

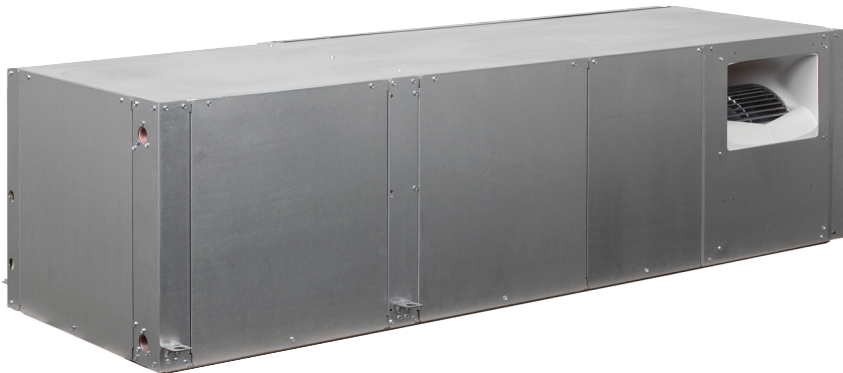


Installation, Operation, and Maintenance

Water Source Heat Pump

Axiom™ Variable Speed - VSH/VSV

24 to 60 MBtuh - 60 Hz



Model Numbers:

VSHE024
VSHE033
VSHE042
VSHE050
VSHE060

VSHE024
VSHE033
VSHE042
VSHE050
VSHE060

⚠ 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.



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 Labeling 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.

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Revision History

- Updated the term Symbio™ 500 throughout the document.
- Updated Model Number Description chapter.



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Model Number Descriptions

Digits 1-3 — Unit Configuration

VSH = Variable Speed Horizontal
VSV = Variable Speed Vertical

Digit 4 — Development Sequence

E = R-410A Refrigerant

Digit 5-7 — Nominal Capacity

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

Digit 8 — Voltage (Volts/Hz/Phase)

1 = 208/60/1
2 = 230/60/1
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 — Current Design Sequence

Digit 12 — Control Type

F = Symbio™ 500/UC400
G = Symbio 500/UC400 with Wireless Comm

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 — Open Digit

0 = Open Digit

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 — On/Off Switch

0 = None

Digit 18 — Filter Type

1 = 1" Throwaway Filter
2 = 2" Throwaway Filter
4 = 2" MERV 8
5 = 2" MERV 13

Digit 19 — Motor Type

A = ECM



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	650 +/-10	550 +/-10	psig

Controls

The control system offered to control the unit is the Symbio™ 500/Tracer® UC400 programmable BACnet® unit controller. The Symbio 500/UC400 controller is standard for all unit sizes.

All power wiring to the equipment is made at the unit power block. VSH/V 460V units require a neutral wire.

System Input Devices and Functions

A zone sensor or building automation system is required to operate the water-source heat pump. The flexibility of having several mode capabilities depends upon the type of sensor and/or remote panel selected.

Troubleshooting and connection diagrams for the Symbio 500/UC400 control systems may be located in the back of this manual.

Pump Module (field installed accessory)

The pump module shall consist of either a single or dual 1/6 HP cast iron pump and a brass 3-way shut-off valve. The pump module kits shall contain the necessary components for the installation, operation and maintenance of the water circuit of a closed-loop distributed pumping application.

Table 2. Refrigerant charge

Model	R-410A (ounces)
VSV024	72
VSV033	72
VSV042	129
VSV050	129
VSV060	139
VSH024	72
VSH033	72
VSH042	138
VSH050	138
VSH060	150



Pre-Installation

⚠ WARNING

Fiberglass Wool!

Exposition 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.

Important: *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

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), which could result in odors and damage to the equipment and building materials. 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.

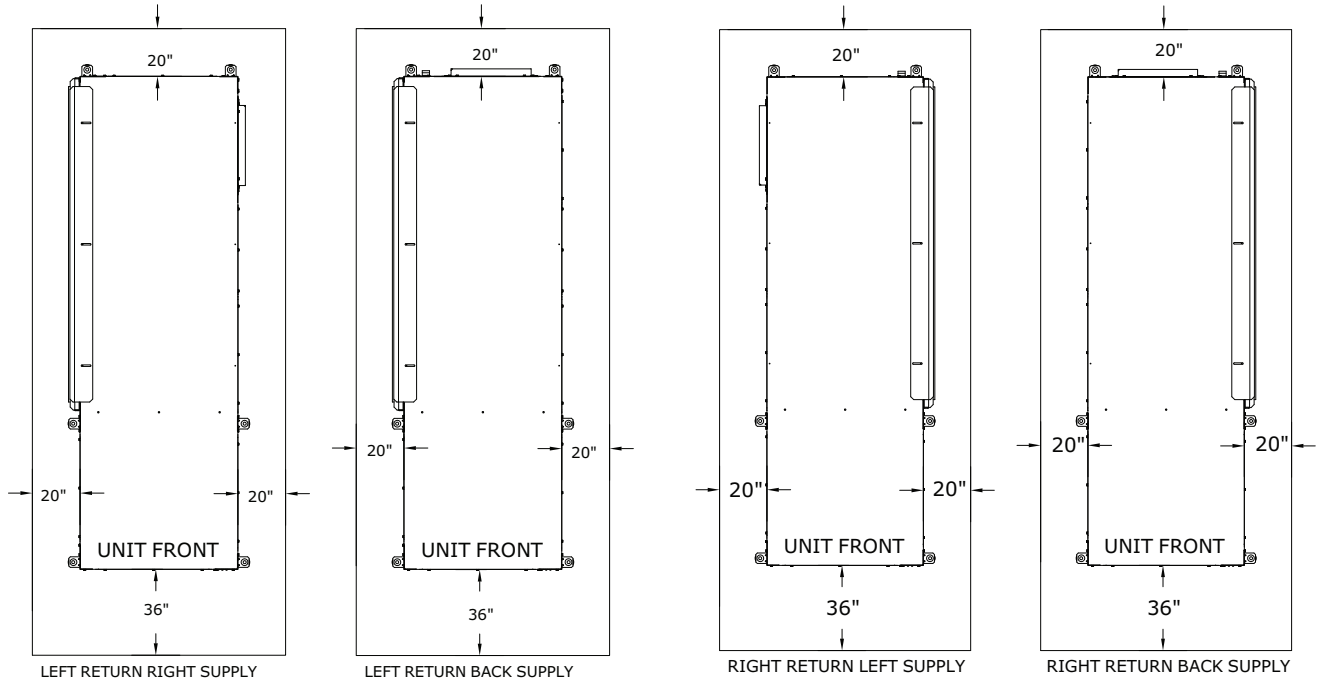
The floor or foundation must be level and the condensate drain at the proper height for proper drainage and condensate flow. Standing water and wet surfaces inside the equipment can become an amplification site for microbial growth (mold). If there is evidence of microbial growth on the interior insulation,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

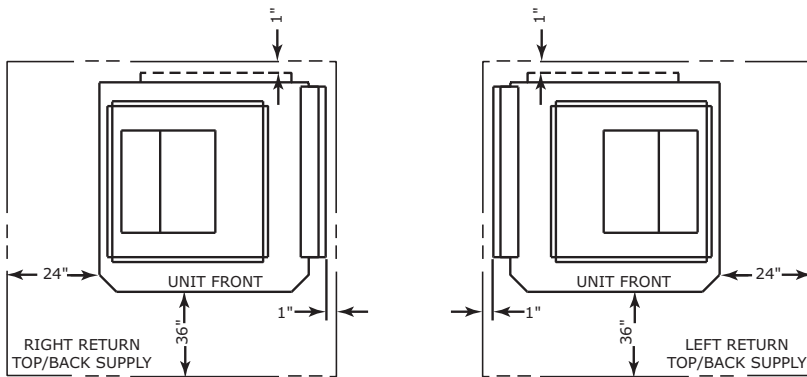
Unit Dimensions

Figure 1. Clearance dimensions^(a) VSH



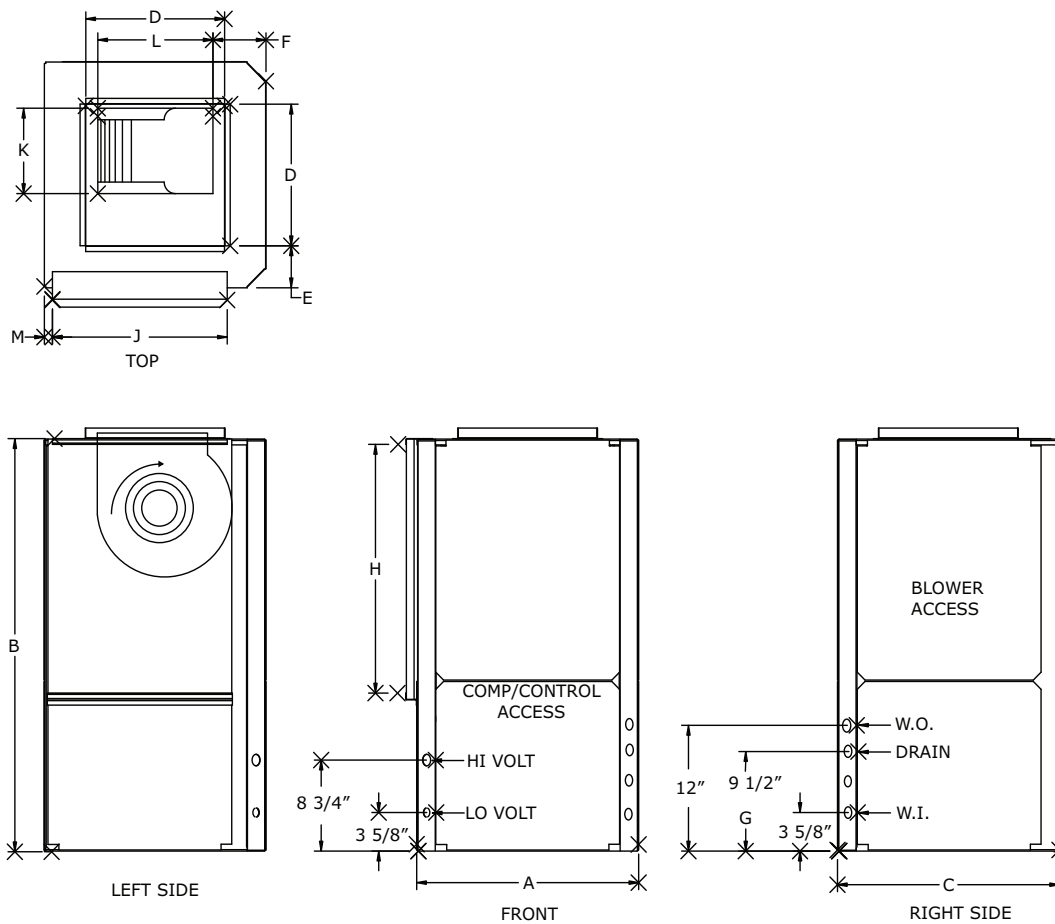
(a) Units in a free return application will require more than a 1-in. clearance to provide proper airflow to the units air-to-refrigerant coil.

Figure 2. Clearance dimensions^(a) VSV



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 3. Left return/top supply VSV

Table 3. 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	24-1/2	41-7/8	26-1/2	18	3-1/4	5-3/4	9-1/2	20	23	10-1/2	13-1/2	3/16	3/4	3/4	3/4
042-050	26-1/2	46-7/8	30-1/2	18	4-1/4	2	9-1/2	24-1/4	27-7/8	13-7/8	11-3/8	1/2	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.



Unit Dimensions

Figure 4. Left return/top supply VSV

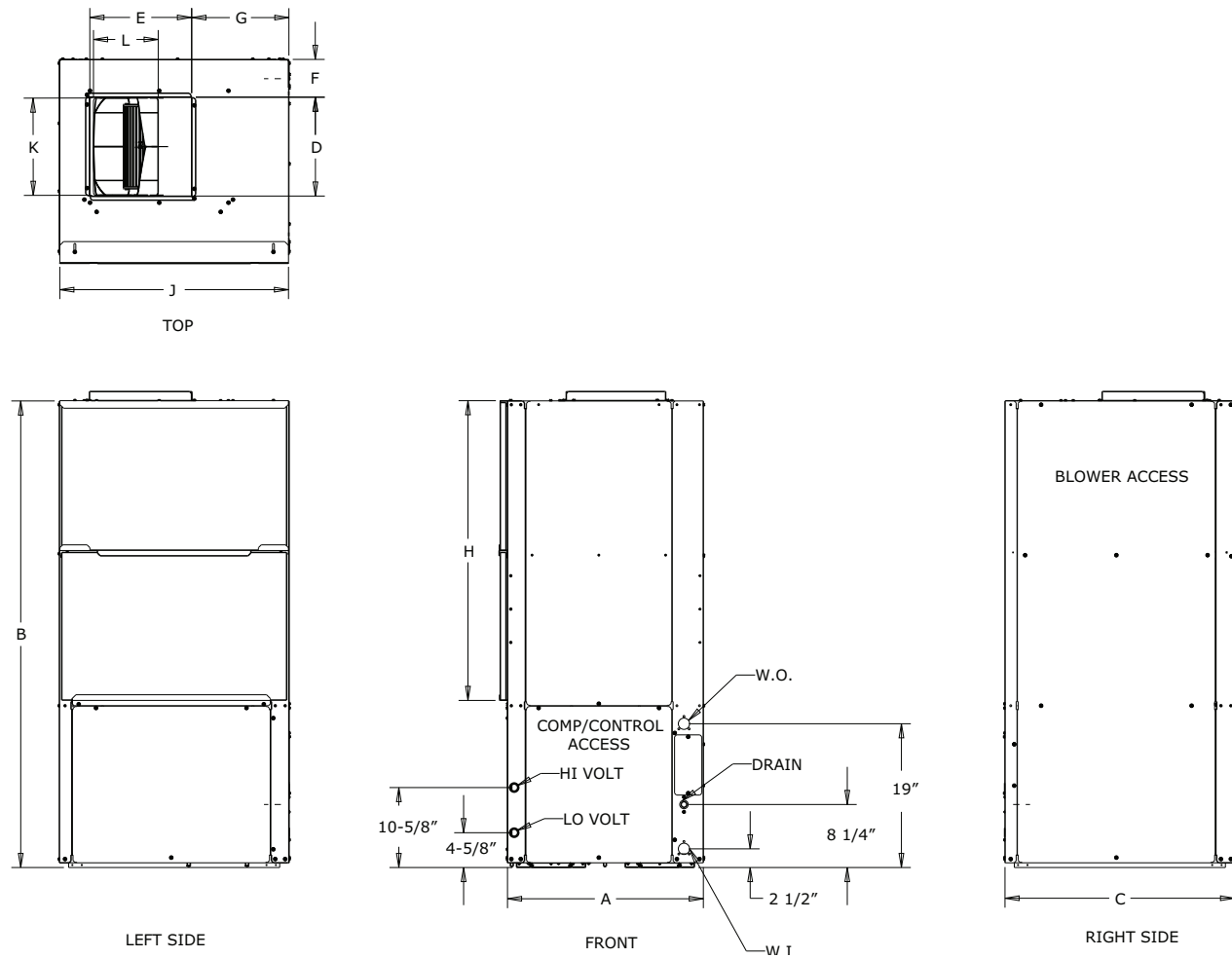


Table 4. Dimensional data—left return/top supply VSV

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
060	26	62	30-1/2	13-1/4	13-5/8	5	13	39-3/4	30-3/8	13	8-5/8	N/A	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. Left return/back supply VSV

