High Efficiency VSCS Series Vertical Stacked Water Source Heat Pumps

A Generation Installation, Operation, and Maintenance Manual

LD27626

Installation Guide

Issue date: 2020-12-10

Form Number: 145.18-IOM1 (1220)

Supersedes: 145.18-IOM1 (620)

Johnson Controls

Contents

General safety guidelines

Important!

Read before proceeding!

This equipment is a relatively complicated apparatus. During rigging, installation, operation, maintenance, or service, individuals may be exposed to certain components or conditions including, but not limited to: heavy objects, refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and others at the site.

This document is intended for use by owner-authorized rigging, installation, and operating/service personnel. It is expected that these individuals possess independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood the on-product labels, this document and any referenced materials. This individual shall also be familiar with and comply with all applicable industry and governmental standards and regulations pertaining to the task in question.

Safety symbols

The following symbols are used in this document to alert the reader to specific situations:

DANGER

Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.

WARNING

Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.

CAUTION

Identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution if proper care is not taken or instructions and are not followed.

Note: Highlights additional information useful to the technician in completing the work being performed properly.

⚠ WARNING

External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the control cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with the manufacturer's published specifications and must be performed only by a qualified electrician. The manufacturer will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

⚠ WARNING

This product can expose you to chemicals including formaldehyde, which is known to the state of California to cause cancer. For more information, go to http://www.P65Warnings.ca.gov.

Changeability of this document

In complying with the manufacturer's' policy for continuous product improvement, the information contained in this document is subject to change without notice. There is no commitment to update or provide current information automatically to the manual or product owner. Updated manuals, if applicable, can be obtained by contacting the nearest service office.

It is the responsibility of rigging, lifting, and operating/ service personnel to verify the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, rigging, lifting, and operating/service personnel should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the equipment.

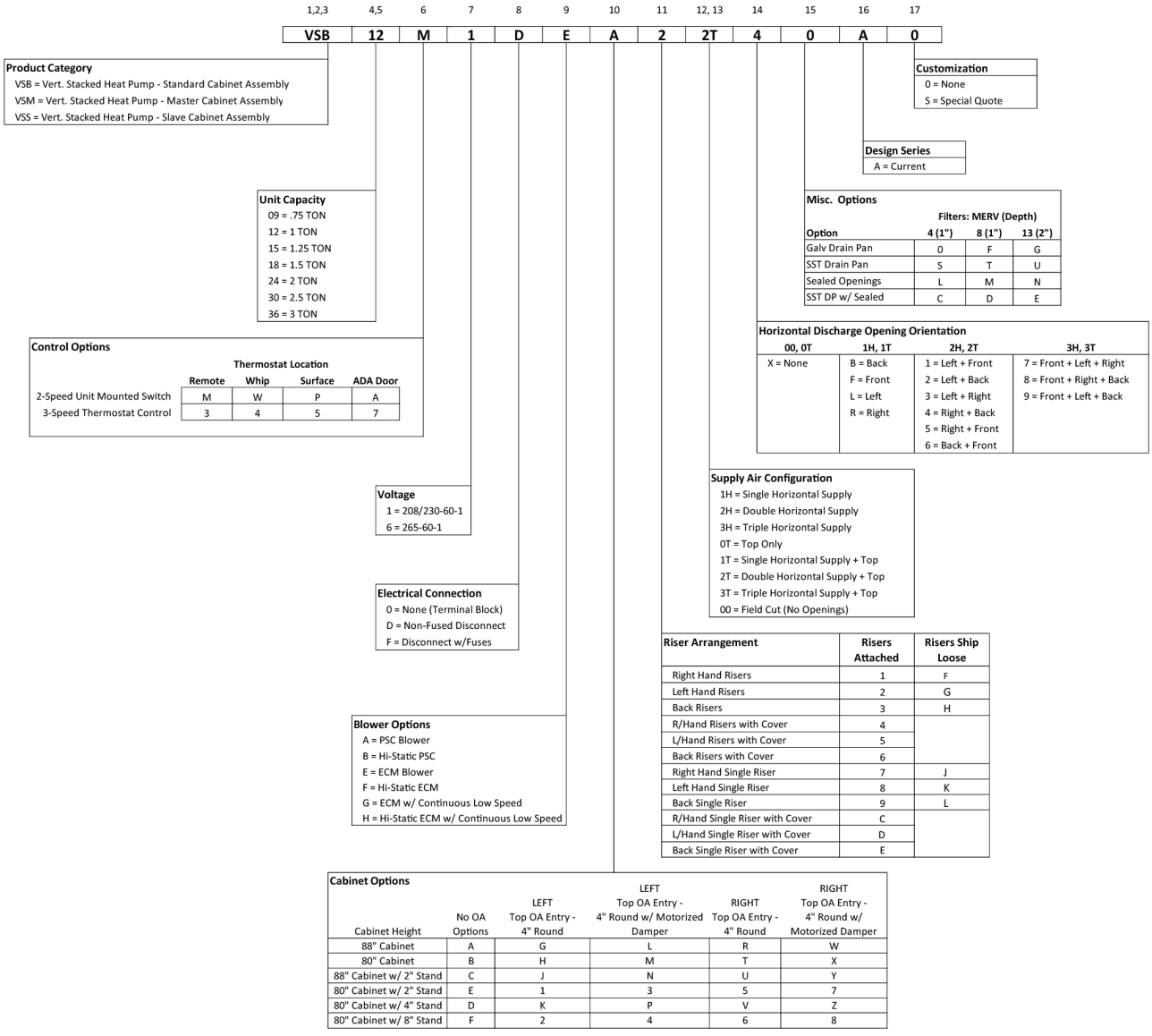
Revision notes

Affected section	Description	Date implemented
Refrigerant charge adjustment	Updated PSC and ECM fan data tables.	November 2020
Cabinet nomenclature	Updated cabinet nomenclature.	November 2020
Chassis nomenclature	Updated chassis nomenclature.	November 2020
Cabinet riser installation	Updated cabinet dimensions.	October 2020
Vertical stack water loop verification	Vertical stack water loop verification added to appendix	August 2020
Placing the cabinet	Added information about the factory isolated anchor kits in Step 6 of Placing the Cabinet	June 2020
Figure 13	Updated figure and table dimensions for OA option with or without a damper in Figure 13 - Critical Return Air (RA) Panel with Unit Cabinet Installation Dimensions	April 2020
Table 1	Added optional 2-inch MERV 13 filter data per model in Table 1 - High Series Physical Data	March 2020
Chassis nomenclature	10.0 USGPM autoflow regulator option removed from Chassis Nomenclature	February 2020
Table 1	Refrigerant charge data updated for each model in Table 1 - High Series Physical Data	February 2020
Start-up and performance checklist	Start-up Checklist added	February 2020

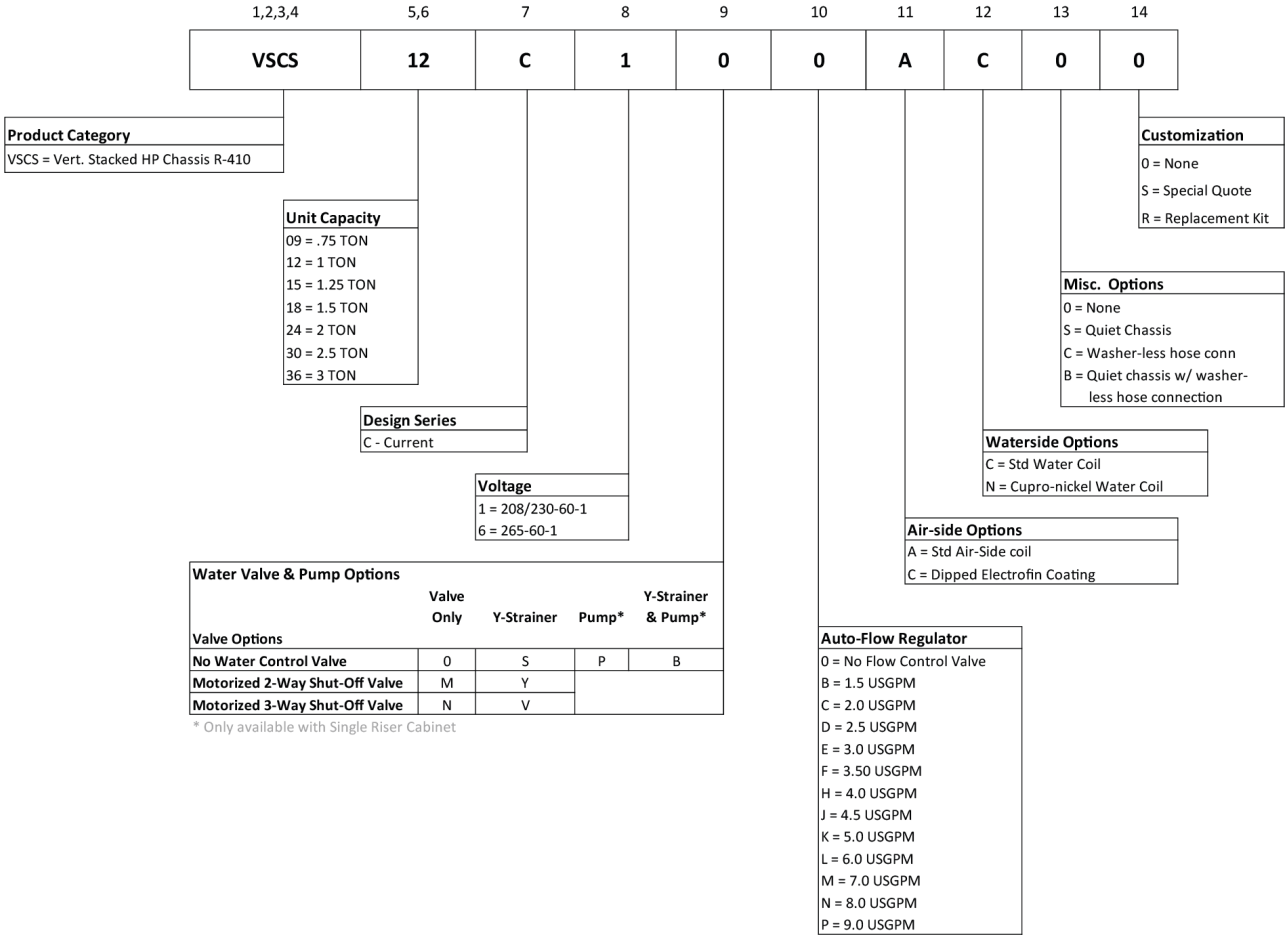
Associated literature

Manual description	Form number
Vertical Stacked Heat Pump Start-Up and Performance Checklist	145.18-CL1
Vertical Stacked Water Source Heat Pump Heating and Cooling Data Record Sheet	145.18-CL2

Cabinet nomenclature



Chassis nomenclature



Installation

Note:

After installing the unit, show the user how to turn off the electricity to the unit. Point out control and switch locations for turning off the electricity.

Ensure the user understands the importance of following all safety precautions.

Notice and disclaimer

This unit contains refrigerant installed by the factory that is approved for use in the unit's intended country of installation or market. Distributors are only authorized to provide refrigerants that have been approved for use in the countries or markets they serve.

The refrigerant used in this unit is identified on the unit's nameplate and in this manual. Any additions of refrigerant into this unit must comply with the country's requirements with regard to refrigerant use and should be obtained from manufacturer approved distributors. Use of unapproved refrigerant substitutes will void all warranties and can cause injury or death.

Disclaimer

Customer modifications to certified products are prohibited. If performed without the express written approval of the manufacturer, modifications will void all warranties (expressed or implied) and may result in hazardous situations resulting in equipment damage, serious physical injury or property damage, or death.

The manufacturer has certified the product as being compliant with applicable government and/or industry standards. Product certification is designated either on the product itself or in the product literature. The certification mark identifies the applicable standards as well as the Nationally Recognized Test Lab (NRTL) or other testing facility that conducted the testing, where applicable.

If changes are made to the product, an engineering review is required to assess the impact to the product certification. In some instances, the changes may require that the NRTL or testing facility review and re-approve the product by means of a field or site inspection and certification.

Modifications may invalidate product certifications or violate country standards. Any person or entity making changes to the product is responsible for obtaining the required engineering review and approval, as well as covering certification and other related costs.

Unauthorized customer modifications to certified products are prohibited for the following reasons:

1. Modifications may create hazards that could result in death, serious injury, or equipment damage.
2. Modifications will void product warranties.
3. Modifications may invalidate product certifications and may violate country standards. Country standards may require that only certified products be used in certain applications, and modifications that result in the loss of product certification may violate those standards.

Pre-installation

Literature

Review this Installation, Operation, and Maintenance (IOM) manual prior to installation. After installing the unit, give this IOM to the end user. If help is needed with any of the installation instructions or matters relating to the unit, contact the sales office where you bought the unit. You may also refer to the unit rating plate for a contact name.

