Installation, Operation, and Maintenance

Water Source Heat Pump
Axiom™ Variable Speed - VSH/VSV

24 to 60 MBtuh - 60 Hz

Model Numbers:
VSHK024-060
VSVK024-060

⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

December 2025

WSHP-SVX024B-EN

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury.

Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/ sleeves, butyl gloves, safety glasses, hard hat/ bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠ WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

⚠ WARNING

R-454B Flammable A2L Refrigerant!

Failure to use proper equipment or components as described below could result in equipment failure, and possibly fire, which could result in death, serious injury, or equipment damage.

The equipment described in this manual uses R-454B refrigerant which is flammable (A2L). Use ONLY R-454B rated service equipment and components. For specific handling concerns with R-454B, contact your local representative.

⚠ WARNING

Cancer and Reproductive Harm!

This product can expose you to chemicals including lead and bisphenol A (BPA), which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

⚠ WARNING

Electrical Shock Hazard!

Failure to follow instructions below could result in death or serious injury.

Properly connect the system's oversized protective earthing (grounding) terminal(s).

⚠ WARNING

Leak Detection System Installed!

Failure to follow instructions below could result in death or serious injury or equipment damage.

The unit is equipped with electrically powered safety measures and must be powered at all times after installation, except during servicing, to detect any leak.

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Trademarks

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Product Safety Information

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

Maximum altitude of use 5000 ft. (1524 meters).

This appliance incorporates an earth connection for functional purposes only.

Revision History

- Added a warning in the Introduction chapter to indicate leak detection system is installed.
- Updated nominal filter size for VSH 042–060.

Table of Contents

Model Number Description

Digits 1, 2, 3 — Unit Configuration

VSH = Variable Speed Horizontal
VSV = Variable Speed Vertical

Digit 4 — Development Sequence

K = R-454B Refrigerant

Digits 5, 6, 7 — Nominal Capacity

024 = 24 MBtuh
033 = 33 MBtuh
042 = 42 MBtuh
050 = 50 MBtuh
060 = 60 MBtuh

Digit 8 — Voltage (Volts/Hz/Phase)

A = 208-230/60/1
B = 208-230/60/3
4 = 460/60/3

Digit 9 — Heat Exchanger

1 = Copper-Water Coil
2 = Cupro-Nickel Water Coil
7 = Insulated Copper-Water Coil and Suction Lines
8 = Insulated Cupro-Nickel Water Coil and Suction Lines

Digit 10, 11— Design Sequence

Digit 12 — Control Types

H = Symbio™ 400-B
J = Symbio 400-B with Air-Fi Wireless Communications

Digit 13 — Freeze Protection

A = 20°F Freezestat (For Glycol Loop)
B = 35°F Freezestat (For Water Loop)

Note: *20°F Freezestat is typically used in a geothermal application. 35°F Freezestat is typically used in a boiler/tower application.*

Digit 14 — Sales Order Special

0 = None
S = Sales Order Special

Digit 15 — Supply Air Arrangement

B = Back Supply Air
L = Left Supply Air
R = Right Supply Air
T = Top Supply Air

Digit 16 — Return Air Arrangement

L = Left Return Air
R = Right Return Air

Digit 17 — Unit Mounted Disconnect

0 = No Unit Mounted Disconnect
2 = Unit Mounted Disconnect

Digit 18 — Filter Type

1 = 1-inch Throwaway Filter
2 = 2-inch Throwaway Filter
4 = 2-inch MERV 8
5 = 2-inch MERV 13

Digit 19 — Fault Sensors

1 = Condensate Overflow Sensor
6 = Condensate Overflow and Fan Status

Digit 20 — Ducted Filter Rack

0 = Non-ducted Filter Rack
A = Ducted Filter Rack (Side Access/LH-RH)
C = Ducted Filter Rack (Bottom Access)

Digit 21 — Insulation

1 = Matte-Faced Insulation
2 = Foil-Faced Insulation

General Information

Unit Description

Before shipment, each unit is leak tested, dehydrated, charged with refrigerant and run tested for proper control operation.

Unit Nameplate

The unit nameplate is located on the outside of the control box access panel at the front of the unit. It includes the unit model number, serial number, electrical characteristics, refrigerant charge, and other pertinent unit data.

Compressor Nameplate

The nameplate for the compressors are located on the compressor shell.

Air-to-Refrigerant Coil

The air-to-refrigerant coil is aluminum fin, mechanically bonded to the copper tubing.

Water-to-Refrigerant Coil

The water-to-refrigerant coil is a copper or cupro-nickel (option) and steel tube (tube-within-a-tube) design, leak tested to assure there is no cross leakage between the water tube (copper/cupro-nickel) and refrigerant gas (steel tube).

Table 1. High/Low pressure switch

	Trip	Recover	Unit
LP	40 +/-4	56 +/-4	psig
HP	600 +/-10	460 +/-20	psig

Controls

The control system offered to control the unit is the Symbio™ 400-B programmable BACnet® unit controller. The Symbio 400-B controller is standard for all unit sizes.

The Symbio 400-B is a BTL Listed BACnet controller that can operate stand- alone or within a Building Automation System (BAS) such as Tracer® SC+. For Installation, operation, and maintenance, see *Symbio™ 400-B/500 Programmable Controllers Water Source Heat Pump (WSHP) Installation, Operation, and Maintenance Guide* (BAS-SVX092*-EN).

All power wiring to the equipment is made at the unit power block.

System Input Devices and Functions

A zone sensor or building automation system is required to operate the water-source heat pump.

Troubleshooting and wiring diagrams for the Symbio 400-B control systems may be located in the back of this manual.

See *Symbio™ 400-B/500 Programmable Controllers Water Source Heat Pump (WSHP) Installation, Operation, and Maintenance Guide* (BAS-SVX092*-EN) for all digital control troubleshooting tips and wiring diagrams.

Refrigerant Charge

Table 2. Refrigerant charge

Model	R-454B (ounces)
VSV024	72
VSV033	65
VSV042	91
VSV050	91
VSV060	91
VSH024	68
VSH033	65
VSH042	95
VSH050	95
VSH060	95

Operating Limits

Table 3. Operating limits

Operating Limits	Cooling	Heating
Air Limits		
Min. ambient air DB	45.0°F (7.2°C)	
Max. ambient air DB	130°F (54.4°C)	
Min. EAT DB/WB	67.0/57.0°F (19.4/ 13.9°C)	59.0°F/– (15.0°C/-)
Max. EAT DB/WB	95.0/71.0°F (35.0/ 21.7°C)	80.0°F/- (26.6°C/-)
Airflow range	195 to 518 CFM/ton[(a)]	
Water Limits		
Min. entering water temperature (EWT)	45.0°F (7.2°C)	25.0°F (-3.8°C)
Max. entering water temperature (EWT)	120°F (48.9°C)	90.0°F (32.2°C)

Table 3. Operating limits (continued)

Operating Limits	Cooling	Heating
Max. water pressure	400 PSIG (2758 kPa)	
Water flow range	1.7 to 4.4 GPM/ton[a]	

[a] This value is an average and varies per model. See performance tables for each model number's rated values.

Pre-Installation

⚠ WARNING

Fiberglass Wool!

Exposure to glass wool fibers without all necessary PPE equipment could result in cancer, respiratory, skin or eye irritation, which could result in death or serious injury. Disturbing the insulation in this product during installation, maintenance or repair will expose you to airborne particles of glass wool fibers and ceramic fibers known to the state of California to cause cancer through inhalation.

You MUST wear all necessary Personal Protective Equipment (PPE) including gloves, eye protection, a NIOSH approved dust/mist respirator, long sleeves and pants when working with products containing fiberglass wool.

Precautionary Measures:

- **Avoid breathing fiberglass dust.**
- **Use a NIOSH approved dust/mist respirator.**
- **Avoid contact with the skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves, and eye protection.**
- **Wash clothes separately from other clothing; rinse washer thoroughly.**
- **Operations such as sawing, blowing, tear-out, and spraying may generate fiber concentrations requiring additional respiratory protection. Use the appropriate NIOSH approved respirator.**

First Aid Measures:

- **Eye Contact - Flush eyes with water to remove dust. If symptoms persist, seek medical attention.**
- **Skin Contact - Wash affected areas gently with soap and warm water after handling.**

Unit Inspection Checklist

- Unpack all components of the kit.
- Check carefully for any shipping damage. If any damage is found it must be reported immediately and a claim made against the transportation company.

  Note: *Equipment is shipped FOB (Free on Board) at the manufacturer. Therefore, freight claims for damages against the carrier must be initiated by the receiver.*
- Visually inspect the components for shipping damage as soon as possible after delivery, before it is stored. Concealed damage must be reported within 15 days.
- If concealed damage is discovered, stop unpacking the shipment.
- Do not remove damaged material from the receiving location. Take photos of the damage, if possible. The owner must provide reasonable evidence that the damage did not occur after delivery.
- Notify the carrier's terminal of damage immediately by phone and by mail. Request an immediate joint inspection of the damage by the carrier and the consignee.
- Do not attempt to repair any damaged parts until the parts are inspected by the carrier's representative.

Jobsite Inspection Checklist

Always perform the following checks before accepting a unit:

- Verify that the nameplate data matches the data on the sales order and bill of lading (including electrical data).
- Verify that the power supply complies with the unit nameplate specifications.
- Visually inspect the exterior of the unit, for signs of shipping damage. Do not sign the bill of lading accepting the unit(s) until inspection has been completed. Check for damage promptly after the unit(s) are unloaded. Once the bill of lading is signed at the jobsite, the unit(s) are now the property of the SOLD TO party and future freight claims MAY NOT be accepted by the freight company.

Jobsite Storage

⚠ WARNING

Risk of Fire — Flammable Refrigerant!

Failure to follow instructions below could result in death or serious injury, and equipment damage.

The equipment shall be stored in a room without continuously operating ignition sources.

NOTICE

Microbial Growth!

Failure to follow instructions below could result in odors and damage to the equipment and building materials.

Wet interior unit insulation can become an amplification site for microbial growth (mold). If there is evidence of microbial growth on the interior insulation, it should be removed and replaced prior to operating the system.

NOTICE

Microbial Growth!

Failure to follow instructions below could result in odors and damage to the equipment and building materials.

The floor or foundation must be level and the condensate drain at the proper height for proper drainage and condensate flow. Standing water and wet surfaces inside the equipment can become an amplification site for microbial growth (mold). If there is evidence of microbial growth on the interior insulation, it should be removed and replaced prior to operating the system.

This unit is intended for indoor use only. To protect the unit from damage due to the elements, and to prevent possible IAQ contaminant sources from growing, the unit should be stored indoors. If indoor storage is not possible, the following provisions for outdoor storage must be met:

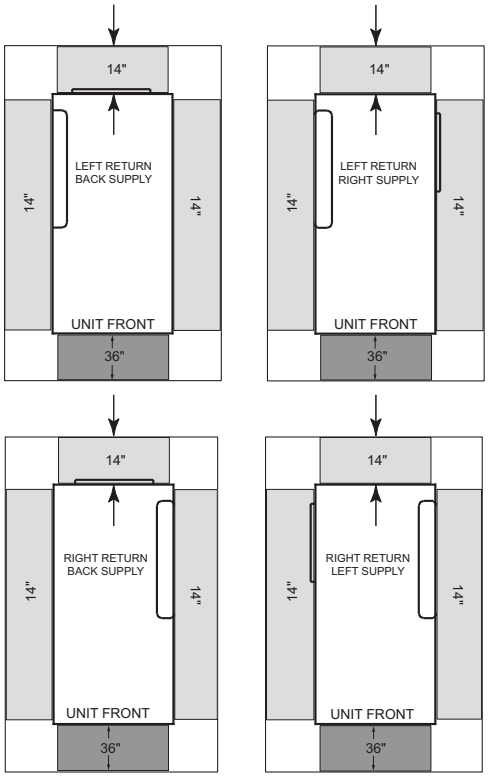
- Place the unit(s) on a dry surface or raise above the ground to assure adequate air circulation beneath the unit.
- Cover the unit(s) with a water proof tarp to protect them from the elements.
- Make provisions for continuous venting of the covered units to prevent moisture from standing on the unit(s) surfaces. Wet interior unit insulation can become an amplification site for microbial growth (mold) which has been determined to be a cause of odors and serious health related indoor air quality problems.
- Store units in the normal UP orientation to maintain oil in the compressor.
- Do not stack vertical units. Horizontal units may be stacked two high.

Unit Dimensions

Clearance Dimensions

Access to the unit for service purposes should be provided at installation. All configurations require clearance from other mechanical and electrical equipment (as shown) to enable panel removal from the unit for service/maintenance ability. Some local and/or NEC codes require a greater service clearance than listed below. Check all code requirements prior to unit installations. The installer is responsible for compliance with local and NEC code requirements.

Figure 1. Clearance dimensions VSH

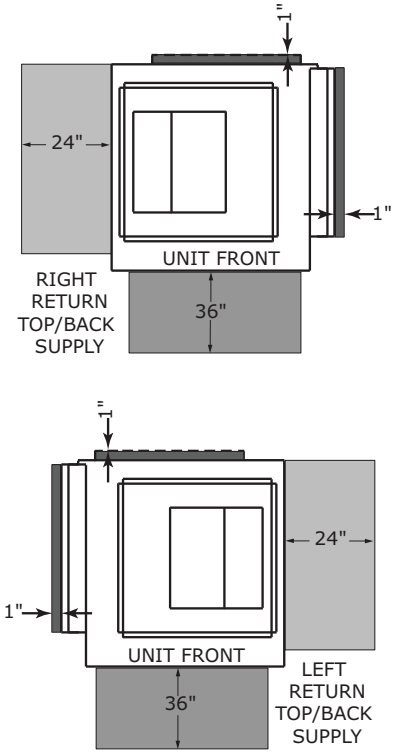


A minimum 14-inch clearance for servicing the unit is required from other mechanical and electrical equipment to enable panel removal from the unit for service/maintenance ability. The optimum clearance required is 20-inches.

Notes:

- *Return air direction (left-hand or right hand) is NOT field convertible. Units must be ordered with correct return air side.*
- *For horizontal models, verify there is enough clearance between the condensate drain and the ceiling to allow for pitching of the condensate line. See "Condensate Drain Connection," p. 35 for pitching requirements.*
- *Units in a free return application will require more than a 1-in. clearance to provide proper airflow to the units air-to-refrigerant coil.*

Figure 2. Clearance dimensions VSV



The 24-inch side clearance on vertical models is for optimal access only. Side clearance is not a requirement as most components can be accessed from the front of the unit.

In a free return application, a 1-inch minimum clearance between the filter rack and any obstacle is required to provide proper air flow to the air-to-refrigerant coil. In a ducted application, a 12-inch minimum clearance between the filter rack and any obstacle should be provided to properly attach ductwork.

Note: *The 1-inch dimension shown at the back of the unit represents the supply duct collar for the back supply option. This clearance is needed only to clear the flanges.*

Dimensional Data

Figure 3. Left return/top supply VSV

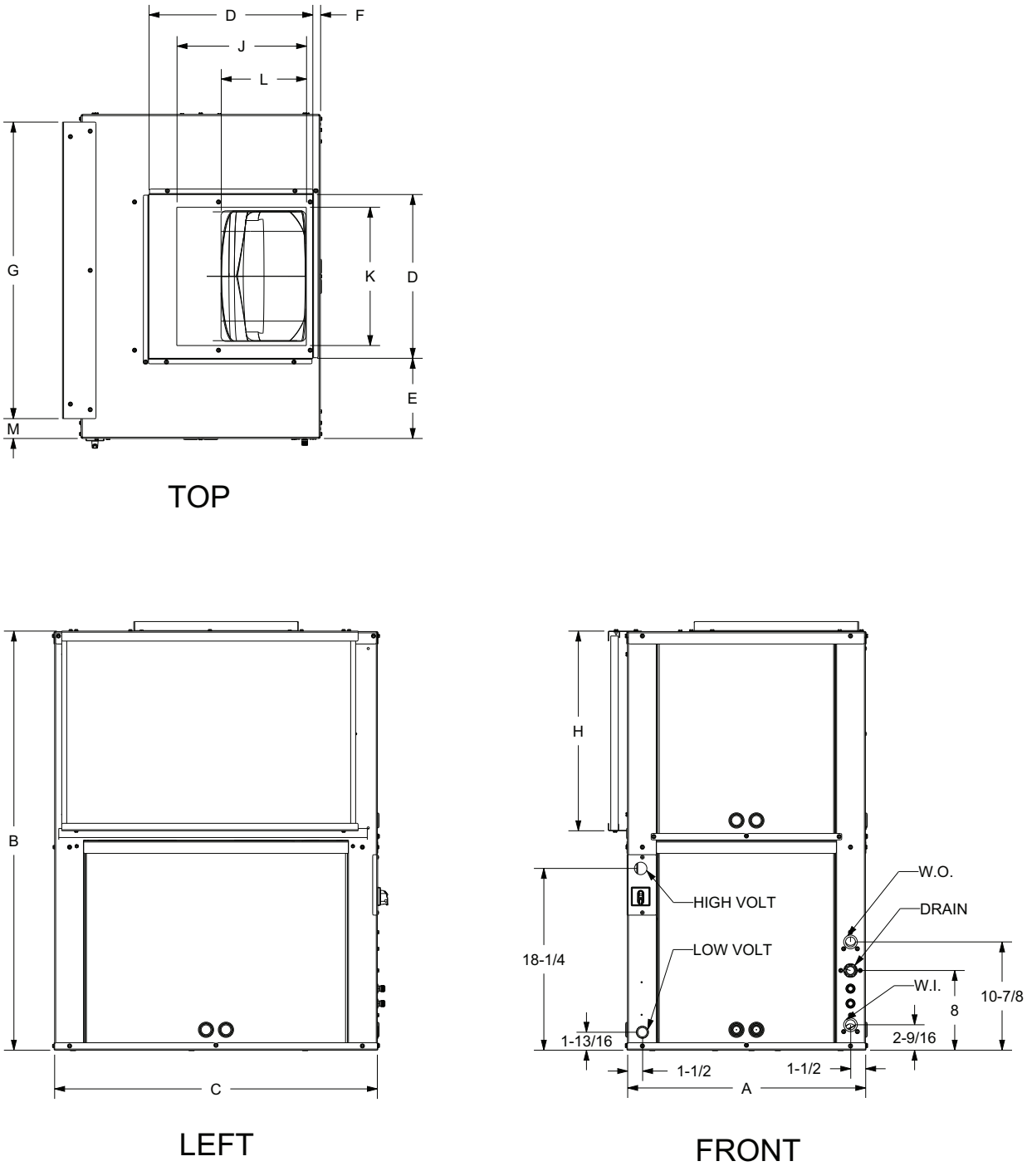


Table 4. Dimensional data—left return/top supply VSV

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024–033	23-7/8	42	32-1/2	16-7/16	8-1/16	13/16	29-3/4	20	13	13-7/8	8-1/2	2	1	1	3/4
042–060	25-3/8	49	32-1/2	16-7/16	8-1/16	13/16	29-3/4	20	13	13-7/8	8-1/2	2	1	1	3/4

Note: Access to the unit for service purposes should be provided at installation. Local and/or NEC codes may require greater service clearance. Check all code requirements prior to the unit installation. Installer is responsible for following all local and NEC code requirements.