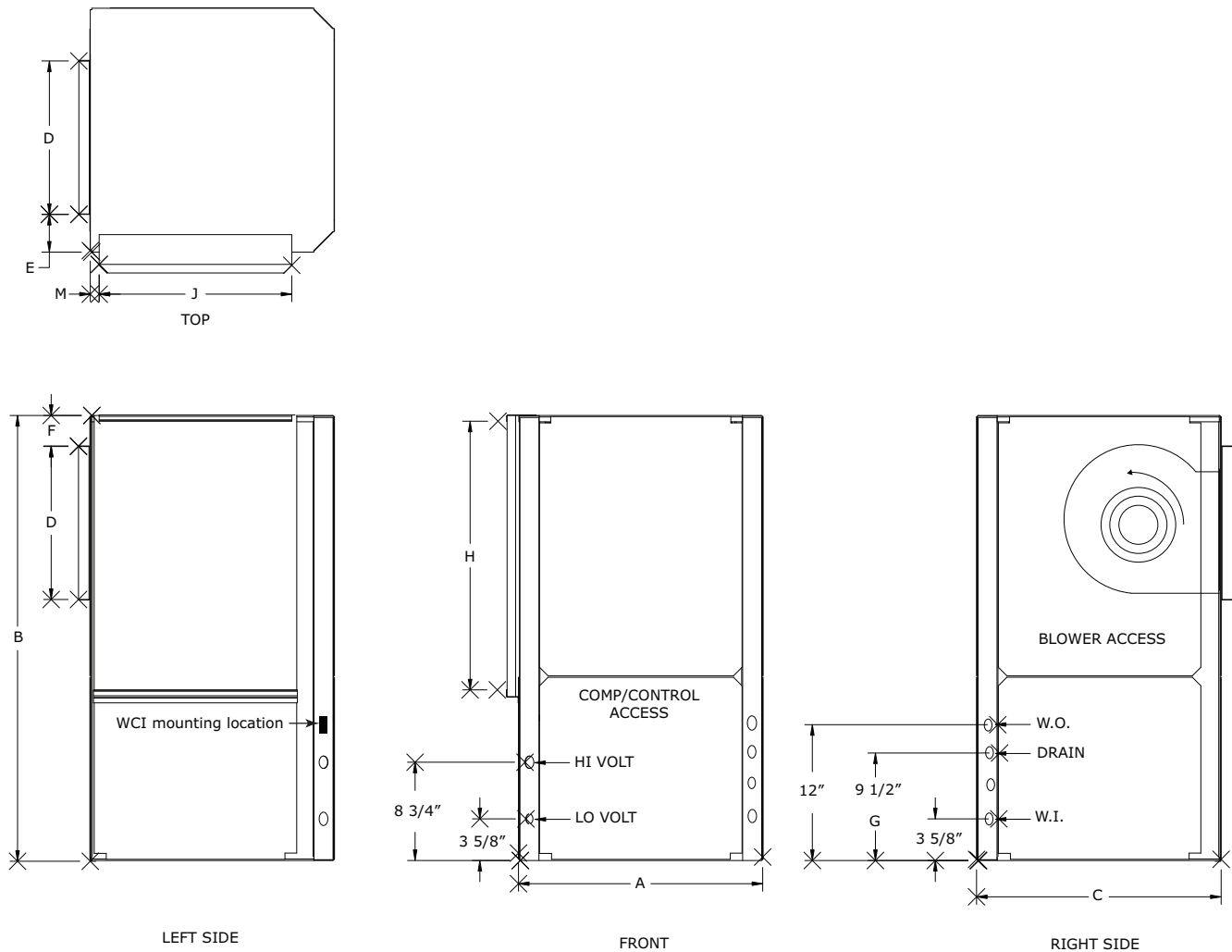


Table 5. Dimensional data—left return/back supply VSV

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024-033	24-1/2	41-7/8	26-1/2	18	3-1/4	1-7/8	9-1/2	20	23	10-1/2	13-1/2	3/16	3/4	3/4	3/4
042-050	26-1/2	46-7/8	30-1/2	18	4-1/4	2	9-1/2	24-1/4	27-7/8	13-7/8	11-3/8	1/2	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.



Unit Dimensions

Figure 6. Left return/back supply VSV

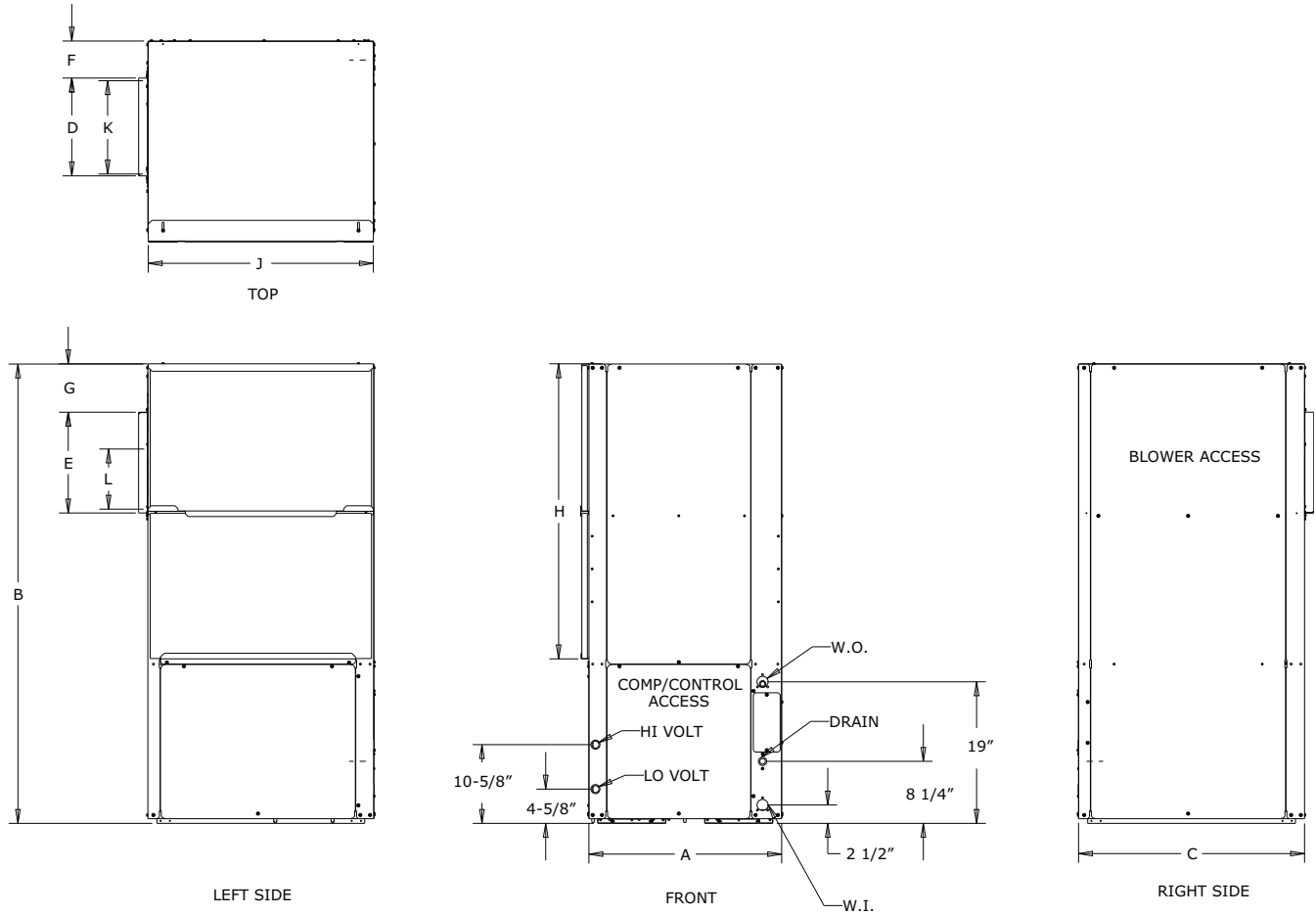


Table 6. Dimensional data—left return/back supply VSV

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
060	26	62	30-1/2	13-1/4	13-5/8	5	6-1/2	39-3/4	30-3/8	13	8-5/8	N/A	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 7. Right return/top supply VSV

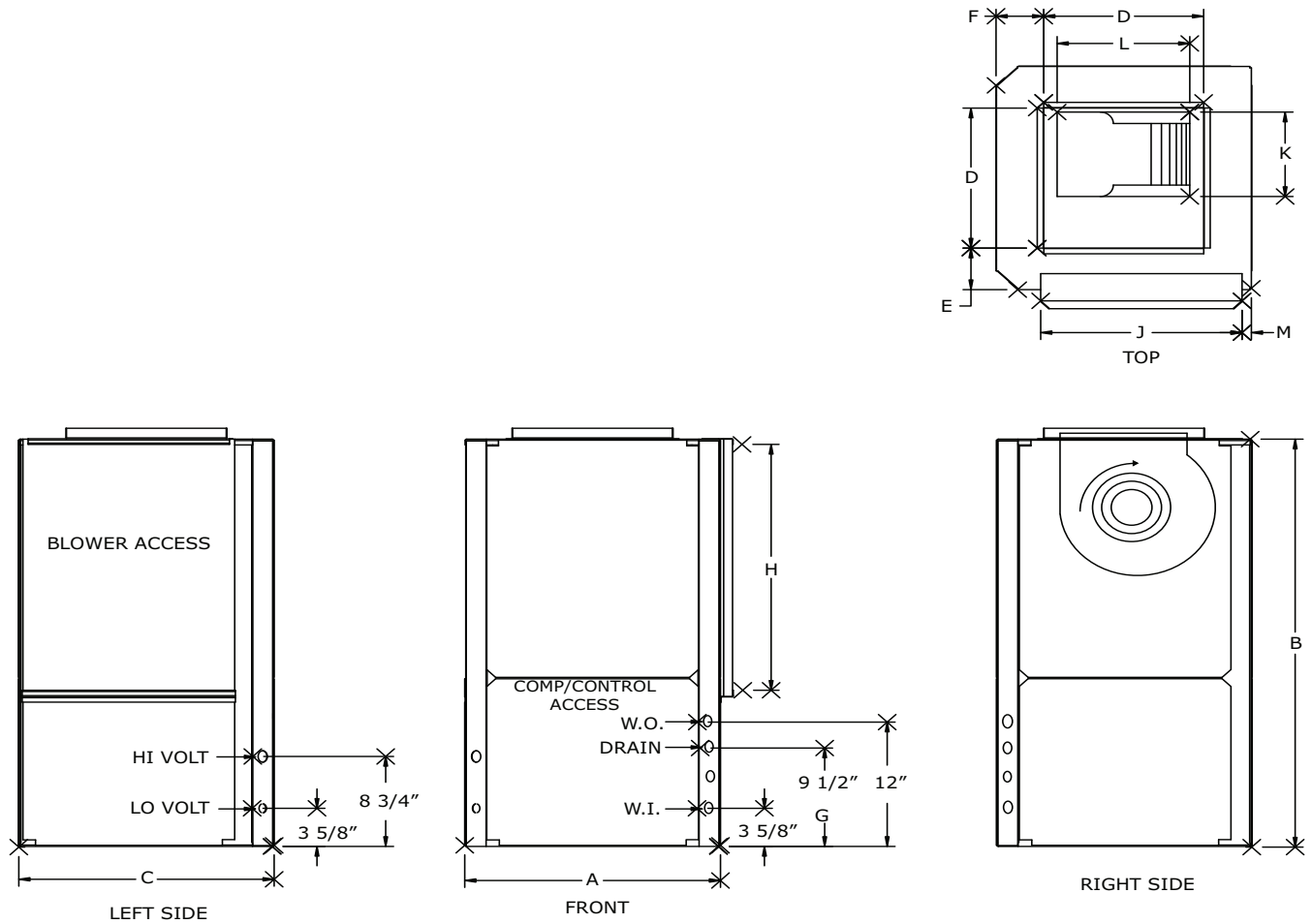


Table 7. Dimensional data—right return/top supply VSV

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024-033	24-1/2	41-7/8	26-1/2	18	3-1/4	5-3/4	9-1/2	20	23	10-1/2	13-1/2	3/16	3/4	3/4	3/4
042-050	26-1/2	46-7/8	30-1/2	18	4-1/4	2	9-1/2	24-1/4	27-7/8	13-7/8	11-3/8	1/2	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.