Shipping

Cabinets and risers ship in one of the following configurations:

- Cabinets are stacked on their side with risers attached. Chassis ship on separate skids.
- Risers ship loose, packaged in boxes and sorted by floor. Cabinets ship upright up to four per skid. Chassis ship on separate skids.
- Risers ship loose, packaged in boxes, and sorted by floor. Cabinets ship upright on skids with chassis inside the cabinet. Chassis electrical and water connections are not installed. The chassis is secured to the service panel. Remove the screws before removing the service panel and chassis.

The cabinet must remain standing upright. Do not place cabinets on their side with the chassis inside.

Inspection and storage

About this task:
Store cabinets, chassis, and risers the same way they were shipped. Ensure the storage area is dry and protected from the environment. Keep the units in their upright position. If the risers are stored at the job site, ensure the pipe ends are capped to prevent foreign object debris and contamination.
In areas where construction is not complete (including dry wall, plaster, paint, and where any emission of dust particulates or fumes from outgassing are present), all precautions must be taken to protect the cabinet, openings, and chassis from contamination or physical damage.
Upon delivery, perform the following inspections:

1. Inspect the unit for shipment damage. Notify the Transportation Company of any damage and note the damage on the shipping receipt.

⚠ CAUTION

Rough handling may dislocate and damage internal components.

2. Inspect the riser projections at each end of the cabinet for misalignment or end damage that would prevent making an acceptable connection.
3. Inspect the thermostats and other accessories that have been shipped separately for quantity and transit damage.

Result
Store the refrigeration chassis in the normal upright orientation to maintain oil in the compressor sump.

Preparations for installing the unit

Before installing the unit, perform the following preparations:

- Verify the model number on the unit nameplate with the ordering and shipping information to ensure the correct unit has been shipped.
- Carefully inspect each unit before delivery to the installation site. All cabinets may not be equipped with the same size riser or the same air supply grille arrangement. In most cases, each cabinet is individually tagged for a specific location in the building.
- Keep the cabinet sealed with the shipping materials until all plastering, painting, and construction work is complete.

- Remove the inner service panel and manually check the blower wheel for free rotation.
- Match the refrigeration chassis to the proper cabinets by referring to the cabinet and chassis nameplate and label information.
- Remove the chassis refrigeration access panel (top cover) and inspect the unit. Ensure that the refrigerant tubing is free from obvious physical damage and kinks, and check that piping does not touch other unit components.
- Ensure the compressor is mounted on neoprene isolators with metal spacing sleeves inside. Secured it with nuts that are snug against the metal spacer sleeves.
- Inspect all electrical connections. Connections must be clean and tight at the terminals.

⚠ CAUTION

Do NOT use the risers to lift the cabinet assembly.

⚠ WARNING

Do NOT install this unit outdoors.

⚠ DANGER

A compressor/unit comprises a pressurized system. Never loosen threaded joints while the system is under pressure, and never open pressurized system parts.

⚠ DANGER

Before servicing, open and tag all disconnect switches.

⚠ DANGER

Do NOT install units in a flammable environment due to the danger of an explosion.

⚠ WARNING

Safety guards, shields, barriers, covers, and protective devices must not be removed while the compressor/unit is operating.

WARNING

All safety features, disengagement, and interlocks must be in place and function correctly before the equipment is put into operation. Never bypass or wire around any safety device.

WARNING

Use gloves and protective goggles where appropriate and have a gas mask close at hand. Use electrical protection equipment and tools suited for electrical operations.

WARNING

Personnel must be qualified according to national safety rules and regulations.

WARNING

Only manufacturer- qualified personnel should install this system. If not, it may cause water leakage, electric shock, or fire.

Rigging

WARNING

Follow all applicable regulations and safety practices during rigging and lifting.

Prepare and follow written rigging and lifting plan. Lifting must be directed by trained, professional rigger.

Spreader bars must be used and be long enough to prevent rigging from contacting unit. Use only the designated lift points according to unit's IOM, and use ALL lift points.

Locate the center of gravity through trial lifts to account for possible variations in unit configuration. Use rigging and lifting techniques that keep the unit stable and level. Keep clear of unit when lifted.

Cabinet riser installation

CAUTION

Do NOT use the risers to lift or move the cabinets.

Refer to Figure 3, which shows the correct location of the cabinet in relation to the floor sleeve and risers.

Risers are not designed to support or lift any part of the cabinet. Do not use them to lift a cabinet. Risers are attached using nylon ties to allow for slight adjustments during installation, and expansion of riser column during operation. Take care during installation to avoid damage to risers and riser stub-outs.

⚠ CAUTION

Improper handling and installation of risers could damage riser stub-outs and valves and could result in property damage, death, or serious injury.

⚠ CAUTION

Do not allow the risers to bottom out. Riser stub-out should be centrally located with the stub-out opening of the cabinet riser. Do not allow riser stub-outs or risers to contact cabinet sheet metal.

⚠ WARNING

Do not drag risers on the floor while moving the cabinet.

When the risers are shipped loose, riser installation can be completed before cabinet installation. When installing risers, ensure the riser stub-outs are centered in the the cabinet openings. Ensure that the risers cannot bottom out in swage (see Figure 1).

When risers are shipped attached to cabinets, complete the installation of risers and cabinet at the same time. Detaching the riser from the cabinet is unnecessary.

Placing the cabinet

About this task:
The correct location of the cabinet in relation to the floor sleeve and risers is shown in Figure . To place the cabinet correctly, perform the following steps:

1. Place the cabinet in a horizontal position on the floor adjacent to its installation location (when risers are attached to cabinet).

   The units are designed to accommodate a maximum supply and return riser stub-out movement of 1-1/2 inches due to expansion and contraction (total movement of 3 inches). If the total calculated riser expansion or contraction exceeds 1-1/2 inches, the field must provide expansion compensation.
2. Install field or factory-provided riser extensions, if required, to the unit-mounted risers prior to moving the cabinet into final position.
3. Raise the cabinet upright. Lower the risers through the floor cutout, aligning the risers into the swaged section of the unit on the floor below.

Note: Take extra care not to scrape or dent risers during positioning. The riser tailpiece should insert approximately 2 inches into the 3-inch long swaged section of the unit below.

CAUTION

DO NOT allow the riser tailpiece to bottom out into the swaged section. This ensures the correct riser positioning and compensates for variations in floor-to-floor dimensions.

4. Center the risers in the pipe chase, and level the cabinet using shims as necessary.
5. Plumb risers in two planes to assure proper unit operation and condensate drainage.
6. Anchor the cabinets into place using rubber isolated sheet metal angles. Approved and tested sheet metal angles are available from factory.

CAUTION

Ensure the unit has vibration isolation pads installed. These pads are required in order to reduce noise transmission into the floor. If the unit does not vibration isolation pads, order them via Source1 and install in the field. Failure to have the isolation kits installed can result in loud unit operation.

WARNING

Do not drill or drive screws into the cabinet in the area of the internal drain pan.

7. Center the risers' horizontal stub-outs (complete with factory-installed shut-off valves) in the cabinet slot openings. Ensure that the stub-outs are perpendicular to the side/back panel.
8. Verify all risers are vertical and that they penetrate the swaged joint at least 1 inch.

   Factory provided risers come with a 3-inch deep swage. Do not allow risers to completely bottom out at 3 inches in the swage. The 3-inch swage depth is oversized to allow for adjustments if necessary to keep riser stub-outs and valves centered in the cabinet opening.
9. Center the riser stub-out in cabinet opening to allow for expansion and contraction. Riser stub-outs must not contact on any sheet metal opening. Otherwise damage can occur to stub-outs, resulting in water leaks and property damage.

Figure 1: Ideal riser insertion depth

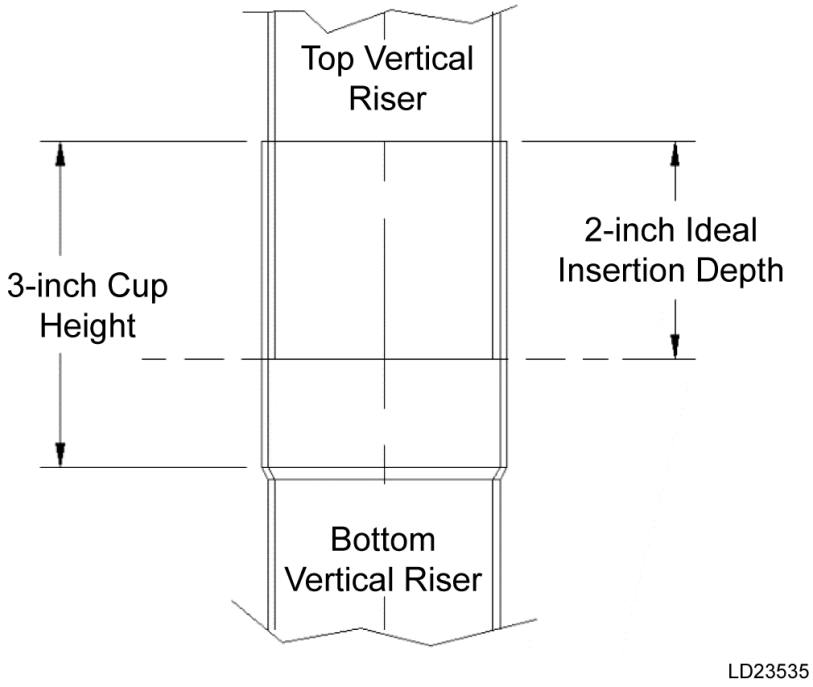
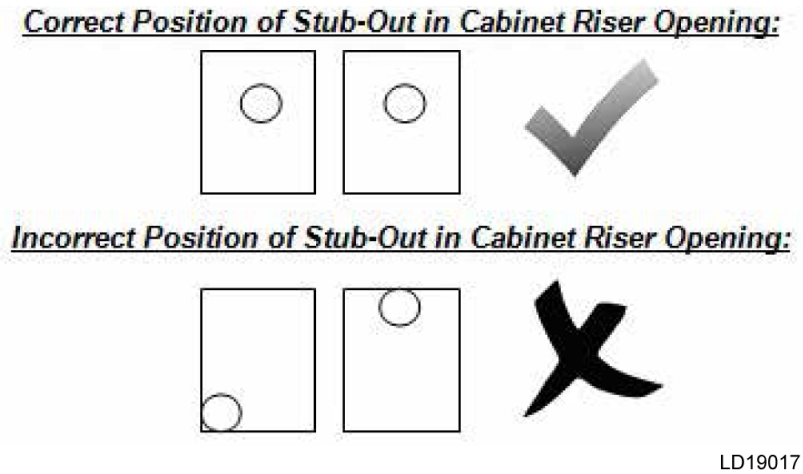


Figure 2: Correct/incorrect stub-out positions in cabinet riser opening



10. Braze or solder riser joints with industry accepted solder or brazing rod material.

⚠ WARNING

The riser system must be secured to building structure. Cabinets are not designed to support the riser system.

11. Secure the riser system at a minimum of one point to the building structure. Cabinets are not intended to support the riser system. If the temperature range of the system exceeds the allowed expansion and contraction limits (1-1/2 inches maximum), the installing contractor must make riser compensation provisions.

12. Ensure that individual unit shut-off valves remain closed until the circulating loop system is cleaned and flushed.

Table 1: High series physical data

High series model	09	12	15	18	24	30	36
Nominal cooling (ton)	0.75	1.0	1.25	1.5	2.0	2.5	3.0
Compressor type	Rotary			Scroll			
Refrigerant charge (oz)	23	31	35	40	46	50	52
Air coil-type	Enhanced Copper Tubes, Enhanced Aluminum Fins						
Face area (sq ft)	1.46	1.56	2.35	2.35	2.63	3.33	3.33
Rows/FPI	2/146	3/14	3/14	3/14	3/14	3/14	3/14
Water coil-type	Enhanced surface co-axial						
Standard Blower/Motor	Double width double inlet (DWDI) forward-curved centrifugal/permanent split capacitor (PSC) direct drive						
Diameter x width (inches)	9x4T	9x4T	9x7T	9x7T	9x7	9x8	9x8
Motor HP	0.10	0.10	0.17	0.17	0.25	0.33	0.50
Hi-static blower/motor	DWDI forward-curved centrifugal/PSC direct drive						
Diameter x width (inches)	9x4T	9x4T	9x7T	9x7T	10x7T	10x8T	10x8T
Motor HP	0.10	0.10	0.17	0.17	0.25	0.33	0.50
EC motor (ECM) blower/ motor	DWDI forward-curved centrifugal/ECM direct drive						
Diameter x width (inches)	9x4T	9x4T	9x7T	9x7T	10x7T	9x8	9x8
Motor HP	0.33	0.33	0.33	0.33	0.33	0.50	0.50
Hi-static ECM blower/ motor	DWDI forward-curved centrifugal/ECM direct drive						
Diameter x width (inches)	9x4T	9x4T	9x7T	9x7T	10x7T	10x8T	10x8T
Motor HP	0.33	0.33	0.33	0.33	0.33	0.50	0.50
Filter quantity/size (inches)	1/14x25x1	1/14x25x1	1/16x30x1	1/16x30x1	1/16x30x1	1/20x30x1	1/20x30x1
Cabinet weight (lb)	130	130	145	145	150	175	175
Chassis weight (lb)	70	75	95	100	140	155	160

Note:

*Nominal capacity is calculated in accordance with ARI/ISO Standard 13256-1 for water loop application.

