be rated at 500 psig water side and 650 psig refrigerant side.

4.7 (**Optional**) High-efficiency chassis shall be provided to meet higher operating efficiency requirements.

4.8 (**Optional**) The chassis shall employ an optional motorized auto shut-off valve to shut off water to the unit when compressor is not running. Valve shall be mounted in the chassis compartment.

4.9 (**Optional**) The chassis shall employ optional autoflow balancing valve mounted in the chassis compartment to maintain specified unit water flow rate over 2-80 psig differential water pressure. Auto flow balancing valve shall be field serviceable.

4.10 (**Optional**) Optional 20 mesh y-strainer shall be installed on the water circuit inside the high efficiency chassis. High Efficiency Chassis Only. On Standard efficiency chassis, y-strainer shall be field installed on the hose kit or at the supply riser shut-off valve.

4.11 (**Optional**) Low Temp Water option: The chassis shall be factory supplied with the High Water Pressure safety switch (LTW) kit. The chassis shall come with high water pressure safety switches factory installed on the water circuit inlet and outlet pipes. In case of freezing or ice formation where hydrostatic pressure increases above 450 psig in the water circuit , compressor operation will be cut-out. The LTW option is recommended on applications where water loops are between 50°F and 60°F in heating mode and do not contain any glycol freeze protection.

4.12 (**Optional**) Geothermal option: The chassis shall be factory supplied with a geothermal kit. The geothermal option includes geothermal rated low-pressure switch, insulated coaxial and insulated water piping. Geothermal option must only be used on loop systems with glycol freeze protection added to the riser loop. Geothermal is required on water loops below 50°F in heating mode.

4.13 **(Optional)** Air coil shall be epoxy coated to aid in the prevention of premature corrosion (formicary, environmental) with minimum 1000 hour salt spray ASTM B117 protection.

4.14 (**Optional**) Optional cupro-nickel coaxial coil shall be provided in lieu of standard copper coaxial for protection from loop water corrosion and fouling and with use in open loop systems.

4.15 (**Optional**) Energize to Heating reversing valve. Reversing valve shall be in cooling on default. On call for Heating reversing valve will energize.

5 CONTROLS

5.1 Each unit shall be factory wired with all necessary controls. Each unit shall come standard with a microprocessor controller mounted in the electrical box. Electrical box shall contain compressor and fan motor contactor, 24 volt control power transformer, terminal block for low voltage field wiring connection, and terminal block for main power electrical connection, unit mounted service disconnect switch.

5.2 The operating and safety controls shall be monitored by the microprocessor controller. Sensor parameters and timers shall be field adjustable to meet site conditions. Controller shall have the following safety switches and sensors:

- Low Pressure Safety Switch
- High Pressure Safety Switch
- Condensate Overflow Switch
- (**Optional**) Entering Water Temperature sensor
- (**Optional**) Leaving Water Temperature sensor
- (**Optional**) High Water Pressure Switches
- Suction line "freeze-stat" temperature sensor
- (**Optional**) Supply Air Temperature sensor
- Compressor Anti-Short Cycle timer
- Water Valve Open and Closed timer
- Low-pressure bypass timer
- Random wait time on unit power up
- Fan-On and Fan-Off timer

5.3 Standard Basic control board shall have High Pressure, Low Pressure, Suction Line (Refrigerant Suction Temperature) sensor alarming capability. Motor speeds can be field programmed when necessary to meet site specific conditions.

5.4 **(Optional)** Deluxe Microprocessor controller shall have embedded webpage diagnostic capability for status updates, quick servicing and troubleshooting on site. Controller shall have data logging with stored alarm states, supply and leaving water temperature, suction line temperature, and supply air temperature readings. Access to controller status and data log shall be available through a smart phone device, tablet or laptop.

5.5 Microprocessor controller shall have 'future proof' feature to accept software updates. Microprocessor board shall be capable of being field updated with newer software patches or custom software as needed.

5.6 Thermostats shall be remote mounted. Thermostats can be

9. MECHANICAL SPECIFICATIONS (CONT'D)

either Heat/Cool or Heat Pump type. Thermostat shall provide 24V signal to G (fan) terminal during a call for cooling or heating.

5.7 Unit shall provide 3 fan speeds . Fan speeds are field selectable for Low, Medium or High fan speed.

5.8 ECM speed settings are field configurable using to meet site CFM and static requirements.

5.9 (**Optional)** Fan operation shall have a low fan speed "whisper mode" for air circulation when there is no call for compressor to circulate Outdoor Fresh Air.

5.10 (**Optional)** SmartOne® compatible RS-485 communication add-on board and remote temperature sensor shall be provide for integration with SmartOne® building systems.

6 TESTING & WARRANTY

6.1 Each chassis unit shall be factory tested using a multi-step computer controlled testing equipment to prevent operator error during factory testing.

6.2 Warranty shall be for parts, 1 year not to exceed 18 months from date of shipment. (Optional) Provide 5-year compressor replacement parts warranty only.

7 EXECUTION

7.1 Units shall be installed neat and level on neoprene vibration isolation pads, supplied by heat pump manufacturer, and secured to floor.

7.2 Flush the system per manufacturer instructions before connecting chassis. Contractor shall join supply and return riser flexible hoses together, at the top/bottom on every riser and at the farthest point from the pump for flushing purposes.

7.3 Installing contractor shall install risers and install riser transition piece connections where riser sizes change.

7.4 The hoses shall be installed in the field by the contractor. The flare fittings on the hoses shall be connected according to industry standard (Finger tighten then tighten with wrench while always using back-up wrench).

7.5 Flush the system per manufacturer instructions before connecting chassis. The riser system shall be flushed, cleaned and commissioned before connecting chassis units to the riser system.

7.6 Contractor shall provide duct and grille canvas connections on all single piece units.

7.7 Start-up of units shall be supervised by trained representatives of the equipment manufacturer.

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