Unit Dimensions

Figure 8. Right return/top supply VSV

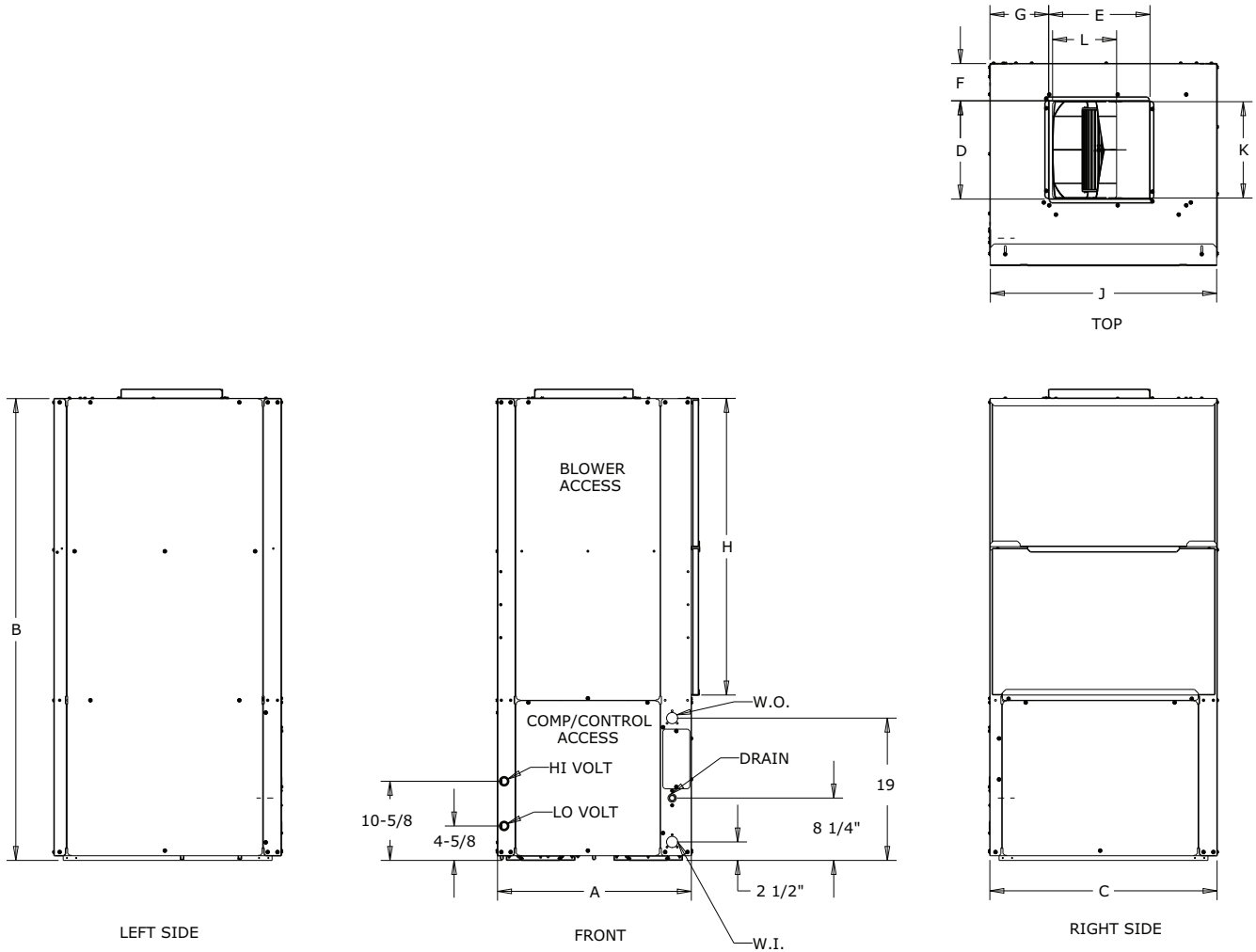
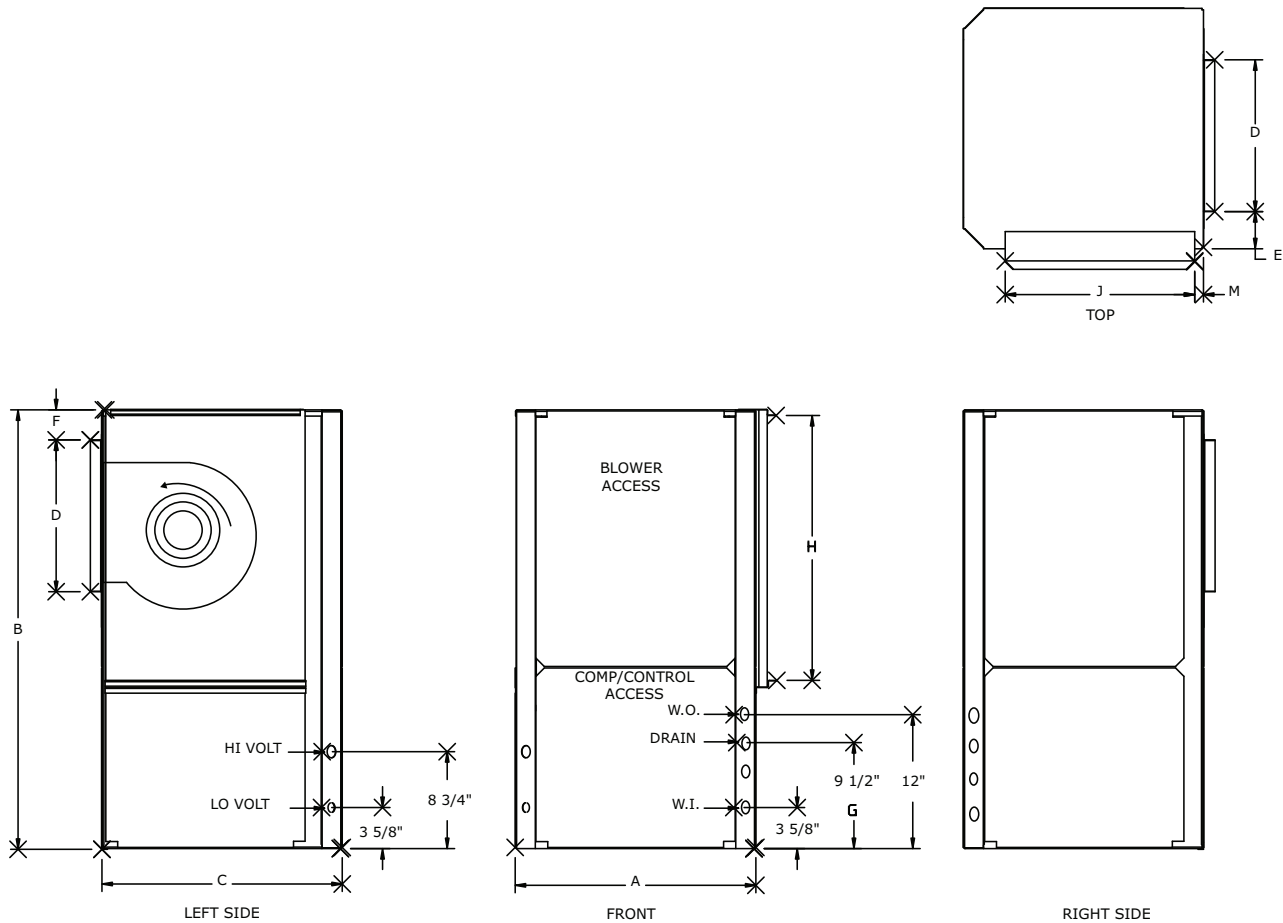


Table 8. Dimensional data—right return/top supply VSV

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
060	26	62	30-1/2	13-1/4	13-5/8	5	7-7/8	39-3/4	30-3/8	13	8-5/8	N/A	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 VSV

Table 9. 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	24-1/2	41-7/8	26-1/2	18	3-1/4	1-7/8	9-1/2	20	23	10-1/2	13-1/2	3/16	3/4	3/4	3/4
042-050	26-1/2	46-7/8	30-1/2	18	4-1/4	2	9-1/2	24-1/4	27-7/8	13-7/8	11-3/8	1/2	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.



Unit Dimensions

Figure 10. Right return/back supply VSV

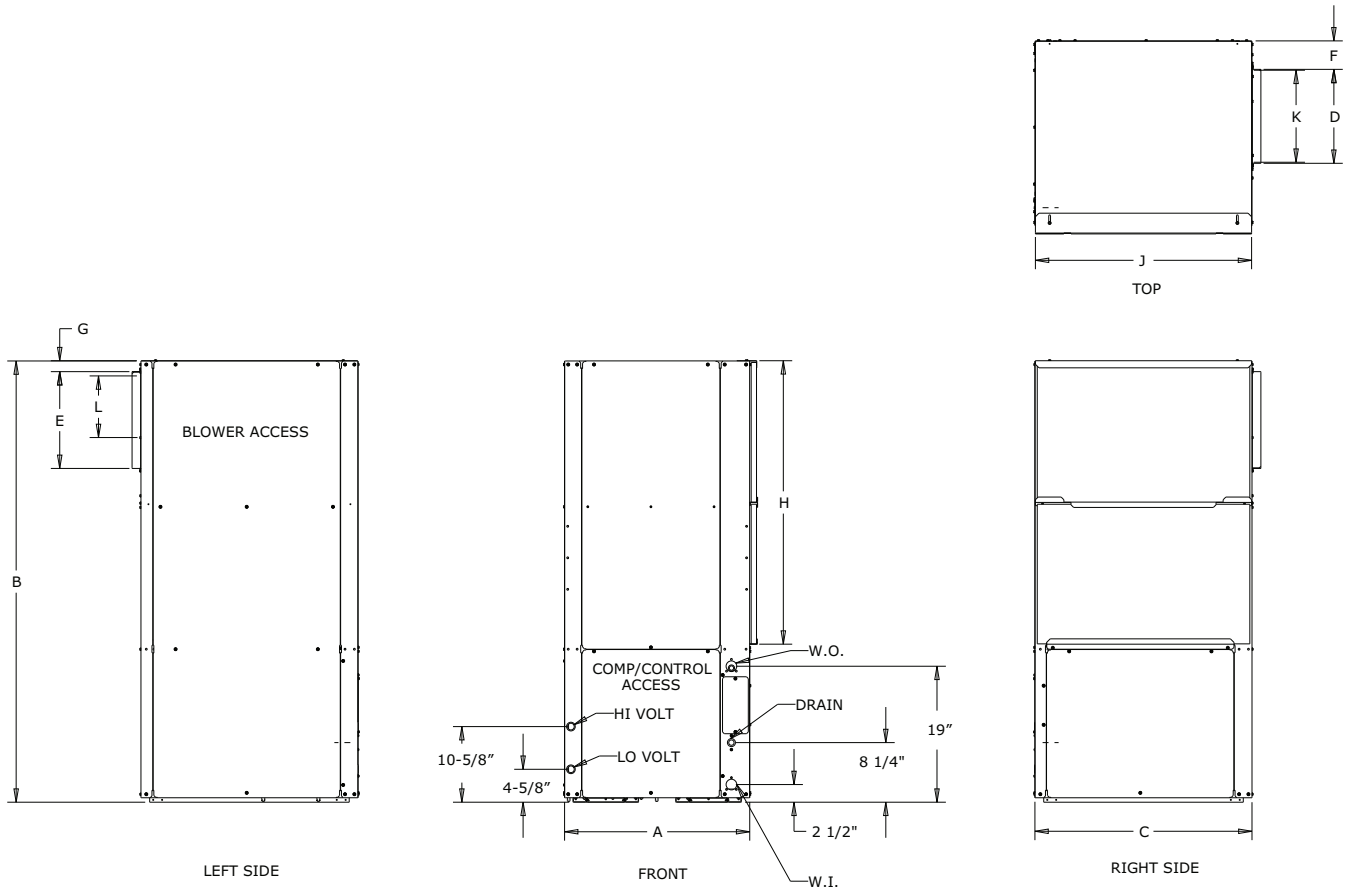


Table 10. Dimensional data—right return/back supply VSV

Units	A	B	C	D	E	F	G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
060	26	62	30-1/2	13-1/4	13-5/8	4	1-1/2	39-3/4	30-3/8	13	8-5/8	N/A	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 11. Left return/back supply VSH

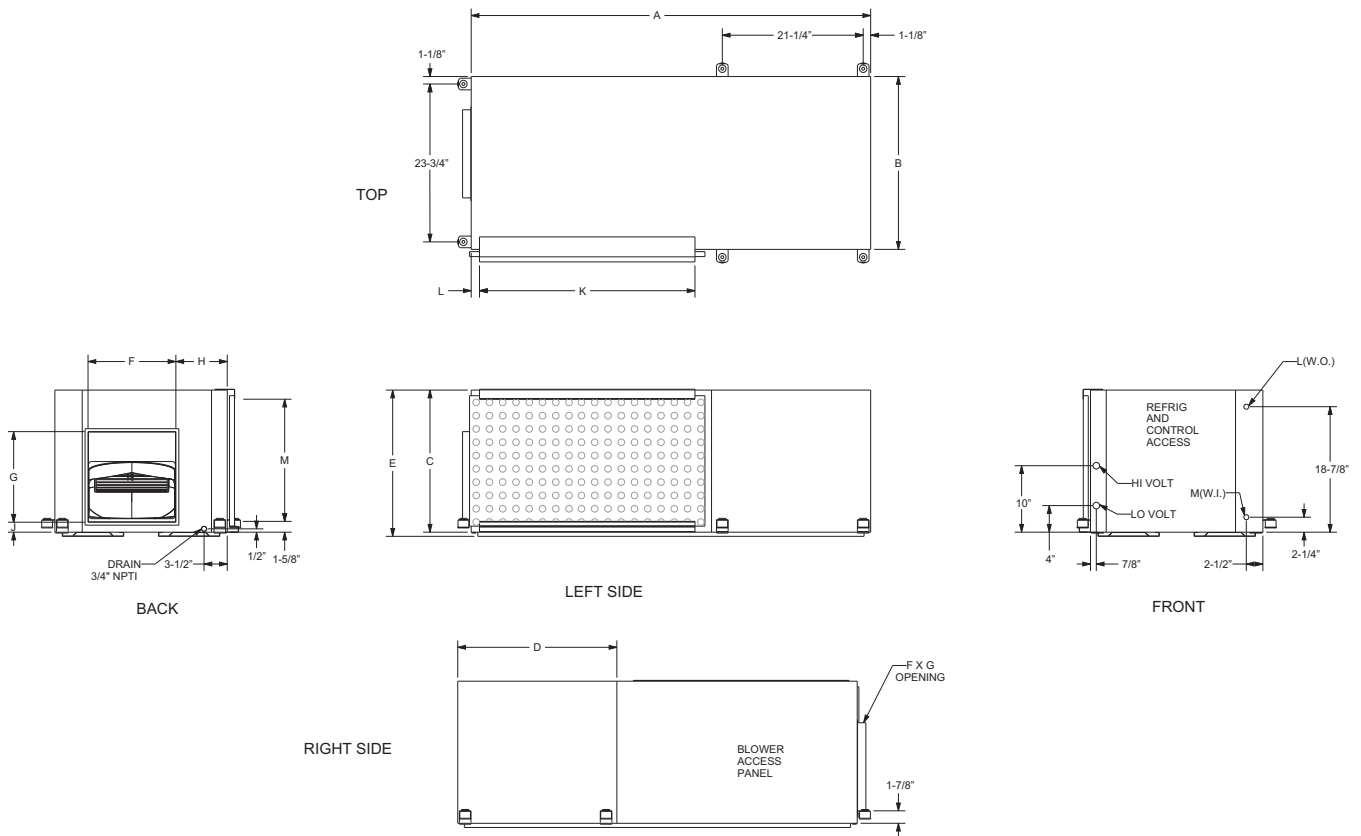


Table 11. Dimensional data— left return/back supply VSH

Units	A	B	C	D	E	F x G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024-033	60-1/4	26	21-3/8	24	22	13-1/4 x 13-5/8	7-3/4	1-1/2	32-1/2	1-1/4	18-3/8	3/4	3/4	3/4
042-060	81-1/4	26	21-3/8	25-1/2	22	13-1/4 x 13-5/8	7-5/8	2-1/8	52	1-1/4	18-3/8	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 12. Left return/right supply VSH