**Cabinet weight is approximate and does not include the weight of the risers.

Figure 3: Cabinet unit dimensions & floor sleeve dimensions

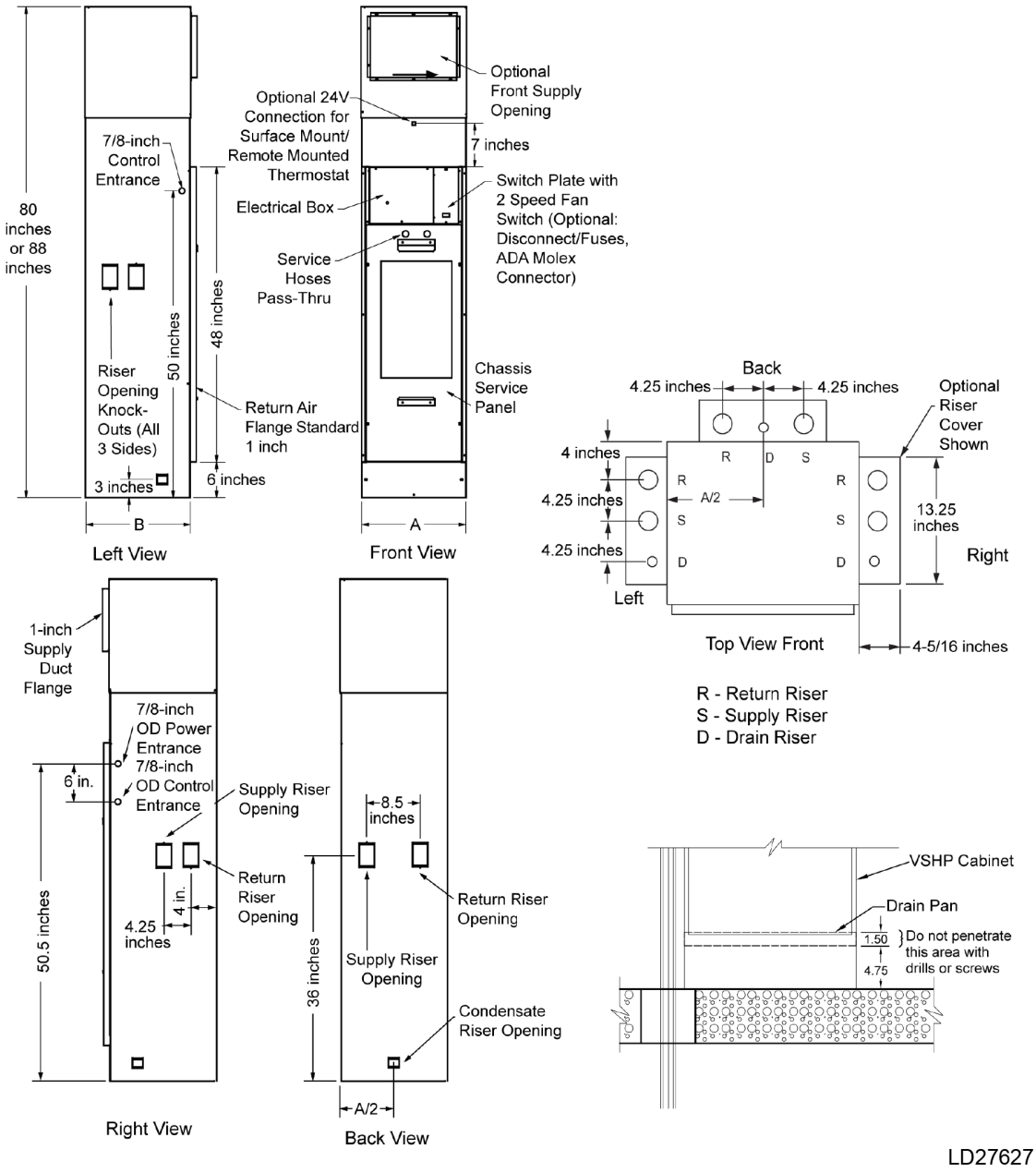


Table 2: Cabinet dimensions

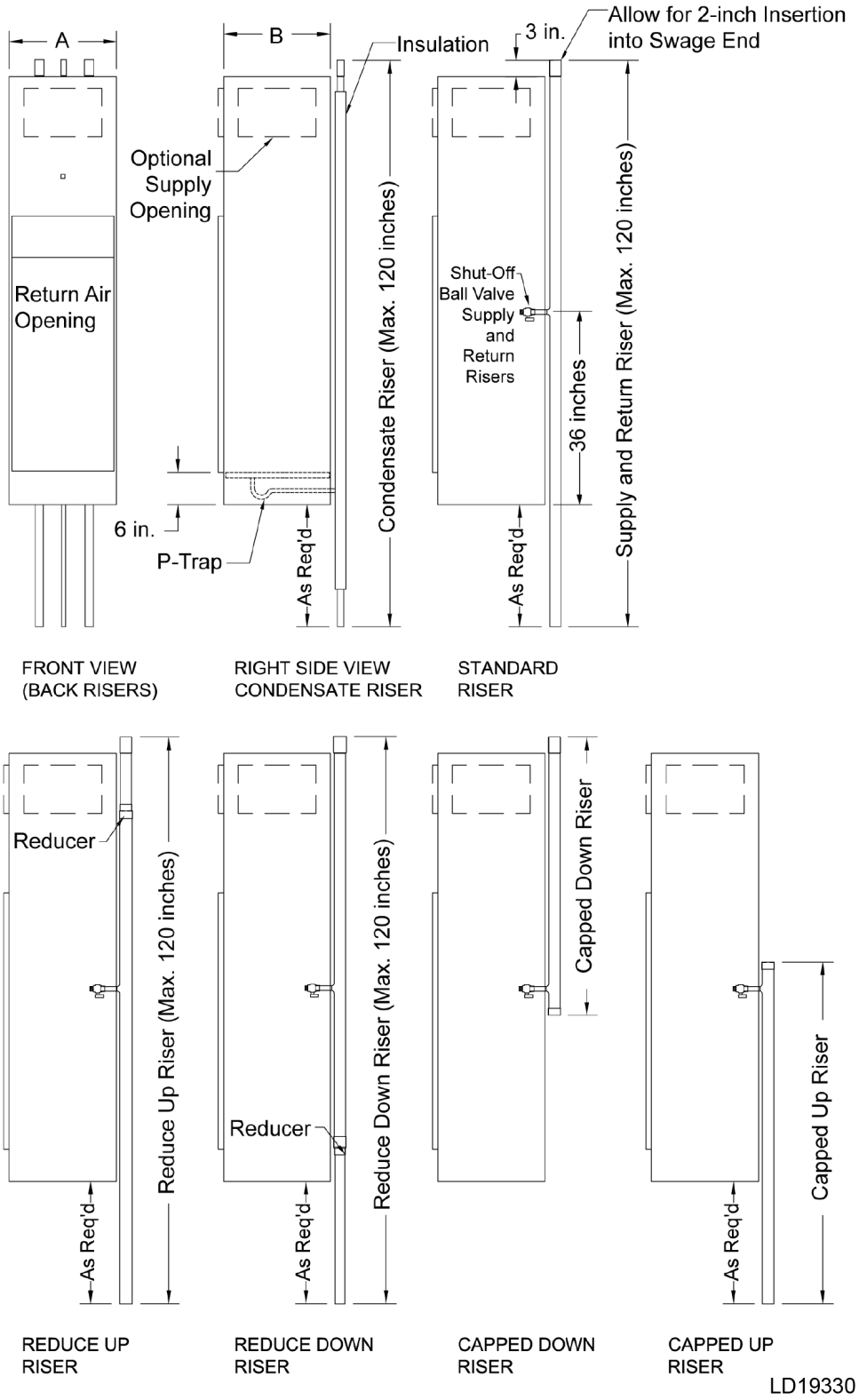
Model	A	B	RA flange width (C)
09-12	17	17	16
15-24	20	20	19
30-36	24	24	23

Note:

a. Supply, return, and condensate riser openings are pre-punched on all sides and field convertible. Cut tabs to remove the knock-out.

b. Supply and return openings are 4 inches x 2.5 inches. During riser installation, ensure the stub-out is centered in supply and return openings.
c. Condensate P-trap is accessible from the front by removing the bottom cover plate.
d. Riser and shut-off location is measured from base of cabinet and does not include the stand height.

Figure 4: Cabinet riser dimensions



Note: Riser shut-off valve is measured from base of cabinet and does not include the stand height.

Riser loop

Note: See Vertical stack water loop verification.

1. Install the following parts at the base of each supply and return riser to enable system flushing, balancing, and servicing:

   - Drain valve
   - Shut-off/balancing valves
   - Flow indicators
   - Drain tees

2. Install strainers at the inlet of each circulating pump.
3. Insulate loop water piping that runs through unconditioned areas of the building or outside the building.
4. When the loop water temperature is maintained between nominal operating limits of 60.0–90.0°F, piping does not sweat or suffer undue heat loss at conditioned space temperatures.
5. Install vents in piping loop as required to bleed residual air from the piping system during filling and servicing.
6. Determine the riser shut-off valves and hose kits required for job specific site conditions:

   a. Factory-supplied risers come with the appropriate hose kits with NPSH or JIC type fittings (see Figure 5 and Figure 7). Before attaching NPSH type hoses, check that the female end gasket is not missing and is free of damage or debris. See for information on replacement gaskets for NPSH hose kits.
   b. For field-supplied risers, it is recommended to order the appropriate NPSH or JIC type field hose kits from the factory, complete with shut-off valves. Shut-off valves are to be field sweat connected to risers (see Figure 6and Figure 8).
   c. Legacy chassis with NPT type connections and matching risers with NPT shut-off valve connections require a special hose kit. The kit comes complete with NPT to NPSH or JIC swivel adapter on the shut-off valve and chassis connection to mate with factory hoses (see Figure 9).

Table 3: Replacement NPSH hose gaskets

Part number	Description
VSGK-UFHW-050	1/2-inch rubber gasket

Hoses

Ensure the correct hose set is matched with the compatible unit size (see Table). Instal the NPSH or JIC factory-provided hoses by completing the following steps:

1. Inspect for missing or damaged NPSH hose gasket. See Table 3 for replacement gasket part numbers.
2. Tighten by hand the screw connections to the male NPSH or JIC fitting on the shut-off valve. Hold the ferrule stationary when tightening.
3. Tighten using a backup wrench a 1/4 turn further. Do not overtighten.

WARNING

When installing hoses, do not apply a twist or torque load on the hose.

WARNING

When tightening hoses, hold the ferrule stationary by hand while tightening the screw connections. Avoid tight bends, or water flow and high pressure drops may occur.

WARNING

Hose gasket does not require extreme tightening to obtain a seal. DO NOT OVERTIGHTEN, or damage to gasket or sealing surface will occur. Do not apply thread sealant.

WARNING

Hoses must be hand tightened, then further tightened for roughly another 1/4 turn. Check for leaks before tightening any further. Do not apply excessive force; rubber gaskets might get damaged.

WARNING

Always use a back-up wrench when tightening hoses to valves. Otherwise, valve solder joint may fail, leading to property damage or serious injury.