Figure 4. Left return/back supply VSV

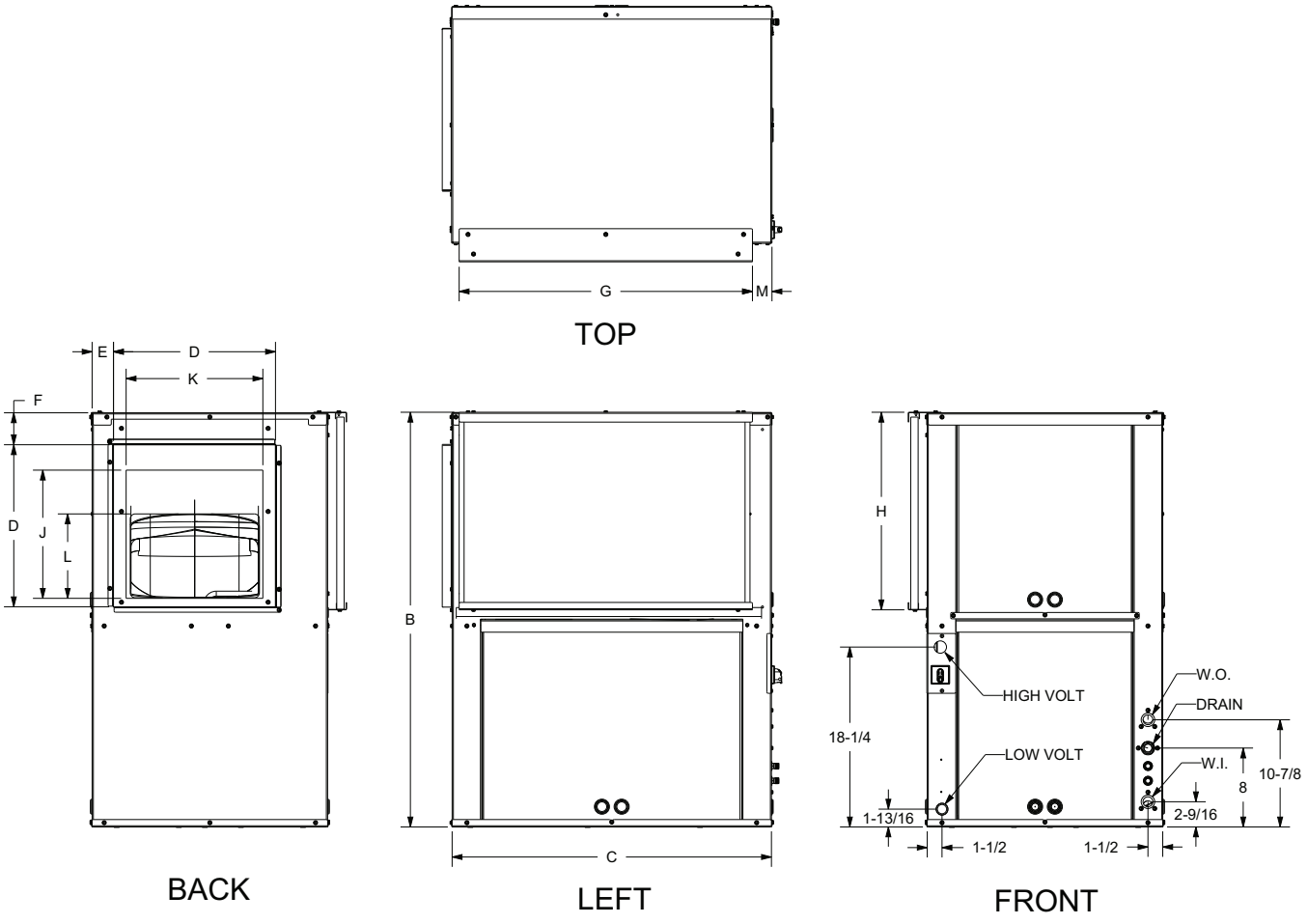


Table 5. Dimensional data—left return/back supply VSV

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024–033	23-7/8	42	32-1/2	16-7/16	2-1/4	3-1/4	29-3/4	20	13	13-7/8	8-1/2	2	1	1	3/4
042–060	25-3/8	49	32-1/2	16-7/16	2-1/4	3-1/4	29-3/4	20	13	13-7/8	8-1/2	2	1	1	3/4

Note: Access to the unit for service purposes should be provided at installation. Local and/or NEC codes may require greater service clearance. Check all code requirements prior to the unit installation. Installer is responsible for following all local and NEC code requirements.

Figure 5. Right return/top supply VSV

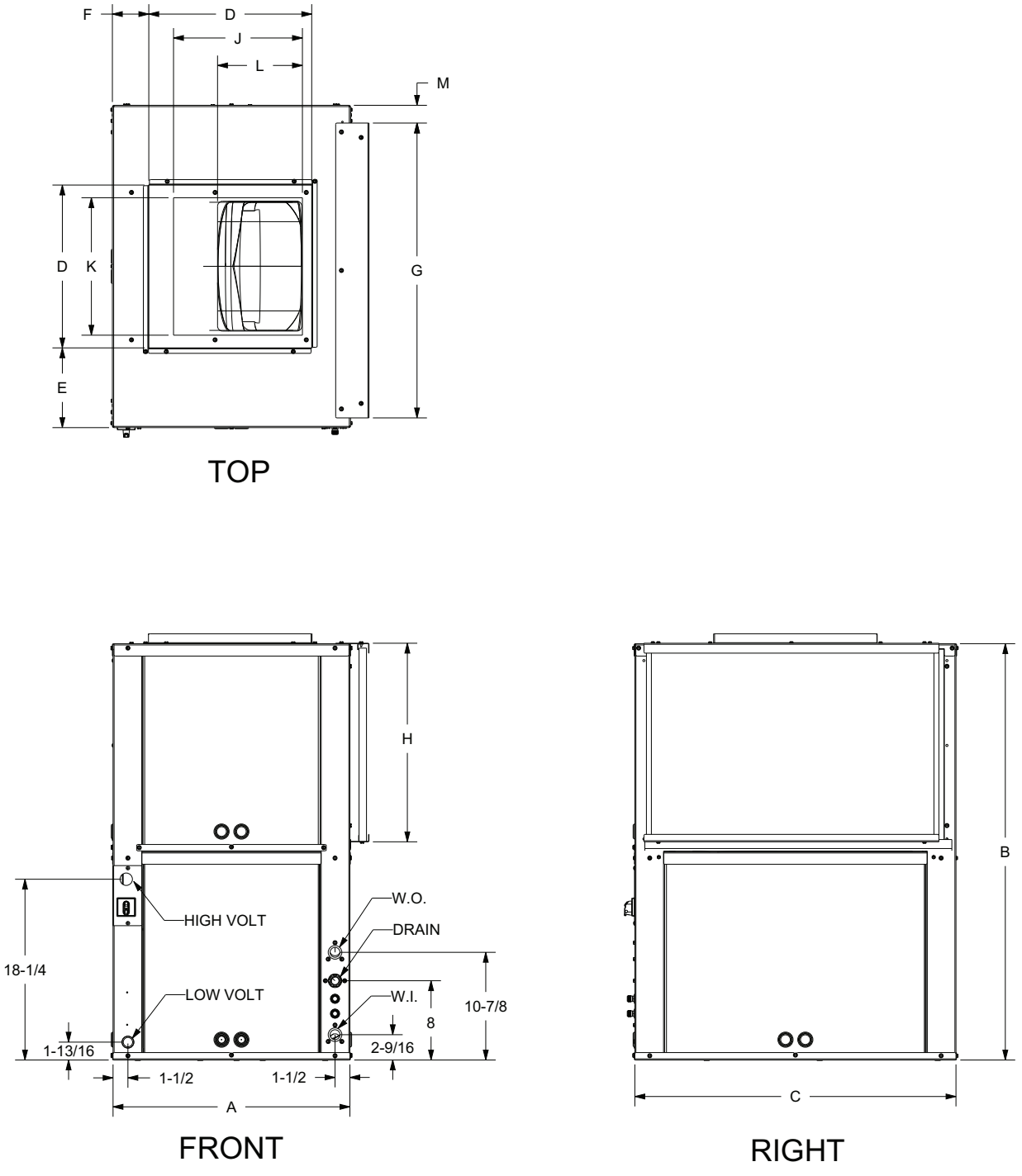


Table 6. Dimensional data—right return/top supply VSV

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024–033	23-7/8	42	32-1/2	16-7/8	8-1/16	13/16	29-3/4	20	13	13-7/8	8-1/2	1-3/4	1	1	3/4
042–060	25-3/8	49	32-1/2	16-7/8	8-1/16	13/16	29-3/4	20	13	13-7/8	8-1/2	1-3/4	1	1	3/4

Note: Access to the unit for service purposes should be provided at installation. Local and/or NEC codes may require greater service clearance. Check all code requirements prior to the unit installation. Installer is responsible for following all local and NEC code requirements.

Figure 6. Right return/back supply VSV

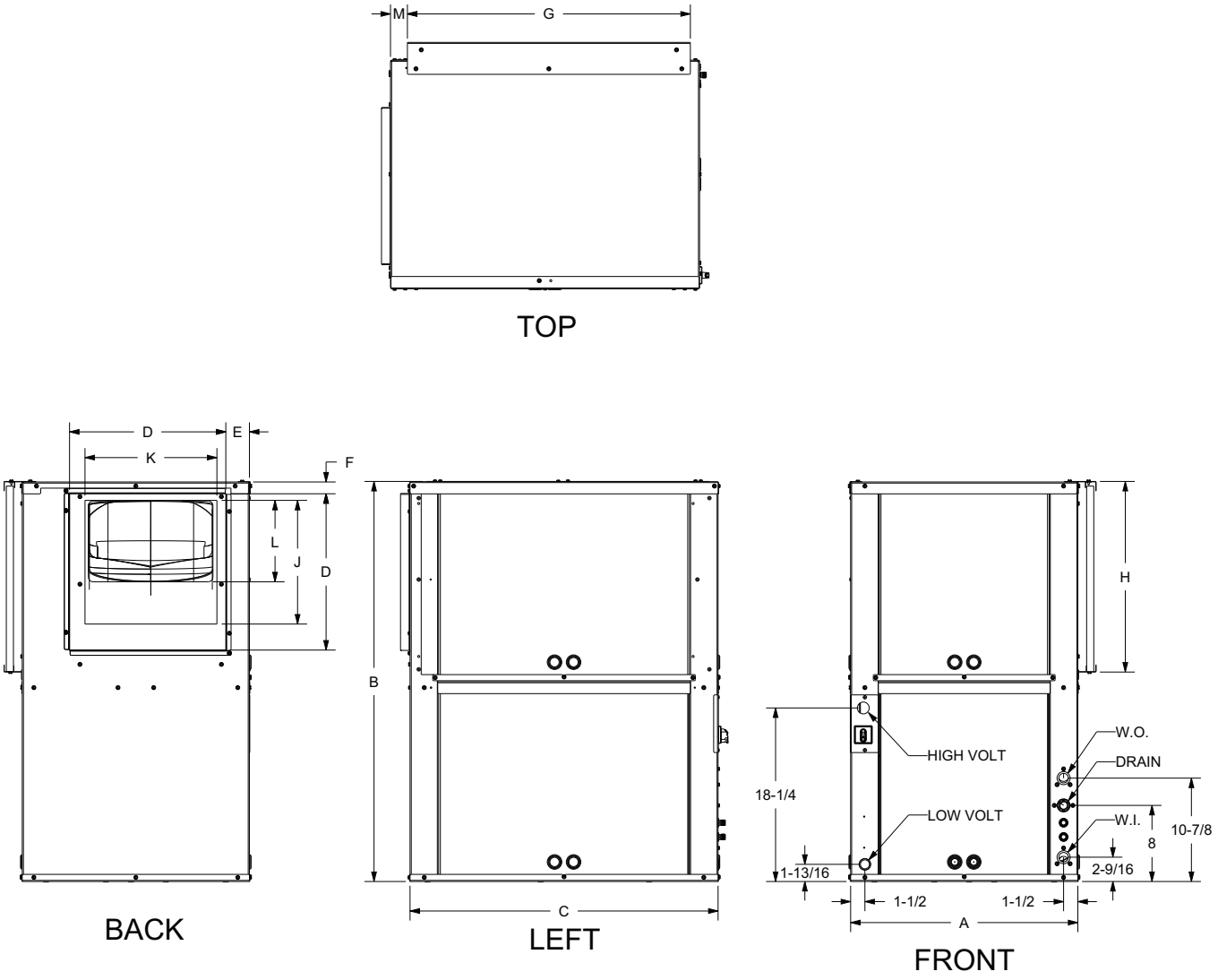


Table 7. Dimensional data—right return/back supply VSV

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024–033	23-7/8	42	32-1/2	16-7/16	2-1/4	3-1/4	29-3/4	20	13	13-7/8	8-1/2	1-3/4	1	1	3/4
042–060	25-3/8	49	32-1/2	16-7/16	2-1/4	3-1/4	29-3/4	20	13	13-7/8	8-1/2	1-3/4	1	1	3/4

Note: Access to the unit for service purposes should be provided at installation. Local and/or NEC codes may require greater service clearance. Check all code requirements prior to the unit installation. Installer is responsible for following all local and NEC code requirements.

Unit Dimensions

Figure 7. Left return/back supply VSH

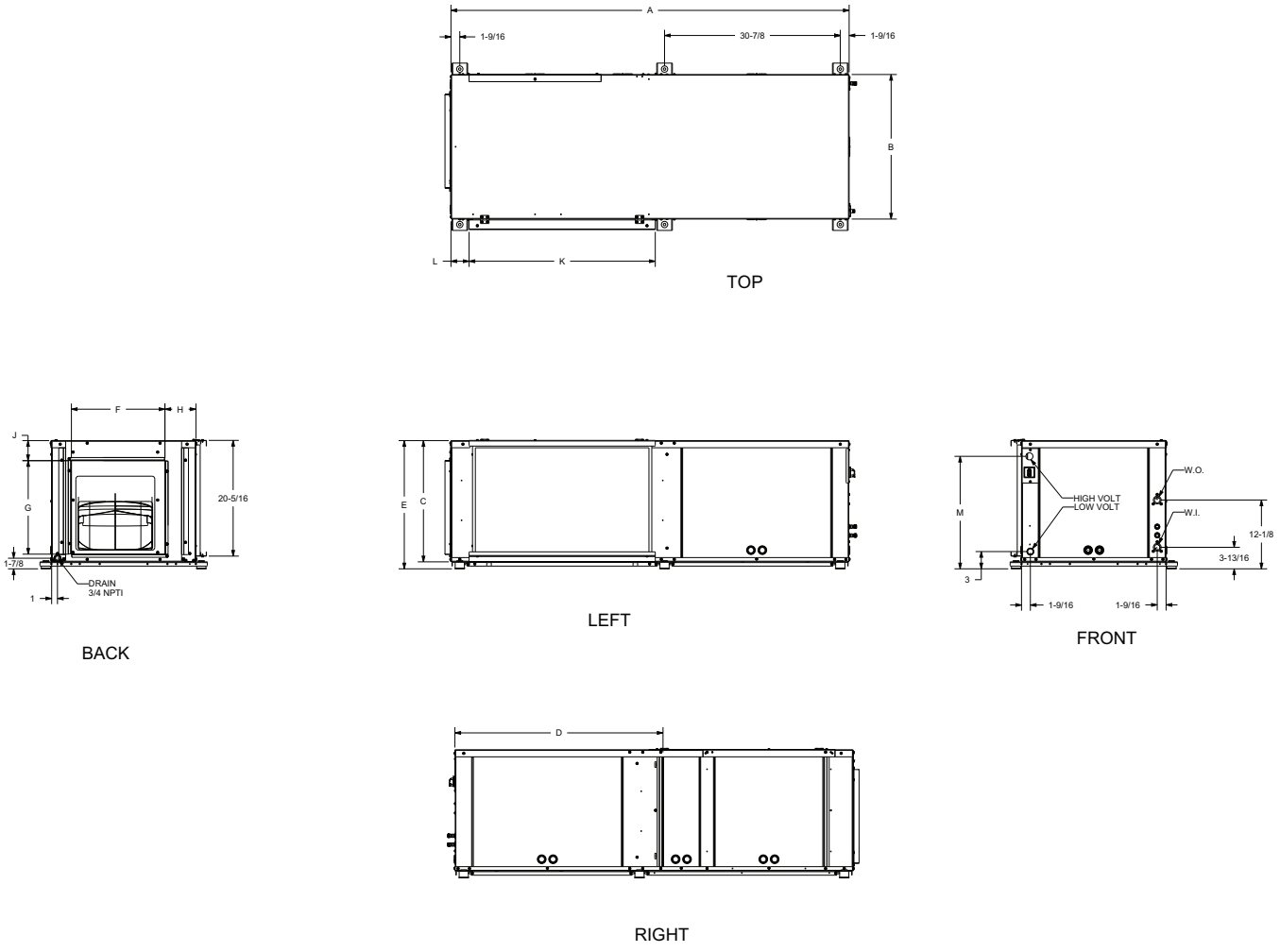


Table 8. Dimensional data— left return/back supply VSH

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024–033	**59-1/2**	**24**	**21**	**35-1/2**	**22-1/4**	**16-7/16**	**16-7/16**	**3-3/4**	**3-3/8**	**21-1/2**	**3-9/16**	**19-1/2**	**1**	**1**	**3/4**
042–060	70	25-3/8	21-1/4	35-1/2	22-1/2	16-7/16	16-7/16	5-3/8	3-1/2	32-11/16	3-3/16	19-3/4	1	1	3/4

Note: Access to the unit for service purposes should be provided at installation. Local and/or NEC codes may require greater service clearance. Check all code requirements prior to the unit installation. Installer is responsible for following all local and NEC code requirements.