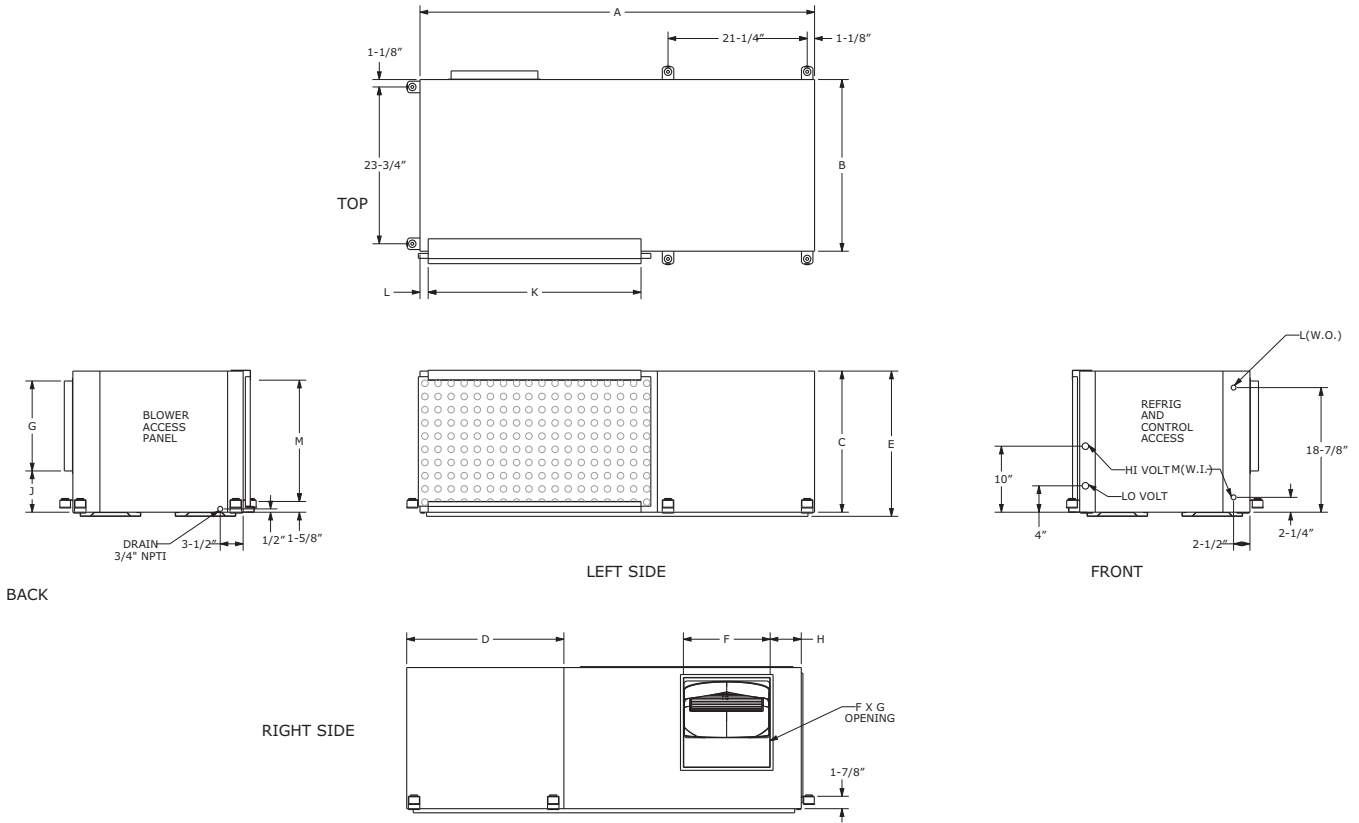


Table 12. Dimensional data— left return/right supply VSH

Units	A	B	C	D	E	F x G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024-033	60-1/4	26	21-3/8	24	22	13-1/4 x 13-5/8	4-3/4	6-1/4	32-1/2	1-1/4	18-3/8	3/4	3/4	3/4
042-060	81-1/4	26	21-3/8	25-1/2	22	13-1/4 x 13-5/8	7-3/4	6-1/4	52	1-1/4	18-3/8	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 13. Right return/back supply VSH

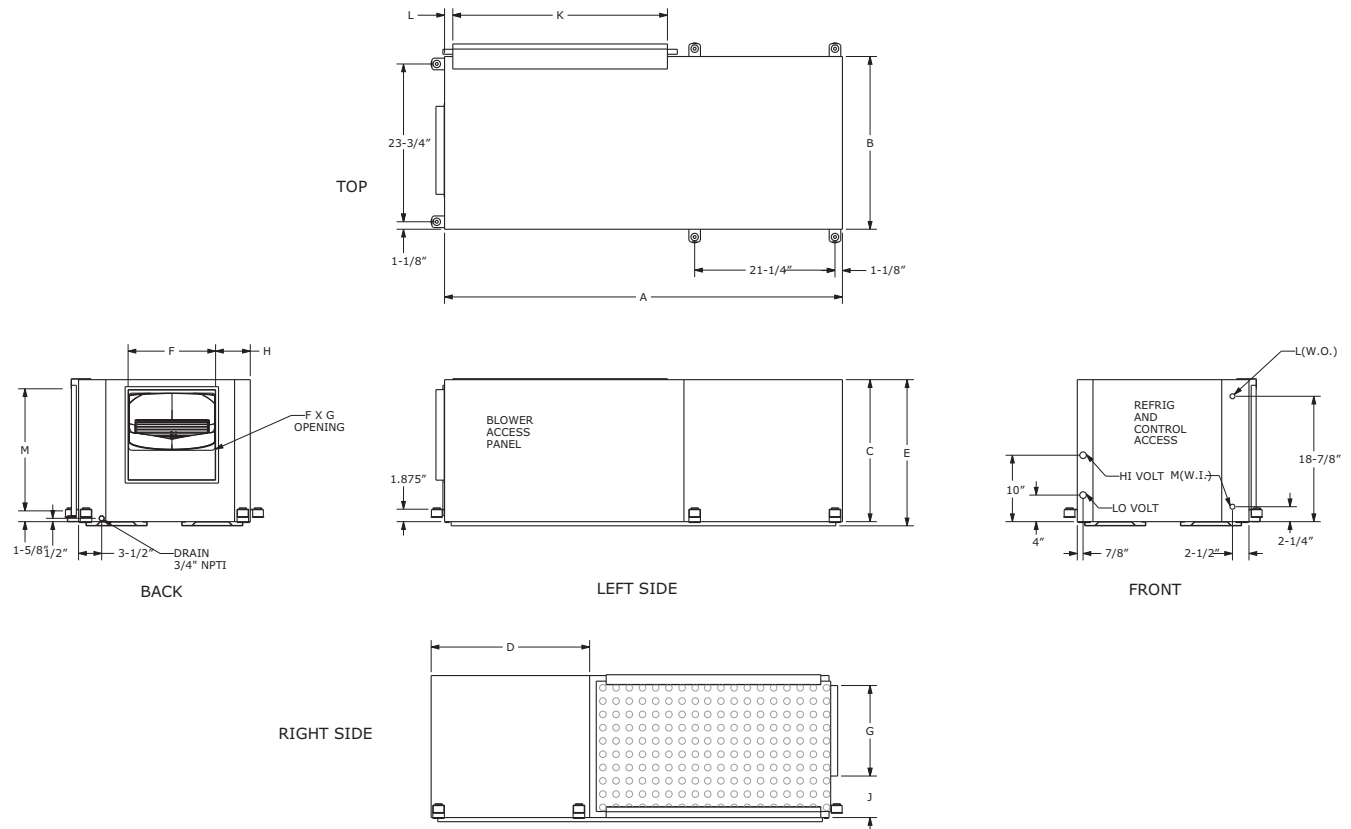


Table 13. Dimensional data — right return/back supply VSH

Units	A	B	C	D	E	F x G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024-033	60-1/4	26	21-3/8	24	22	13-1/4 x 13-5/8	5-1/4	6-1/4	32-1/2	1-1/4	18-3/8	3/4	3/4	3/4
042-060	81-1/4	26	21-3/8	25-1/2	22	13-1/4 x 13-5/8	5-1/8	6-1/4	52	1-1/4	18-3/8	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 14. Right return/left supply VSH

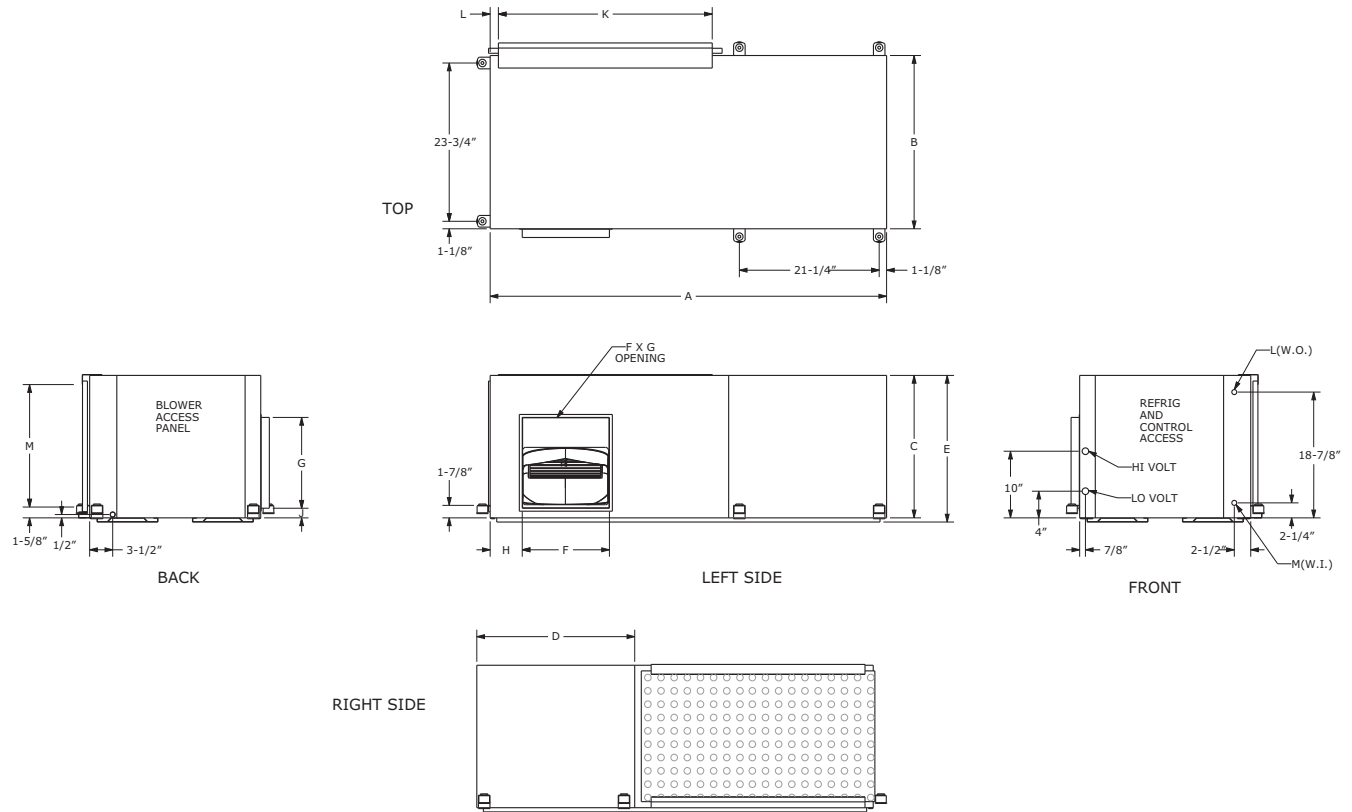


Table 14. Dimensional data — right return/left supply VSH

Units	A	B	C	D	E	F x G	H	J	K	L	M	W.I. NPTI	W.O. NPTI	Drain FPT
024-033	60-1/4	26	21-3/8	24	22	13-1/4 x 13-5/8	4-7/8	1-1/2	32-1/2	1-1/4	18-3/8	3/4	3/4	3/4
042-060	81-1/4	26	21-3/8	25-1/2	22	13-1/4 x 13-5/8	4-3/4	1-1/2	52	1-1/4	18-3/8	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 15. 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

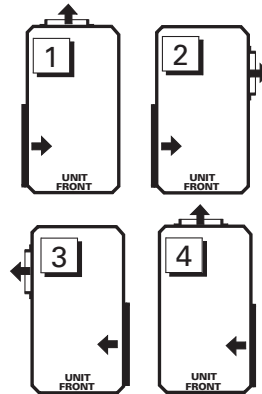


Figure 16. Vertical supply/return air configuration

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

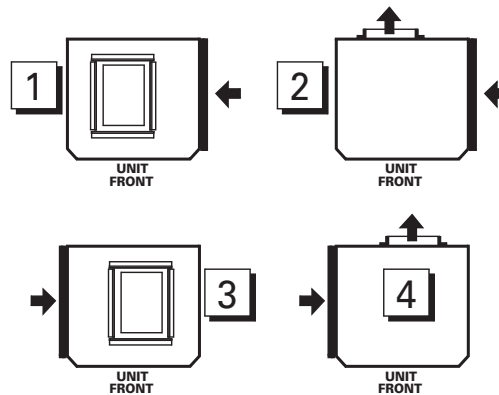


Table 15. Cabinet

Model VSH*		VSH*024	VSH*033	VSH*042	VSH*050	VSH*060
Unit size	Length (inch)	60.2	60.2	81.2	81.2	81.2
	Height (inch)	22.0	22.0	22.0	22.0	22.0
	Width (inch)	26.0	26.0	26.0	26.0	26.0
Compressor type		Rotary	Rotary	Scroll	Scroll	Scroll
Approximate weight	With pallet (lb)	381	381	591	591	591
Approximate weight	Without pallet (lb)	333	333	524	524	524
Nominal Filter size	Inches	16 x 20	16 x 20	20 x 25	20 x 25	20 x 25
	Inches	20 x 20	20 x 20	20 x 30	20 x 30	20 x 30
Water in/out size (NPTI)	Inches	3/4	3/4	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 VSH*	VSH*024	VSH*033	VSH*042	VSH*050	VSH*060
Working pressure	650	650	650	650	650
Tubes high	20	20	20	20	20



General Data

Table 16. Air-to-refrigerant coil (continued)

Model VSH*	VSH*024	VSH*033	VSH*042	VSH*050	VSH*060
Tubes deep	3	3	4	4	4
Number of circuits	3	3	5	5	5
Finned volume (H, W, D: inches)	20 x 31.5 x 2.6	20 x 31.5 x 2.6	20 x 51 x 3.5	20 x 51 x 3.5	20 x 51 x 3.5
Coil surface area (ft ²)	4.375	4.375	7.083	7.083	7.083
Fins per inch	12	12	12	12	12
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 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 18. Cabinet

Model VSV*		VSV*024	VSV*033	VSV*042	VSV*050	VSV*060
Unit size	Length (inch)	26-1/2	26-1/2	30-1/2	30-1/2	30 1/2
	Height (inch)	41-7/8	41-7/8	46-7/8	46-7/8	62 1/2
	Width (inch)	24-1/2	24-1/2	26-1/2	26-1/2	26
Compressor type		Rotary	Rotary	Scroll	Scroll	Scroll
Approximate weight	With pallet (lb)	334	334	495	495	511
	Without pallet (lb)	309	309	460	460	488
Nominal Filter size	Inches	20 x 25	20 x 25	24 x 30	24 x 30	(2) 20 x 30
Water in/out size (NPTI)	Inches	3/4	3/4	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 8	11 x 8	12 x 11	12 x 11	11 x 10

Table 19. Air-to-refrigerant coil

Model VSV*	VSV*024	VSV*033	VSV*042	VSV*50	VSV*060
Working pressure	650	650	650	650	650
Tubes high	18	18	24	24	39
Tubes deep	3	3	4	4	4
Number of circuits	4	4	6	6	6
Finned volume (H, W, D: inches)	18 x 21 x 2.6	18 x 21 x 2.6	24 x 25 x 3.5	24 x 25 x 3.5	39 x 29.3 x 3.5
Coil surface area (ft ²)	2.63	2.63	4.17	4.17	6.97
Fins per inch	12	12	12	12	12
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 20. 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 21. ECM fan performance