Table 4: Chassis hoses

Chassis model	Hose type
09–18	1/2-inch NPSH or JIC female-female
24–36	3/4-inch JIC female-female

Figure 5: Standard factory supplied npsh hose kits and risers

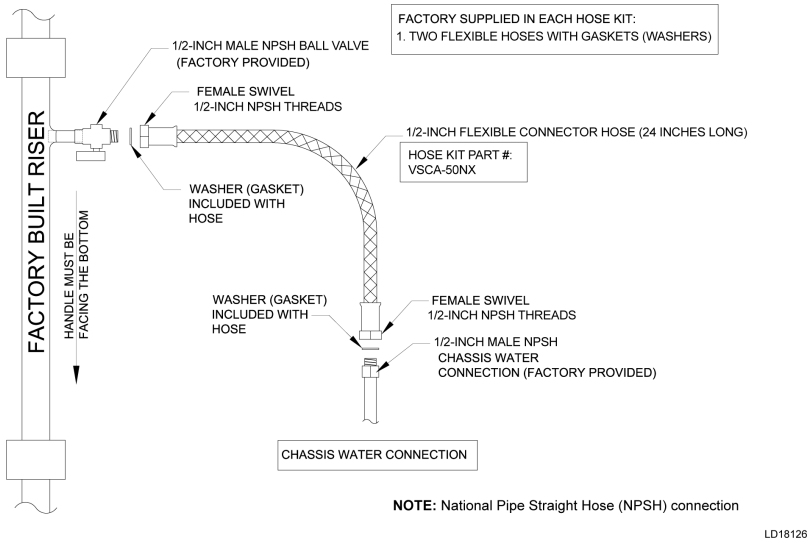


Figure 6: Optional field supplied risers with factory supplied NPSH hose kits and shut-off valves

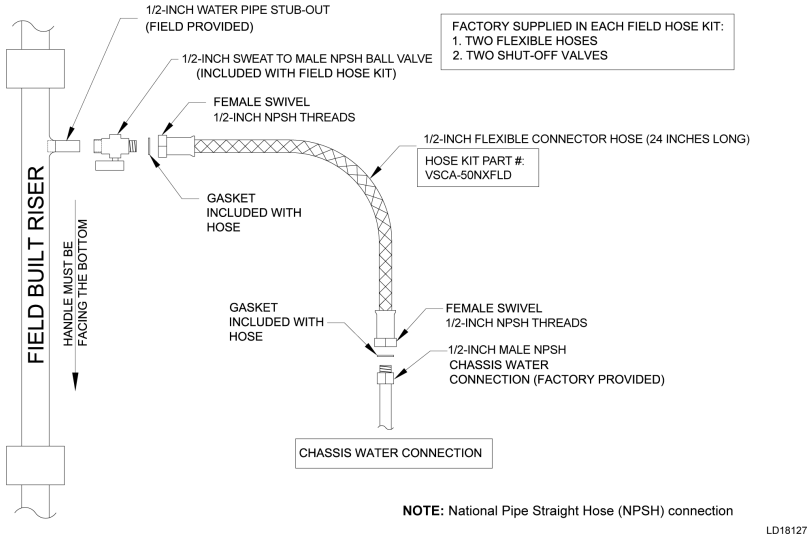


Figure 7: Standard factory supplied JIC hose kits and risers

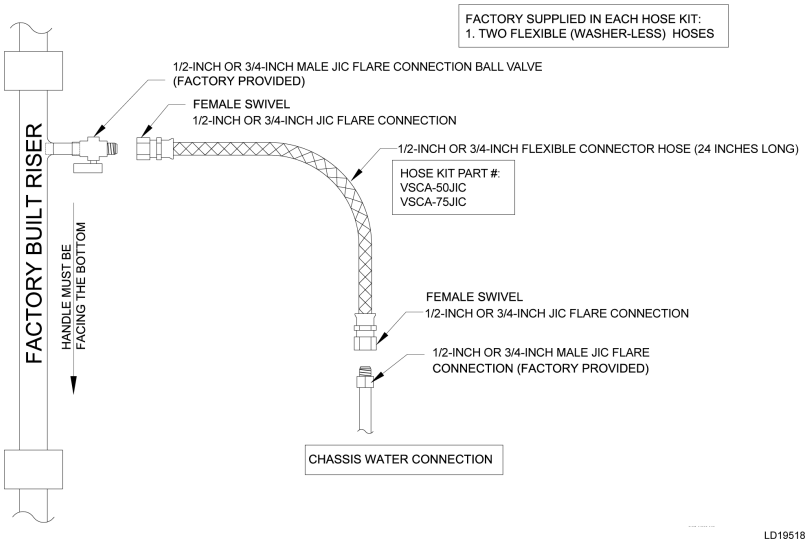


Figure 8: Optional field supplied risers with factory-supplied JIC hose kits and shut-off valves

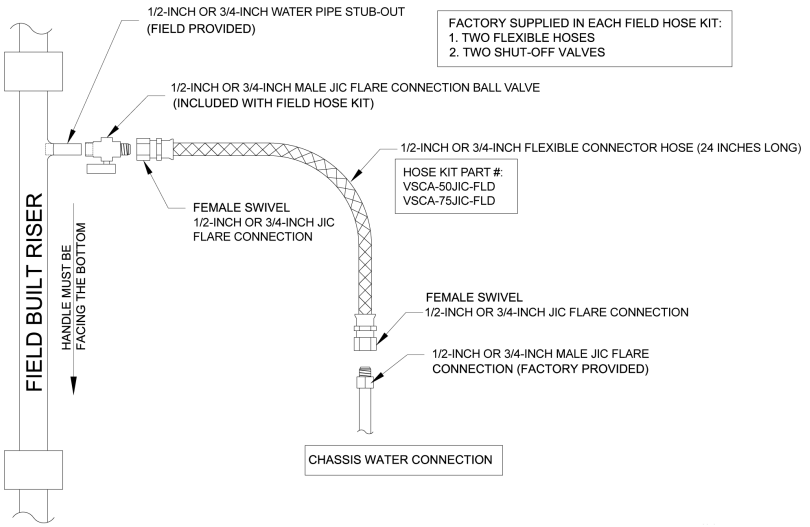
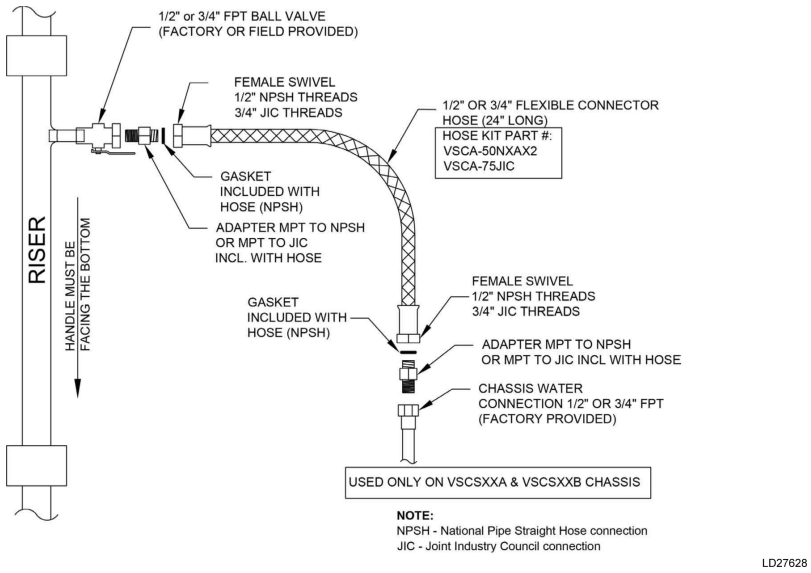


Figure 9: Conversion of NPT to NPSH or JIC type fittings (VB units with NPT fittings only)



Electrical wiring

WARNING

Lock all electrical power supply switches in the OFF ***position before installing the unit. Failure to disconnect power supply may result in electrical shock or even death.***

Field-installed power wiring

Power wiring to the equipment must conform to National Electrical Codes (NEC), local electrical codes, and must be performed by a licensed electrician.

Provide each unit with its own separate electrical circuit, means of circuit protection, and electrical disconnect switch. Follow current NEC ANSI/NFPA 70, CSA C22.1 C.E.C. Part 1, and state and local codes.

WARNING

Failure to provide these shut-off means could cause electrical shock or fire, resulting in damage, injury, or death.

CAUTION

Use copper conductors only! Failure to use copper conductors can result in equipment damage.

Verify that the available unit power supply is compatible with the unit's nameplate rating. Ensure the breaker is properly sized as per the nameplate. The line voltage supply enters through the right side of the cabinet at the 7/8-inch power entrance knock-out.

Connect to the line side of the factory-installed terminal block. Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors may result in equipment damage.

Field-installed low voltage wiring

Select a location for room thermostat, away from supply air registers, on draft-free interior wall that is far from lights, television, direct sunlight, or other heat sources.

⚠ CAUTION

Locate thermostat away from supply drafts. Ensure the back of the thermostat is sealed and protected from air drafts. Short cycling can result in damage to the unit.

Install the thermostat by connecting the remote thermostat wiring to microprocessor board low voltage terminal strip. See Figure for typical wiring connections.

Ensure that the control wiring between the thermostat and the unit's terminations does not exceed 1 ohm.

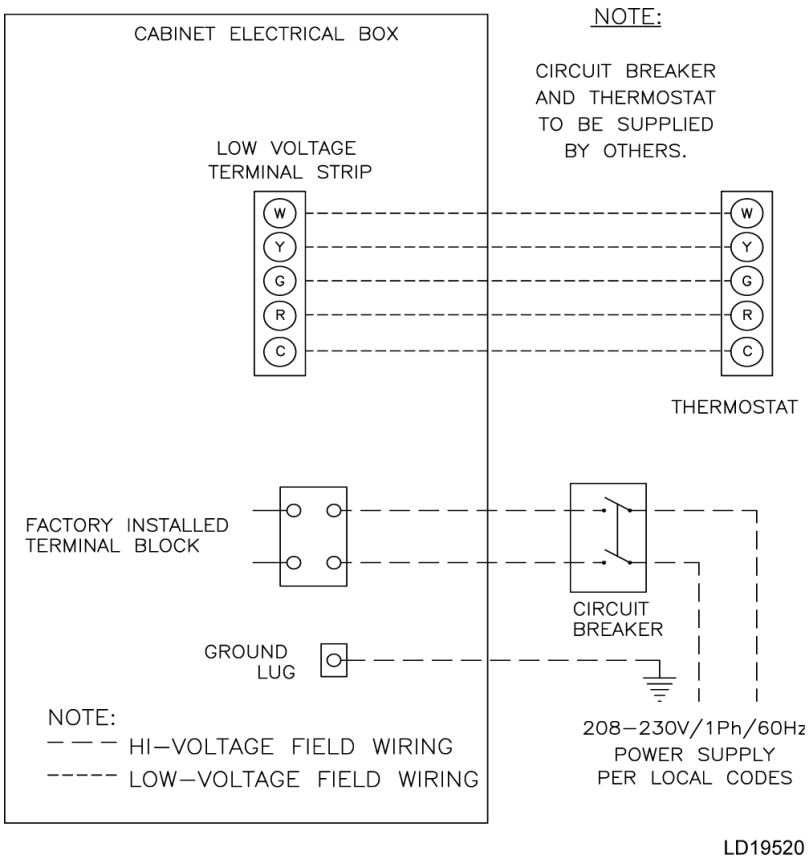
ⓘ **Note:** Resistance in excess of 1 ohm may cause component damage due to insufficient AC voltage supply.

ⓘ **Note:** Check all loads and conductors for grounds, shorts, or miswiring. Do not run the low voltage wiring in the same conduit with the high voltage power wiring.

Table 5: Typical wire connections

Recommended wire size (gauge)	Maximum low voltage wire length (feet)
20	50
18	75
16	125

Figure 10: Field wiring diagram



Optional surface mount thermostat connection wiring

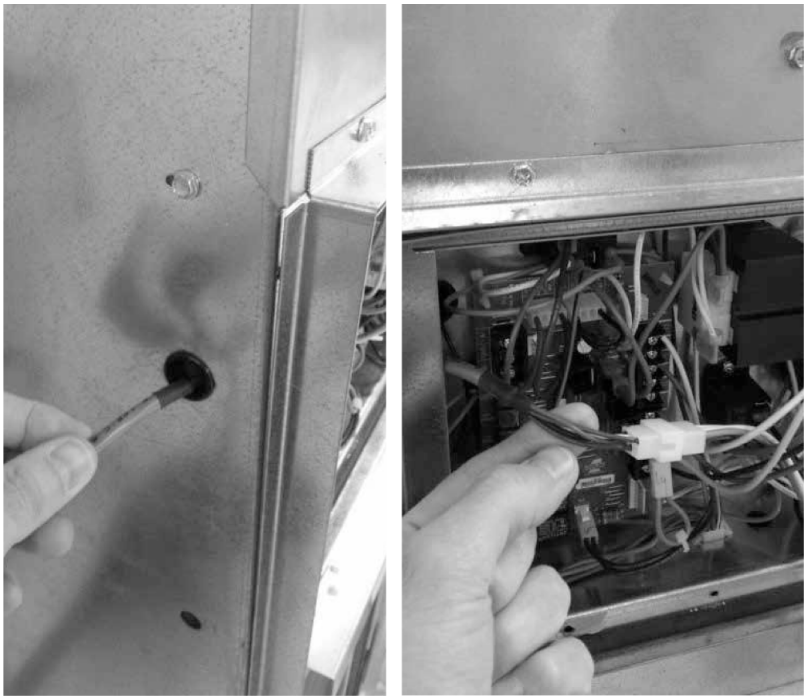
For applications where the thermostat is mounted directly above the return air (RA) panel, select cabinet control option P (for example, VB12P). The thermostat Molex pigtail harness (shipped loose) is field wired to thermostat terminals. The Molex connector clips to the panel-mounted, mating Molex connector on unit cabinet that is located 7 inches above the electrical box. See optional 24V surface mount connection in Figure 3.