Figure 8. Left return/right supply VSH

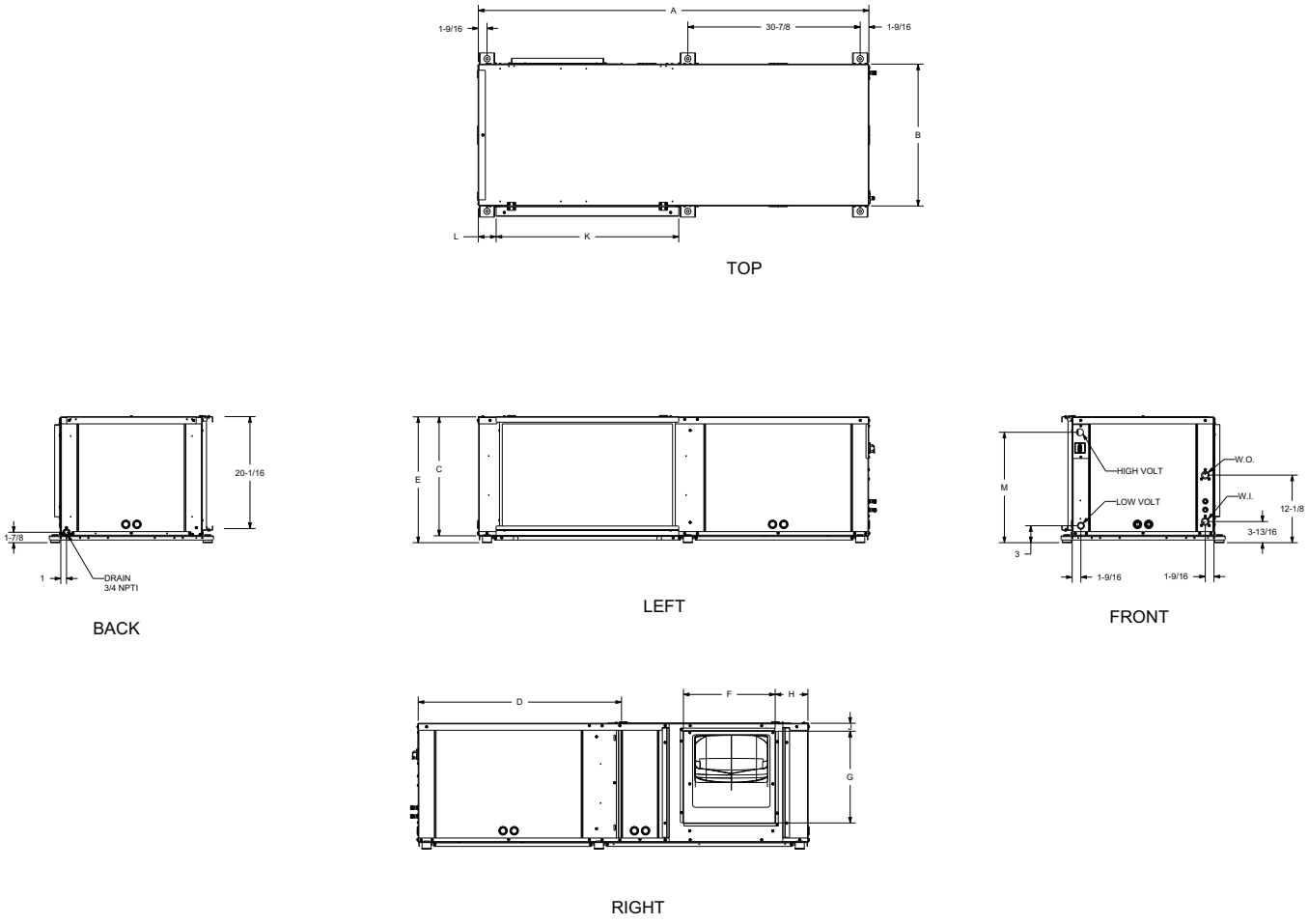


Table 9. Dimensional data— left return/right supply VSH

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024–033	59-1/2	24	21	35-1/2	22-1/4	16-7/16	16-7/16	5-1/2	1-1/4	21-1/2	3-9/16	19-1/2	1	1	3/4
042–060	70	25-3/8	21-1/4	35-1/2	22-1/2	16-7/16	16-7/16	6	1-7/16	32-11/16	3-3/16	19-3/4	1	1	3/4

Note: Access to the unit for service purposes should be provided at installation. Local and/or NEC codes may require greater service clearance. Check all code requirements prior to the unit installation. Installer is responsible for following all local and NEC code requirements.

Figure 9. Right return/back supply VSH

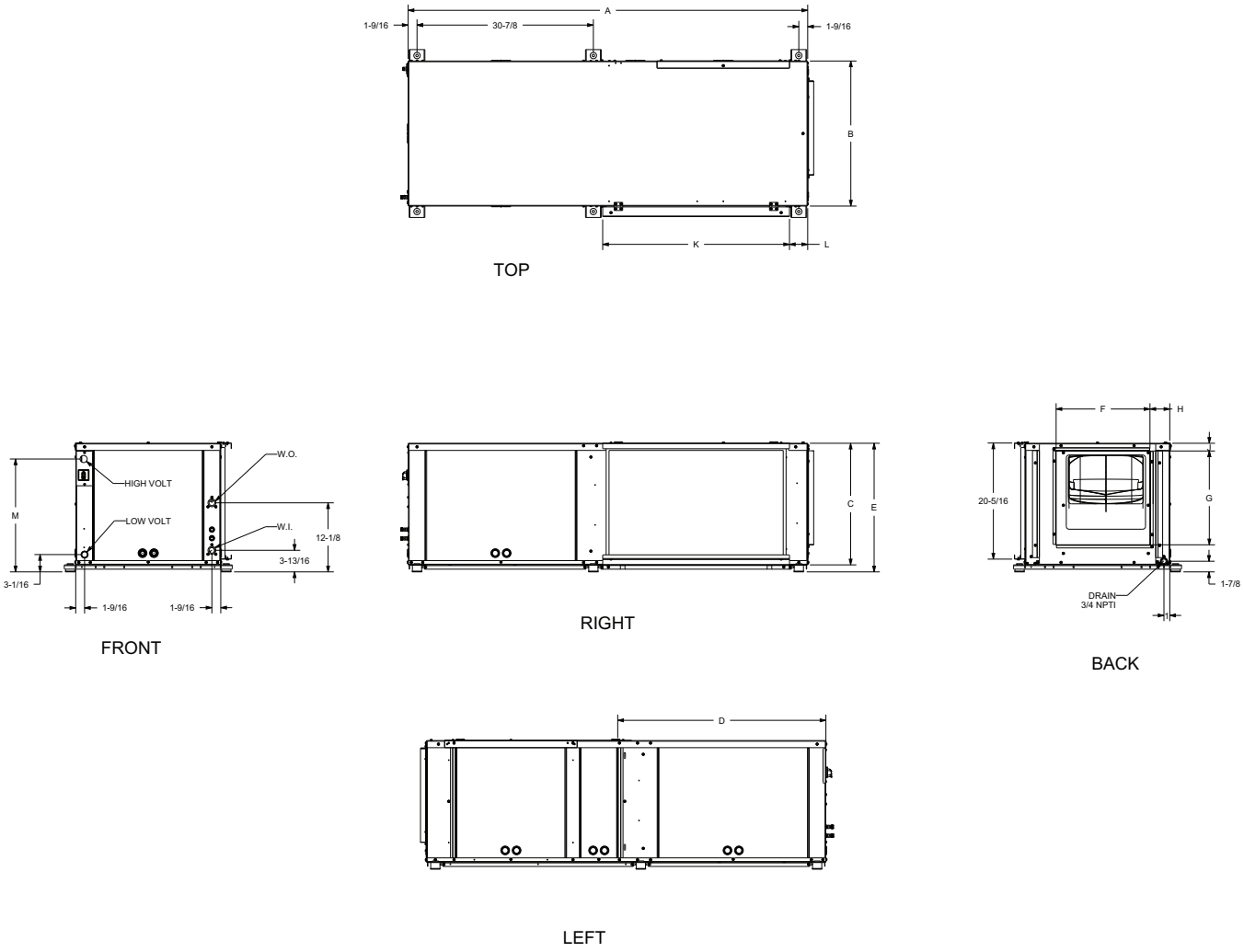


Table 10. Dimensional data — right return/back supply VSH

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024–033	59-1/2	24	21	35-1/2	22-1/4	16-7/16	16-7/16	3-3/4	1-1/4	21-1/2	3-9/16	19-1/2	1	1	3/4
042–060	70	25-3/8	21-1/4	35-1/2	22-1/2	16-7/16	16-7/16	3-1/2	1-7/16	32-11/16	3-3/16	19-3/4	1	1	3/4

Note: Access to the unit for service purposes should be provided at installation. Local and/or NEC codes may require greater service clearance. Check all code requirements prior to the unit installation. Installer is responsible for following all local and NEC code requirements.

Figure 10. Right return/left supply VSH

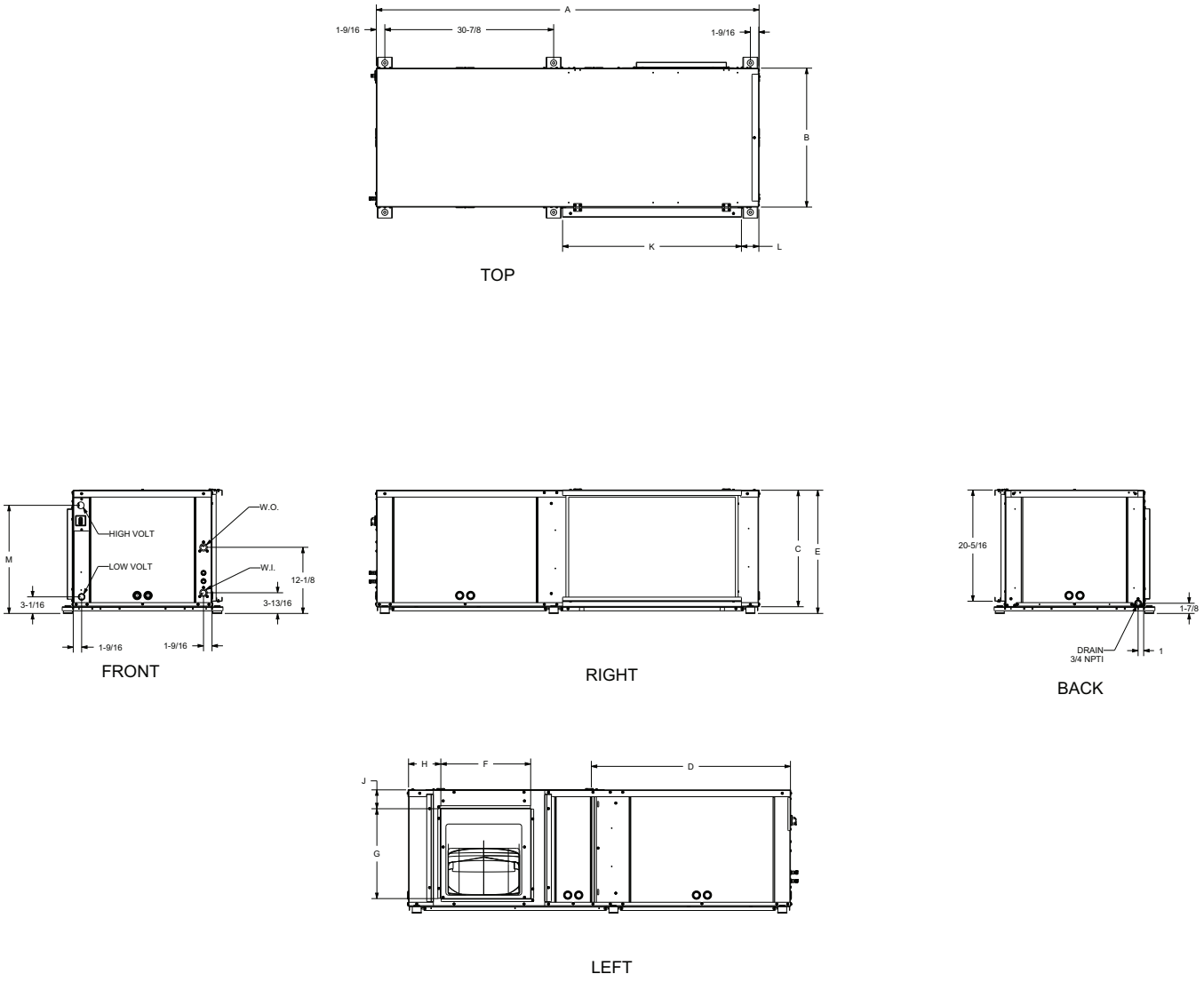


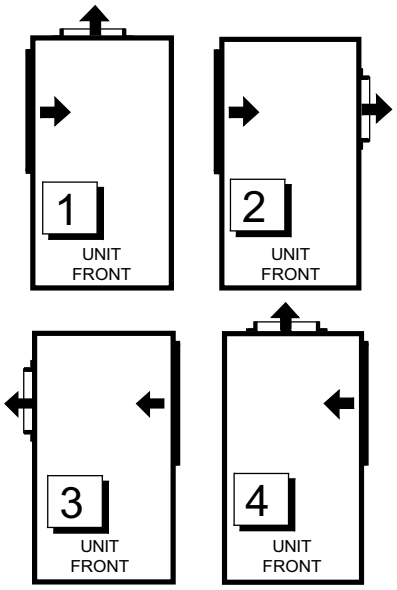
Table 11. Dimensional data — right return/left supply VSH

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024–033	59-1/2	24	21	35-1/2	22-1/4	16-7/16	16-7/16	5-1/2	3-3/8	21-1/2	3-9/16	19-1/2	1	1	3/4
042–060	70	25-3/8	21-1/4	35-1/2	22-1/2	16-7/16	16-7/16	6	3-1/2	32-11/16	3-3/16	19-3/4	1	1	3/4

Note: Access to the unit for service purposes should be provided at installation. Local and/or NEC codes may require greater service clearance. Check all code requirements prior to the unit installation. Installer is responsible for following all local and NEC code requirements.

General Data

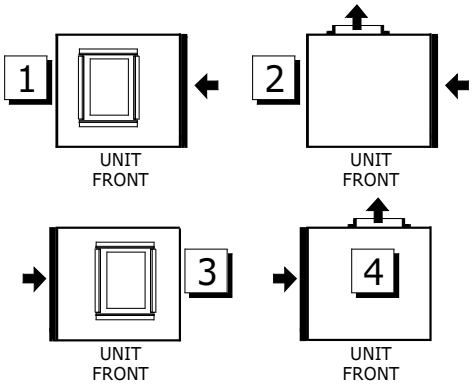
Figure 11. Horizontal Supply/Return Air Configuration



The unit's supply and return air configuration is built to order to meet unique installation requirements. The combinations include:

1. Left return air with back supply air
2. Left return air with right supply air
3. Right return air with left supply air
4. Right return air with back supply air

Figure 12. Vertical Supply/Return Air Configuration



The unit's supply and return air configuration is built to order to meet unique installation requirements. The combinations include:

1. Right return-air with top supply-air combination
2. Right return-air with back supply-air combination
3. Left return-air with top supply -air combination
4. Left return-air with back supply-air combination

Table 12. Cabinet

Model VSH*		VSH*024	VSH*033	VSH*042	VSH*050	VSH*060
Unit size	Length (inch)	59-1/2	59-1/2	70.0	70.0	70.0
	Height (inch)	21.0	21.0	21-1/4	21-1/4	21-1/4
	Width (inch)	24.0	24.0	25-3/8	25-3/8	25-3/8
Compressor type		Scroll	Scroll	Scroll	Scroll	Scroll
Approximate weight	With pallet (lb)	425	425	505	505	505
Approximate weight	Without pallet (lb)	349	349	429	429	429
Nominal Filter size	Inches	20 x 22	20 x 22	20 x 32	20 x 32	20 x 32
Water in/out size (NPTI)	Inches	1	1	1	1	1
Condensate size (NPTI)	Inches	3/4	3/4	3/4	3/4	3/4
Blower wheel size	Direct drive (inch)	11 x 10	11 x 10	11 x 10	11 x 10	11 x 10

Table 13. Air-to-refrigerant coil

Model VSH*	VSH*024	VSH*033	VSH*042	VSH*050	VSH*060
Working pressure	600	600	600	600	600
Tubes high	20	20	20	20	20
Tubes deep	3	3	4	4	4
Number of circuits	4	4	5	5	5
Finned volume (H, W, D: inches)	20 x 19.75 x 3.5	20 x 19.75 x 3.5	20 x 30.25 x 3.5	20 x 30.25 x 3.5	20 x 30.25 x 3.5
Coil surface area (ft^2)	2.750	2.750	4.200	4.200	4.200
Fins per inch	14	14	14	14	14

Table 13. Air-to-refrigerant coil (continued)

Model VSH*	VSH*024	VSH*033	VSH*042	VSH*050	VSH*060
Tube material	Copper	Copper	Copper	Copper	Copper
Tube OD (inch)	3/8	3/8	3/8	3/8	3/8
Wall thickness (inch)	0.014	0.014	0.014	0.014	0.014
Return bends	Copper	Copper	Copper	Copper	Copper

Table 14. Water volume

Model VSH*	VSH*024	VSH*033	VSH*042	VSH*050	VSH*060
Internal water volume (in^3)	142.4	142.4	331.2	331.2	331.2
Internal water volume (ft^3)	0.082	0.082	0.192	0.192	0.192
Internal water volume (gal)	0.616	0.616	1.434	1.434	1.434

Table 15. Cabinet

Model VSV*		VSV*024	VSV*033	VSV*042	VSV*050	VSV*060
Unit size	Length (inch)	32-1/2	32-1/2	32-1/2	32-1/2	32-1/2
	Height (inch)	42	42	49	49	49
	Width (inch)	23-7/8	23-7/8	25-3/8	25-3/8	25-3/8
Compressor type		Scroll	Scroll	Scroll	Scroll	Scroll
Approximate weight	With pallet (lb)	388	388	441	441	441
Approximate weight	Without pallet (lb)	340	340	393	393	393
Nominal Filter size	Inches	20 x 30	20 x 30	27 x 30	27 x 30	27 x 30
Water in/out size (NPTI)	Inches	1	1	1	1	1
Condensate size (NPTI)	Inches	3/4	3/4	3/4	3/4	3/4
Blower wheel size	Direct drive (inch)	11 x 10	11 x 10	11 x 10	11 x 10	11 x 10

Table 16. Air-to-refrigerant coil

Model VSV*	VSV*024	VSV*033	VSV*042	VSV*50	VSV*060
Working pressure	600	600	600	600	600
Tubes high	20	20	27	27	27
Tubes deep	3	3	3	3	3
Number of circuits	5	5	6	6	6
Finned volume (H, W, D: inches)	20 x 28.25 x 2.6	20 x 28.25 x 2.6	27 x 28.25 x 2.6	27 x 28.25 x 2.6	27 x 28.25 x 2.6
Coil surface area (ft^2)	3.92	3.92	5.30	5.30	5.30
Fins per inch	14	14	14	14	14
Tube material	Copper	Copper	Copper	Copper	Copper
Tube OD (inch)	3/8	3/8	3/8	3/8	3/8
Wall thickness (inch)	0.014	0.014	0.014	0.014	0.014
Return bends	Copper	Copper	Copper	Copper	Copper

Table 17. Water volume

Model VSV*	VSV*024	VSV*033	VSV*042	VSV*050	VSV*060
Internal water volume (in^3)	212	212	414	414	414
Internal water volume (ft^3)	0.123	0.123	0.24	0.24	0.24
Internal water volume (gal)	0.918	0.918	1.792	1.792	1.792