Model	External Static Pressure															
	0			0.05		0.1		0.15		0.2		0.25		0.3		
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	
VSH024	796	0.040	300	0.050	362	0.060	419	0.070	470	0.080	516	0.090	557	0.099	595	
	840	0.042	311	0.053	372	0.064	427	0.074	477	0.085	523	0.095	564	0.105	601	
	885	0.045	323	0.057	382	0.068	436	0.079	485	0.090	529	0.100	570	0.111	606	
	930	0.048	334	0.060	392	0.072	445	0.083	493	0.095	536	0.106	576	0.117	612	
	974	0.052	346	0.064	403	0.076	454	0.088	501	0.100	544	0.112	582	0.123	618	
	1019	0.056	359	0.069	414	0.081	464	0.094	509	0.106	551	0.118	589	0.130	623	
		0.35		0.4		0.45		0.5		0.55		0.6				
VSH024	796	0.109	629	0.118	660	0.127	689	0.136	715	0.145	739	0.155	762			
	840	0.115	634	0.125	665	0.134	693	0.144	720	0.154	745	0.163	768			
	885	0.121	640	0.131	670	0.142	698	0.152	725	0.162	750	0.172	774			
	930	0.128	645	0.139	675	0.149	703	0.160	730	0.171	755	0.181	779			
	974	0.135	650	0.146	680	0.157	708	0.168	734	0.180	760	0.191	785			
	1019	0.142	655	0.154	685	0.166	713	0.177	739	0.189	765	0.200	790			
		0			0.05		0.1		0.15		0.2		0.25		0.3	
VSH033	1014	0.084	397	0.097	451	0.110	501	0.123	546	0.135	587	0.148	624	0.160	658	
	1076	0.090	415	0.104	467	0.118	515	0.131	558	0.144	597	0.157	633	0.170	667	
	1138	0.098	433	0.112	483	0.126	529	0.140	570	0.154	608	0.168	643	0.181	675	
	1200	0.106	452	0.121	500	0.136	544	0.151	583	0.165	620	0.179	653	0.193	684	
	1262	0.116	472	0.132	518	0.147	559	0.162	597	0.177	632	0.192	664	0.206	693	
	1324	0.127	493	0.143	536	0.159	575	0.175	611	0.190	644	0.205	675	0.220	703	
		0.35		0.4		0.45		0.5		0.55		0.6				
VSH033	1014	0.172	690	0.184	719	0.196	747	0.208	774	0.220	799	0.232	824			
	1076	0.183	697	0.195	726	0.208	754	0.221	780	0.233	806	0.246	831			
	1138	0.195	705	0.208	733	0.221	760	0.234	787	0.247	813	0.260	839			
	1200	0.207	713	0.221	741	0.235	767	0.248	793	0.262	819	0.276	846			
	1262	0.221	722	0.235	749	0.249	775	0.264	800	0.278	826	0.292	853			
	1324	0.235	731	0.250	757	0.265	782	0.280	808	0.295	833	0.309	860			
		0			0.05		0.1		0.15		0.2		0.25		0.3	
VSH042	1414	0.102	451	0.117	488	0.133	523	0.149	556	0.164	588	0.180	619	0.196	647	
	1485	0.117	471	0.133	507	0.150	541	0.166	573	0.183	604	0.199	633	0.216	662	
	1579	0.140	499	0.157	532	0.175	565	0.192	596	0.210	626	0.228	654	0.245	681	
	1650	0.158	519	0.177	552	0.195	583	0.214	613	0.232	642	0.251	670	0.269	697	
	1721	0.179	539	0.198	571	0.217	601	0.237	631	0.256	659	0.276	686	0.295	712	
	1815	0.208	566	0.229	596	0.250	625	0.270	654	0.291	681	0.312	707	0.332	733	

Table 21. ECM fan performance (continued)

Model	External Static Pressure															
		0.35			0.4		0.45		0.5		0.55		0.6			
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM			
VSH042	1414	0.211	675	0.226	701	0.241	726	0.256	749	0.270	771	0.284	792			
	1485	0.232	689	0.248	714	0.264	738	0.279	762	0.294	783	0.309	804			
	1579	0.262	708	0.279	732	0.296	756	0.312	779	0.328	800	0.344	821			
	1650	0.287	722	0.305	747	0.322	770	0.340	792	0.356	814	0.373	834			
	1721	0.314	737	0.332	761	0.351	784	0.369	806	0.386	828	0.403	848			
	1815	0.352	757	0.372	781	0.391	803	0.411	825	0.429	846	0.448	866			
		0			0.05		0.1		0.15		0.2		0.25		0.3	
VSH050	1414	0.102	451	0.117	488	0.133	523	0.149	556	0.164	588	0.180	619	0.196	647	
	1485	0.117	471	0.133	507	0.150	541	0.166	573	0.183	604	0.199	633	0.216	662	
	1579	0.140	499	0.157	532	0.175	565	0.192	596	0.210	626	0.228	654	0.245	681	
	1650	0.158	519	0.177	552	0.195	583	0.214	613	0.232	642	0.251	670	0.269	697	
	1721	0.179	539	0.198	571	0.217	601	0.237	631	0.256	659	0.276	686	0.295	712	
	2077	0.301	624	0.326	652	0.350	679	0.374	705	0.399	730	0.423	754	0.447	778	
		0.35			0.4		0.45		0.5		0.55		0.6			
VSH050	1414	0.211	675	0.226	701	0.241	726	0.256	749	0.270	771	0.284	792			
	1485	0.232	689	0.248	714	0.264	738	0.279	762	0.294	783	0.309	804			
	1579	0.262	708	0.279	732	0.296	756	0.312	779	0.328	800	0.344	821			
	1650	0.287	722	0.305	747	0.322	770	0.340	792	0.356	814	0.373	834			
	1721	0.314	737	0.332	761	0.351	784	0.369	806	0.386	828	0.403	848			
	2077	0.471	801	0.494	823	0.517	845	0.540	866	0.562	886	0.584	906			
		0			0.05		0.1		0.15		0.2		0.25		0.3	
VSH060	1803	0.240	574	0.262	609	0.282	641	0.301	671	0.319	698	0.337	724	0.354	748	
	1908	0.275	603	0.298	637	0.319	667	0.340	696	0.360	722	0.379	747	0.397	770	
	2014	0.314	631	0.338	664	0.361	693	0.383	721	0.405	746	0.425	770	0.445	792	
	2120	0.357	659	0.383	690	0.408	719	0.431	745	0.454	770	0.476	793	0.497	815	
	2226	0.405	685	0.432	716	0.458	744	0.483	769	0.508	793	0.531	816	0.554	837	
	2332	0.457	711	0.486	741	0.514	768	0.541	793	0.567	816	0.592	838	0.617	859	
		0.35			0.4		0.45		0.5		0.55		0.6			
VSH060	1803	0.371	770	0.388	792	0.405	813	0.422	833	0.439	854	0.457	875			
	1908	0.416	792	0.434	813	0.452	834	0.470	854	0.488	874	0.507	895			
	2014	0.465	814	0.484	834	0.503	855	0.523	874	0.542	894	0.562	915			
	2120	0.518	836	0.539	856	0.560	876	0.580	895	0.601	915	0.623	935			
	2226	0.577	857	0.599	877	0.621	896	0.644	916	0.666	935	0.689	956			
	2332	0.641	879	0.665	898	0.689	917	0.712	936	0.736	955	0.761	976			



Unit Fan Performance

Table 22. ECM fan performance

Model	External Static Pressure															
		0			0.05		0.1		0.15		0.2		0.25		0.3	
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	
VSV024	837	0.070	456	0.079	505	0.090	551	0.101	595	0.114	637	0.127	677	0.140	714	
	884	0.081	483	0.090	529	0.101	572	0.113	614	0.126	654	0.140	692	0.154	729	
	930	0.092	508	0.102	551	0.113	593	0.125	633	0.139	671	0.153	708	0.168	743	
	977	0.105	534	0.115	575	0.127	614	0.140	652	0.154	689	0.168	724	0.184	758	
	1023	0.118	559	0.129	597	0.141	635	0.154	671	0.169	706	0.184	739	0.200	772	
		0.35			0.4		0.45		0.5		0.55		0.6			
VSV024	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM			
	837	0.153	750	0.167	784	0.180	815	0.192	845	0.204	873	0.214	899			
	884	0.168	763	0.182	796	0.196	827	0.210	857	0.222	885	0.234	911			
	930	0.183	776	0.198	808	0.213	839	0.227	868	0.240	896	0.253	923			
	977	0.200	790	0.215	821	0.231	851	0.246	880	0.261	908	0.274	935			
1023	0.217	804	0.233	834	0.250	864	0.266	892	0.281	920	0.296	947				
VSV033		0			0.05		0.1		0.15		0.2		0.25		0.3	
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	
	1080	0.118	538	0.128	571	0.138	603	0.151	634	0.164	664	0.178	693	0.192	722	
	1140	0.137	568	0.147	598	0.158	628	0.171	657	0.184	685	0.199	713	0.214	740	
	1200	0.158	596	0.168	624	0.179	652	0.192	679	0.207	705	0.222	731	0.238	757	
	1260	0.181	625	0.191	651	0.203	676	0.217	701	0.232	726	0.247	751	0.264	775	
1320	0.206	653	0.217	676	0.229	700	0.243	723	0.259	746	0.275	770	0.292	793		
VSV033		0.35			0.4		0.45		0.5		0.55		0.6			
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM			
	1080	0.207	750	0.222	777	0.237	803	0.252	829	0.267	854	0.280	879			
	1140	0.230	766	0.246	792	0.262	818	0.278	844	0.293	869	0.308	894			
	1200	0.254	783	0.271	808	0.288	833	0.305	858	0.322	883	0.338	908			
	1260	0.281	800	0.299	824	0.317	849	0.335	874	0.352	898	0.369	923			
1320	0.310	817	0.329	841	0.348	865	0.366	889	0.385	913	0.403	938				
VSV042		0			0.05		0.1		0.15		0.2		0.25		0.3	
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	
	1485	0.175	553	0.207	599	0.237	641	0.266	680	0.294	716	0.320	750	0.346	782	
	1568	0.202	580	0.236	624	0.268	665	0.299	703	0.328	737	0.357	770	0.385	801	
	1650	0.231	607	0.267	650	0.301	689	0.334	725	0.366	758	0.396	790	0.426	820	
	1733	0.262	634	0.300	674	0.336	711	0.371	746	0.405	778	0.437	808	0.469	837	
1815	0.294	659	0.334	698	0.373	733	0.410	766	0.446	797	0.481	826	0.515	854		
VSV042		0.35			0.4		0.45		0.5		0.55		0.6			
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM			
	1485	0.372	812	0.398	841	0.424	870	0.451	898	0.480	927	0.509	956			
	1568	0.413	830	0.441	859	0.469	887	0.498	916	0.528	944	0.559	974			
	1650	0.456	848	0.486	876	0.516	904	0.547	932	0.579	961	0.613	991			
	1733	0.501	865	0.533	893	0.566	920	0.599	948	0.633	977	0.668	1007			
1815	0.549	881	0.583	908	0.617	935	0.652	963	0.689	991	0.726	1021				

Table 22. ECM fan performance (continued)

Model	External Static Pressure															
	0			0.05		0.1		0.15		0.2		0.25		0.3		
	CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	
VSV050	1701	0.265	636	0.305	678	0.343	716	0.379	752	0.414	785	0.448	817	0.481	847	
	1796	0.304	666	0.346	706	0.387	742	0.426	776	0.463	808	0.500	838	0.535	867	
	1890	0.345	695	0.391	733	0.434	767	0.475	799	0.515	829	0.554	858	0.593	886	
	1985	0.390	724	0.438	759	0.483	791	0.528	821	0.570	850	0.612	877	0.653	903	
	2079	0.436	751	0.486	783	0.535	814	0.582	842	0.628	868	0.672	894	0.716	919	
VSV050		0.35		0.4		0.45		0.5		0.55		0.6				
		CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM		
	1701	0.514	875	0.547	904	0.581	932	0.615	960	0.650	990	0.687	1020			
	1796	0.571	895	0.607	922	0.643	950	0.679	978	0.717	1007	0.757	1038			
	1890	0.631	912	0.669	939	0.708	966	0.747	994	0.788	1023	0.830	1054			
	1985	0.694	929	0.735	955	0.777	981	0.819	1009	0.862	1038	0.906	1068			
2079	0.760	944	0.804	969	0.848	995	0.892	1022	0.938	1050	0.986	1081				
VSV060		0			0.05		0.1		0.15		0.2		0.25		0.3	
		CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM
	1816	0.153	515	0.185	558	0.214	598	0.242	634	0.269	667	0.295	696	0.319	724	
	1918	0.185	542	0.218	585	0.249	623	0.279	658	0.308	690	0.335	719	0.362	746	
	2019	0.220	570	0.256	612	0.289	649	0.321	683	0.351	714	0.380	742	0.409	768	
	2121	0.261	598	0.299	639	0.334	676	0.367	708	0.400	738	0.431	765	0.461	790	
2222	0.308	627	0.347	666	0.384	702	0.420	734	0.454	763	0.487	789	0.519	813		
VSV060		0.35		0.4		0.45		0.5		0.55		0.6				
		CFM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM	kW	RPM		
	1816	0.344	750	0.368	774	0.392	798	0.417	821	0.443	845	0.469	869			
	1918	0.388	771	0.414	794	0.440	818	0.466	840	0.493	864	0.521	888			
	2019	0.437	792	0.464	815	0.492	838	0.520	860	0.549	883	0.578	907			
	2121	0.491	814	0.520	837	0.550	859	0.579	881	0.610	903	0.641	926			
2222	0.550	836	0.582	858	0.613	880	0.645	901	0.677	923	0.710	946				



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: *The VSV units have been tied to the skid by (2) shipping bolts. The removal of these bolts will require a 3/8-inch (9.7 mm) ratchet with a 1/2-inch (12.7 mm) socket.*

Note: *The VSH units have been secured to the skid by shipping brackets. The removal requires a 1/2-inch socket with a 3/8-inch ratchet.*

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.

Note: *Removal of compressor shipping brackets is required on models VSHE 042, 050, 060 & VSVE060. The removal of the shipping brackets requires a 1/2-inch socket with a 3/8-inch ratchet. A bracket is provided on the right and left side of the compressor and requires the removal of 4 bolts per bracket.*

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 codes 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 electrical codes.

Main Electrical

8. Verify the power supply complies with the unit nameplate specifications.
9. Inspect all control panel components; tighten any loose connections.
10. Connect properly sized and protected power supply wiring to a field-supplied/installed disconnect switch and to the power block.
11. Install proper grounding wires to an earth ground. VSV/ VSH 460V units require a neutral (a four wire system).

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

Low Voltage Wiring (AC) Requirements

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

Filter Installation

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

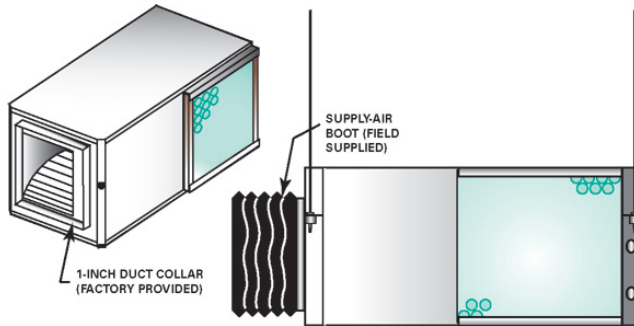
Note: *Do not operate the unit without filters.*

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 17. Flexible supply-air connector (field provided)


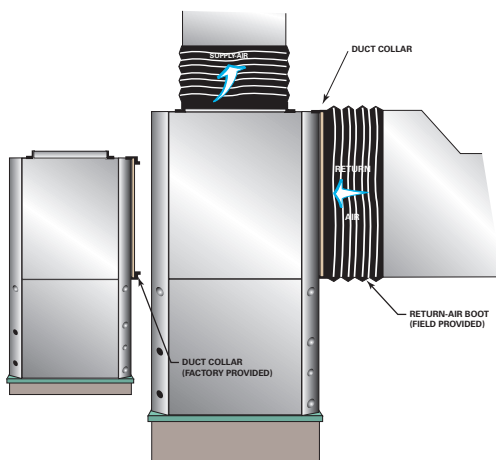
Return-Air Ductwork

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.*

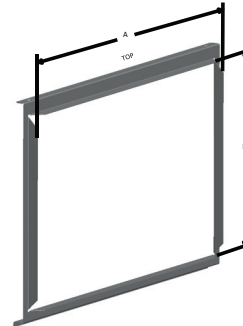
Figure 18. Flexible return-air connector (field provided)


Return Air Ducted Panel

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

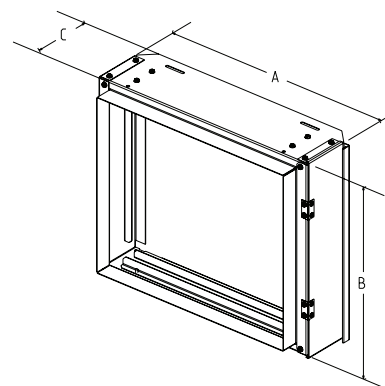
typically used when the return air filter is placed up stream of the unit or placed within a field provided filter rack assembly.