Optional remote mounted thermostat wiring

For units ordered with an extended thermostat harness option, the thermostat is remote mounted. A specific, plenum rated extended harness length can be ordered.

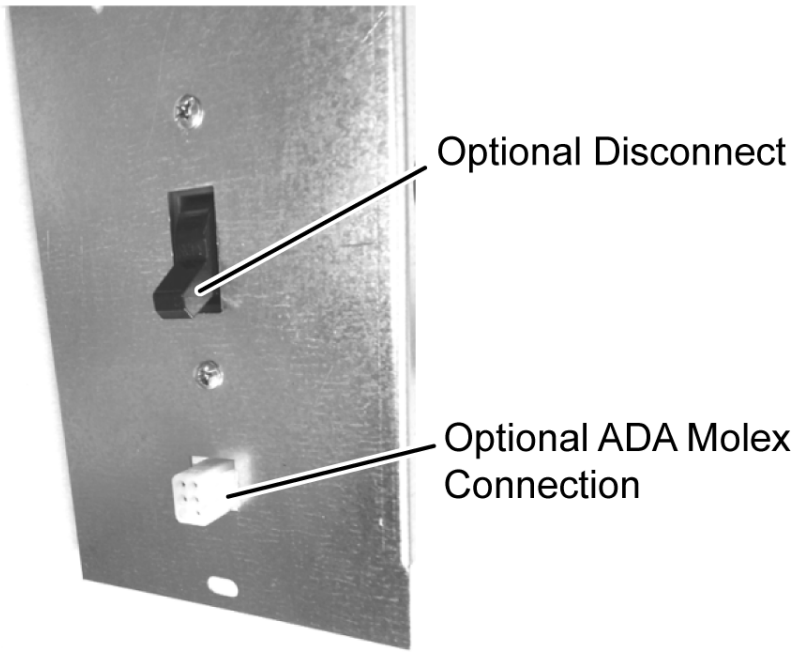
Use low voltage 7/8-inch knock-out on the side of the unit at the electrical box to field wire the low voltage thermostat wiring. Using a plastic bushing to pass the harness inside electrical box to the factory wired mating Molex harness (see Figure). The thermostat pigtail Molex harness ships loose for field wiring to the thermostat terminals.

Figure 11: Remote thermostat wiring



LD27629 LD27630

Figure 12: Unit switch plate with ADA thermostat connection



LD27631

Optional ADA door mounted thermostat

For units ordered with the Americans with Disabilities Act (ADA) thermostat option to meet ADA requirements, the thermostat is located on the RA panel door at a height of 48 inches from the base of the cabinet. Unit is supplied with a custom RA door panel with thermostat mounting holes, unit

switch plate with a Molex connector, and an ADA Molex pigtail harness. See Acoustic return air (RA) panel and Figure 16.

Wire leads from the ADA thermostat harness are field wired to thermostat terminals. The Molex end of the ADA thermostat harness is field connected to the surface mounted Molex connector at unit switch plate.

Mount the thermostat using the factory provided 1/4-inch number 8 screws. The ADA thermostat harness is plenum rated. It hangs behind the RA door. For chassis servicing, unclip harness from unit switch plate.

EC motor (ECM) continuous fan

This option features a factory wired continuous low speed fan circuit. Because of the five available motor speed taps, the EC motor (ECM) offers an ideal range for supporting continuous low speed fan.

The fan runs continuously on the low fan speed setting even if there is no demand for cooling or heating. The continuous fan is controlled by a dry contact to provide interlocking to energy recovery ventilator (ERV) or room occupancy control. See Figure 33 for electrical schematics.

Closet and drywall installation

Note: To avoid potential vibration and noise issues, the RA panel should not contact any part of the unit cabinet or sleeve. Maintain a sufficient gap between RA panel frame and cabinet.

Build a closet enclosure for the cabinet that incorporates the RA panel size while maintaining a sufficient gap between the closet and cabinet. This prevents the cabinet from contacting the RA panel and closet enclosure. Refer to Acoustic return air (RA) panel, Figure 13, and Figure 14.

1. Cover the supply and return openings with plastic or cardboard before installing drywall around cabinet. This prevents dust or debris from entering the unit components.
2. Install the drywall using conventional construction methods. Do not fasten studs or drywall directly to the cabinet surface. Space the framing members according to the RA access and the type/quantity of supply air (SA) outlets. See Figure 13 and Figure 14.
3. Install sheetrock around unit cabinet by securing the drywall to the building construction studs.
4. Cut holes around the SA and RA openings to allow access to the unit chassis, unit controls, and the SA connection.
5. Vacuum all dust and construction debris from the unit drain pan, electrical box, and discharge plenum after cutting out the supply/returns openings.

WARNING

To prevent electrical shorts and drain pan leaks, DO NOT penetrate unit components when driving screws near the unit control box or drain pan. Do not allow screws or nails to penetrate chassis, risers, electrical junction boxes, conduits, or to interfere with chassis removal.

Acoustic return air (RA) panel

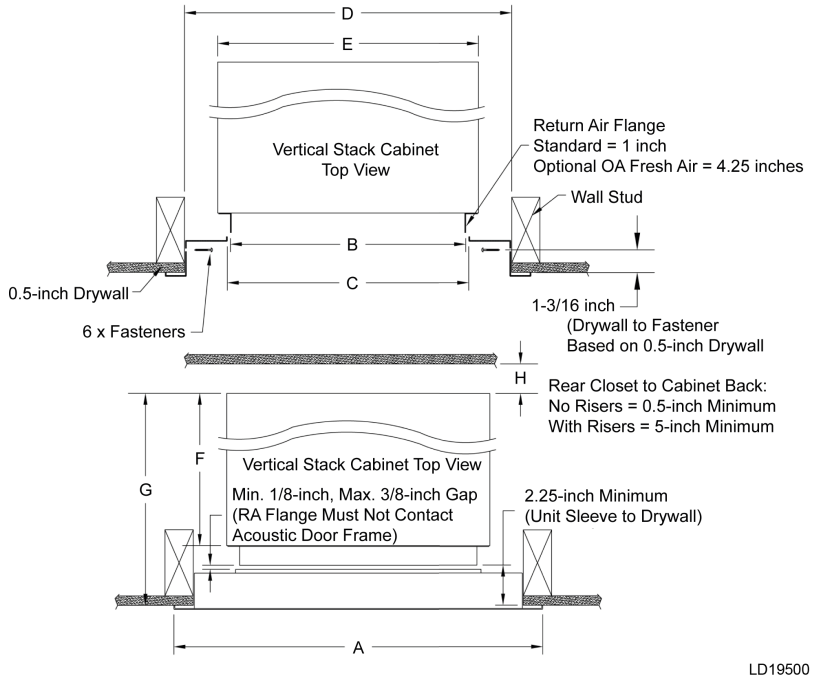
RA panels are painted standard appliance white. Carefully unpack RA panels from their shipping box. RA panels with optional key locks require the key locks to be field installed to the slot in the panel door. ADA RA door panels come with an opening and pilot holes mounting a thermostat.

The ADA harness for wiring the thermostat and connecting to the unit is shipped loose with the thermostats.

1. Locate the drywall opening at a distance from the unit so that it prevents the RA panel from contacting the unit sleeve. See Figure and Figure .
2. Center the RA panel throat opening to the unit cabinet RA flange opening.
3. Fasten the RA panel to frame opening using the screws provided. See Figure .

Figure shows the opening for mounting an ADA compliant thermostat at 48 inches above floor. Note that location of the opening on the door changes if the cabinet is ordered with a stand. A left hand opening door is shown. The RA panel with ADA is not reversible. It must be ordered in either a left or right-hand opening configuration, determined by the location of the door hinge.

Figure 13: Critical return air (RA) panel with unit cabinet installation dimensions



Unit size	A (panel width)	B (sleeve width)	C (R/A panel opening)	D (rough in width)	E (unit width)	F (unit depth)	G (no OA option)	G (OA option)
09/12/15/18	25 3/4	19	19 1/4	23 3/4 ± 1/8	20	20	23 1/4 MIN 23 1/2 MAX	27 1/4 MIN 27 1/2 MAX
24/30/36	29 3/4	23	23 1/4	27 3/4 ± 1/8	24	24	27 1/4 MIN 27 1/2 MAX	31 1/4 MIN 31 1/2 MAX

Note: All dimensions are in inches.

Figure 14: RA panel cross section installation at floor level

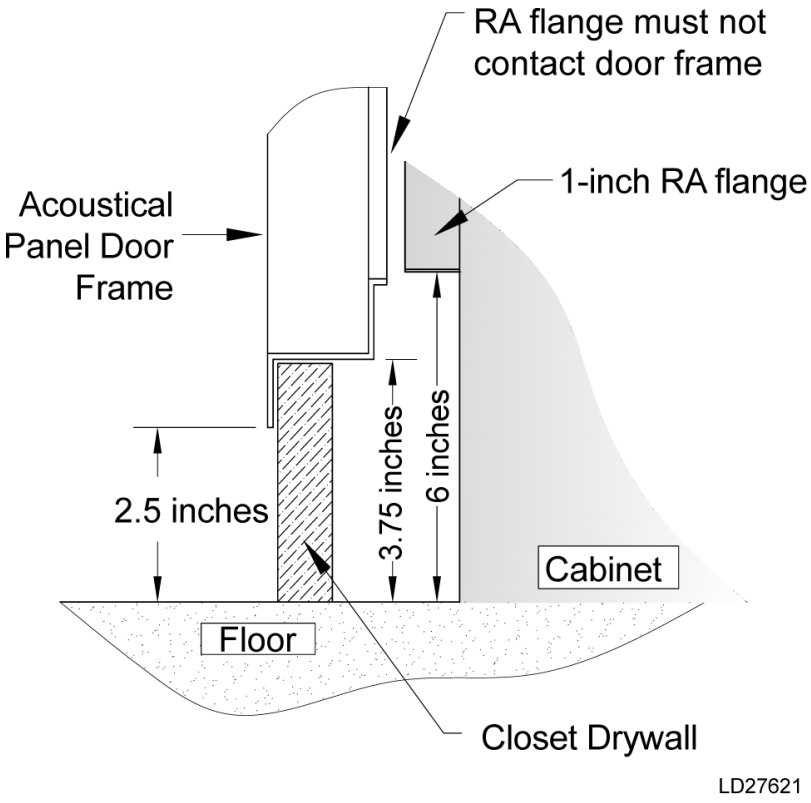
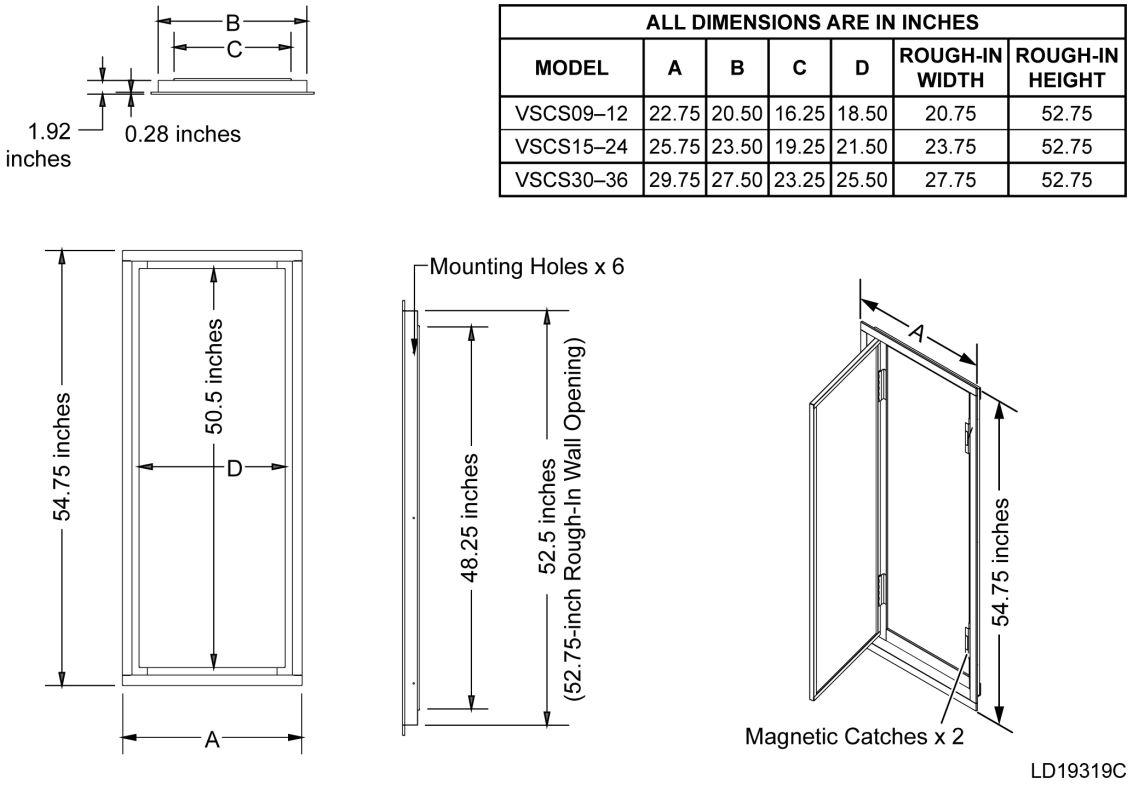


Figure shows a cutaway view for a standard cabinet with no stand. Add the stand height to the cabinet to obtain the correct dimension of the RA panel from floor.