Unit Fan Performance

Table 18. ECM fan performance

Model	External Static Pressure																										
		0		0.05		0.10		0.15		0.20		0.25		0.30		0.35		0.40		0.45		0.50		0.55		0.60	
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM
VSH024	796	0.070	535	0.080	570	0.090	604	0.099	635	0.109	665	0.120	694	0.131	722	0.142	749	0.153	774	0.165	799	0.178	824	0.191	847	0.204	870
	840	0.083	563	0.092	596	0.102	628	0.112	659	0.123	688	0.134	716	0.145	743	0.157	769	0.169	794	0.182	818	0.195	842	0.208	865	0.222	888
	885	0.095	591	0.105	623	0.115	654	0.126	683	0.138	711	0.149	738	0.161	765	0.174	790	0.187	814	0.200	838	0.214	861	0.228	884	0.243	906
	930	0.109	620	0.119	650	0.131	680	0.142	708	0.154	735	0.167	761	0.180	787	0.193	811	0.207	835	0.221	859	0.235	881	0.250	903	0.265	925
	974	0.124	647	0.135	677	0.147	705	0.159	732	0.172	759	0.185	784	0.199	809	0.213	833	0.227	856	0.242	879	0.257	901	0.273	923	0.289	944
	1019	0.140	676	0.153	704	0.165	731	0.179	758	0.192	783	0.206	808	0.221	832	0.235	855	0.251	878	0.266	900	0.282	921	0.298	943	0.314	963
VSH033	1014	0.138	673	0.151	701	0.163	728	0.176	755	0.190	780	0.204	805	0.218	829	0.233	853	0.248	875	0.263	897	0.279	919	0.295	940	0.311	961
	1076	0.165	712	0.178	738	0.192	764	0.206	790	0.220	814	0.235	838	0.251	861	0.267	884	0.283	906	0.299	927	0.315	948	0.332	969	0.349	989
	1138	0.194	750	0.209	776	0.224	801	0.239	825	0.255	848	0.271	871	0.287	893	0.304	915	0.320	936	0.337	957	0.354	978	0.371	998	0.388	1017
	1200	0.228	789	0.244	814	0.260	837	0.276	860	0.293	883	0.310	905	0.327	926	0.344	947	0.361	968	0.378	988	0.395	1008	0.412	1027	0.429	1046
	1262	0.266	828	0.282	851	0.299	874	0.316	896	0.333	918	0.351	939	0.368	960	0.385	980	0.403	1000	0.419	1019	0.436	1038	0.452	1057	0.468	1076
	1324	0.307	867	0.324	889	0.341	911	0.359	932	0.376	953	0.393	973	0.410	993	0.427	1013	0.444	1032	0.459	1051	0.475	1070	0.490	1088	0.504	1106
VSH042	1414	0.163	584	0.176	608	0.188	632	0.202	655	0.215	679	0.230	702	0.244	725	0.259	748	0.275	771	0.291	794	0.307	816	0.324	839	0.341	861
	1485	0.188	607	0.201	630	0.214	654	0.228	677	0.242	699	0.257	722	0.272	745	0.288	767	0.304	789	0.320	811	0.337	833	0.354	855	0.372	876
	1579	0.224	638	0.238	660	0.252	683	0.266	705	0.281	727	0.296	749	0.312	770	0.328	792	0.345	813	0.362	834	0.380	855	0.398	876	0.416	897
	1650	0.254	661	0.268	683	0.283	704	0.298	726	0.313	747	0.329	769	0.345	790	0.362	811	0.379	831	0.397	852	0.415	872	0.433	893	0.452	913
	1721	0.287	684	0.301	705	0.316	727	0.332	748	0.348	768	0.364	789	0.381	809	0.398	830	0.416	850	0.434	870	0.452	890	0.471	909	0.491	929
	1815	0.333	715	0.348	736	0.364	756	0.380	776	0.397	796	0.414	816	0.431	835	0.449	855	0.467	874	0.486	893	0.505	912	0.525	931	0.545	950
VSH050	1414	0.163	584	0.176	608	0.188	632	0.202	655	0.215	679	0.230	702	0.244	725	0.259	748	0.275	771	0.291	794	0.307	816	0.324	839	0.341	861
	1485	0.188	607	0.201	630	0.214	654	0.228	677	0.242	699	0.257	722	0.272	745	0.288	767	0.304	789	0.320	811	0.337	833	0.354	855	0.372	876
	1579	0.224	638	0.238	660	0.252	683	0.266	705	0.281	727	0.296	749	0.312	770	0.328	792	0.345	813	0.362	834	0.380	855	0.398	876	0.416	897
	1650	0.254	661	0.268	683	0.283	704	0.298	726	0.313	747	0.329	769	0.345	790	0.362	811	0.379	831	0.397	852	0.415	872	0.433	893	0.452	913
	1721	0.287	684	0.301	705	0.316	727	0.332	748	0.348	768	0.364	789	0.381	809	0.398	830	0.416	850	0.434	870	0.452	890	0.471	909	0.491	929
	2077	0.484	803	0.501	821	0.519	839	0.537	857	0.555	874	0.574	892	0.593	909	0.613	926	0.633	943	0.654	960	0.675	977	0.696	993	0.718	1010

Table 18. ECM fan performance (continued)

Model	External Static Pressure																											
		0		0.05		0.10		0.15		0.20		0.25		0.30		0.35		0.40		0.45		0.50		0.55		0.60	
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM
VSH060	1803	0.327	711	0.342	732	0.358	752	0.374	772	0.390	793	0.407	812	0.425	832	0.442	852	0.461	871	0.479	890	0.498	909	0.518	928	0.538	947
	1908	0.383	746	0.399	766	0.415	785	0.432	805	0.449	824	0.467	843	0.485	861	0.504	880	0.523	899	0.542	917	0.562	935	0.582	953	0.603	971
	2014	0.445	782	0.462	800	0.479	819	0.496	837	0.514	855	0.533	873	0.551	891	0.571	909	0.590	927	0.611	944	0.631	961	0.652	978	0.674	995
	2120	0.512	817	0.529	835	0.547	853	0.565	870	0.584	887	0.603	905	0.623	921	0.643	938	0.663	955	0.684	971	0.706	988	0.727	1004	0.750	1020
	2226	0.584	853	0.602	870	0.621	887	0.640	903	0.659	920	0.679	936	0.700	952	0.720	968	0.741	983	0.763	999	0.785	1014	0.808	1029	0.831	1044
	2332	0.662	889	0.680	905	0.700	921	0.719	937	0.740	952	0.760	967	0.781	982	0.803	997	0.825	1012	0.847	1027	0.870	1041	0.893	1055	0.917	1069

Table 19. ECM fan performance

Model	External Static Pressure																											
		0		0.05		0.10		0.15		0.20		0.25		0.30		0.35		0.40		0.45		0.50		0.55		0.60	
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM
VSV024	837	0.047	436	0.056	468	0.065	500	0.075	532	0.084	563	0.094	593	0.103	623	0.113	652	0.123	681	0.133	709	0.143	737	0.154	764	0.164	791
	884	0.054	449	0.064	482	0.073	513	0.083	545	0.092	575	0.102	605	0.112	635	0.123	664	0.133	692	0.143	720	0.154	748	0.165	775	0.176	801
	930	0.062	463	0.072	495	0.081	526	0.091	557	0.101	587	0.112	617	0.122	647	0.132	675	0.143	704	0.154	731	0.165	758	0.176	785	0.187	811
	977	0.070	476	0.080	508	0.090	539	0.100	570	0.111	600	0.121	630	0.132	659	0.143	687	0.154	715	0.165	743	0.177	769	0.188	796	0.200	822
	1023	0.079	490	0.089	522	0.099	552	0.110	583	0.121	613	0.132	642	0.143	671	0.154	699	0.166	727	0.177	754	0.189	780	0.201	806	0.213	832
VSV033	1080	0.090	507	0.101	538	0.112	569	0.123	599	0.134	628	0.145	657	0.157	686	0.169	714	0.181	741	0.192	768	0.205	794	0.217	820	0.229	845
	1140	0.103	526	0.114	556	0.126	586	0.137	616	0.149	645	0.161	674	0.173	702	0.185	730	0.197	757	0.210	783	0.222	809	0.235	834	0.248	859
	1200	0.117	544	0.129	574	0.141	604	0.153	634	0.165	662	0.177	691	0.189	718	0.202	746	0.215	772	0.228	798	0.241	824	0.254	849	0.267	873
	1260	0.132	563	0.144	593	0.156	622	0.169	651	0.181	680	0.194	708	0.207	735	0.220	762	0.233	788	0.247	814	0.260	839	0.274	864	0.288	888
	1320	0.148	582	0.160	612	0.173	641	0.186	669	0.199	697	0.212	725	0.226	752	0.239	778	0.253	804	0.267	830	0.281	855	0.295	879	0.309	903
VSV042	1485	0.120	541	0.135	568	0.150	595	0.165	621	0.180	647	0.195	673	0.211	698	0.226	723	0.242	748	0.258	772	0.275	796	0.291	820	0.307	843
	1568	0.146	563	0.162	590	0.177	616	0.193	642	0.208	667	0.224	692	0.240	717	0.257	741	0.273	765	0.290	789	0.306	812	0.323	835	0.340	858
	1650	0.175	586	0.191	612	0.207	637	0.223	662	0.239	687	0.256	712	0.272	736	0.289	759	0.306	783	0.323	806	0.340	829	0.358	851	0.375	873
	1733	0.208	609	0.224	634	0.240	659	0.257	684	0.274	708	0.291	732	0.308	755	0.325	778	0.343	801	0.360	824	0.378	846	0.396	868	0.414	889
	1815	0.243	632	0.259	657	0.276	681	0.294	705	0.311	729	0.328	752	0.346	775	0.364	797	0.382	820	0.400	841	0.418	863	0.436	884	0.455	905
VSV050	1701	0.195	600	0.211	625	0.227	650	0.244	675	0.260	700	0.277	724	0.294	748	0.311	771	0.328	794	0.346	817	0.363	839	0.381	861	0.399	883
	1796	0.234	627	0.251	651	0.268	675.9	0.285	700	0.302	724	0.319	747	0.337	770	0.354	793	0.372	815	0.390	837	0.408	859	0.427	880	0.445	901
	1890	0.277	654	0.294	678	0.312	702	0.329	725	0.347	748	0.365	771	0.383	793	0.401	815	0.420	837	0.438	858	0.457	879	0.476	900	0.495	920
	1985	0.324	682	0.342	705	0.360	728	0.378	751	0.396	773	0.415	795	0.434	817	0.452	838	0.471	859	0.491	880	0.510	900	0.529	920	0.549	940
	2079	0.374	710	0.393	732	0.411	755	0.430	777	0.449	798	0.468	820	0.487	841	0.507	861	0.526	882	0.546	902	0.566	921	0.586	940	0.606	959
VSV060	1816	0.243	632	0.260	657	0.277	681	0.294	705	0.311	729	0.329	752	0.346	775	0.364	798	0.382	820	0.400	842	0.418	863	0.437	884	0.455	905
	1918	0.290	662	0.308	686	0.326	709	0.343	732	0.361	755	0.379	778	0.398	800	0.416	822	0.435	843	0.453	864	0.472	885	0.491	906	0.510	926
	2019	0.342	692	0.360	715	0.378	738	0.397	760	0.415	782	0.434	804	0.453	825	0.472	846	0.491	867	0.510	888	0.530	908	0.549	927	0.569	947
	2121	0.398	722	0.417	745	0.436	767	0.455	789	0.474	810	0.493	831	0.513	852	0.532	872	0.552	892	0.572	912	0.592	931	0.613	950	0.633	968
	2222	0.458	753	0.478	775	0.497	796	0.517	817	0.537	838	0.557	858	0.577	878	0.597	898	0.617	917	0.638	936	0.659	954	0.680	973	0.701	990

A2L Information and Installation Requirements

Installation/Code Compliance Requirements

Building level controls may need to be upgraded/modified to demand leak mitigation actions as described in “Leak Detection System (Refrigerant charge greater than 3.91 lb per circuit),” p. 29. Those actions include, but are not limited to, fully opening damper and VAV boxes (if present), and disabling electric heat in VAV boxes (if present).

Verify the equipment refrigerant charge is in accordance with the room area limitation as described in Minimum Room Area Limits section.

Ensure that there are labels on the equipment stating it contains a flammable refrigerant.

A2L Work Procedures

⚠ WARNING

Risk of Fire — Flammable Refrigerant!

Failure to follow instructions below could result in death or serious injury, and equipment damage.

- **To be repaired only by trained service personnel.**
- **Do not puncture refrigerant tubing.**
- **Dispose of properly in accordance with federal or local regulations.**
- **The equipment shall be stored in a room without continuously operating ignition sources.**

⚠ WARNING

Refrigerant under High Pressure!

Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage.

System contains refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

The units described in this manual use R-454B refrigerant. Use ONLY R-454B rated service equipment or components with these units. For specific handling concerns with R-454B, contact your local Trane representative.

Installation, repair, removal, or disposal should be performed by trained service personnel.

At all times, Trane’s maintenance and service guidelines shall be followed. If in doubt, contact Trane technical support for assistance.

Servicing

Prior to initiating work on equipment, check the area with an appropriate refrigerant detector. Ensure the service personnel are properly trained regarding work in potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed, or intrinsically safe. Be aware that the refrigerant does not contain an odor.

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available on hand. A dry powder or CO_2 fire extinguisher should be located adjacent to the charging area.

At all times, Trane’s maintenance and service guidelines shall be followed. If in doubt, contact Trane technical support for assistance.

All maintenance staff and others working in the local area shall be instructed on the nature of the work being carried out. Work in confined spaces shall be avoided.

Ignition Source Mitigation

Do not use any sources of ignition when working on the refrigeration system.

Keep all ignition sources, including cigarette smoking, away from the site of installation, repair, removal or disposal, during which refrigerant can potentially be released to the surrounding space.

Survey the area around the equipment before initiating work to ensure no flammable hazards or ignition risks are present.

“No Smoking” signs shall be displayed.

Do not use devices that can be a source of ignition to accelerate defrosting of components. Use only defrost and cleaning procedures recommended by Trane. Do not pierce or burn.

Ventilation

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere. If present, check that the ventilation system, including outlets, are operating adequately and are not obstructed.

Refrigerating Equipment

Refrigerant piping or components should not be installed in locations where substances which may corrode them are present.

Check that equipment hazard markings are visible and legible. Replace them if they are not.

For equipment using secondary fluids, like water or glycol, check that refrigerant is not present in the secondary fluid loop before conducting any hot work.

Electrical Devices

Do not apply power to the circuit if a fault exists which compromises safety. If the fault cannot be corrected immediately, but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment, so all parties are advised.

Initial safety checks shall include:

- Cabling is not subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. Account for the effects of aging or continual vibration from sources such as compressors or fans.
- Capacitors are discharged. This shall be done in a safe manner to avoid possibility of sparking.
- No live electrical components and wiring are exposed while charging, recovering, or purging the system.
- Verify continuity of earth bonding.
- Replace electrical components with Trane replacement parts, or those meeting the same ratings and qualified for flame arrest protection, UL LZGH2 category.

Leak Detection

Never use an open flame to detect leaks. A halide torch should not be used. Use only approved leak detection methods per this instruction manual.

The following leak detection methods are deemed acceptable for all refrigerant systems.

Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Verify the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL gas (25% maximum) is confirmed.

Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

Examples of leak detection fluids are:

- Bubble method
- Fluorescent method agents

If a leak is suspected, all naked flames shall be removed/ extinguished.

If a refrigerant leak is found which requires brazing, all refrigerant shall be recovered from the system, or isolated (by means of shut-off valves) in a part of the system remote from the leak.

Refrigerant Removal and Evacuation

Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (special cylinders for the recovery of refrigerant, for example). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration.

The following procedure shall be adhered to:

1. Safely remove refrigerant following local and national regulations.
2. Evacuate.
3. Purge the circuit with inert gas.
4. Evacuate (optional for A2L).
5. Continuously flush or purge with inert gas when using flame to open circuit.
6. Open the circuit.

Prior to refrigerant removal, open all appropriate valves, including solenoid and electronic expansion valves (EXVs). Use control settings, where available. When not available, manually open all electronically controlled valves using acceptable service procedures.

The recovery equipment shall be in good working order with instructions available. Equipment shall be suitable for the recovery of the flammable refrigerant. For specific handling concerns, contact the manufacturer. Ensure all hose connections are checked for tightness to avoid refrigerant leaks.

In addition, a set of calibrated weighing scales shall be available and in good working order.

The refrigerant shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. Do not mix refrigerants in recovery unit and especially not in cylinders.

Refrigerant recovery unit should be purged with an inert gas after each use or before using with a different refrigerant Class – for example, A2L to A1.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

The system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

The system shall be vented down to atmospheric pressure to enable work to take place.

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

Refrigerant Charging

In addition to conventional charging procedures, the following requirements shall be followed.

- Ensure that contamination of different refrigerants does not occur when using charging equipment.
- Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigerating system.

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Prior to refrigerant charging, open all appropriate valves, including solenoid and electronic expansion valves (EXVs). Use control settings, where available. When not available, manually open all electronically controlled valves using acceptable service procedures.

Verify the equipment refrigerant charge is in accordance with the room area limitation as described in Minimum Room Area Limits section.

Decommissioning

Before carrying out the decommissioning procedure, it is essential that the trained service personnel is completely familiar with the equipment and all its details. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation.
2. Isolate system electrically.
3. Before attempting the procedure, ensure that:
    a. Mechanical handling equipment is available, if required, for handling refrigerant cylinders.
    b. All personal protective equipment is available and being used correctly.
    c. The recovery process is supervised at all times by a competent person.
    d. Recovery equipment and cylinders conform to the appropriate standards.
4. Pump down refrigerant system, if possible.
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
6. Make sure that cylinder is situated on the scales before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.
8. Do not overfill cylinders (no more than 80% volume liquid charge).
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
11. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.
12. When equipment has been decommissioned, attach a signed and dated label stating it has been decommissioned and emptied of refrigerant.
13. Ensure that there are labels on the equipment stating it contains flammable refrigerant.

A2L Application Considerations

This product is listed to UL standard 60335-2-40, Household and Similar Electrical Appliances – Safety – Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers, which defines safe design and use strategies for equipment using A2L

refrigerants. This standard limits the refrigerant concentration in a space in the event of a refrigerant leak. To meet the requirements, the UL standard defines minimum room area, refrigerant charge limit, minimum circulation airflow and/or ventilation airflow requirements, and limits the use of ignition sources in spaces. The standard may require a unit refrigerant leak detection system.

For equipment with R-454B and charge amounts less than or equal to 3.91 lbs per circuit, this UL standard does not prescribe a room area limit and does not require a refrigerant leak detection system or any circulation airflow or ventilation airflow mitigation strategies. However, ignition sources in ductwork must be evaluated.

Depending on the application, a specific requirement of ANSI/ASHRAE Standard 15, Safety Standard for Refrigeration Systems, could be more stringent than UL 60335-2-40 requirements. See *Refrigeration Systems and Machinery Rooms Application Considerations for Compliance with ASHRAE® Standard 15-2022 Application Engineering Manual* (APP-APM001*-EN) for more information.

Ignition Sources in Ductwork

Do not install open flames in the ductwork. Hot surfaces exceeding 700°C (1290°F) should not be installed in the ductwork unless the average airflow velocity is not less than 1.0 m\s (200 ft\min) across the heater and proof of airflow is verified before system is energized.

Electric heaters can exceed the surface temperature limit if airflow distribution is poor, or insufficient airflow is provided over the heater.

Surface temperatures of most gas heaters do not exceed the surface temperature limits due to ANSI construction requirements.

Ignition Sources in Unit

This unit does not contain any ignition sources. All potential ignition sources, (including factory or field installed accessory electric heaters, gas heaters, relays, and contactors) were evaluated during product UL listing.

Minimum Room Area Limits (Refrigerant charge greater than 3.91 lb per circuit)

Equipment with R–454B charge amounts greater than 3.91 lb per circuit may require additional circulation or ventilation airflow mitigation strategies. In this case, two minimum room area (A_{min}) thresholds:

- The first threshold defines when equipment serving a single room is required to provide circulation airflow, either continuous or activated by a leak detection system. A ducted system requires circulation airflow unless the smallest room it serves is larger than the adjusted A_{min} threshold. This product contains a leak detection system if a circuit charge is greater than 3.91 lbs. As a result, no further leak detection system evaluation is required.
- The second threshold defines when additional ventilation airflow is required. If the room area, A or TA, is below the adjusted A_{min} or TA_{min} threshold, additional ventilation is required to remove refrigerant in the event of a leak. See the UL 60335-2-40 Clause GG.8 and ANSI\ASHRAE Standard 15 Section 7 for natural and mechanical ventilation requirements.

Table 20. Minimum room area — vertical

Models	Minimum Room Area (m^2) 0.6 meters height	Minimum Room Area (ft^2) 1.9 feet height
VSVK024	23.0	247.6
VSVK033	20.7	222.9
VSVK042	29.1	313.3
VSVK050	29.1	313.3
VSVK060	29.1	313.3

Table 21. Minimum room area — horizontal

Models	Minimum Room Area (m^2) 2.2 meters height	Minimum Room Area (ft^2) 7.2 feet height
VSHK024	5.9	63.6
VSHK033	5.7	61.4
VSHK042	8.3	89.4
VSHK050	8.3	89.4
VSHK060	8.3	89.4

Minimum Room Area (A_{min}) Adjustments

Use equation below to adjust the minimum room area, as applicable, based on the unit's installation height, altitude, and occupancy level it serves.

$$A_{min.adj} = \text{Nameplate } A_{min} \times \text{Altitude Adj} \times \text{Height Adj} \times F_{occ}$$

Multiply the altitude adjustment factor in the table below by A_{min} listed on the unit nameplate or in the Installation, Operation, and Maintenance (IOM) manual.