Figure 19. Ducted panel

Table 23. Return air ducted panel (horizontal only)

Unit	A	B	Part Number
024, 033	31.5-in.	19.2-in.	4476 0334 0100
042, 050, 060	51.1-in.	19.2-in.	4476 0335 0100

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 side or bottom access configurations.

Figure 20. Ducted filter rack

Table 24. Ducted filter rack dimensions

Unit	A	B	C
VSH 024, 033	35.8-in.	20.2-in.	5.5-in.
VSH 042, 050, 060	54.8-in.	20.2-in.	5.5-in.

Table 25. Ducted filter opening size

Unit	A	B	C
VSV 024, 033	25.7-in.	22.4-in.	4.3-in.
VSV 042, 050	30.7-in.	26.6-in.	5.5-in.
VSV060	30.7-in.	40.2-in.	5.5-in.

Sound Attenuation Pad

For sound-sensitive installations, a vibration pad (field provided) should be placed beneath the vertical unit. The pad should be 1/2-inch (12.7 mm) thick, and equal to the overall unit foot print.

Hanging the Horizontal Unit

⚠ WARNING

Proper Structural Support Required!

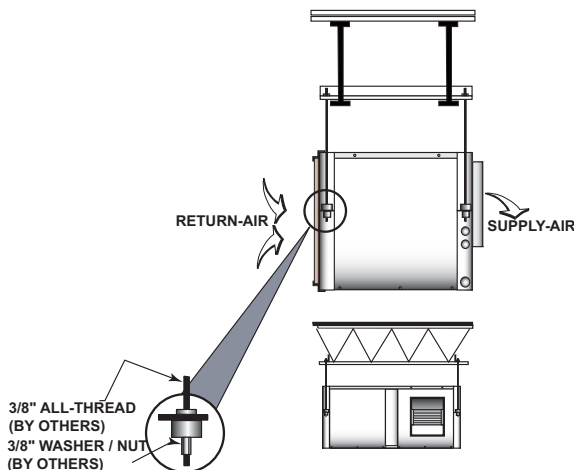
Failure to ensure proper structural ceiling support could result in unit falling from its location which could result in death or serious injury.

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:

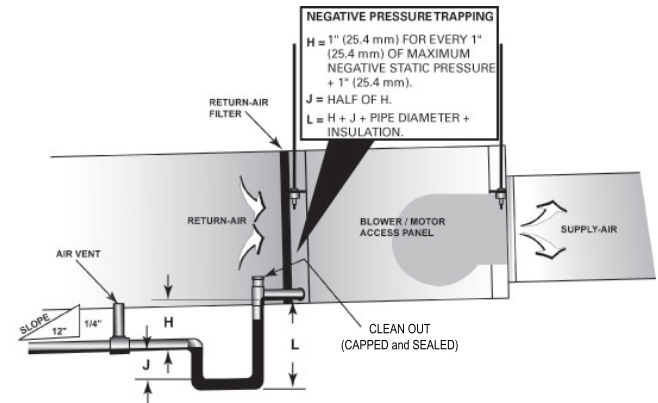
1. Install the hanging isolators (located in the return-air section of the unit) into the six hanging brackets.
2. Secure the equipment to a joist, concrete, etc. with the use of 3/8 in. field provided (all-thread) rod. Each corner should contain field provided nuts and washers to complete the hanging installation.
3. Slope horizontal units in two directions. The unit should contain a dual 1/4-12 pitch toward the drain connection. This will insure proper drainage of the unit. All plumbing to the unit should conform per national and local codes and is the responsibility of the contractor.

Figure 21. Hanging the unit



Condensate Drain Connection

Figure 22. Negative pressure system



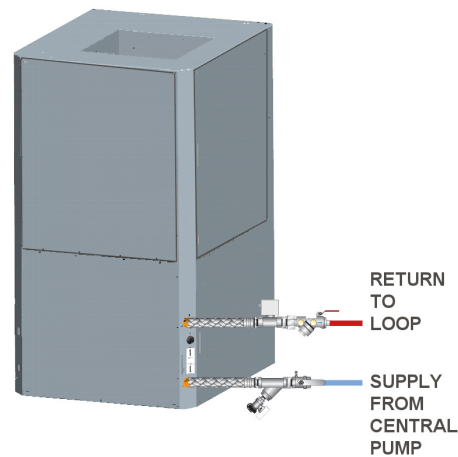
Install proper trapping to the equipment. The unit drain connection is 3/4-inch NPT.

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 23. 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 range 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. Shut down 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 shut down.*

Field Installed Power Wiring

WARNING

Proper Field Wiring and Grounding Required!

Failure to follow codes 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 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 unit's nameplate. Use only copper conductors to connect the power supply to the unit.

Main Unit Power Wiring

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow codes 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 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 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 75 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.

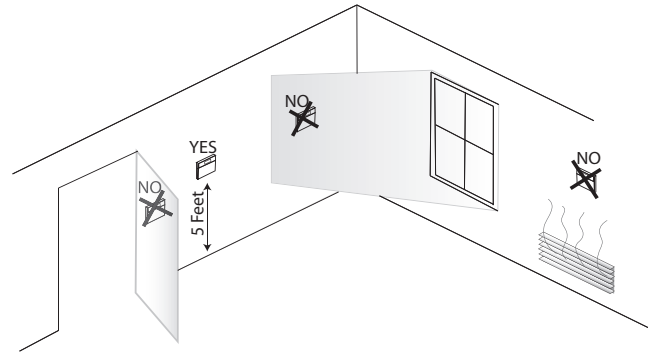
⚠ WARNING

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.

Sensor Location

Figure 24. 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.

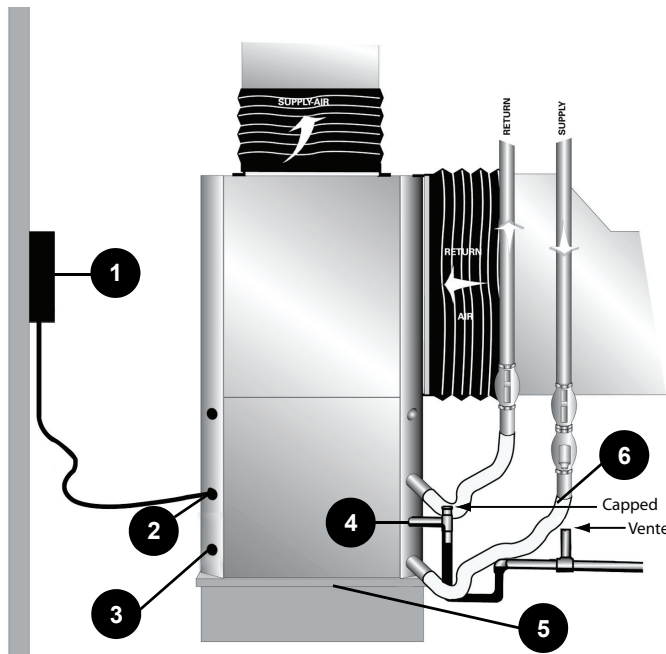
2. Ensure that the wiring between controls and the unit's termination point does not exceed two and a half (2.5) ohms/conductor for the length of the run.
3. Do not run the electrical wires transporting DC signals in or around conduit housing high voltage wires.

Table 26. Zone sensor module wiring

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

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.



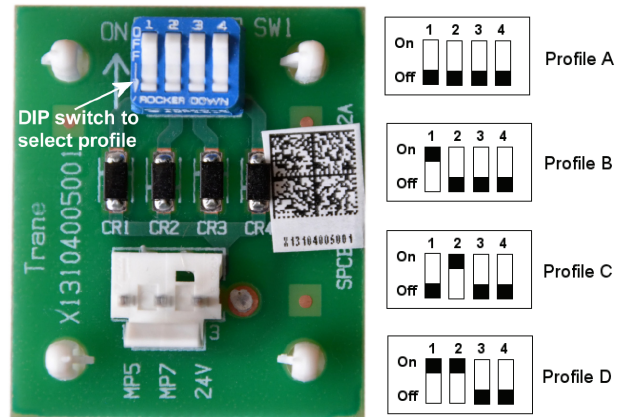
The field supplied line voltage disconnect (1) should be installed for branch circuit protection.

Check local codes for requirements.

- The units (2) 3/4-inch high voltage and (3) 1/2-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 1/2-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.

Airflow Adjustment

Figure 25. Units with Symbio™ 500/UC400 controls and ECM motors – DIP switch settings



Installations at altitudes above 2000 feet may require an adjustment to the fan speed setting to achieve the proper airflow. To adjust the airflow to get the desired CFM, set the DIP switches located in the control box to the proper profile setting. Tracer® TU can be used to make further adjustments to the fan speed.

Use the following table to select the correct profile to use.

Table 27. Profiles for altitude range

Profile	Altitude (feet)
A	0–2000
B	2000–4000
C	4000–6000
D	Above 6000



Electrical Data

Table 28. VSH* electrical data with ECM

Model No.	Unit Volts	Total Unit FLA	Comp RLA (ea)	No. of Compressors	Blower Motor FLA	Blower Motor hp	Fan Motor Num.	Minimum Circuit Ampacity	Maximum Overcurrent Protective Device
VSH*024	208/60/1	10.2	9.2	1	0.97	1/2	1	12.47	20
	230/60/1	10.2	9.2	1	0.97	1/2	1	12.47	20
	460/60/3	3.7	2.9	1	1.29	1/2	1	4.43	15
VSH*033	208/60/1	14.4	12.9	1	1.48	1/2	1	17.61	30
	230/60/1	14.4	12.9	1	1.48	1/2	1	17.61	30
	460/60/3	5.5	4.2	1	1.29	1/2	1	6.54	15
VSH*042	208/60/1	15.1	13.1	1	2.03	1	1	18.41	30
	230/60/1	15.1	13.1	1	2.03	1	1	18.41	30
	460/60/3	6.1	4.2	1	1.86	1	1	7.11	15
VSH*050	208/60/1	20.5	17.8	1	2.69	1	1	24.94	40
	230/60/1	20.5	17.8	1	2.69	1	1	24.94	40
	460/60/3	7.5	5.0	1	2.48	1	1	8.73	15
VSH*060	208/60/1	25.8	21.8	1	4.03	1	1	31.28	50
	230/60/1	25.8	21.8	1	4.03	1	1	31.28	50
	460/60/3	8.8	4.9	1	3.84	1	1	10.00	15

Note: 460/60/3 installations using the ECM fan/motor require a neutral wire.

Table 29. VSV* electrical data with ECM

Model No.	Unit Volts	Total Unit FLA	Comp RLA (ea)	No. of Compressors	Blower Motor FLA	Blower Motor hp	Fan Motor Num.	Minimum Circuit Ampacity	Maximum Overcurrent Protective Device
VSV*024	208/60/1	11.3	9.2	1	2.1	3/4	1	13.6	20
	230/60/1	11.3	9.2	1	2.1	3/4	1	13.6	20
	460/60/3	4.9	2.9	1	2.0	3/4	1	5.6	15
VSV*033	208/60/1	15.7	12.9	1	2.8	3/4	1	18.9	30
	230/60/1	15.7	12.9	1	2.8	3/4	1	18.9	30
	460/60/3	6.9	4.2	1	2.7	3/4	1	8.0	15
VSV*042	208/60/1	17.7	13.1	1	4.6	1	1	20.9	30
	230/60/1	17.7	13.1	1	4.6	1	1	20.9	20
	460/60/3	8.2	4.2	1	4.0	1	1	9.3	15
VSV*050	208/60/1	24.8	17.8	1	7.0	1	1	29.3	45
	230/60/1	24.8	17.8	1	7.0	1	1	29.3	45
	460/60/3	11.6	5.0	1	6.6	1	1	13.25	15
VSV*060	208/60/1	25.8	21.8	1	4.03	1	1	31.28	50
	230/60/1	25.8	21.8	1	4.03	1	1	31.28	50
	460/60/3	8.8	4.9	1	3.84	1	1	10.00	15

Note: 460/60/3 installations using the ECM fan/motor require a neutral wire.



Variable-Speed WSHP Symbio™ 500/Tracer® UC400 Controller

I/O Definitions

Hard-wired input/outputs for the variable-speed WSHP Symbio 500/UC400 controller are defined in the following table.

Table 30. Symbio 500/UC400 hard wired input/output definitions

Connection type	Symbio 500/UC400 terminal	Variable-speed WSHP configuration	Connection specifications ^(a)	Valid range
Analog Inputs	AI1	Zone Temp Sensor/Timed Override and Timed Override Cancel	10 kΩ Thermistor	-40-212°F
	AI2	Zone Setpoint	0-1000 Ω	40-115°F
	AI3	Fan Mode (Control Auto/Off) AHRI Audit Test Mode Initiate	200-100 kΩ	Auto/Off Test Mode Active/Inactive
	AI4	Heat Sink Temperature Sensor	10 kΩ Thermistor	-40-212°F
	AI5	Entering Water Temperature Sensor	10 kΩ Thermistor	-40-212°F
Universal Inputs	UI1	Relative Humidity Sensor	4–20 mA	0-100%RH
	UI2	Leaving Water Temperature	10 kΩ Thermistor	-40-212°F
Binary Inputs	BI1	Local Occupancy	24 Vac detect	Normally Open Occ./Unocc
	BI2	Condensate Overflow		Normally Closed Okay/Failed
	BI3	Compressor Protection Status – Discharge Line Thermostat/Low/High Pressure Cut Out/Overload Relay Status		Normally Closed Okay/Failed
Binary Outputs (Relay) ^(b)	BO1	Supply Fan On/Off Control	2.88 A @24 Vac pilot duty	Energized/De-Energized
	BO2	Isolation Valve		Energized/De-Energized
	BO3	Compressor 1		Energized/De-Energized
Binary Outputs (Triac) ^(c)	BO4	NA	0.5 A max @24–277 Vac, resistive and pilot duty	Energized/De-Energized
	BO5	NA		Energized/De-Energized
	BO6	NA		Energized/De-Energized
	BO7	Reversing Valve		Energized/De-Energized
	BO8	NA		Energized/De-Energized
	BO9	NA		Energized/De-Energized
Analog Outputs/Binary Inputs	AO1/ BI4	Supply Fan Motor Control Signal	PWM Output: 80Hz	0-100% Duty Cycle
	AO2/ BI5	Variable Speed Compressor Control Signal	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	Test Mode Input	3-Wire:+5Vdc, Signal, Gnd	0Vdc/5Vdc (Normal/Test Mode Active)
	PI2	Feedback from Compressor VFD	3-Wire:+5Vdc, Signal, Gnd	0Vdc/5Vdc (Okay/Drive Disabled or Failed)

(a) For more information on the Symbio 500/UC400 connection specifications, refer to the Symbio 500/UC400 installation sheet; Literature Order Number X39641064-01.