Note: For maximum return airflow, the flush mounted acoustic panel must be centered vertically and horizontally over the RA opening of the cabinet. SA duct collar extensions may be required to prevent short cycling.

Figure 15: RA panel dimensions

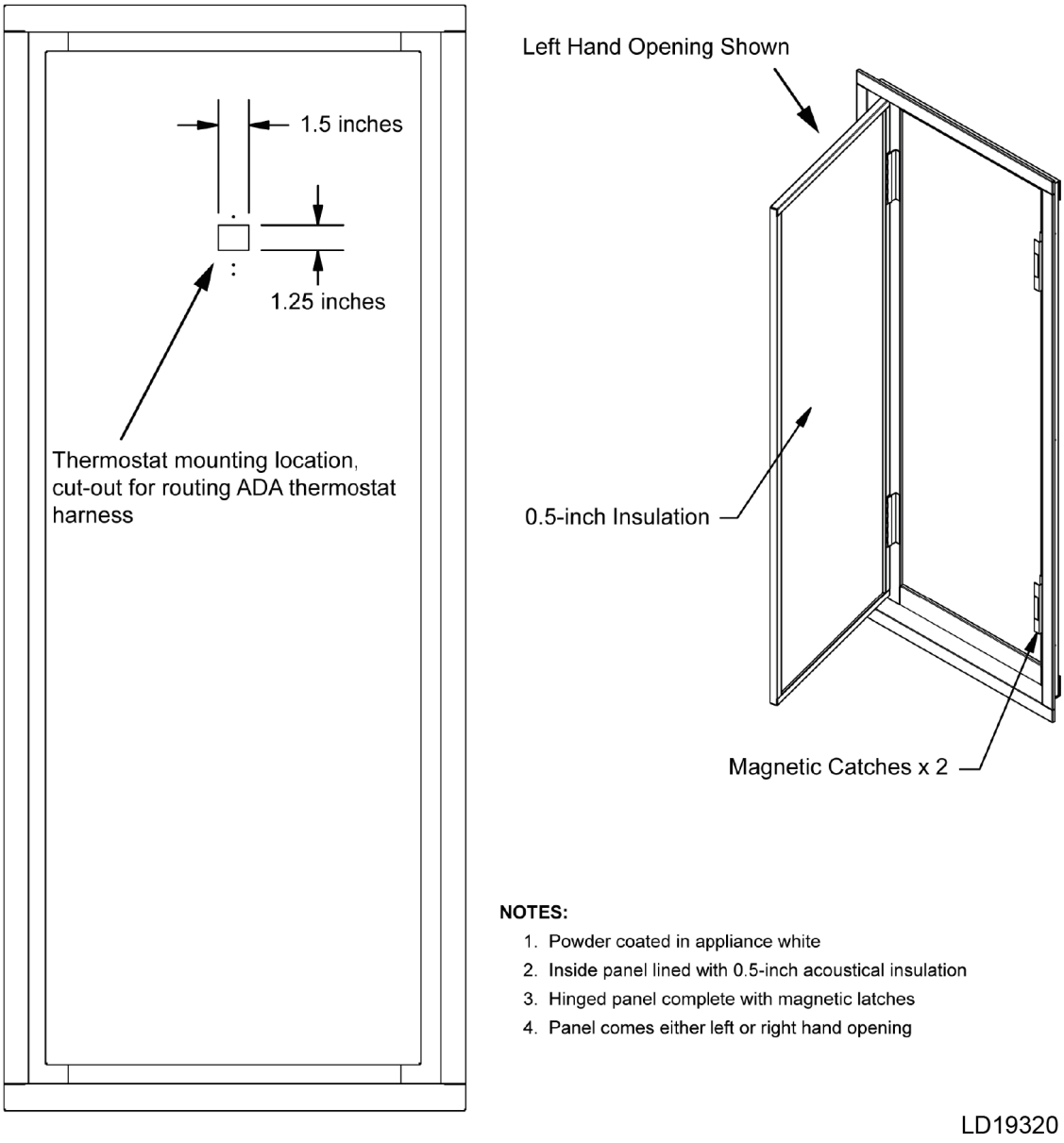


ALL DIMENSIONS ARE IN INCHES						
MODEL	A	B	C	D	ROUGH-IN WIDTH	ROUGH-IN HEIGHT
VSCS09–12	22.75	20.50	16.25	18.50	20.75	52.75
VSCS15–24	25.75	23.50	19.25	21.50	23.75	52.75
VSCS30–36	29.75	27.50	23.25	25.50	27.75	52.75

Note:

1. Acoustic panel is powder coated in appliance white
2. Acoustic panel can be installed on the right hand side or left hand side.
3. See Figure for additional RA panel and cabinet installation information.

Figure 16: Optional RA panel with ADA mounted thermostat



Supply air (SA) ductwork

ⓘ **Note:** Ensure there is no direct contact between cabinet sheet metal parts and drywall enclosure. This includes RA and SA flanges. Failure to follow these instructions will negatively affect unit sound performance.

Horizontal supply air

A 2-inch duct flange (field provided) may be required to eliminate supply air recirculation when shallow profile, single deflection supply grilles are installed at the cabinet discharge openings. If the discharge from the cabinet is not ducted completely into the conditioned space, air can recirculate into the RA opening from the space inside the drywall enclosure.

Manufacturer supplied grilles have a clearance of a 1/4 inch around the perimeter to fit inside the unit supply flange. Other grille manufacturers could have different clearances that should be verified.

Field supplied gasket must be applied in order to prevent air recirculation and vibration transfer when supply grilles are mounted to unit supply opening. When mounting supply grilles with optional volume damper directly to cabinet supply flange, the volume damper fits inside the cabinet supply flange. It is recommended to apply 1/8-inch neoprene tape (field supplied) around the perimeter of the volume damper prior to inserting it into the supply opening. See Figure 17 for an example. This assists in reducing noise transmission and air recirculation into the unit closet.

For ducted openings, connect the unit supply opening to the supply ductwork using a watertight flexible duct connector. This minimizes the transmission of operating sounds through the supply ductwork. Elbows with turning vanes or splitters are recommended to minimize air noise due to turbulence and to help reduce static pressure.

Top discharge supply air

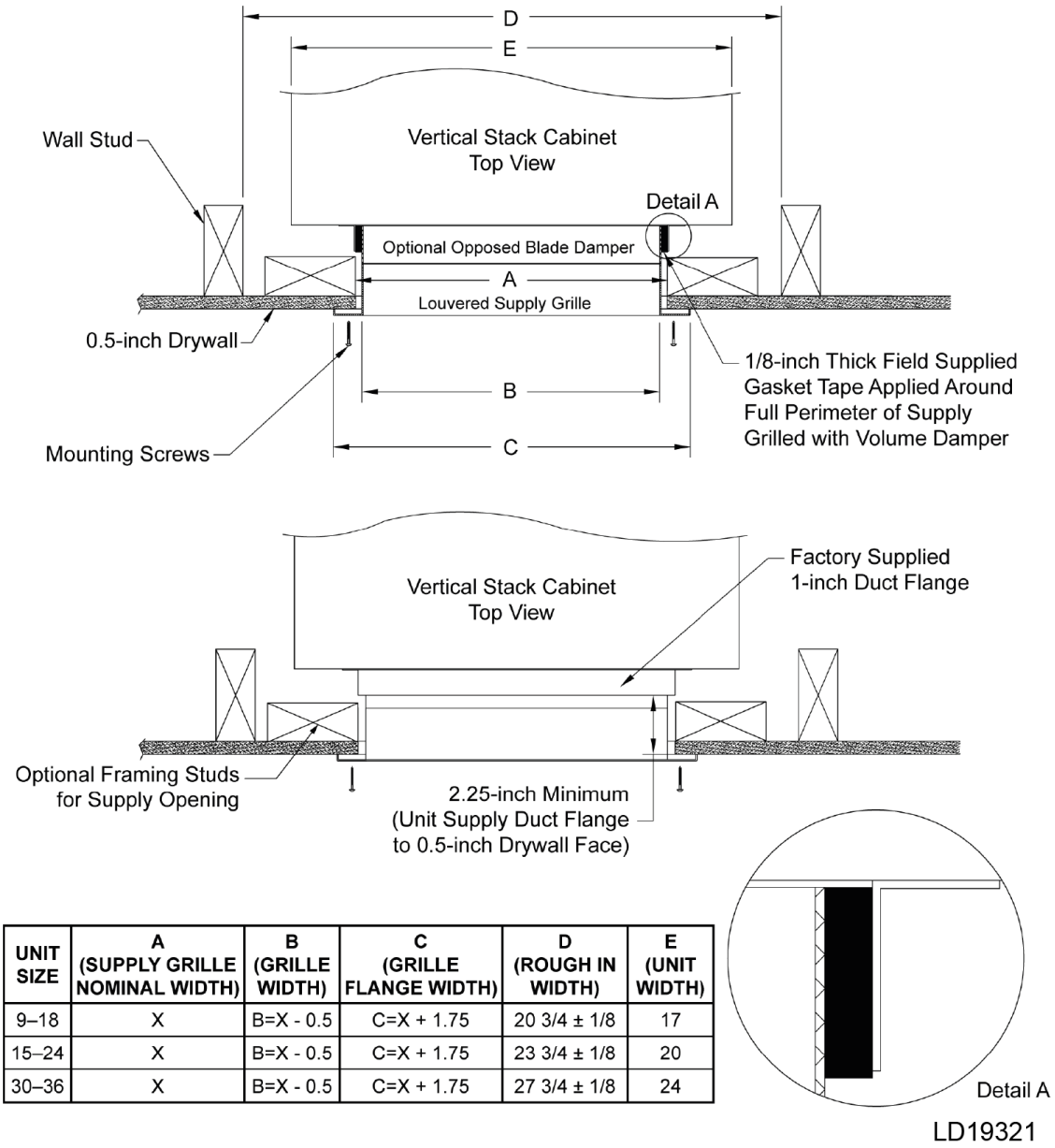
Units that are installed with a top discharge should be connected to the supply ductwork with a watertight flexible connector. This minimizes the transmission of operating sounds through the supply ductwork. Elbows with turning vanes or splitters are recommended to minimize air noise due to turbulence and to help reduce static pressure.

For information on available unit horizontal and top supply openings see Table 6 and Table 7. Recommended face velocity at the outlet supply grille is 300–500 FPM. Table 7 gives face velocity at the unit supply openings in relation to Table 6. To calculate the face velocity at the supply grille, take the FPM from Table 7 and divide by the supply grille area factor.

Figure 17: Supply grille with volume damper and 1/8-inch neoprene tape applied to perimeter

LD27622

Figure 18: Unit mounted supply grille installation



UNIT SIZE	A (SUPPLY GRILLE NOMINAL WIDTH)	B (GRILLE WIDTH)	C (GRILLE FLANGE WIDTH)	D (ROUGH IN WIDTH)	E (UNIT WIDTH)
9–18	X	B=X - 0.5	C=X + 1.75	20 3/4 ± 1/8	17
15–24	X	B=X - 0.5	C=X + 1.75	23 3/4 ± 1/8	20
30–36	X	B=X - 0.5	C=X + 1.75	27 3/4 ± 1/8	24

Note:

1. All dimensions are in inches and typical for factory supplied grilles only.
2. Check dimensions for field-supplied grilles because dimensions can be different.

Table 6: Unit supply opening sizes

	Horizontal openings					Top opening
	Single horizontal		Double horizontal		Triple horizontal	
Model	No top opening	Top opening	No top opening	Top opening	No top opening	
9	14W x 12H	14W x 6H	14W x 8H	Consult application engineer	Consult application engineer	12 x 8
12	14W x 14H	14W x 6H	14W x 10H	Consult application engineer	Consult application engineer	12 x 8
15	16W x 14H	14W x 6H	14W x 10H	Consult application engineer	14W x 8H	14 x 12
18	Consult application engineer	14W x 6H	14W x 12H	14W x 6H	14W x 10H	14 x 12
24	Consult application engineer	14W x 10H	16W x 14H	14W x 6H	14W x 10H	14 x 12
30	Consult application engineer	14W x 6H	20W x 14H	14W x 6H	16W x 12H	18 x 16
36	Consult application engineer	14W x 10H	Consult application engineer	14W x 6H	16W x 14H	18 x 16

Note:

1. Unit mounted supply grilles are supplied as double-deflection type.
2. Grilles for unequal airflow applications (for example, unit mounted plus ducted supply) are provided with integral opposed blade dampers.
3. All grilles are supplied in standard appliance white painted finish.
4. Grilles are shipped loose for field installation upon completion of cabinet/ductwork/drywall installation.
5. Top opening size does not change. When combined with any other discharge arrangement, it is included in determining horizontal opening grille size.
6. Openings marked Not Available result in face velocities outside the recommended 300–500 FPM range.
7. Hi-static blower option or single horizontal discharge openings with unit mounted supply grille are not recommended.