Table 22. Altitude adjustment factor

Altitude (ft)	Sea Level to 2000	2001 to 4000	4001 to 6000	6001 to 8000	8001 to 10000	10001 to 12000	12001 to 14000	14001 to 15000	Over 15000
A_{min} Adjustment	1	1.05	1.11	1.17	1.24	1.32	1.41	1.51	1.57

In addition, A_{min} can be adjusted if the unit is installed in a room at a height that is higher than the minimum height shown on the unit. To adjust A_{min}, multiply by the ratio of the unit minimum release height (in meters) / actual release height (in meters). Use 0.6 m in the ratio for unit minimum installation heights less than or equal to 0.6 m.

For institutional occupancies, ASHRAE Standard 15 applies an additional adjustment factor F_{occ} to the amount of a charge allowed in a space. To calculate the adjusted A_{min} for institutional occupancies, multiply the A_{min} on the nameplate by two.

EXAMPLE 1: 20 Ton Packaged Rooftop Multi-Zone VAV System Serving an Institutional Occupancy Space

The packaged unit serves 7600 ft.^{2} of a nursing home located at an attitude of 4000 ft. The unit has two equally charged 10 ton refrigeration circuits. Each circuit has 12 lbs of refrigerant with a minimum room area requirement of 180 ft.^{2} with a 2.2 m release height.

$$TA_{min.adj} = 180 \text{ ft.}^2 \times 1.05 \times 2 = 378 \text{ ft.}^2$$

No additional ventilation is required.

EXAMPLE 2: 10 Ton Split System Serving a Single Commercial Occupancy Space

The split system serves a 1500 ft.^{2} manufacturing space at 5000 ft. altitude. The final installed charge of the single circuit 10 ton unit is 20 lb. The unit has an open return with a release height of 1 m and ducted supply air. The unit A_{min} is 660 ft.^{2}.

$$A_{min.adj} = 660 \text{ ft.}^2 \times 1.11 = 733 \text{ ft.}^2$$

No additional ventilation is required.

Determining Room Area (A or TA)

The room area (A) is the room area enclosed by the projection to the floor of the walls, partitions, and doors of the space that the equipment serves. For ducted systems, total room area (TA) of all rooms connected by ducts, may be used instead of A.

Rooms connected by drop ceilings only are not considered a single room.

Rooms on the same floor of the building, and connected by an open passageway, can be considered part of the same room if the passageway is a permanent opening, extends to the floor and is intended for people to walk through.

Adjacent rooms on the same floor of the building and connected by permanent openings in the walls and/or doors between rooms (including gaps between the wall and the floor), can be considered part of the same room if the openings meet the following criteria.

- The opening is permanent and cannot be closed.
- Openings extending to the floor, such as door gaps, need to be at least 20 mm above the floor covering surface.
- Natural ventilations opening areas must meet the requirements of ANSI\ASHRAE Standard 15-2022, Section 7.2.3.2.

Rooms that are connected by a mechanical ventilation system can be considered a single room area if the mechanical ventilation system meets the requirements of ANSI\ASHRAE Standard 15-2022, Section 7.6.4.

Leak Detection System (Refrigerant charge greater than 3.91 lb per circuit)

The leak detection system consists of one or more refrigerant detection sensors. When the system detects a leak, the following mitigation actions will be initiated until refrigerant has not been detected for at least 5 minutes:

- Energize the supply fan(s) to deliver a required minimum amount of circulation airflow.
- Disable compressor operation.
- Provide an output signal that can be used to fully open zone dampers and/or VAV boxes and disable electric heat in VAV boxes.
- Provide an output signal that can be used to energize additional mechanical ventilation (if needed).
- Units without airflow proving will disable electric heat sources.

Building fire and smoke systems may override this function.

If the refrigerant sensor has a fault, is at the end of its life, or is disconnected, the unit will initiate the mitigation actions. Mitigation actions may be verified by disconnecting the sensor.

The refrigerant sensors do not need service. Use only manufacturer-approved sensors when replacement is required.

Installation

General Installation Checks

The checklist below is a summary of the steps required to successfully install a commercial unit. This checklist is intended to acquaint the installing personnel with what is required in the installation process. It does not replace the detailed instructions called out in the applicable sections of this manual.

1. Remove packaging and inspect the unit. Check the unit for shipping damage and material shortage; file a freight claim and notify appropriate sales representation.

Note: *All units are anchored to the skid with four angle brackets. Remove these brackets before lifting unit into place.*

2. Verify the correct model, options and voltage from the unit nameplate.
3. Pull out all field attached parts (i.e. filter rack, duct collar, filter and mounting screws) from the unit packaging for field mounting.
4. Verify the installation location of the unit will provide the required clearance for proper operation.
5. Remove refrigeration access panel and inspect the unit. Be certain the refrigerant tubing has clearance from adjacent parts.
6. Fabricate and install duct work.
7. Install and connect a condensate drain line and trap to the drain connection.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

Important: *If the unit is not equipped with an optional factory-installed non-fused disconnect switch, a field-supplied disconnect switch must be installed at or near the unit in accordance with National Electrical Code (NEC latest version).*

Main Electrical

1. Verify the power supply complies with the unit nameplate specifications.
2. Inspect all control panel components; tighten any loose connections.
3. Connect properly sized and protected power supply wiring to the disconnect switch and/or to the power block, depending on options selected. Proper torque for 30A disconnect switch is 7.1 in-lbs and for 60A disconnect switch is 17.7 in-lbs. Refer to Table 23, p. 31 for power block wire torque.

Table 23. Power block wire torque

Power Supply Wire Size (AWG)	Torque (in-lbs)
10-14	35
8	40
4-6	45
2	50

4. Install proper grounding wires to an earth ground. Refer toTable 24, p. 31 for ground wire torque.

Note: *All field-installed wiring must comply with NEC and applicable local codes.*

Table 24. Ground wire torque

Ground Wire Size (AWG)	Torque (in-lbs)
10-14	35
8	40
4-6	45
2/0-0	50

Low Voltage Wiring (AC) Requirements

1. Install the zone sensor.
2. Connect properly sized control wiring to the proper termination points between the zone sensor and the unit control panel.

Filter Installation

Each unit ships with 1-inch or 2-inch disposable, MERV 8 or MERV 13 filter(s). The filter is factory installed.

Note: *Do not operate the unit without filters.*

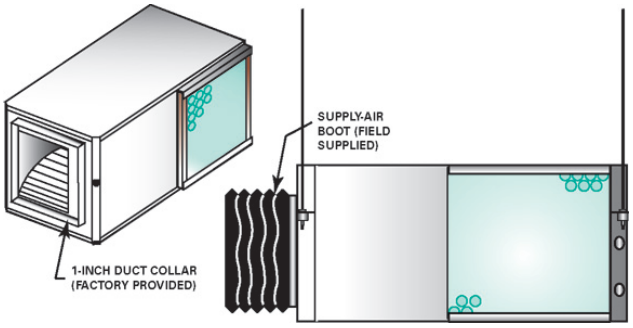
Supply-Air Ductwork

Install the 1-inch supply-air duct flange to the unit with the (8) 5/16-inch factory supplied head screws. The duct collar assembly for each unit is shipped with the unit in the same box where the IOM manual is located.

When attaching the field ductwork to the unit, provide a watertight flexible connector at the unit to prevent operating sounds from transmitting through the ductwork. See the following figure for more information.

Elbows with turning vanes or splitters are recommended to minimize air noise due to turbulence and to reduce static pressure.

Figure 13. Flexible supply-air connector (field provided)



Return-Air Ductwork

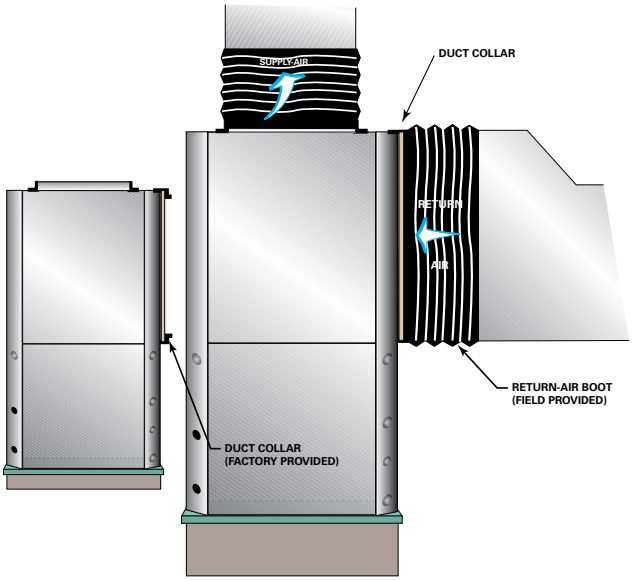
The equipment factory ships with the filter rail and filter(s) installed for free return.

When a ducted return is required, a ducted filter rack or ducted panel must be installed on the unit. When attaching the field ductwork to the unit, provide a water tight flexible connector at the unit to prevent operating sounds from transmitting through the ductwork. See the following figure for more information.

Elbows with turning vanes or splitters are recommended to minimize air noise due to turbulence and to reduce static pressure.

Note: *Installation of a return-air ducted panel or ducted filter rack require the removal of the filter rails.*

Figure 14. Flexible return-air connector (field provided)



Return Air Ducted Panel

The return-air arrangement may be easily converted from a free return-air system to a ducted return-air system with the addition of a return-air ducted panel. By replacing the filter rail with the return-air panel, a complete seal from the duct to the unit is possible. The 1-inch duct panel facilitates ease of field connection to the mechanical system. This accessory is typically used when the return air filter is placed up stream of the unit or placed within a field provided filter rack assembly.

Figure 15. Ducted panel

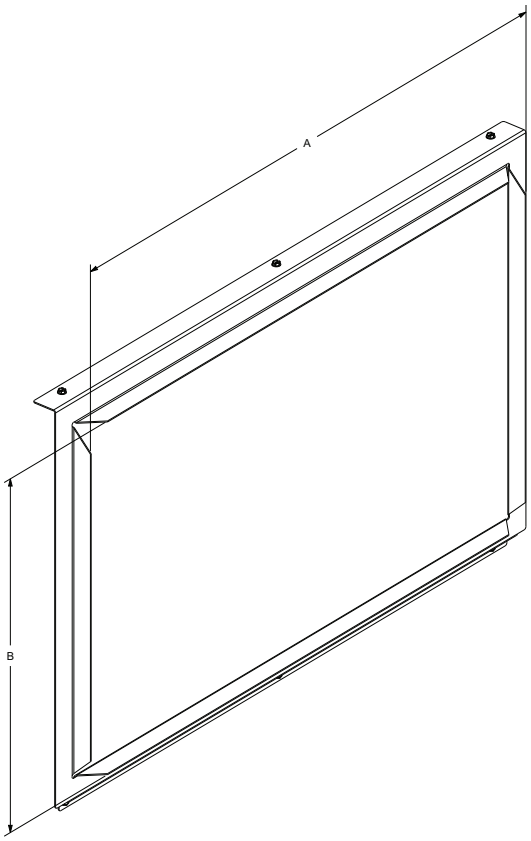


Table 25. Return air ducted panel

Unit	A	B	Part Number
H 042–060	31–3/8 inches	18–15/16 inches	WSHPPND00084
H 024–033	21–3/8 inches	18–5/8 inches	WSHPPND00085
V 042–060	28–3/16 inches	26–3/16 inches	WSHPPND00006
V 024–033	28–3/16 inches	19—1/2inches	WSHPPND00005

Ducted Filter Rack

When it is necessary to have filter access at the unit in a ducted return, a ducted filter rack is available. This option allows access to the filter at the unit. Vertical unit filter racks are available in right or left access configurations. Horizontal units are available in bottom access configurations.

Figure 16. Ducted filter rack – dimensions

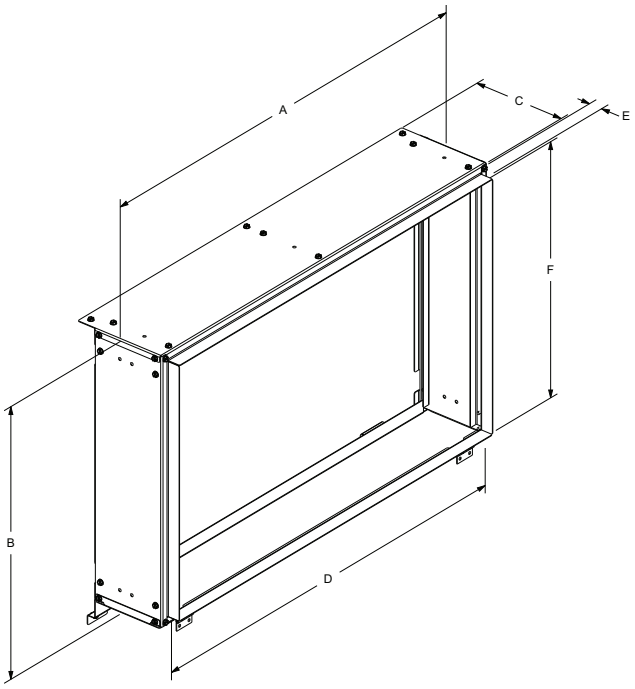


Table 26. Ducted filter rack dimensions

Unit	Filter Size	A	B	C	D	E	F	Part Number
H 042–060	1–2	32–1/4	20	5	31–1/16	1	18–7/8	WSHPFL-T00134
H 042–060	2–4	32–1/4	20	7	31–1/16	1	18–7/8	WSHPFL-T00135
H 024–033	1–2	21–7/8	20	5	20–3/4	1	18–7/8	WSHPFL-T00130
H 024–033	2–4	21–7/8	20	7	20–3/4	1	18–7/8	WSHPFL-T00131
V 042–060	1–2	30	26–3/4	5	28–3/4	1	25–5/8	WSHPFL-T00065 WSHPFL-T00122
V 042–060	2–4	30	26–3/4	7	28–3/4	1	25–5/8	WSHPFL-T00048 WSHPFL-T00117
V 024–033	1–2	30	26–3/4	5	28–3/4	1	25–5/8	WSHPFL-T00064 WSHPFL-T00121
V 024–033	2–4	30	26–3/4	7	28–3/4	1	25–5/8	WSHPFL-T00047 WSHPFL-T00116

Sound Attenuation Pad

For sound-sensitive installations, a vibration pad (field provided) should be placed beneath the vertical unit. The pad should be ½-inch (12.7 mm) thick, and equal to the overall unit foot print.

Hanging the Horizontal Unit

⚠ WARNING

Proper Structural Support Required!

Failure to ensure proper structural ceiling support could result in unit falling from its location which could result in death or serious injury.

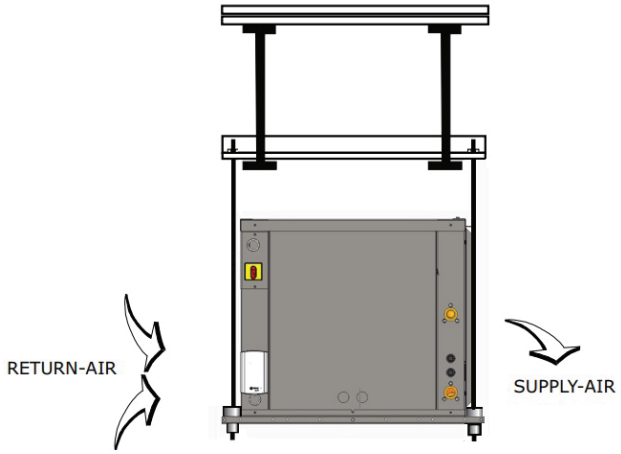
Ceiling structure must be strong enough to support the weight of the unit and any accessories. If unsure, check with a structural engineer.

To hang the horizontal configuration follow the steps below:

1. Install the hanging isolators (located in the control box of the unit) into the six hanging brackets.
2. Use a lift with a large supporting surface or a wooden structure supporting the base of the unit (hanging rails) when the unit is lifted for installation.
3. Secure the equipment to a joist, concrete, etc. with the use of 3/8 in. field provided (all-thread) rod. Each corner should contain field provided nuts and washers to complete the hanging installation.
4. All horizontal units should be installed level. All plumbing to the unit should conform per national and local codes and is the responsibility of the contractor.

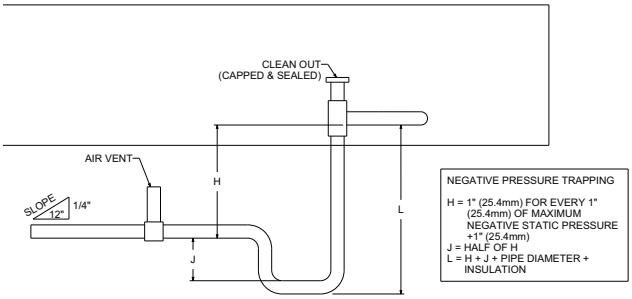
Note: *Rods must be perpendicular to the mounting holes in the base rail of the horizontal unit.*

Figure 17. Hanging the unit



Condensate Drain Connection

Figure 18. Negative pressure system



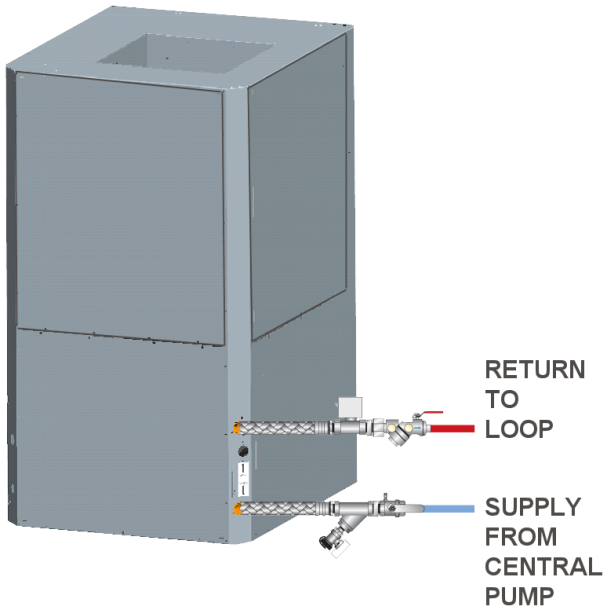
Install proper trapping to the equipment. The unit drain connection is ¾-inch NPT.

When designing the condensate trap for the water-source system, it is important to consider the unit draw-thru design requiring negative pressure trapping.

In a properly trapped system, when condensate forms during normal operation, the water level in the trap rises until there is a constant flow. It is imperative to maintain water in the trap and not allow the trap to dry out during heating season. Keeping trap primed at all times will enable the water to flow properly. See the negative pressure system figure for appropriate dimensions required in a negative pressure system.

Supply/Return Pipe Connections

Figure 19. Supply/return pipe connections



Connect the supply and return hoses to the water-inlet (from supply) and water-outlet (to return) of the unit. For vibration isolation, it is recommended that flexible steel braided hoses be installed instead of hard piping the equipment to the main loop system. The above figure

shows connection of a balancing hose kit to the water-in and water-out of a vertical unit.

Note: *Supply/return pipe connections figure example incorporates the balancing hose kit and a 2-position isolation valve into the system design. An isolation valve is often used in variable-speed pumping applications. The isolation valve is designed to stop water flow to the unit during non-operation times. This allows the loop water pumps to run only when a requirement for pumping is needed for greater energy efficiency of the overall system design.*

System Balancing Hose Kit

For automatic system balancing of a water source heat pump, the self-balancing hose kit provides a constant flow rate over the pressure differential rage of 2 to 80 psid. As system pressure changes (through further addition of heat pumps, for example) each individual flow control valve will automatically adjust to the new system conditions. In variable water volume applications, a self-balancing hose kit can provide continuous balancing because of its ability to automatically adjust to the varying system conditions.