(b) For Triac output control, 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 500/UC400 will provide a contact closure for output control.



Variable-Speed WSHP Symbio™ 500/Tracer® UC400 Controller

XM30 Configurable Connections

The following table provides information about the XM30 configurable connections.

Table 31. Device connections

Connection	Quantity	Types	Range
Inputs	Can be configured using any combination of analog or binary inputs/ analog outputs	Thermistor	2252 Ω, 10 k, 20 k, 100 kΩ
		Resistive (Setpoint)	100 Ω to 1 MΩ
		RTD	1 kΩ; platinum, Balco™ or nickel
		Current	0-20 mA (linear)
		Voltage	0-10 Vdc (linear)
		Binary	Dry Contact
		Pulse Accumulator	Minimum 20 milliseconds open or closed
Outputs		Current	0-20 mA @ 16 V
		Voltage	0-16 Vdc @ 20 mA
Overall Point Total	4		

Symbio™ 500/UC400 Setpoints and Setup Parameters

The setpoints shown in the table below are available for modification through the Tracer® TU Field Service Tool if changes from the factory default values are required.

Table 32. Symbio 500/UC400 setpoints

Input Name	Selections	Default
Default Setpoints		
Space Temperature Setpoint Source	BAS Local Source Default	Local Source
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	40–100%	60%

The setup parameters shown in the Symbio 500/UC400 setup parameters table are available for modification through the Tracer TU Field Service Tool if changes are required.

Note: *The Symbio 500/UC400 setup parameters table indicates only product-specific setup parameters and does not include standard Tracer TU parameters (for example, units of measure).*

Variable-Speed WSHP Symbio™ 500/Tracer® UC400 Controller

Table 33. Symbio 500/UC400 setup 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	33-100% ^(b)	33%
Supply Fan Speed High Limit	75-110%	100%
Filter Runtime Hours Enable	Enable/Disable	Enable
Filter Runtime Hours Setpoint	0-10000 hours	600 hrs.
Bypass Time		
Occupied Bypass Time ^(c)	0-240 minutes	120 minutes
Humidity/Dehumidification		
Space Dehumidification Setpoint Default	40-100%	60%

(a) Fan will cycle when unoccupied.

(b) The minimum supply fan speed percent is dependent upon the maximum supply fan speed PWM percent. The maximum supply fan speed percent 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 other than heating and cooling that are controlled by the variable-speed WSHP Symbio™ 500/UC400 controller are described in this section.

Random Start Timer

At power-up, the Symbio 500/UC400 controller will generate a random timer (unique to each controller) from 5–30 seconds. During this time period, all unit functionality will be held off until the timer expires.

Maintenance Timer

The Symbio 500/UC400 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. These setpoints will be available locally through the Symbio 500/UC400 or may be provided from a BAS.

The Symbio 500/UC400 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, respectively). 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 500/UC400 has default values for heating and cooling and they are 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 500/UC400 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 VSPD WSHP Symbio 500/UC400:

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
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 500/UC400 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).

Occupied Standby Mode

The occupied standby mode allows the unit to operate at a heating or cooling setpoint between the occupied and unoccupied setpoints (space temperature setpoint \pm 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

The 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 k Ω 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 operation, the supply fan will be commanded ON and will ramp up to minimum speed once the unit determines that there is a request for cooling or heating operation. 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 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.

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.



Sequence of Operation

Unit Mode Arbitration

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 the auto-changeover section below. 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 following table 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.*

Table 34. 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 WARMUP	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.

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 500/UC400 supports a two-position water isolation valve without needing any special configuration; by default, the Symbio 500/UC400 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. The water isolation valve will be driven open during all heating and cooling requests, even if the compressor output is not energized, such as during low load conditions when the compressor is operating in the duty cycle routine in order to achieve its minimum capacity. To reduce excessive cycling of the isolation valve, once opened, the isolation valve will remain open for a minimum of 10 minutes.

Entering Water Temperature (EWT) Sampling

The controller will sample the entering water temperature to determine proper control action for all units that utilize a hard-wired entering water temperature indication. If the entering

water temperature is communicated to the controller via a BAS system, then no sampling will be required. When the EWT sampling function is invoked, the isolation valve output will be driven open for 3 minutes and the EWT reading is taken at that time.

EWT sampling will not occur automatically at power up, only when all of the following conditions are met:

- EWT is not communicated via BAS system
- There is a new request for compressor operation.
- The isolation valve is not OPEN.
- It has been more than an hour since the last time that the isolation valve was opened.

After the 3-minute EWT sampling time period expires, the isolation valve will remain open for compressor operation.

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. Under normal operating modes, the reversing valve does not change states until the compressor is energized and reaches its startup speed.

Cooling and Heating Operation

For normal cooling and heating operation, the unit cooling or heating capacity will modulate and cycle based on a PI algorithm in order to meet the active space setpoint. The following fan and compressor actions are based on the required unit capacity:

- When no unit capacity is required, the compressor output(s) will be OFF. When compressor is OFF, the crank case heater will be energized.
- When the required unit capacity is less than the compressor can provide at its minimum speed, the unit will operate in a duty cycle scheme based on a required ON/OFF time in order to meet the space demand.
- When the required unit capacity is greater than the minimum capacity for the unit, the unit will operate the compressor and fan between minimum and maximum capacity in order to meet the space demand.

Unoccupied Cooling and Heating Operation

The unit will control the zone temperature to the active unoccupied setpoints during unoccupied periods.

Demand Limit Operation

The 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 and heating). During this period, the supply fan tracks the compressor as normal and is limited by the user-selected minimum and maximum fan speeds. Demand limit requests do not override compressor startup and shutdown sequences or unit protection modes.



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 9-12°F); 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 5-9°F 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 35. 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

Table 35. Checklist (continued)

MODE	Heat	Cool
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.



Start-Up

Table 36. 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	—	—	—	—	84-97	252-321	5-7	15-24
	35	6.2	—	—	—	—	84-97	253-321	4-6	15-24
	45	5.0	125-144	166-212	12-15	19-25	98-113	266-338	7-8	19-26
	45	6.2	125-144	161-204	10-12	19-25	99-114	267-340	5-7	18-28
	55	5.0	127-146	189-241	12-15	18-24	116-134	281-358	8-10	21-31
	55	6.2	127-146	183-233	9-12	18-24	118-136	282-359	6-8	22-31
	65	5.0	131-151	216-275	11-14	18-24	130-149	291-370	9-11	24-34
	65	6.2	131-151	210-267	9-12	18-24	132-152	294-374	7-9	25-35
	75	5.0	133-153	250-318	11-14	18-24	150-173	309-394	10-13	28-38
	75	6.2	133-153	243-309	9-11	18-24	154-177	311-396	8-10	28-39
	85	5.0	136-157	287-365	11-14	17-23	173-199	327-416	11-14	31-42
	85	6.2	136-156	279-355	9-11	17-23	178-205	331-422	9-12	32-43
	95	5.0	138-159	327-416	11-13	17-23	—	—	—	—
	95	6.2	138-159	319-406	9-11	17-23	—	—	—	—
VSH033	35	6.9	—	—	—	—	80-92	259-330	5-7	16-24
	35	8.6	—	—	—	—	80-93	259-330	4-5	16-25
	45	6.9	124-142	172-219	11-15	19-25	96-110	271-345	6-8	20-27
	45	8.6	123-142	166-211	9-12	19-25	97-111	272-346	5-6	19-28
	55	6.9	124-142	194-247	11-15	19-24	114-131	287-365	7-9	22-31
	55	8.6	124-142	188-239	9-12	19-24	115-133	289-368	6-7	22-32
	65	6.9	125-144	221-281	11-14	18-24	126-145	302-384	8-10	25-35
	65	8.6	125-144	214-273	9-12	18-24	128-148	304-386	7-9	25-35
	75	6.9	127-146	255-324	11-14	18-24	147-169	321-408	9-12	28-39
	75	8.6	127-146	248-315	9-11	18-24	150-173	323-411	8-10	29-39
	85	6.9	129-148	292-371	11-14	17-23	169-195	342-436	11-13	32-43
	85	8.6	128-148	284-362	9-11	17-23	174-200	345-439	9-11	33-44
	95	6.9	131-150	332-423	11-13	17-23	—	—	—	—
	95	8.6	130-150	325-413	9-11	17-23	—	—	—	—
VSH042	35	8.4	—	—	—	—	81-93	249-317	6-7	15-23
	35	10.5	—	—	—	—	82-95	251-319	5-6	14-24
	45	8.4	109-125	160-203	12-15	17-23	96-111	259-329	7-9	18-26
	45	10.5	109-125	154-196	10-12	17-23	98-113	261-333	5-7	18-27
	55	8.4	126-145	185-236	12-15	17-23	112-129	271-345	8-10	20-30
	55	10.5	126-145	179-228	9-12	17-23	115-132	272-347	6-8	21-30
	65	8.4	133-153	215-273	11-15	18-24	130-150	282-359	9-11	23-33
	65	10.5	133-153	208-264	9-12	18-24	133-154	285-363	7-9	24-34
	75	8.4	134-155	248-315	11-14	18-24	151-174	298-379	10-13	26-36
	75	10.5	134-154	240-306	9-11	18-24	156-179	302-384	8-11	27-37
	85	8.4	137-158	283-361	11-14	17-23	175-201	316-402	11-14	29-40
	85	10.5	137-158	276-351	9-11	17-23	180-208	320-407	9-12	30-41
	95	8.4	139-160	323-411	11-13	16-22	—	—	—	—
	95	10.5	139-160	316-402	8-11	17-23	—	—	—	—
VSH050	35	10.2	—	—	—	—	80-92	255-324	6-7	16-25
	35	12.7	—	—	—	—	81-94	256-326	5-6	16-26
	45	10.2	126-145	164-208	12-15	15-21	94-108	265-337	7-9	20-27

Table 36. 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)
VSH050	45	12.7	126-145	159-202	9-12	15-21	96-110	267-340	6-7	19-29
	55	10.2	128-147	188-240	11-15	17-23	108-124	277-353	8-10	22-32
	55	12.7	128-147	182-232	9-12	17-23	113-130	281-358	6-8	22-32
	65	10.2	129-148	216-276	11-14	18-24	123-142	292-371	9-11	25-35
	65	12.7	129-148	210-267	9-12	18-24	126-146	295-375	7-9	25-36
	75	10.2	131-150	250-318	11-14	18-24	144-165	309-393	10-13	28-38
	75	12.7	130-150	243-309	9-11	18-24	148-170	313-399	8-10	29-39
	85	10.2	133-153	285-363	11-14	17-23	167-192	328-417	11-14	31-42
	85	12.7	133-153	278-354	9-11	17-23	172-198	332-423	9-12	32-43
	95	10.2	135-155	325-413	11-14	17-23	—	—	—	—
95	12.7	135-155	317-404	9-11	17-23	—	—	—	—	
VSH060	35	12.5	—	—	—	—	82-95	271-345	6-7	19-28
	35	15.6	—	—	—	—	83-96	274-348	5-6	19-29
	45	12.5	121-140	152-194	12-15	18-24	94-108	286-364	7-9	23-31
	45	15.6	122-140	147-187	10-12	18-24	96-110	289-368	6-7	23-32
	55	12.5	121-139	190-241	11-15	18-24	111-128	306-389	8-10	25-35
	55	15.6	118-135	183-233	9-12	18-24	114-131	308-392	7-8	26-36
	65	12.5	119-137	221-282	11-14	18-24	124-142	322-409	9-11	29-39
	65	15.6	119-137	215-273	9-11	18-24	127-147	327-416	7-9	30-40
	75	12.5	121-139	255-324	11-14	18-24	144-166	346-440	10-13	33-43
	75	15.6	121-139	248-315	9-11	18-24	149-171	350-445	8-11	33-44
	85	12.5	128-147	289-368	11-14	18-24	167-192	369-470	11-14	37-48
	85	15.6	127-147	282-359	9-11	18-24	173-199	376-478	9-12	38-49
	95	12.5	130-149	329-419	11-14	18-24	—	—	—	—
	95	15.6	129-149	322-409	9-11	18-24	—	—	—	—

Table 37. 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	—	—	—	—	—	83-95	258-328	5-6	14-23
	35	—	—	—	—	—	85-98	259-330	4-5	15-24
	45	5.0	125-144	154-196	11-15	18-24	98-113	275-350	6-8	18-27
	45	6.2	124-143	148-189	9-12	19-24	100-115	277-352	5-7	18-28
	55	5.0	128-147	180-229	11-14	18-24	114-131	288-366	7-9	21-30
	55	6.2	128-147	174-222	9-12	18-24	117-134	290-369	6-8	21-31
	65	5.0	132-152	209-266	11-14	18-24	129-148	304-387	8-11	24-34
	65	6.2	132-151	203-258	9-11	19-24	133-153	308-391	7-9	24-34
	75	5.0	134-154	241-307	11-14	18-24	148-170	321-408	10-12	27-37
	75	6.2	133-153	235-299	9-11	18-24	153-176	325-414	8-10	28-38
	85	5.0	136-156	277-352	11-13	17-23	169-194	341-433	11-14	31-41
	85	6.2	136-156	270-344	9-11	18-23	175-201	346-441	9-11	32-42
	95	5.0	138-159	316-402	10-13	17-23	—	—	—	—
	95	6.2	138-158	309-394	8-11	17-23	—	—	—	—