Table 7: Unit supply face velocity (FPM)

Model	Horizontal openings					Top opening
	Single horizontal		Double horizontal		Triple horizontal	
	No top opening	Top opening	No top opening	Top opening	No top opening	
9	291	272	219	Consult application engineer	Consult application engineer	510
12	316	344	221	Consult application engineer	Consult application engineer	645
15	354	314	283	Consult application engineer	236	471
18	Consult application engineer	391	294	294	235	587
24	Consult application engineer	397	273	364	291	729
30	Consult application engineer	416	276	339	269	538
36	Consult application engineer	410	Consult application engineer	385	261	610

Note:

1. Tabulated face velocities do not account for supply grille free area factor. Face velocities at supply grille are higher depending on grille type.
2. Face velocities are based on the nominal rated CFM and feet per minute (FPM).
3. Face velocities are calculated by taking the average across all openings. Tabulated top opening face velocity is only for units with single top opening and no horizontal openings.

Top mounted fresh air intake

The optional fresh air intake provides a 4-inch round duct connection on top of the unit (see Figure 23 for right and left hand version). The fresh air is discharged upstream of the direct expansion (DX) coil through the discharge collector box.

WARNING

Do not allow incoming air to bypass the DX coil, otherwise, damage to the unit may occur.

Units can be selected with the fresh air opening located on the top left or right hand side for ease of installation.

It is recommended that applications requiring 10% or more outdoor air utilize a pressurized fresh air system. Unit cabinet static pressure at the RA opening is not designed to draw 10% or more in passive fresh air systems.

The fresh air duct inside the unit is insulated to protect the unit from condensation in the event of high humidity air. However excessively moist fresh air over prolonged periods can result in condensate inside unit or closet.

CAUTION

To avoid condensate developing inside ducts and equipment, it is recommended to pretreat fresh air with a high humidity ratio before it enters the unit assembly through ERVs or make-up air units.

The unit comes with a 4-1/4 inch RA sleeve. Front supply openings come with a 4-1/4 inch supply plaster flange.

Top mounted fresh air intake with motorized damper

This include the same features as the top mounted fresh air intake option with the addition of a motorized damper assembly inside the discharge collector box similar (see Figure 24).

The damper assembly can be easily removed for servicing (see Removing the Actuator on page). The motorized damper assembly opens during FAN ON operation. See Figure 34 for the electrical schematic. For other control options, please contact the factory.

Note: During transportation, handling or installation of the cabinet, excessive handling can cause an inner black plastic cover to come loose and jam the actuator, preventing the damper from opening.

During start-up, check that the damper is opening when the unit fan is running. It can take 20 seconds to fully open. If the damper opens, the unit is operating as intended. If the damper fails to open, the cause is likely a loose cover preventing actuator from rotating. Remove the actuator to service the damper.

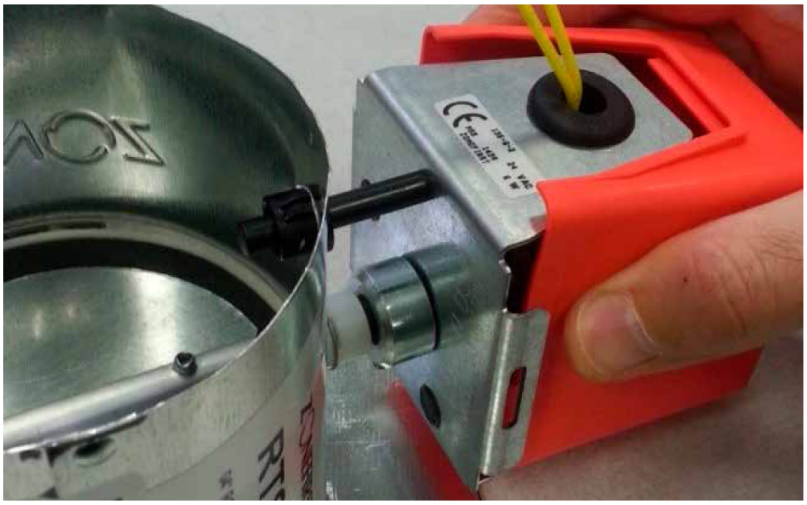
Removing the actuator

1. Remove the damper plate:
    a. Look underneath the top of the RA flange to notice the damper assembly.
    b. Remove the seven fasteners holding the damper plate (see Figure).
    c. Drop the plate and disconnect the quick-connect terminals from the harness.
2. Remove the red cover from the actuator body (see Figure).

Figure 19: Damper plate fasteners

LD23557

Figure 20: Remove the red cover



LD23558

Figure 21: Position black cover

LD23559

LD23560

4. If the black cover is loose, position it in place and slide it back onto the actuator (see).
5. Secure the red cover back over the actuator assembly.
6. Ensure the plastic tabs are secured to the metal body bracket.
7. Connect the quick-connect terminals, and insert the damper assembly into the discharge collector box.
8. Fasten the assembly using the seven fasteners.

System flushing and cleaning

After the piping system is complete, and before connecting the refrigeration chassis, flush and clean the risers This ensures a proper start-up and continued efficient operation of the system (see Figure 22).

Flushing the system

About this task:

1. Ensure the supply and return riser shut-off valves are closed at each unit.
2. Using flexible hoses or piping, connect the supply and return stub-outs in the unit located at the end of the riser run(s).

   If the building has more than ten floors, connect the supply and return stub-outs in the last two units to divide the water flow and reduce pressure drop at the pump (see Figure 22).
3. Open the shut-off valves in the units that have had the supply and return risers interconnected.
4. Fill the water circulation system with clean water from the make-up water supply. Ensure the air vents are open during initial filling. Do not allow the system to overflow.
5. Close the air vents, and start the circulating pump.
6. Ensure that all air is bled from the system by cracking each air vent.

Note: Make-up water must be available in sufficient volume to replace the volume occupied by the air that is bled off.

7. When all the air is vented and the water is circulating under pressure, check the entire system for leaks. Repair any leaks as required.
8. Raise the temperature to approximately 85.0°F by setting the loop temperature controls. Visually check for any leaks that may have occurred due to the increased heat. Repair any leaks as required.
9. Open the drain at the lowest point in the system.

   Note: The make-up water flow rate must be equal to the rate of the drain bleed.
10. Continue to bleed the system until the water leaving the drain is clear, no less than 2 hours.
11. Completely drain the piping system.

Cleaning the system

1. After the initial flushing, chemically clean the system. Repeat the method in Flushing the system to refill the system and circulate the cleaning solution.

   It is recommended to use the services of a professional water treatment company for the type of solution to be used and the duration of the cleaning application.
2. Once the cleaning process is complete, shut off the circulating pump and completely drain the system.
3. Refill the system with clean water to prepare for refrigeration chassis connection and system start-up.

CAUTION

It is recommended that a professional water treatment company perform ongoing maintenance of the water loop including chemical analysis and flushing, if necessary. The water loop testing should be performed at intervals recommended by the professional water treatment consultant.

It is recommended that the water loop testing be performed at least once a year. Standard practice is once a month or quarterly.

The customer is responsible for completing adequate water loop maintenance over the lifespan of the units. Otherwise, damage to the units may occur.

Figure 22: System flushing and cleaning

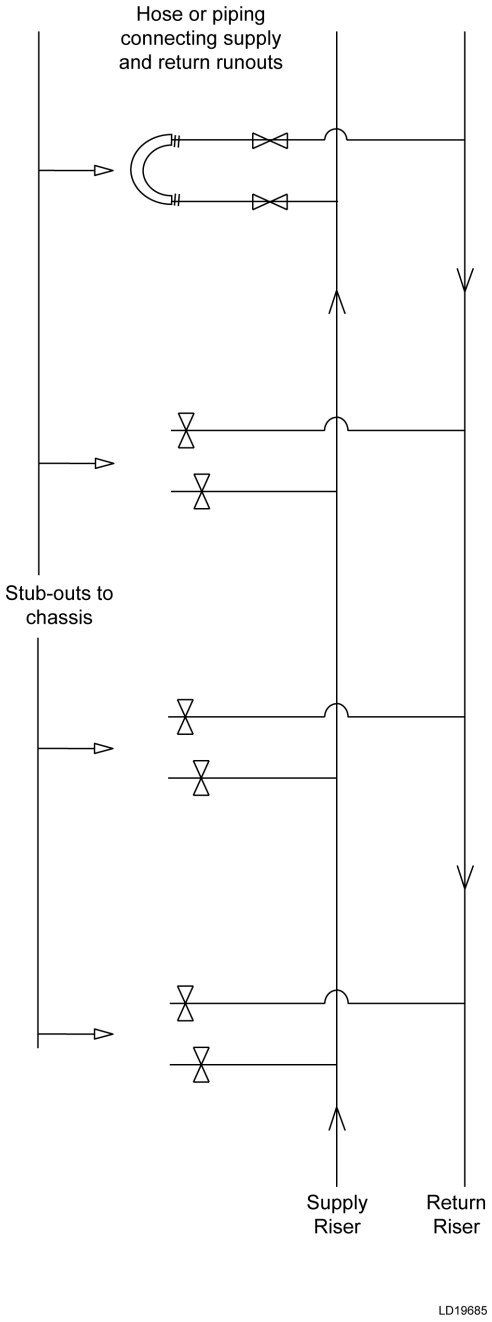
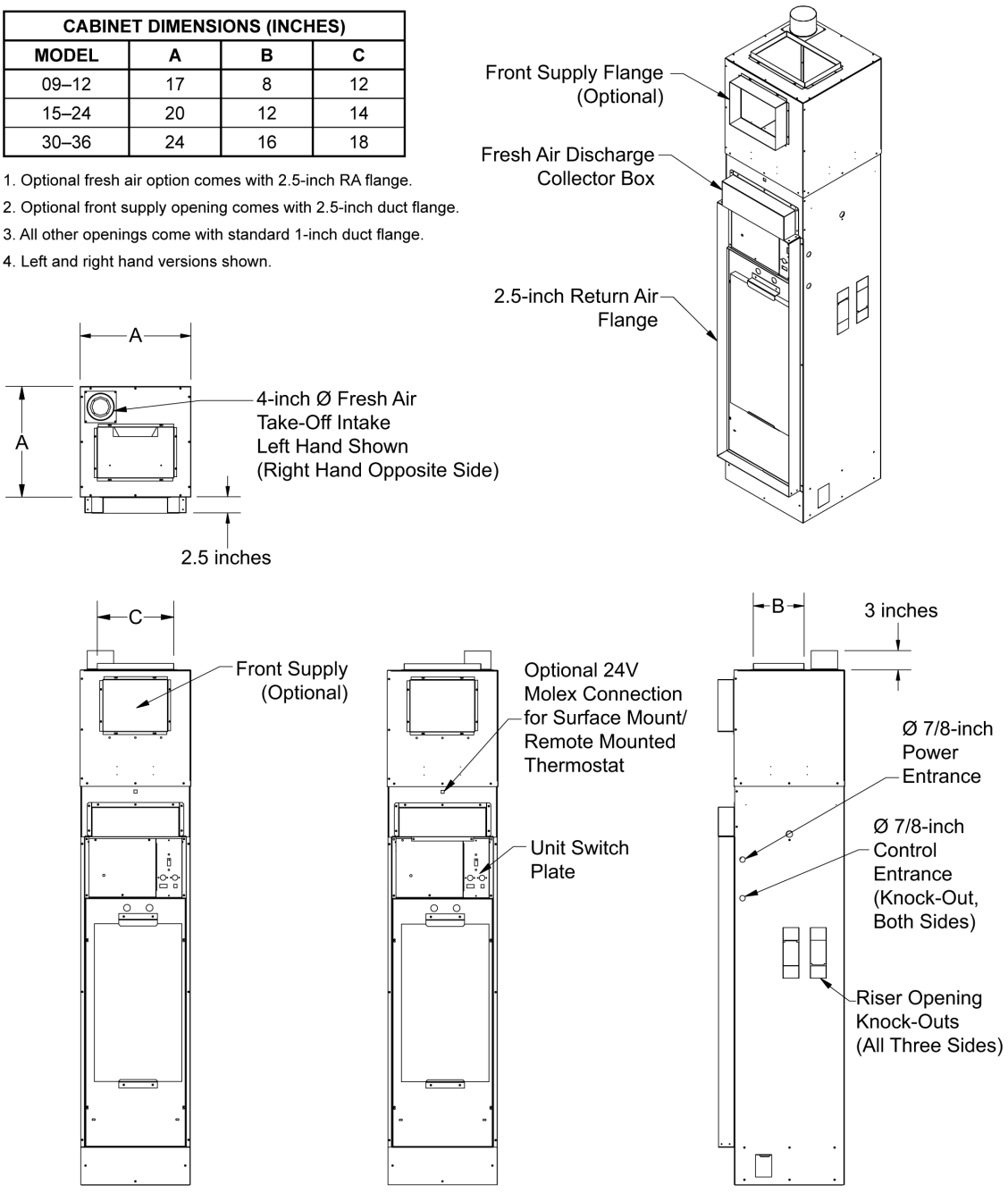


Figure 23: Fresh air opening without motorized damper – left and right hand unit shown

CABINET DIMENSIONS (INCHES)			
MODEL	A	B	C
09–12	17	8	12
15–24	20	12	14
30–36	24	16	18

1. Optional fresh air option comes with 2.5-inch RA flange.
2. Optional front supply opening comes with 2.5-inch duct flange.
3. All other openings come with standard 1-inch duct flange.
4. Left and right hand versions shown.