Note: *At low differential pressure the flow area required to achieve higher flow can exceed the flow area available for the respective series. Therefore, the minimum pressure differential requirement is increased for the higher flow ranges of each series valve.*

Additional accessories, such as a strainer are recommended for use to eliminate contaminants from entering the co-axial water-to-refrigerant heat exchanger.

Cleaning and Flushing the Water Loop

After the piping system is complete, the flexible hose connectors should be disconnected from the unit and linked together using field supplied couplings (avoiding trash settle-out in the condenser). An extra pipe may be necessary to connect the hose kits.

1. Water circulation system should be filled with clean water using the water make up connections.

   Note: *Air vents should be open during filling.*

2. With the air vents closed, start the circulating pump and then crack the air vents to bleed off the trapped air, assuring circulation through all components of the system.

   Note: *Make up water must be available to the system to replace the volume formerly occupied by the air that is bled off.*

3. With the air vented and the water circulating, the entire system should be checked for leaks with repairs made as required.
4. Operate the supplementary heat system (boiler) if applicable making checks per manufacturer's instructions. During this operation, visual checks should be made for leaks that may have occurred due to increased heat. Repair as required.
5. Open the system at the lowest point for the initial blow down (making sure the make up water is equal to the water being dumped). Continue blow down until the water leaving the drain runs clear, but not less than 2 hours.
6. Shutdown pumps and supplementary heat system (if applicable). Reconnect the hoses placing the water-to-refrigerant heat exchanger in the water circulating system.

   Note: *Vents should be open when the pumps and supplementary heat system are shutdown.*

Field Installed Power Wiring

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

When it is necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks.

NOTICE

Use Copper Conductors Only!

Failure to use copper conductors could result in equipment damage as the equipment was not designed or qualified to accept other types of conductors.

Verify that the power supply available is compatible with the units nameplate. Use only copper conductors to connect the power supply to the unit.

Main Unit Power Wiring

⚠ WARNING

Electrical Shock Hazard!

Failure to follow instructions below could result in death or serious injury.

System contains oversized grounding terminal. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

A field supplied disconnect switch must be installed at or near the unit in accordance with the National Electric Code (NEC latest edition).

Location of the applicable electric service entrance for HIGH (line voltage) may be found in the Dimensions section of this manual.

The high-voltage connection is made at the optional disconnect switch or the power block inside the unit control box. Refer to the customer connection diagram that is shipped with the unit for specific termination points.

Provide proper grounding for the unit in accordance with the local and national codes.

Control Power Transformer

The 24V control power transformer is to be used only with the accessories called out in this manual. All variable-speed WSHP units include a 100 VA control transformer equipped with a circuit breaker. If a circuit breaker trips, turn **OFF** all power to the unit before attempting to reset it.

⚠ WARNING

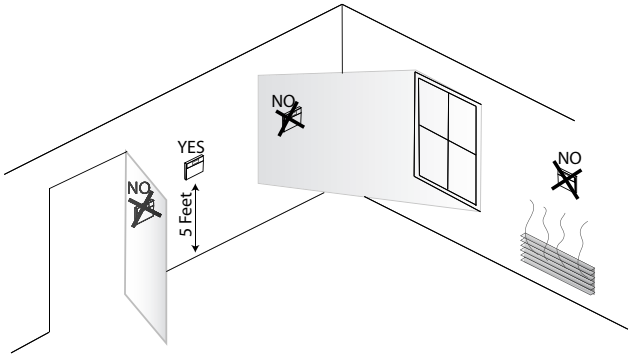
Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Sensor Location

Figure 20. Sensor location



Location of the zone sensor is an important element of effective room control.

Areas where the zone sensor should not be located include:

- Behind doors or corners
- Near hot or cold air ducts
- Near radiant heat (this is heat emitted from appliances or the sun)
- Near concealed pipes or chimneys
- On outside walls or other non conditioned surfaces
- In airflows from adjacent zones or other units.

Controls Using DC Analog Input/ Outputs (Standard Low Voltage Multiconductor Wire)

Before installing any connecting wiring between the unit and components utilizing a DC analog input/output signal, refer to the Dimensional information in the Dimension and Weights chapter for the electrical access locations provided on the unit.

1. The zone sensor module wiring table lists the conductor sizing guidelines that must be followed when interconnecting the DC binary output devices and the system components utilizing a DC analog input/output signal to the unit.

   Note: *Resistance in excess of 2.5 ohms per conductor can cause deviations in the accuracy of the controls.*

2. Ensure that the wiring between controls and the unit's termination point does not exceed two and a half (2.5) ohms/conductor for the length of the run.
3. Do not run the electrical wires transporting DC signals in or around conduit housing high voltage wires.

Table 27. Zone sensor module wiring

Distance from unit to control (feet)	Recommended wire size (gauge)
0-385	18
386-610	16
611-970	14

Figure 21. Low voltage wire connection

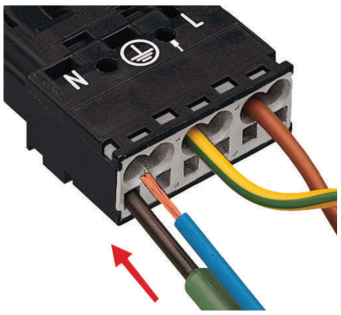
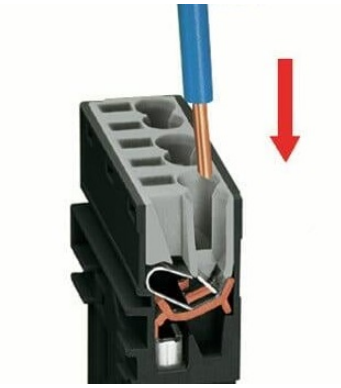
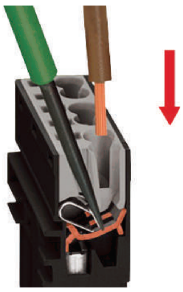


Figure 22. Low voltage single wire connection



Note: *Make connection for a single wire by inserting a single wire after stripping off the coating.*

Figure 23. Low voltage stranded wire connection



Connect the stranded wire as follows:

1. Release the spring with a dedicated screwdriver (blade width 2.5 mm).
2. Insert the stripped cable until it goes no further.
3. Complete the connection by removing the screwdriver.

Figure 24. Zone sensor controls

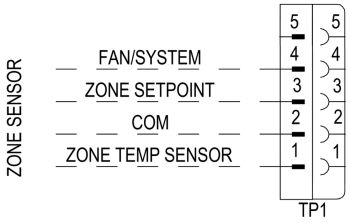
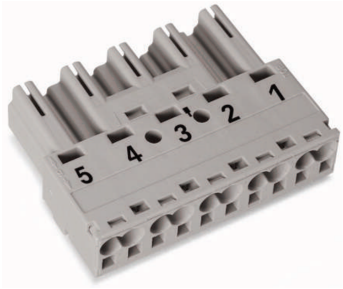
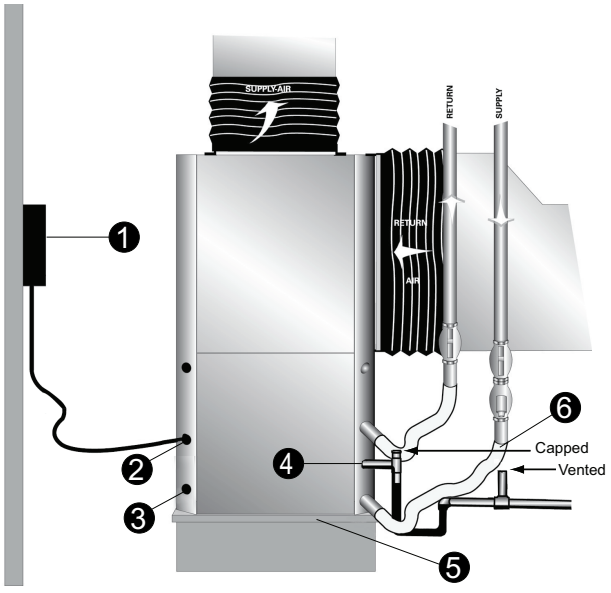


Figure 25. TP1 connection type



Installation of the Axiom Model VS

Whether securing the Axiom model VS to a central pumping system or a distributed pumping system, Trane recommends a few accessory considerations to the system installation.



The field supplied line voltage disconnect (1) should be installed for branch circuit protection.

Check local codes for requirements.

- The units (2) ¾-inch high voltage and (3) ½-inch low voltage connections are located on the left corner of the unit. They are designed to accept conduit.
- Trane recommends that the condensate system (4) be set-up per negative pressure trapping in consideration of the unit's draw-through design. With this properly trapped system, when condensate forms during normal operation, the water level in the trap rises until there is a constant outflow.
- For acoustically sensitive areas, a ½-inch thick field provided vibration pad (5) should be installed below the vertical unit. This field provided piece should be equal to the overall footprint size of the unit to provide sound damping of the unit while in operation.
- Hose kits (6) are used to connect the water supply and return lines to the water inlet and outlets. Trane includes various hose kit combinations to better facilitate system flow balancing. These flexible hoses, reduce vibration between the unit and the rigid piping system.

Variable-Speed WSHP Symbio™ 400-B Controller

I/O Definitions

Hard-wired input/outputs for the variable speed WSHP Symbio 400-B controllers are defined in Table 28, p. 40.

Table 28. Symbio 400-B hard wired input/output definitions

Connection Type	Symbio 400-B Terminal	Variable-speed WSHP Configuration	Connection Specifications[a]	Valid Range
Analog Inputs	AI1	Zone Temp Sensor/Timed Override and Timed Override Cancel	10kΩ Thermistor	-40-212°F
	AI2	Zone Setpoint	0-1000Ω	50-90°F
	AI3	Fan Mode (Control Auto/Off) AHRI Audit Test Mode Initiate	200-100kΩ	Auto/Off Test Mode Active/ Inactive
	AI4	Discharge Air Temperature	10kΩ Thermistor	-40-212°F
	AI5	Entering Water Temperature Sensor	10kΩ Thermistor	-40-212°F
Universal Inputs	UI1	Relative Humidity Sensor	4–20 mA	0-100%RH
	UI2	Leaving Water Temperature	10kΩ Thermistor	-40-212°F
Binary Inputs	BI1	Local Occupancy	24 Vac detect	Normally Open Occ./Unocc
	BI2	Compressor Protection Status - Low/High Pressure Cut Out, Discharge Alarm & Refrigeration Faults		Normally Closed Okay/Failed
	BI3	Frost Detect		Normally Closed Okay/Failed
Binary Outputs (Relay)[b]	BO1	Supply Fan On/Off Control	0.5 A max @24Vac, resistive and pilot duty	Energized/De-Energized
	BO2	Drive Fault Reset		Energized/De-Energized
	BO3	NA		NA
Binary Outputs (Triac)[c]	BO4	NA		NA
	BO5	NA		NA
	BO6	NA		NA
	BO7	Reversing Valve		Energized/De-Energized
	BO8	Isolation Valve / External Pump		Energized/De-Energized
	BO9	NA		NA
Analog Outputs/ Binary Inputs	AO1/ BI4	ECM Motor Control Signal	PWM Output: 17Vdc; 80Hz	0-100% Duty Cycle
	AO2/ BI5	Variable Speed Compressor Control Signal	Linear: 0-10Vdc	0-100% Compressor Output
Communication	IMC +	NA	Comm.	NA
	IMC -	NA	Comm.	NA
	LINK +	BACnet Comm. +	Comm.	NA
	LINK -	BACnet Comm. -	Comm.	NA
Pressure Inputs	PI1	NA	NA	NA
	PI2	NA	NA	NA
Service button	“Service”	Test Mode Input	NA	NA

[a] For more information on the Symbio 400-B connection specifications, see *Symbio™ 400–B/500 Programmable Controllers Water Source Heat Pump (WSHP) Installation Operation and Maintenance (BAS-SVX092*-EN)*.

[b] 24Vac will be supplied to the Triac Supply input to be used for the Triac outputs.

[c] 24 Vac will be connected to the binary outputs and the Symbio 400-B will provide a contact closure for output control.

Hard-wired input/outputs for the variable speed WSHP HEX I/O are defined in Table 29, p. 41.

Table 29. HEX LLID hard wired input/output definitions

Connection Type	HEX I/O Terminal	Variable-speed WSHP configuration	Connection specifications	Valid range
Hex LLID UIO	UIO1	Refrigerant Leak Detection System Input (A2L)	Binary Input Contact Closure	• Open = Leak Detected • Closed = Inactive Normal
	UIO2	Supply Fan Status	Binary Input Contact Closure	• Open = Fan Off • Closed = Fan Running
	UIO3	Condensate Overflow Input	Binary Input Contact Closure	• Open = Overflow • Closed = Inactive Normal
	UIO4	Drive Fault Status (General Drive Fault)	Binary Input Contact Closure	• General drive fault via Drive Relay • Latches after 10 consecutive trips • Does not require a drive reset unless the drive is latched (after 3 min minimum off time)
	UIO5	Test Mode Input Enables Field Test mode and remote control of AHRI test	Binary Input Contact Closure	• Open = Inactive • Closed = Initiate test step
	UIO6	Analog Input	0-10Vdc	VFD Feedback

Symbio™ 400-B Setpoints and Set-up Parameters

The setpoints shown in Table 30, p. 41 are available for modification through the Tracer® TU Field Service tool if changes from the factory default values are required.

Table 30. Symbio™ 400-B setpoints

Input Name	Selections	Default
Default Setpoint		
Unoccupied Cooling Setpoint	40°F to 115°F	85°F
Unoccupied Heating Setpoint	40°F to 115°F	60°F
Occupied Offset	0.9°F to 18°F	1.5°F
Standby Offset	0.9°F to 18°F	7.5°F
Space Temperature Setpoint Default	40 to 115°F	72.5°F
Setpoint Limits		
Cooling Setpoint High Limit	40 to 115°F	110°F
Cooling Setpoint Low Limit	40 to 115°F	40°F
Heating Setpoint High Limit	40 to 115°F	105°F
Heating Setpoint Low Limit	40 to 115°F	40°F
Humidity Setpoint	40 to 100%	60%

Product-specific set-up parameters shown in Table 31, p. 42 are available for modification through the Tracer TU Field Service tool if changes are required and does not include standard Tracer TU parameters (for example, units of measure).

Table 31. Symbio™400-B set-up parameters

Input Name	Range	Default
Device		
Occupancy Request Source	Local Source BAS	Local Source
Heat Cool Mode Request Source	Local Source BAS	Local Source
Emergency Override Command Source	Local Source BAS	Local Source
Space Temperature Source	Local Source BAS	Local Source
Space Humidity Source	Local Source BAS	Local Source
Entering Water Temperature Source	Local Source BAS	Local Source
Supply Fan		
Supply Fan Configuration Command	Continuous[a] Cycling with capacity	Continuous
Enable Local Supply Fan Switch Control	Enable Disable	Enable
Supply Fan Speed Low Limit	33 to 100%[b]	33%
Space Temperature Setpoint Source	BAS Default	Local Source
Supply Fan Speed High Limit	75 to 110%	100%
Filter Runtime Hours Enable	Enable Disable	Enable
Filter Runtime Hours Setpoint	0 to 10000 hours	600 hrs.
Bypass Time		
Occupied Bypass Time[c]	0 to 240 minutes	120 min.
Humidity/Dehumidification		
Space Dehumidification Setpoint Default	40 to 100%	60%

[a] Fan will cycle when unoccupied.
[b] The minimum supply fan speed percentage is dependent upon the maximum supply fan speed PWM percentage. The maximum supply fan speed percentage is based on the user selected maximum and is the highest fan speed the unit will run: 100% cool output.
[c] The occupied bypass timer is used for timed override applications.

Sequence of Operation

During normal operation, the compressor and supply fan outputs modulate to maintain the space temperature at the user-selected space temperature setpoint(s). Functions outside heating and cooling controlled by the variable speed WSHP Symbio™ 400-B controller are described in this section.

When refrigerant monitor detects leak, all outputs are set to OFF or 0 volts/mA except the fan.

Important: *Equipment with A2L sensors may start fan in an HVAC OFF state if the sensor or sensor wiring is compromised, IMC communications are interrupted, sensor fails, or a refrigerant leak is detected.*

Random Start Timer

At power-up, the Symbio™ 400-B controller will generate a random timer (unique to each controller) from 5–30 seconds. During this time period, unit functionality will be held off until the timer expires.

Maintenance Timer

The Symbio™ 400-B controller will compare the amount of fan run time against an adjustable filter runtime hours Setpoint (stored in the controller) to determine when maintenance is recommended for the unit (check the filter status and other routine maintenance items as necessary). The filter runtime hours setpoint can be user-edited as required through the Tracer® TU service tool. The valid range for the filter runtime hours setpoint is 0 to 10000 hours and the default value is 600 hours. If the user selects a setpoint of 0, the Filter Change Required diagnostic is disabled.

Once the filter runtime hours setpoint has been exceeded, the controller generates a Filter Change Required diagnostic. The user will be notified of this diagnostic in building automation system applications or through Tracer TU.

The Filter Change Required diagnostic is cleared whenever a filter timer reset request is communicated to the controller and the fan run hours has exceeded the fan run hours limit. At that point, the fan run time is reset (to zero) and the process starts over.

Setpoint Arbitration

Variable speed WSHP units will require traditional zone heating and cooling setpoints, as well as a humidity setpoint for the dehumidification feature. These setpoints will be available locally through the Symbio™ 400-B or may be provided from a BAS.

The Symbio 400-B has provisions for a local zone setpoint input with a range of 50-85°F which will be used in conjunction with the occupied and standby offsets (default 1.5°F and 7.5°F). The local occupied zone setpoints will be calculated as follows depending on the occupancy status of the unit:

- Cooling Setpoint = Space Temp Setpoint Default + (Occupied Offset or Standby Offset)
- Heating Setpoint = Space Temp Setpoint Default - (Occupied Offset or Standby Offset)
- For unoccupied zone setpoints, the Symbio 400-B has default values for heating and cooling adjustable through Tracer TU.

When multiple setpoint sources are available (local and BAS), the controller will use the following logic for determining which setpoint should be used for active control:

1. If a valid communicated setpoint value is present, the communicated value will be used for control.
2. If a valid communicated setpoint value is not present but a valid hard-wired setpoint value is present, the hard-wired value will be used for control.
3. If neither valid communicated or hard-wired setpoint values are present, the controller will use the default setpoints.

Sensor Arbitration

The following sensor values can be provided to the Symbio™ 400-B via hard-wired inputs or through BACnet® communication. The controller will use a valid communicated value for unit control, regardless of the status of the hard-wired input.

- Space temperature
- Entering water temperature
- Space humidity

Occupancy Determination

The following standard occupancy modes and arbitration are supported in the variable speed WSHP Symbio™ 400-B:

MSV occupancy request[a]	Local occupancy input	Bypass timer	MSV occupancy status
Occupied	Occupied	N/A	Occupied
	Unoccupied	Zero	Standby
		Not zero	Bypass
Bypass	Occupied	N/A	Occupied
	Unoccupied	Zero	Standby
		Not zero	Bypass

MSV occupancy request[a]	Local occupancy input	Bypass timer	MSV occupancy status
Unoccupied	N/A	Zero	Unoccupied
		Not zero	Bypass
Standby	N/A	Zero	Standby
		Not zero	Bypass
Auto	Occupied	N/A	Occupied
	Unoccupied	Zero	Unoccupied
		Not zero	Bypass

[a] MSV occupancy request is a communicated occupancy mode request from a BAS.