Start-Up

Table 37. 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)
VSV033	35	—	—	—	—	—	79-91	267-339	5-7	15-24
	35	—	—	—	—	—	81-94	268-341	4-5	16-25
	45	6.6	116-133	159-202	12-15	22-20	94-108	283-360	6-8	19-28
	45	8.3	115-133	154-196	9-12	18-24	96-110	285-363	5-7	19-28
	55	6.6	120-138	186-236	12-15	18-24	110-126	297-378	7-9	22-31
	55	8.3	120-138	180-229	9-12	18-24	113-130	300-381	6-8	22-32
	65	6.6	124-143	214-273	12-15	18-24	126-145	317-404	8-11	25-35
	65	8.3	124-143	208-265	9-12	18-24	130-150	321-409	7-9	26-36
	75	6.6	126-145	247-314	11-14	18-24	146-168	337-429	10-12	28-39
	75	8.3	126-145	241-306	9-11	18-24	151-173	342-435	8-10	29-40
	85	6.6	129-149	282-359	11-14	17-23	167-192	359-457	11-14	32-43
	85	8.3	129-149	276-351	9-11	18-24	173-199	365-465	9-11	33-44
	95	6.6	132-151	322-409	11-14	17-23	—	—	—	—
95	8.3	131-151	315-401	9-11	17-23	—	—	—	—	
VSV042	35	—	—	—	—	—	83-95	260-330	5-7	14-23
	35	—	—	—	—	—	84-97	261-332	4-5	15-23
	45	8.7	126-144	154-196	12-15	19-25	98-112	276-352	7-8	18-27
	45	10.9	125-144	149-189	10-12	19-25	100-115	278-354	5-7	18-28
	55	8.7	129-148	180-230	12-15	19-25	115-133	291-371	8-10	21-31
	55	10.9	128-148	175-223	9-12	19-25	118-136	293-373	6-8	22-31
	65	8.7	133-153	210-267	11-14	19-24	131-151	309-394	9-11	24-34
	65	10.9	133-152	204-260	9-12	19-25	135-155	313-398	7-9	25-35
	75	8.7	134-155	242-308	11-14	18-24	150-172	326-415	10-13	28-38
	75	10.9	134-154	236-300	9-11	18-24	155-178	331-421	8-11	28-39
	85	8.7	137-158	277-352	11-14	18-24	170-196	346-441	11-14	31-42
	85	10.9	137-157	270-344	9-11	18-24	176-203	352-448	9-12	32-43
	95	8.7	139-160	315-401	11-14	17-23	—	—	—	—
95	10.9	139-160	309-393	9-11	17-23	—	—	—	—	
VSV050	35	—	—	—	—	—	81-93	273-348	6-7	16-25
	35	—	—	—	—	—	83-95	275-350	5-6	17-26
	45	10.4	117-134	154-196	11-15	18-24	95-109	294-375	7-9	20-30
	45	13.0	117-134	151-192	9-12	18-24	98-112	296-377	6-7	21-30
	55	10.4	122-140	182-231	11-15	18-24	111-127	309-394	8-10	23-33
	55	13.0	121-140	177-225	9-12	18-24	114-131	313-398	6-8	24-34
	65	10.4	128-147	211-268	11-14	18-24	126-145	330-420	9-12	27-37
	65	13.0	128-147	205-261	9-12	19-24	130-150	334-426	7-10	28-38
	75	10.4	130-149	243-309	11-14	18-24	145-167	351-446	10-13	31-41
	75	13.0	129-149	237-302	9-11	18-24	151-173	357-454	9-11	32-42
	85	10.4	132-152	278-354	11-14	18-24	167-192	375-477	12-15	35-46
	85	13.0	132-152	272-346	9-11	18-24	173-199	383-487	10-12	36-47
	95	10.4	134-154	317-403	11-13	17-23	—	—	—	—
95	13.0	134-154	311-395	9-11	17-23	—	—	—	—	
VSV060	35	12.5	—	—	—	—	78-90	260-331	6-7	19-27
	35	15.6	—	—	—	—	80-92	262-334	5-6	18-28

Table 37. 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	45	12.5	119-137	158-201	12-15	16-22	94-108	277-353	7-9	23-30
	45	15.6	116-133	153-194	9-12	16-22	97-111	279-355	6-7	22-32
	55	12.5	125-144	190-242	12-15	20-26	111-128	296-377	8-10	25-35
	55	15.6	122-140	184-234	9-12	20-26	115-132	299-380	7-8	26-36
	65	12.5	127-147	220-280	12-15	20-25	131-151	311-396	9-12	29-39
	65	15.6	127-146	213-271	9-12	20-25	135-156	315-401	7-10	30-40
	75	12.5	129-149	253-322	11-14	19-25	152-175	335-426	10-13	33-44
	75	15.6	129-149	246-313	9-12	19-25	158-181	339-432	8-11	34-45
	85	12.5	133-153	288-367	11-14	19-25	175-202	361-459	12-15	37-48
	85	15.6	133-153	281-357	9-11	19-25	182-210	366-466	10-12	38-50
	95	12.5	135-155	328-417	11-14	18-24	—	—	—	—
	95	15.6	135-155	320-407	9-11	18-24	—	—	—	—

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

Model VSH	EWT °F	GPM	Ft. Pressure
VSH024	85	6.2	3.5
VSH033	85	8.6	6.1
VSH042	85	10.5	3.0
VSH050	85	12.7	4.1
VSH060	85	15.6	5.7

Table 39. Heating water pressure drops (WPD) in feet of head - VSH

Model VSH	EWT °F	GPM	Ft. Pressure
VSH024	70	6.2	3.8
VSH033	70	8.6	6.5
VSH042	70	10.5	3.2
VSH050	70	12.7	4.4
VSH060	70	15.6	6.1

Table 40. Cooling water pressure drops (WPD) in feet of head - VSV

Model VSV	EWT °F	GPM	Ft. Pressure
VSV024	85	6.2	3.7
VSV033	85	8.3	6.2
VSV042	85	10.9	3.1
VSV050	85	13.0	4.2
VSV060	85	15.6	5.1

Table 41. Heating water pressure drops (WPD) in feet of head - VSV

Model VSV	EWT °F	GPM	Ft. Pressure
VSV024	70	6.2	4.0
VSV033	70	8.3	6.7
VSV042	70	10.9	3.5
VSV050	70	13.0	4.7
VSV060	70	15.6	5.4

Water Volume

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

Table 42. 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 43. 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 45, p. 50](#).

Table 44. Filter sizing for disposable filters - VSH

Size (60 Hz)	Nominal Filter Size (inch)
VSH 024-033	16 x 20 20 x 20
VSH 042-060	20 x 25, 20 x 30

Table 45. Filter sizing for disposable filters - VSV

Size (60 Hz)	Nominal Filter Size (inch)
VSV 024-033	20 x 25
VSV 042-050	24 x 30
VSV 060	(2) 20 x 30

Table 46. Ducted filter rack assemblies

Unit Size	Unit Return (Digit 16)	Filter Rack Opening Orientation ^(a)	Filter Rack Assembly
VSV060	L	Back	4474-0156-0100
VSV060	R	Front	4474-0156-0100
VSV060	L	Front	4474-0157-0100
VSV060	R	Back	4474-0157-0100

(a) No digit available

⚠ 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.

Check the contactors and 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 loop 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 47. 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
Carbon Dioxide	Less than 75 ppm
Total dissolved solids (TDS)	Less than 1000 ppm
Biological Growth	
Iron Bacteria	Low
Erosion	
Suspended Solids	Low

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

⚠ 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.

General Unit Troubleshooting¹

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
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 airflow	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

¹ Variable speed compressors sound different than single speed compressors. The compressor sound will change as the speed and operating conditions change.



Troubleshooting

Problem	Heating	Cooling	Cause	Correction
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 airflow	Check, clean blower and coil
Low suction pressure	X	X	Undercharged	Locate leak; repair and recharge
	X	X	Restricted thermal expansion valve	Repair / replace
		X	Inadequate airflow	Check, clean blower and coil
		X	Dirty filter	Clean/replace
Low pressure switch open	X		Inadequate GPM	Increase GPM
	X		Water too cold	Increase temperature
		X	Inadequate airflow	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

The variable-speed compressor drive includes internal protection functions that limit the compressor operation, or in some cases, disable compressor operation completely. In an event occurs that causes the compressor operation to shut

down, the compressor drive sends a binary signal to the VSPD WSHP Symbio™ 500/UC400 controller and a diagnostic is generated. Refer to the following table for the correct DIP switch settings for each unit. The DIP switches are located on the interface module located in the compressor drive assembly.

Note: Reference WSHP-SVG02*-EN for additional details.

Table 48. DIP switch settings

Model	Voltage	SW1	SW2	SW3	SW4	SW5	SW6
VSVE024/033	208/60/1	OFF	OFF	OFF	OFF	OFF	OFF
	230/60/1	OFF	OFF	OFF	OFF	OFF	OFF
	460/60/3	OFF	OFF	OFF	OFF	OFF	OFF
VSVE042/050/060	208/60/1	OFF	OFF	OFF	OFF	OFF	ON
	230/60/1	OFF	OFF	OFF	OFF	OFF	ON
	460/60/3	OFF	OFF	OFF	OFF	OFF	ON
VSHE024/033	208/60/1	OFF	OFF	OFF	OFF	OFF	OFF
	230/60/1	OFF	OFF	OFF	OFF	OFF	OFF
	460/60/3	OFF	OFF	OFF	OFF	OFF	OFF
VSHE042/050/060	208/60/1	OFF	OFF	OFF	OFF	OFF	ON
	230/60/1	OFF	OFF	OFF	OFF	OFF	ON
	460/60/3	OFF	OFF	OFF	OFF	OFF	ON



Control Wiring

Figure 26. 208V single-phase wiring with ECM

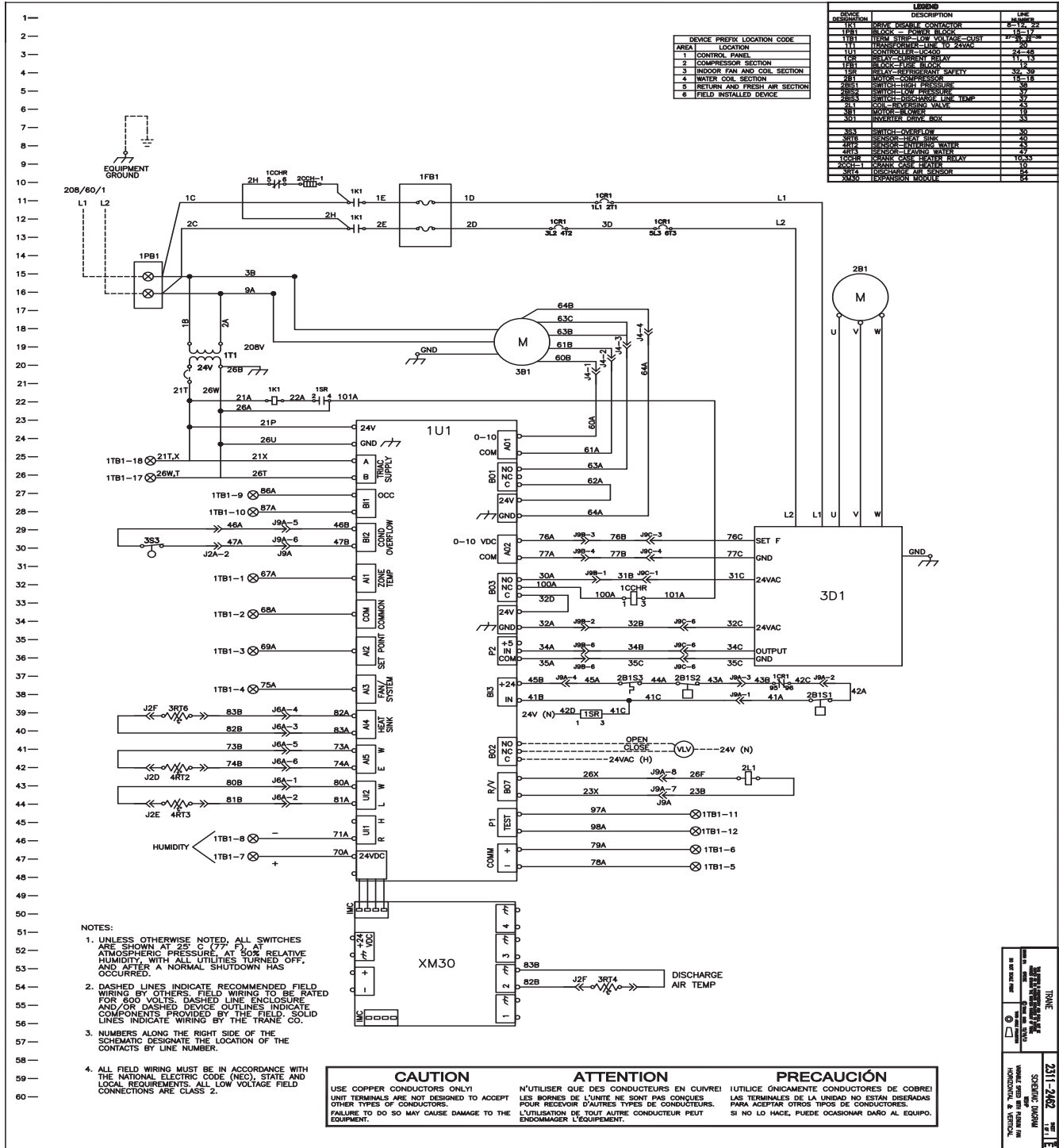
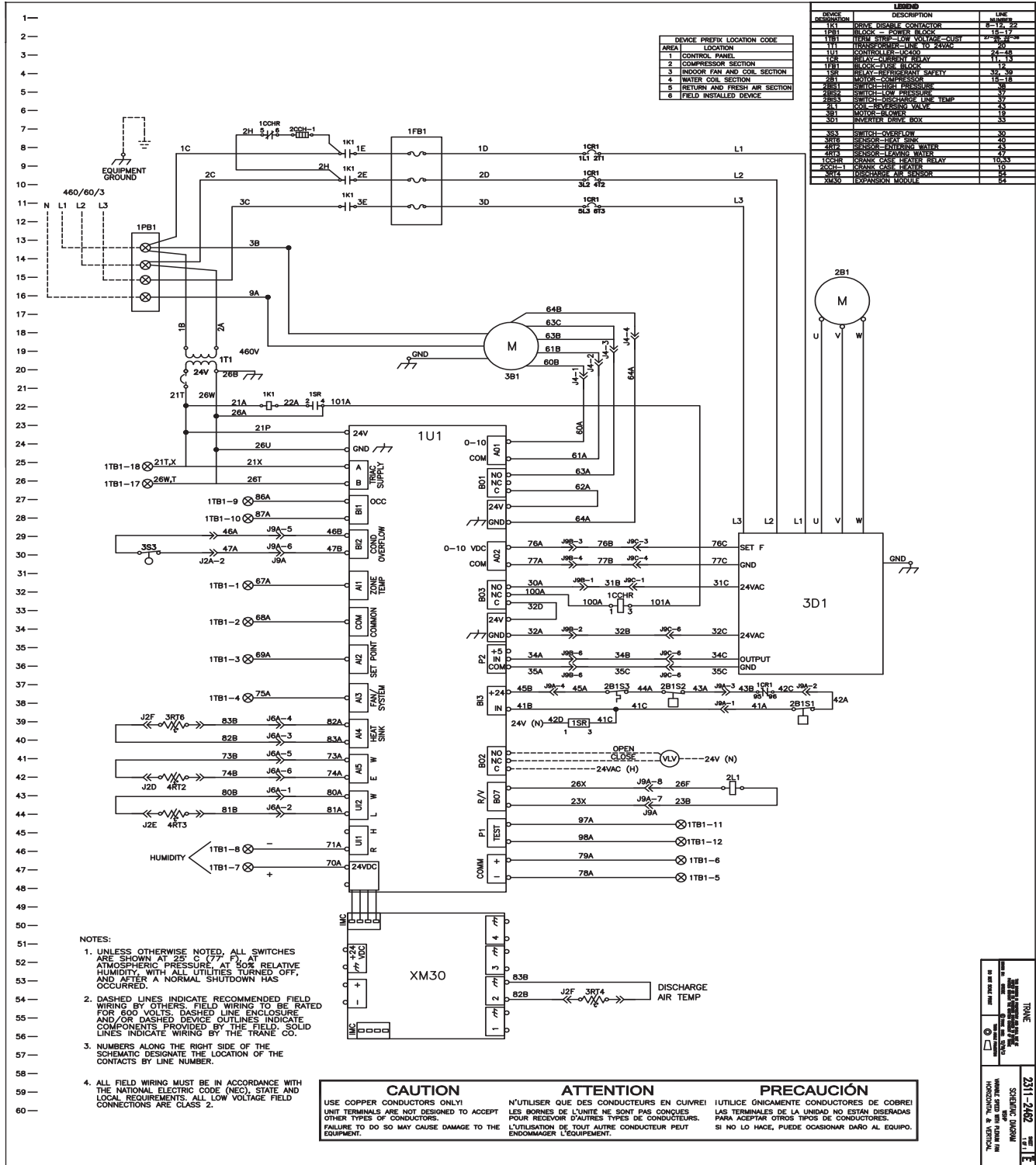


Figure 27. 460V three-phase wiring with ECM



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