Occupied Mode

When the controller is in occupied mode, the unit will attempt to maintain the space temperature to the active occupied heating or cooling setpoint. Occupied mode is the default mode of the Symbio 400-B controller.

Unoccupied Mode

When the controller is in unoccupied mode, the unit will attempt to maintain the space temperature at the stored unoccupied heating or cooling setpoint (configurable through the BAS or Tracer® TU).

Refer to the sections below for information on heating, cooling, and dehumidification operation during unoccupied periods.

Occupied Standby Mode

Occupied standby mode allows the unit to operate at a heating or cooling setpoint between the occupied and unoccupied setpoints (Space Temperature Setpoint ± Standby Offset) to help maintain the space while decreasing energy consumption. Unit operation in this mode is identical to the occupied mode except for the different heating and cooling setpoints.

Occupied Bypass Mode

Occupied bypass mode is used to transition the unit from the Unoccupied mode to the occupied mode for a period of time from 0 to 4 hours (configurable through Tracer TU).

The controller can be placed in occupied bypass mode by either communicating an occupancy request of bypass or by using the Timed Override (for example, ON) functionality of the controller and applicable zone sensors:

Timed Override Operation

While the unit is operating in unoccupied mode, if the timed override request button on the zone sensor is selected for 0.2 to 5 seconds, the unit will recognize this as a timed override request. This request is always accepted, but will only transition to occupied bypass mode if the controller was in unoccupied mode. Once initiated, the unit will enter occupied bypass mode for the duration of the occupancy bypass timer (default 120 minutes) or until the timed override request is cancelled.

While the unit is operating in occupied bypass mode, the timed override operation can be cancelled by a timed override cancel request. This request is always accepted, but the unit will transition back to unoccupied mode only if the unit is currently operating in occupied bypass mode.

Some Trane zone sensors have ON and CANCEL buttons for timed override operation. Pressing the ON button on the zone sensor applies a direct short across the space temperature input, as described above, and when the unit is in unoccupied mode, initiates the occupied bypass mode. The CANCEL button applies 1.5 kΩ across the space temperature input and is used to return a unit operating in occupied bypass mode back into unoccupied mode before the occupancy bypass timer has expired.

Supply Fan Mode Operation

Variable speed WSHP units can be set up to have either cycling or continuous fan mode operation. This feature is selectable through Tracer® TU or through a BAS as a communicated value. The default value for the supply fan mode is continuous.

Supply Fan Mode: Cycling

For active cooling, heating, and dehumidification operation, the supply fan will be commanded ON and will ramp up to the appropriate minimum speed (as described in the following sections) once the unit determines that there is a request for active compressor output control. Once the control determines that there is no longer a capacity request, and the compressor output is OFF, the supply fan will be de-energized once any supply fan off delays have timed out. During the supply fan off delay, the supply fan will remain energized for the predetermined time at the previous unit function's minimum speed.

Note: *During heating only, there will be a 30 second supply fan off delay.*

Supply Fan Mode: ON

For active unit control with the supply fan mode set to continuous, the unit will energize the supply fan and hold the fan speed output at the active minimum speed until there is a request for the fan speed to increase. This will hold true for all cases except during unoccupied periods in which the supply fan mode is forced to operate in cycling mode.

Zone Sensor Fan Switch

The variable speed WSHP controller supports a fan switch selection that is selectable by an applicable zone sensor module. When the fan switch is set to AUTO, the unit will utilize the configured supply fan mode (Cycling or Continuous) for supply fan output control and will operate heating, cooling, and dehumidification in order to meet the space demand. When the fan switch is set to OFF, the unit

will enter OFF mode. All heating and cooling capacity will be de-energized after the associated minimum on timers expire, the isolation valve will be de-energized, and the supply fan will de-energize once any associated off delay timer has expired; no heating, cooling, or supply fan operation will be allowed when the fan switch is set to OFF unless the unit is responding to refrigerant leak detection. If the refrigerant leak detection diagnostic is active, the fan will be enabled regardless of fan switch position.

If required, the user can enable/disable the zone sensor fan switch functionality through BAS or the Tracer TU service tool. A fan mode can also be requested through BAS. If a requested fan mode is requested through BAS, the local setting is ignored.

Unit Mode Arbitration

Table 32. Unit operating mode based on communicated value

Heat Cool Mode Request	Effective Unit Mode Operation	Description
Auto	Auto	Mode determined by active setpoint/sensor values.
Heat	Heat	Fan operation and heating operation allowed; no cooling or dehumidification.
Morning warm up	Heat	Fan operation and heating operation Allowed; no cooling or dehumidification.
Cooling	Cool	Fan operation, cooling operation, dehumidification operation allowed; no heating operation.
Night purge	Auto	Mode determined by active setpoint/sensor values.
Pre-cool	Cool	Fan operation, cooling operation, dehumidification operation allowed; no heating operation.
Off	Off	Fan, cooling, heating, and dehumidification operation disabled.
Test	Auto	Mode determined by active setpoint/sensor values.
Emergency heat	Heat	Fan operation and heating operation allowed; no cooling or dehumidification.
Fan only	Fan only	Fan operation at maximum speed only; no heating or cooling available.
Free cool	Auto	Mode determined by active setpoint/sensor values.
Ice-making	Auto	Mode determined by active setpoint/sensor values.
Max heat	Auto	Mode determined by active setpoint/sensor values.
Economizing	Auto	Mode determined by active setpoint/sensor values.
Dehumidify	Auto	Mode determined by active setpoint/sensor values.
Calibrate	Auto	Mode determined by active setpoint/sensor values.

Manual Mode Determination

Any BAS request for AUTO mode or any other enumeration for the Heat Cool Mode Request object that results in a system mode request of AUTO will result in the unit alternating between heating and cooling operation automatically as described in " Auto-Changeover," p. 45. If unit mode requests for modes other than AUTO are provided through the BAS, arbitration is used to determine the active mode as follows:

Refer to the table below to determine the unit operating mode based on communicated heat cool mode request values:

Note: *If the local fan switch functionality is enabled and the switch selection is set to OFF, the unit will be OFF regardless of the heat cool mode request from the BAS.*

Auto-Changeover

When the effective unit mode is auto, the following auto-changeover rules are used to determine the active unit mode:

At power-up, or after a unit reset, the active unit mode is set to:

- Heat, if the active space temperature < the cooling setpoint
- Cool, if the active zone temperature > the cooling setpoint

If the active unit mode is cool, the active unit mode is switched to heat when both of the following conditions are met:

- Active space temperature < the heating setpoint
- There is no longer a request for cooling

If the active unit mode is heat, the active unit mode is switched to cool when both of the following conditions are met:

- Active zone temperature > cooling setpoint
- There is no longer a request for Heating

Note: *Once the controller determines that there is a need to change the active unit mode, the compressor will not energize for the new mode until the compressor minimum off time has been met.*

Isolation Valve Operation

For all units, the Symbio™ 400-B supports a two-position water isolation valve without needing any special configuration; by default, the Symbio 400-B will control as though isolation valves are present.

Isolation Valve ON Control

The isolation valve output will be energized prior to the compressor (controlled open) during active compressor heating, cooling, dehumidification, and when forced open during manual output override testing. When the isolation valve is driven open for compressor operation, the output will be energized 20 seconds prior to the compressor and indoor fan (if not already energized) outputs to confirm adequate water flow to the heat exchanger. The water isolation valve will be driven open during all heating and cooling requests if there is a request for the compressor. During duty cycle conditions, the valve will follow the OFF control conditions.

Isolation Valve OFF Control

The isolation valve output will be de-energized (controlled closed) when there is no longer a request for compressor operation and the 10 minute minimum on time has expired or the manual output override test has driven it closed.

Reversing Valve Operation

For normal unit operation, the reversing valve output is energized when the unit is in cooling mode and de-energized in heating mode. When changing position of 4-way reversing valve from heating to cooling or cooling to heating, the compressor speed must be high enough (>20rps) to provide enough differential pressure to adequately shift the reversing valve position, while remaining below 40rps. Position of 4-way reversing valve is set during compressor startup when compressor speed command is ~35rps.

Cooling and Heating Operation

For normal cooling, dehumidification, and heating operation, the controller will use a PI cascade control algorithm to hold space temperature at the space temperature setpoint. The PI cascade control algorithm will sequence compressor cooling/heating and modulate fan speed to control space load. The algorithm predicts a discharge air temperature setpoint based on difference between space temperature and the space temperature setpoint. Minimum compressor speed is dependent on unit size, heat/cool mode, and entering water temperature.

Compressor speed is adjusted to maintain discharge air temperature to meet the predicted discharge air temperature setpoint, holding supply fan at a predicted minimum speed. The supply fan minimum speed will increase if the predicted discharge air setpoint reaches the discharge air temperature minimum for cooling, or maximum discharge air setpoint in heating, or if the compressor reaches maximum speed.

Based on the required unit capacity to meet the space demand, the unit will operate in four states:

- **Start-up:** At start-up, the supply fan ramps up to minimum speed and the compressor ramps up to minimum speed based on the prescribed start-up sequence.
- **Running:** During the running state, the compressor and fan speeds are modulated between the minimum and maximum values.
- **Shutdown:**During shutdown, the fan runs at the minimum speed, and the compressor operates per the prescribed shutdown sequence.
- **Unit Off:** Compressor remains OFF.

Cooling Sequence

If the unit has determined that the active unit mode should be cool and if the control determines that there is a need for active cooling capacity, the unit will energize the isolation valve and begin to control the compressor and supply fan outputs based on the space demand.

Heating Sequence

If the unit has determined that the active unit mode should be heat and if the control determines that there is a need for active heating capacity, the unit will energize the isolation valve and begin to control the compressor and supply fan outputs based on the space demand.

Unoccupied Cooling and Heating Operation

For variable-speed WSHP units, the unit will control the zone temperature to the active unoccupied setpoints utilizing the same PI control algorithm as is used during occupied operation.

Note: *All compressor protection schemes will be in effect during unoccupied operation, including the compressor startup and shutdown sequences.*

Demand Limit Operation

The variable speed WSHP controller supports a communicated request for demand limiting operation of the compressor and supply fan outputs. Demand limiting operates as follows: If the point is placed into the Active state, the unit limits the compressor capacity output to 50%

for all unit modes (cooling, heating, and dehumidification). During this period, the supply fan tracks the compressor capacity per unit mode.

Leak Detection System (Refrigerant charge greater than 3.91 lb per circuit)

The leak detection system consists of one or more refrigerant detection sensors. When the system detects a leak, the following mitigation actions will be initiated until refrigerant has not been detected for at least 5 minutes:

- Energize the supply fan(s) to deliver a required minimum amount of circulation airflow.
- Disable compressor operation.
- Provide an output signal that can be used to fully open zone dampers and/or VAV boxes and disable electric heat in VAV boxes.
- Provide an output signal that can be used to energize additional mechanical ventilation (if needed).
- Units without airflow proving will disable electric heat sources.

Building fire and smoke systems may override this function.

If the refrigerant sensor has a fault, is at the end of its life, or is disconnected, the unit will initiate the mitigation actions. Mitigation actions may be verified by disconnecting the sensor.

The refrigerant sensors do not need service. Use only manufacturer-approved sensors when replacement is required.

Pre-Start Checklist

Before energizing the unit, the following system devices must be checked:

- Is the high voltage power supply correct and in accordance with the nameplate ratings?
- Is the field wiring and circuit protection the correct size?
- Is the low voltage control circuit wiring correct per the unit wiring diagram?
- Is the piping system clean/complete and correct?
- Is vibration isolation provided? (i.e. unit isolation pad, hose kits)
- Is unit serviceable? See the Clearance Dimensions information within the manual.
- Are the low/high-side pressure temperature caps secure and in place?
- Are all the unit access panels secure and in place?
- Is the water flow established and circulating through all the units?
- Is the duct work correctly sized, run, taped, insulated, and weather proofed with proper unit arrangement?
- Is the condensate line properly sized, run, trapped, pitched, and primed?
- Is the zone sensor correctly wired and in a good location?
- Does the indoor blower turn freely without rubbing?
- Has all work been done in accordance with applicable local and national codes?
- Has heat transfer fluid been added in the proper mix to prevent freezing in closed system application?

Start-Up

Note: *Start-up with the heat pump zone sensor is included below:*

1. Cooling mode expectations: On the zone sensor, set the fan/system mode switch to the **AUTO** position.
2. Reduce the zone sensor setpoint until the compressor, reversing valve, solenoid valve, and loop pump are energized. Adjust water flow utilizing pressure/temperature plugs and comparing to tables contained in specification sheet data.

   Cool air should blow from the register. Water leaving the heat exchanger should be warmer than the entering water temperature (approximately 9-12ºF); blower operation should be smooth; compressor and blower amps should be within data plate ratings; the suction line should be cool with no frost observed on the refrigerant circuit.
3. Check the cooling refrigerant pressures against values in the Operating Pressures table.
4. Turn the zone sensor fan/system mode switch to the **OFF** position. Unit should stop running and the reversing valve should de-energize.
5. Leave unit off for approximately 5 minutes to allow for pressure equalization.
6. Turn the zone sensor setpoint to the highest setting.
7. Heating mode expectations: Set the zone system fan/system mode switch to the **AUTO** position.
8. Wait until the unit energizes the Fan and Compressor for Heating operation. Warm air should blow from the register. A water temperature decrease of approximately 5-9ºF leaving the heat exchanger should be noted. The blower and compressor operation should be smooth with no frost observed on the refrigeration circuit.
9. Check the heating refrigerant pressures against values in the Operating Pressures table.
10. Set the zone sensor setpoint to the appropriate setting according to the application requirements. Note the Occupied Offset selection when determining the desired cooling and heating setpoints.
11. Instruct the owner on system operation.

Table 33. Checklist

MODE	Heat	Cool
Entering fluid temperature	_____F	_____F
Leaving fluid temperature	_____F	_____F
Temperature differential	_____F	_____F
Return-air temperature DB/WB	_____F	_____F
Supply-air temperature DB/WB	_____F	_____F
Temperature differential	_____F	_____F
Water coil heat exchanger (Water Pressure IN)	_____PSIG	_____PSIG
Water coil heat exchanger (Water Pressure OUT)	_____PSIG	_____PSIG
Pressure Differential	_____PSIG	_____PSIG
COMPRESSOR		
Amps		
Volts		
Discharge line temperature (after 10 minutes)	_____F	_____F

Operating Pressures

There are many variables (airflow, air temperatures) in an air conditioning system that will affect operating refrigerant pressures and temperatures. The charts below shows approximate conditions and is based on airflow at the rated SCFM, entering air at 80°F(DB), 67°F(WB) in cooling, 68°F (DB) in heating. (+)Heating data with 35°F EWT is based on the use of an anti-freeze solution having a freezing point 20°F lower than the minimum expected entering temperature.

Table 34. Operating pressures in cooling/heating - VSH

Model No.	Cooling						Heating			
	Entering Water Temp (°F)	Water Flow (GPM)	Suction Pressure, PSIG	Discharge Pressure (PSIG)	Water Temp Rise (°F)	Air Temp Drop °F (DB)	Suction Pressure (PSIG)	Discharge Pressure (PSIG)	Water Temp Drop (°F)	Air Temp Rise (°F DB)
VSH024	35	5.0	—	—	—	—	72-88	233-285	6-7	17-20
	35	6.2	—	—	—	—	74-90	235-287	5-6	17-21
	45	5.0	104-127	121-148	11-13	22-26	87-107	254-311	7-9	20-25
	45	6.2	104-127	116-142	9-11	22-26	90-109	256-313	6-7	21-25
	55	5.0	105-128	144-177	11-13	21-26	104-127	266-325	8-10	23-28
	55	6.2	105-128	139-170	9-11	21-26	107-130	268-327	7-8	23-29
	65	5.0	106-129	171-209	11-13	21-26	116-142	281-343	9-11	26-32
	65	6.2	106-129	165-202	9-11	21-26	120-146	283-346	8-9	27-32
	75	5.0	108-131	199-244	11-13	21-25	135-165	293-358	11-13	29-35
	75	6.2	107-131	194-237	9-11	21-25	140-171	295-361	9-11	30-36
	85	5.0	113-138	231-282	11-13	20-25	156-191	305-372	12-15	32-39
	85	6.2	113-138	224-274	9-11	21-25	162-198	308-376	10-12	33-40
	95	5.0	118-144	264-323	11-13	20-25	180-220	317-387	13-16	35-42
	95	6.2	118-144	258-315	9-10	20-25	187-229	320-391	11-13	35-43
VSH033	35	6.9	—	—	—	—	71-86	245-299	6-8	19-23
	35	8.6	—	—	—	—	73-89	246-301	5-6	19-23
	45	6.9	97-118	125-153	11-13	21-26	83-101	259-317	7-9	22-27
	45	8.6	97-118	120-147	8-10	21-26	85-104	261-319	6-7	22-27
	55	6.9	98-120	149-182	11-13	21-26	99-121	271-331	8-10	25-31
	55	8.6	98-120	144-176	8-10	21-26	102-124	273-334	7-8	26-31
	65	6.9	99-121	176-215	11-13	21-26	111-135	285-349	9-11	28-34
	65	8.6	99-121	170-208	8-10	21-26	114-140	288-352	8-9	28-35
	75	6.9	101-123	205-250	11-13	21-25	129-158	298-364	10-13	31-38
	75	8.6	101-123	199-243	8-10	21-25	134-163	301-368	9-11	32-39
	85	6.9	105-129	235-287	10-13	20-25	149-183	311-380	12-14	34-42
	85	8.6	105-128	229-279	8-10	20-25	155-190	315-384	10-12	35-43
	95	6.9	109-133	270-330	10-13	20-25	171-209	322-394	13-16	38-46
	95	8.6	109-133	263-321	8-10	20-25	179-219	328-401	11-13	38-47

Table 34. Operating pressures in cooling/heating - VSH (continued)

Model No.	Cooling						Heating			
	Entering Water Temp (°F)	Water Flow (GPM)	Suction Pressure, PSIG	Discharge Pressure (PSIG)	Water Temp Rise (°F)	Air Temp Drop °F (DB)	Suction Pressure (PSIG)	Discharge Pressure (PSIG)	Water Temp Drop (°F)	Air Temp Rise (°F DB)
VSH042	35	8.7	—	—	—	—	71-87	230-282	6-7	16-20
	35	10.9	—	—	—	—	73-89	232-283	5-6	16-20
	45	8.7	105-128	122-150	11-13	21-26	81-100	241-294	6-8	19-23
	45	10.9	104-128	118-144	9-10	21-26	84-102	242-296	5-6	19-24
	55	8.7	105-129	145-177	11-13	21-25	97-119	252-308	8-9	22-26
	55	10.9	105-129	140-171	8-10	21-25	100-122	254-310	6-8	22-27
	65	8.7	106-130	171-209	10-13	20-25	106-129	262-321	8-10	24-29
	65	10.9	106-130	165-202	8-10	20-25	109-133	265-324	7-8	24-30
	75	8.7	107-131	199-243	10-13	20-24	124-151	275-336	10-12	27-33
	75	10.9	107-131	193-236	8-10	20-24	128-157	278-340	8-10	28-34
	85	8.7	111-136	229-280	10-13	20-24	144-175	288-353	11-14	30-37
	85	10.9	111-136	223-273	8-10	20-24	149-182	292-357	9-11	31-38
	95	8.7	113-139	263-321	10-12	19-24	165-202	302-369	13-15	33-40
	95	10.9	113-138	256-313	8-10	19-24	172-210	306-375	10-13	34-41
VSH050	35	10.4	—	—	—	—	69-85	241-295	6-7	18-22
	35	13.0	—	—	—	—	71-87	243-297	5-6	18-22
	45	10.4	103-126	128-156	11-14	22-27	83-102	257-314	7-9	21-26
	45	13.0	103-126	123-150	9-11	22-27	86-105	259-317	6-7	22-27
	55	10.4	104-127	151-184	11-14	22-26	99-121	270-330	8-10	24-30
	55	13.0	104-127	145-178	9-11	22-26	102-125	273-333	7-8	25-30
	65	10.4	105-129	177-216	11-14	21-26	113-138	288-352	9-12	28-34
	65	13.0	105-128	171-209	9-11	21-26	117-143	290-355	8-10	28-34
	75	10.4	106-130	205-251	11-13	21-25	132-161	303-370	11-13	31-38
	75	13.0	106-130	199-243	9-11	21-25	137-167	306-374	9-11	32-39
	85	10.4	110-135	235-288	11-13	20-25	153-186	318-389	12-15	34-42
	85	13.0	110-135	229-280	9-11	20-25	159-194	322-394	10-12	35-43
	95	10.4	112-136	268-328	11-13	20-24	174-212	330-403	14-17	39-47
	95	13.0	112-136	262-320	8-10	20-25	182-222	336-410	12-14	40-48

Table 34. Operating pressures in cooling/heating - VSH (continued)

Model No.	Cooling						Heating			
	Entering Water Temp (°F)	Water Flow (GPM)	Suction Pressure, PSIG	Discharge Pressure (PSIG)	Water Temp Rise (°F)	Air Temp Drop °F (DB)	Suction Pressure (PSIG)	Discharge Pressure (PSIG)	Water Temp Drop (°F)	Air Temp Rise (°F DB)
VSH060	35	12.5	—	—	—	—	67-82	253-309	6-8	20-25
	35	15.6	—	—	—	—	69-85	255-311	5-6	21-25
	45	12.5	98-120	130-159	11-14	22-27	81-99	272-332	7-9	24-29
	45	15.6	98-119	125-153	9-11	22-27	84-102	274-335	6-7	24-30
	55	12.5	99-121	152-186	11-14	22-27	97-118	287-350	8-10	27-33
	55	15.6	99-121	147-180	9-11	22-27	100-122	289-354	7-8	28-34
	65	12.5	100-122	178-218	11-13	21-26	110-135	306-374	9-12	30-37
	65	15.6	100-122	173-211	9-11	21-26	114-139	309-378	8-10	31-38
	75	12.5	101-123	206-252	11-13	21-25	128-157	323-395	11-13	34-42
	75	15.6	101-123	201-245	9-11	21-26	133-163	327-400	9-11	35-43
	85	12.5	107-130	238-290	11-13	21-25	149-182	341-417	12-15	38-46
	85	15.6	107-130	231-283	9-11	21-26	155-189	346-423	10-12	39-47
	95	12.5	105-129	270-330	11-13	20-25	171-209	360-441	14-17	42-51
	95	15.6	105-129	263-322	8-10	20-25	179-218	366-447	11-14	43-52

Table 35. Operating pressures in cooling/heating - VSV

Model No.	Cooling						Heating			
	Entering Water Temp (°F)	Water Flow (GPM)	Suction Pressure, PSIG	Discharge Pressure (PSIG)	Water Temp Rise (°F)	Air Temp Drop °F (DB)	Suction Pressure (PSIG)	Discharge Pressure (PSIG)	Water Temp Drop (°F)	Air Temp Rise (°F DB)
VSV024	35	5	—	—	—	—	72-88	239-293	6-7	16-20
	35	6.3	—	—	—	—	74-91	241-295	5-6	17-20
	45	5.0	110-134	124-151	11-14	22-27	85-104	253-309	7-8	20-24
	45	6.3	110-134	119-145	9-11	22-27	88-107	255-312	6-7	20-25
	55	5.0	111-135	148-181	11-14	22-27	101-124	266-325	8-10	22-27
	55	6.3	111-135	142-174	9-11	22-27	105-128	268-327	6-8	23-28
	65	5.0	112-136	176-215	11-14	22-26	112-137	279-341	9-11	25-30
	65	6.3	111-136	169-207	9-11	22-26	116-142	282-345	7-9	26-31
	75	5.0	113-138	203-248	11-13	21-26	131-160	293-358	10-12	28-34
	75	6.3	113-138	197-241	9-11	21-26	136-166	296-362	8-10	29-35
	85	5.0	116-142	235-287	11-13	21-25	152-186	306-374	12-14	31-38
	85	6.3	116-142	228-278	9-11	21-25	158-193	309-378	9-12	31-38
	95	5.0	119-145	268-328	11-13	20-25	175-214	319-389	13-16	33-41
	95	6.3	119-145	261-319	8-10	20-25	183-223	322-394	10-13	34-42
VSV033	35	5	—	—	—	—	69-84	241-294	8-9	17-20
	35	6.2	—	—	—	—	71-87	243-297	6-8	17-21
	45	5.0	102-125	139-170	16-19	23-28	81-99	253-309	9-10	20-24
	45	6.2	102-125	132-162	13-15	23-28	84-102	255-312	7-9	20-25
	55	5.0	103-126	164-201	16-19	22-27	96-117	265-324	10-12	22-27
	55	6.2	103-126	156-191	13-15	22-27	99-121	268-328	8-10	23-28
	65	5.0	104-128	190-232	15-19	22-27	107-130	277-339	11-13	24-30
	65	6.2	104-127	182-223	12-15	22-27	111-135	280-343	9-11	25-31
	75	5.0	106-130	217-265	15-18	21-26	124-152	291-355	13-15	27-33
	75	6.2	106-129	209-256	12-15	21-26	129-158	294-360	10-13	28-34
	85	5.0	111-136	250-306	15-18	21-26	144-175	304-372	14-17	30-37
	85	6.2	111-135	242-296	12-15	21-26	150-183	308-377	12-14	31-38
	95	5.0	113-138	284-347	15-18	20-25	165-202	318-388	16-19	33-40
	95	6.2	112-137	274-335	12-14	20-25	173-211	322-394	13-16	33-41

Table 35. Operating pressures in cooling/heating - VSV (continued)

Model No.	Cooling						Heating			
	Entering Water Temp (°F)	Water Flow (GPM)	Suction Pressure, PSIG	Discharge Pressure (PSIG)	Water Temp Rise (°F)	Air Temp Drop °F (DB)	Suction Pressure (PSIG)	Discharge Pressure (PSIG)	Water Temp Drop (°F)	Air Temp Rise (°F DB)
VSV042	35	8.7	—	—	—	—	69-84	237-290	6-8	17-21
	35	10.9	—	—	—	—	71-86	239-292	5-6	17-21
	45	8.7	101-124	122-149	11-13	22-27	78-95	249-305	7-8	19-23
	45	10.9	101-124	117-143	9-11	22-27	80-98	251-307	5-7	20-24
	55	8.7	102-125	144-176	11-13	21-26	93-114	261-319	8-10	22-27
	55	10.9	102-125	139-170	9-11	21-26	96-118	263-322	6-8	22-27
	65	8.7	103-126	170-207	11-13	21-25	105-129	276-338	9-11	25-30
	65	10.9	103-126	164-201	9-11	21-25	109-133	279-341	7-9	25-31
	75	8.7	104-127	198-242	11-13	20-25	123-151	289-353	10-13	28-34
	75	10.9	104-127	192-234	9-10	20-25	128-156	292-357	8-10	29-35
	85	8.7	110-135	229-280	11-13	20-25	143-175	302-370	12-14	31-38
	85	10.9	110-135	222-272	9-11	20-25	149-182	306-374	10-12	32-39
	95	8.7	112-137	262-321	11-13	20-24	165-202	317-387	13-16	34-42
	95	10.9	112-137	255-312	8-10	20-24	172-210	321-392	11-13	35-43
VSV050	35	10.4	—	—	—	—	67-82	242-296	6-7	17-21
	35	13	—	—	—	—	69-84	244-298	5-6	18-22
	45	10.4	97-118	123-151	11-13	22-27	77-94	256-312	7-8	20-24
	45	13.0	97-118	119-145	8-10	22-27	79-96	257-315	5-7	20-25
	55	10.4	98-119	146-178	10-13	21-26	92-112	268-327	8-9	23-28
	55	13.0	98-119	141-172	8-10	21-26	95-116	270-330	6-8	23-28
	65	10.4	99-120	171-209	10-13	21-25	102-124	282-345	9-10	25-30
	65	13.0	98-120	166-202	8-10	21-25	105-128	285-348	7-9	25-31
	75	10.4	99-122	199-243	10-13	20-25	119-146	296-362	10-12	28-34
	75	13.0	99-121	193-236	8-10	20-25	123-151	299-366	8-10	29-35
	85	10.4	106-130	230-281	10-13	20-25	139-169	310-379	11-14	31-38
	85	13.0	106-130	224-273	8-10	20-25	144-176	314-384	9-11	32-39
	95	10.4	110-134	265-323	11-13	20-25	160-195	326-398	12-15	35-42
	95	13.0	109-134	258-315	8-10	20-25	166-203	330-403	10-13	35-43

Table 35. Operating pressures in cooling/heating - VSV (continued)

Model No.	Cooling						Heating			
	Entering Water Temp (°F)	Water Flow (GPM)	Suction Pressure, PSIG	Discharge Pressure (PSIG)	Water Temp Rise (°F)	Air Temp Drop °F (DB)	Suction Pressure (PSIG)	Discharge Pressure (PSIG)	Water Temp Drop (°F)	Air Temp Rise (°F DB)
VSV060	35	12.5	—	—	—	—	69-84	253-309	6-7	19-23
	35	15.6	—	—	—	—	71-86	255-312	5-6	19-24
	45	12.5	92-113	127-155	10-13	22-26	82-100	271-331	7-8	22-27
	45	15.6	92-113	123-150	8-10	22-26	84-102	273-333	6-7	22-27
	55	12.5	94-115	149-183	10-13	21-26	97-119	285-348	8-10	25-31
	55	15.6	94-114	145-177	8-10	21-26	100-122	287-350	6-8	26-31
	65	12.5	95-116	175-214	10-13	21-26	110-135	305-373	9-11	28-34
	65	15.6	95-116	170-208	8-10	21-26	114-139	307-376	7-9	29-35
	75	12.5	97-118	204-249	10-13	21-25	129-158	320-392	10-12	31-38
	75	15.6	96-118	199-243	8-10	21-26	133-163	323-395	8-10	32-39
	85	12.5	104-128	235-288	11-13	21-26	150-183	337-412	11-14	35-43
	85	15.6	104-127	229-280	8-10	21-26	155-190	341-416	9-11	36-44
	95	12.5	107-131	269-329	10-13	21-25	173-211	355-434	13-16	38-47
	95	15.6	107-131	263-321	8-10	21-25	179-219	360-439	10-13	39-48

Water Pressure Drop

The tables within this section should be used to define feet of head/pressure drop. Note that the feet of pressure (ft/head) provided is at AHRI/ISO standard.

To calculate feet of head, when using gauges that read in PSIG, multiply PSI by 2.31.

Table 36. Cooling water pressure drops (WPD) in feet of head - VSH

Model VSH	Entering Water Temp. (°F)	Water Flow (GPM)	Ft. Pressure
VSH024	85	6.2	3.7
VSH033	85	8.6	6.4
VSH042	85	10.9	4.2
VSH050	85	13.0	5.4
VSH060	85	15.6	7.6

Table 37. Heating water pressure drops (WPD) in feet of head – VSH

Model VSH	Entering Water Temp. (°F)	Water Flow (GPM)	Ft. Pressure
VSH024	70	6.2	3.9
VSH033	70	8.6	6.8
VSH042	70	10.9	4.4
VSH050	70	13.0	5.7
VSH060	70	15.6	8.0

Table 38. Cooling water pressure drops (WPD) in feet of head – VSV

Model VSV	Entering Water Temp. (°F)	Water Flow (GPM)	Ft. Pressure
VSV024	85	6.3	4.1
VSV033	85	8.3	6.5
VSV042	85	10.9	4.3
VSV050	85	13.0	5.6
VSV060	85	15.6	8.2

Table 39. Heating water pressure drops (WPD) in feet of head – VSV

Model VSV	Entering Water Temp. (°F)	Water Flow (GPM)	Ft. Pressure
VSV024	70	6.3	4.3
VSV033	70	8.3	6.7
VSV042	70	10.9	4.5
VSV050	70	13.0	6.4
VSV060	70	15.6	8.6

Water Volume

The tables within this section are provided for use in calculating glycol requirements for the unit.

Table 40. Water volume – VSH

Model VSH	VSH024	VSH033	VSH042	VSH050	VSH060
Internal water volume (in^3)	142.4	142.4	331.2	331.2	331.2
Internal water volume (ft^3)	0.082	0.082	0.192	0.192	0.192
Internal water volume (gal)	0.616	0.616	1.434	1.434	1.434

Table 41. Water volume – VSV

Model VSV	VSV024	VSV033	VSV042	VSV050	VSV060
Internal water volume (in^3)	212	212	414	414	414
Internal water volume (ft^3)	0.123	0.123	0.24	0.24	0.24
Internal water volume (gal)	0.918	0.918	1.792	1.792	1.792

Maintenance

Preventive Maintenance

Maintenance on the unit is simplified with the following preventive suggestions:

Filter maintenance must be performed to assure proper operation of the equipment. Filters should be inspected at least every three months, and replaced when it is evident they are dirty. Filter sizing is shown in Table 42, p. 57 and Table 43, p. 57.

Table 42. Filter sizing for disposable filters - VSH

Size (60 Hz)	Nominal Filter Size (inch)
VSH 024-033	20 x 22
VSH 042-060	20 x 32

Table 43. Filter sizing for disposable filters - VSV

Size (60 Hz)	Nominal Filter Size (inch)
VSV 024-033	20 x 30
VSV 042-060	27 x 30

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Check the relays within the control panel at least once a year. It is good practice to check the tightness of the various wiring connections within the control panel.

A strainer (60 mesh or greater) must be used on an open loo system to keep debris from entering the unit heat exchanger and to ensure a clean system.

For units on well water, it is important to check the cleanliness of the water-to-refrigerant heat exchanger. Should it become contaminated with dirt and scaling as a result of bad water, the heat exchanger will have to be back flushed and cleaned with a chemical that will remove the scale. This service should be performed by an experienced service person.

It should be noted that the water quality should be checked periodically (See the table below).

Table 44. Water quality

Scaling	Amount
Calcium and magnesium (total hardness)	Less than 350 ppm
Corrosion	
pH	7-9.5
Hydrogen Sulfide	Less than 1 ppm
Sulfates	Less than 25 ppm
Chlorides	Less than 125 ppm
Total dissolved solids (TDS)	Less than 1000 ppm
Biological Growth	
Iron Bacteria	Low
Erosion	
Suspended Solids	Low

Table 44. Water quality (continued)

NOTICE

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime.

Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Condensate Trap

For units incorporating a negative trap design, ensure that the condensate system is primed with water at all times. Allowing a negative, pressure condensate system to run dry could cause a break in the condensate seal allowing the fan to draw water from the condensate line to spray moisture into the mechanical system. By maintaining a primed condensate trap, a seal will be created and will help prevent these complications. The condensate trap must be field installed.

Note: *When maintenance is performed on this unit, care should be taken not to damage the foil face insulation surfaces. If damage occurs repair damage with foil faced tape.*

Troubleshooting

General Unit Troubleshooting

Notes:

- *Variable speed compressors sound different than single speed compressors. The compressor sound will change as the speed and operating conditions change.*
- *See Water Source Heat Pump Axiom™ Variable Speed — Service Guide (WSHP-SVG003*-EN) for additional information.*

⚠ WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.

Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

Table 45. General unit troubleshooting

Problem	Heating	Cooling	Cause	Correction
No response to any zone sensor setting	X	X	Main power off	Check fuses
	X	X	Defective control transformer	Replace
	X	X	Broken or loose connection	Repair
	X	X	Defective zone sensor	Replace
	X	X	Transformer	Reset Transformer
Unit short cycles	X	X	Zone sensor improperly located	Relocate
Blower runs but compressor does not	X	X	Supply Voltage too low	Correct
	X	X	Defective windings	Replace
	X	X	Limit switches open	Check cause/replace or repair
	X	X	Zones sensor error	Check cause/replace or repair
	X	X	Compressor drive error	Check cause/replace or repair

Table 45. General unit troubleshooting (continued)

Problem	Heating	Cooling	Cause	Correction
Insufficient capacity	X	X	Dirty filter	Replace/clean
	X	X	Blower RPM too low	Correct
	X	X	Loss of conditioned air due to leaks in ductwork	Repair leaks
		X	Introduction of excessively hot return air	Correct
	X		Introduction of excessively cold return air	Correct
	X	X	Low on refrigerant charge	Locate leak, repair and recharge by weight (not by superheat)
	X	X	Restricted thermal expansion valve	Replace
	X	X	Zone sensor improperly located	Relocate
	X	X	Unit undersized	Recalculate heat gains/losses
	X	X	Inadequate water flow	Increase GPM
	X	X	Scaling in heat exchanger	Clean or replace
		X	Water too hot	Decrease temperature
	X		Water too cold	Increase temperature
	X	X	Filter drier blocked	Replace
	X	X	Defective reversing valve	Check or replace
High pressure switch open		X	Inadequate GPM	Increase water flow to unit
		X	Water too hot	Decrease temperature
	X		Inadequate air flow	Check, clean blower and coil
	X		Dirty filter	Clean/replace
	X	X	Overcharged with refrigerant	Decrease charge
	X	X	Defective pressure switch	Check or replace
High head pressure		X	Trash in heat exchanger	Backflush
		X	Low water flow	Increase GPM
	X	X	Overcharge of refrigerant	Decrease charge
	X	X	Non-condensable in system	Evacuate and recharge by weight
	X	X	Water too hot	Decrease temperature
	X		Dirty filter	Clean/replace
	X		Inadequate air flow	Check, clean blower and coil

Table 45. General unit troubleshooting (continued)

Problem	Heating	Cooling	Cause	Correction
Low suction pressure	X	X	Undercharged	Locate leak; repair and recharge
	X	X	Restricted thermal expansion valve	Repair / replace
		X	Inadequate air flow	Check, clean blower and coil
		X	Dirty filter	Clean/replace
	X		Inadequate GPM	Increase GPM
Low pressure switch open	X		Inadequate GPM	Increase GPM
	X		Water too cold	Increase temperature
		X	Inadequate air flow	Increase CFM
		X	Dirty filter	Clean/replace
	X	X	Undercharged with refrigerant	Increase charge
	X	X	Defective pressure switch	Replace
	X	X	Heat transfer fluid too cold	Raise water temperature

Compressor Drive Troubleshooting

See *Water Source Heat Pump Axiom™ Variable Speed — Compressor Inverter Troubleshooting Guide* (WSHP-SVG004*-EN) for compressor drive troubleshooting information and procedures.

Control Wiring

Table 46. Wiring diagram matrix (2 to 5 tons — VSV/VSH)

Number	Unit Description	Model
23116740	WSHP VARIABLE SPEED SINGLE PHASE	208V/230V 1-Phase only
23116741	WSHP VARIABLE SPEED THREE PHASE	208V/230V 3-Phase and 460V

Notes

Trane - by Trane Technologies (NYSE: TT), a global innovator - creates comfortable, energy efficient indoor environments for commercial and residential applications. For more information, please visit trane.com or tranetechnologies.com.

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