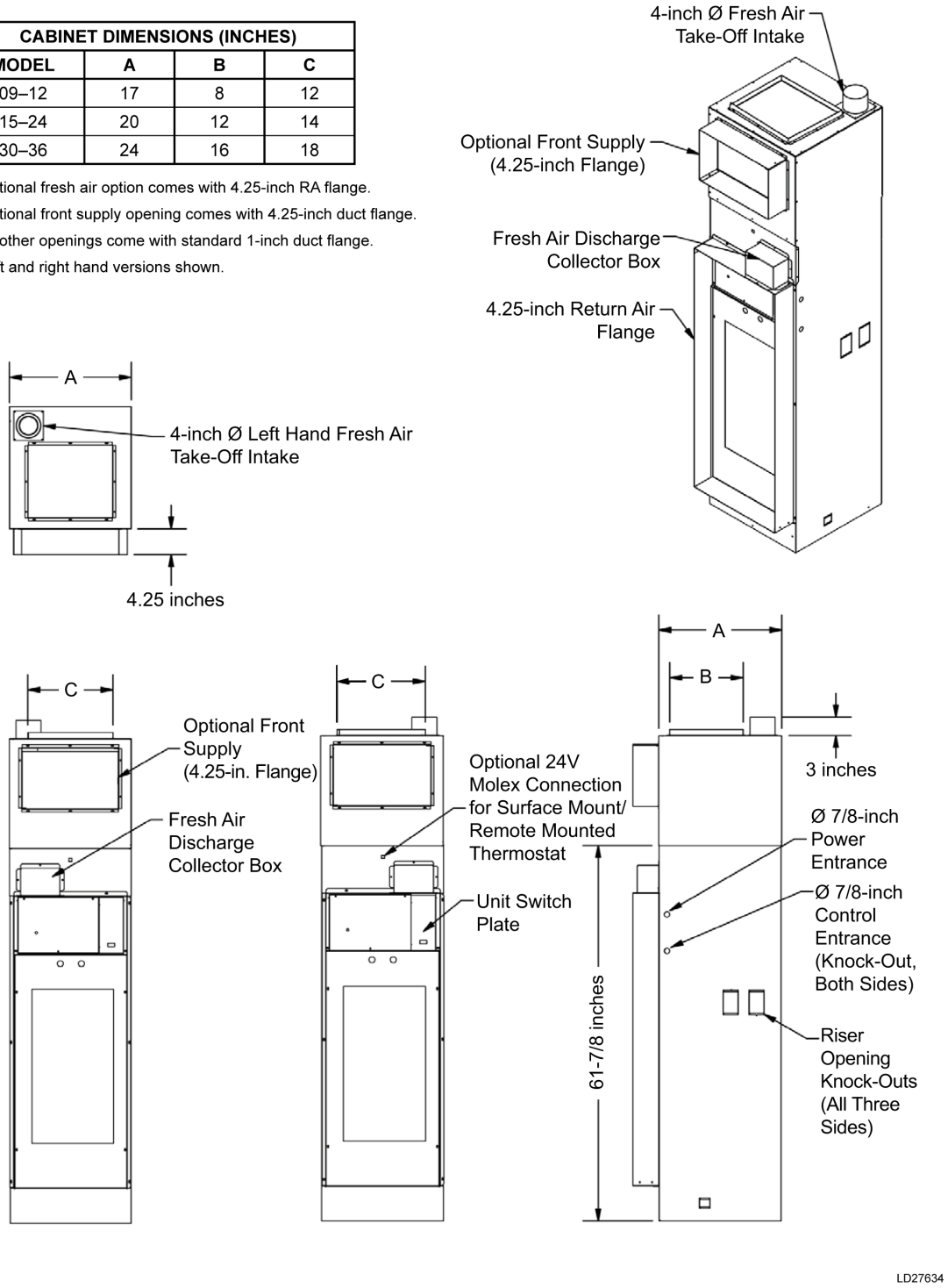


LD27632

Figure 24: Fresh air opening with motorized damper – left and right hand unit shown

CABINET DIMENSIONS (INCHES)			
MODEL	A	B	C
09–12	17	8	12
15–24	20	12	14
30–36	24	16	18

1. Optional fresh air option comes with 4.25-inch RA flange.
2. Optional front supply opening comes with 4.25-inch duct flange.
3. All other openings come with standard 1-inch duct flange.
4. Left and right hand versions shown.



Chassis installation

CAUTION

Prior to installation of the refrigeration chassis and connection to the supply and return risers, the entire water loop system must be flushed and cleaned. See System flushing and cleaning.

CAUTION

Do not apply sealing tape or pipe dope on NPSH style fittings.

CAUTION

Check that the female end gasket from the hose is not missing, has no visible damage, and is free of debris.

CAUTION

Always use a backup wrench when installing hoses.

CAUTION

Protect the chassis from physical damage, drywall dust, paint fumes, and any other construction contamination during installation.

WARNING

Hoses must be hand tightened then further tightened no more than 1/4 turn. Do not apply excessive force.

WARNING

Always use a backup wrench when tightening hoses to valves. Otherwise, damage to the valve solder joint can lead to property damage or serious injury.

Remove the inner service panel from the cabinet, and inspect the interior compartment for debris. Clear all debris and vacuum construction dust from the cabinet.

Locate the supply and return shut-off valves. Verify the following:

- The valves are closed.
- The type of hose kit fittings provided with the unit. Units shipped after June 2013 feature NPSH fittings (straight thread), while previous generation hose kits are NPT type (tapered thread). Refer to Riser Loop on page for more information.

For units with NPSH valve connection and hose sets

About this task:
NPSH flexible connection hoses do not require any pipe dope or sealant tape. DO NOT ADD THREAD SEALANT OR PIPE DOPE TO NPSH FITTINGS. Connect the hoses to the NPSH fitting on the shut-off valves. Always use a backup wrench when tightening the hose to the valve fitting. Allow the hoses to hang free inside the cabinet.
Slide the chassis into place using the following steps:

1. Attach the NPSH hoses to the NPSHfittings on the chassis stub-outs by projecting through the top of the compressor compartment access cover.
2. Use a backup wrench to prevent twisting of the copper water piping within the chassis assembly.
3. For chassis installation, see For units with NPT style (tapered pipe thread) valve connection and hoses.

For units with NPT style (tapered pipe thread) valve connection and hoses

Factory supplied NPT flexible connection hoses come with thread sealing compound pre-applied. NO ADDITIONAL THREAD SEALING TAPE SHOULD BE REQUIRED. Connect the hoses to the female pip thread fitting on the shut-off valves. Always use a backup wrench when tightening the hose to the valve fitting. Allow the hoses to hang free inside the cabinet.

Slide chassis into place using the following steps. A J-swivel adapter (supplied with the hose kit) comes with thread sealing compound pre-applied. NO ADDITIONAL THREAD SEALANT SHOULD BE REQUIRED.

1. Thread the swivel adapters into the female pipe thread fittings projecting through the top of the compressor compartment access cover. To prevent twisting of the copper water piping in the chassis assembly, always use a backup wrench.

   ⓘ **Note:** To minimize the possibility of damage to the chassis or cabinet and for maximum ease of installation, the use of a two-wheeled dolly is strongly recommended.

⚠ CAUTION

Do not contact the finned coil face. Damage to the fins will result.

2. Lift chassis from the front of chassis (see Figure 25).
3. Align chassis with the opening of the cabinet. Tilt the chassis sufficiently for the base of the chassis to clear the mounting rails on the cabinet drain pan (see Figure 26).
4. Insert the chassis midway into the opening of the cabinet. Lower the rear of the chassis until the base of the chassis touches the formed mounting rails in the cabinet drain pan (see Figure 27).

Figure 25: Lift the chassis front

LD23564

Figure 26: Tilt the chassis

LD23565

Figure 27: Insert the chassis

LD23566

CAUTION

Before fully inserting chassis, ensure wiring harness and or water hoses will not be pinched.

5. Pivot the chassis base on the front edge of the drain pan rails. Before fully inserting the chassis, ensure the wiring harness and water hoses cannot be pinched between the chassis and cabinet (see Figure 28).

Figure 28: Pivot the chassis

LD23567

Figure 29: Slide the chassis

LD23568

Figure 30: Check the chassis

LD23569

CAUTION

Do not apply excessive force when sliding chassis into cabinet.

6. Slide the chassis into the cabinet until at least 3/4 of the depth of the chassis is supported. The chassis should slide easily on the drain pan rails. DO NOT APPLY EXCESSIVE FORCE. Ensure that the chassis will not tip forward before removing dolly (see Figure 29).

WARNING

To avoid damage from clogged coil surfaces, plugged motor ventilation openings, and potential unit failure, DO NOT operate unit without compete enclosure, supply grille, RA panel, and filter in place.

7. Connect the hoses to the chassis. Ensure that the hoses cannot be pinched once the chassis is slid into place.
8. Without touching the flanges on either side, ensure the chassis' alignment in the cabinet is centered in the cabinet opening (see Figure 30).
9. Complete the electrical connections to the chassis using the two quick-connect mating plugs. The unit-mounted plug ends are located on the bottom of the control box.

10. Remove the shipping cover from the face of the air-to-refrigerant coil.

11. Install the inner service panel and check that the foam gasket seal between the panel and the chassis is slightly compressed.

    12. If necessary, pull the chassis forward slightly to ensure an adequate seal between the chassis and the service panel.

13. Install the air filter onto the face of the service panel. Slide the filter upward into the top-retaining clip until the bottom of the filter can be dropped onto the lower clip.
14. Install service panel.

15. Install the RA panel into the drywall opening if not already installed. Refer to Acoustic return air (RA) panel. Secure the panel into the drywall with six screws.

Start-up and performance checklist

VERTICAL STACKED HEAT PUMPS

Document Part No. VSHP-CL1

VSCS SERIES HIGH EFFICIENCY
START-UP & PERFORMANCE CHECKLIST

JOB NAME: _____ JOB #: _____

JOB ADDRESS: _____ DATE: _____

_____ INSTALLER'S ADDRESS: _____

INSTALLER: _____ SERVICE TECHNICIAN: _____

UNIT INFORMATION

CABINET MODEL #: _____ CABINET SERIAL #: _____

CHASSIS MODEL #: _____ CHASSIS SERIAL #: _____

LOCATION / ROOM # OF HEAT PUMP: _____

PREREQUISITE CHECKLIST
(To be completed prior to start-up)

Refer to the Installation, Operation, and Maintenance (IOM) manual (*VSCS Series Vertical Stacked Water Source Heat Pump IOM Manual (145.18-IOM1)*) before evaluating the information on this Checklist. Completing this Checklist is acknowledgment that you have read the IOM manual.

A. SYSTEM VERIFICATION

- Water quality, piping, and filters physically inspected ☐
- Nearby construction is completed ☐
- Protective coverings are intact but removed prior to start-up ☐

B. ELECTRICAL INSPECTION

- All electrical connections inspected, and connections at terminals verified to be clean and tight ☐
- High voltage power supply correct and in accordance with the nameplate ratings ☐
- Field wiring and circuit protection the correct size as stated on the unit nameplate ☐
- Unit electrically grounded ☐
- Low voltage control wiring correct per the unit wiring diagram ☐

C. PHYSICAL INSPECTION

- Removed the inner service panel, and manually checked the blower wheel for free rotation ☐
- Removed the chassis refrigeration access panel (top cover) and inspected the unit. Ensured that refrigerant tubing is free from obvious physical damage and kinks, and checked that piping does not touch other unit components ☐
- All safety features are in place and functioning prior to start-up ☐
- Inspected for obvious physical damage to the unit ☐
- Verified cabinet is level ☐
- Chassis is centered in cabinet opening without touching the flanges on sides of cabinet opening ☐
- Vibration isolation provided (unit isolation pad, flexible hoses, etc.) ☐
- Low / high-side pressure temperature caps in place and secured ☐
- All unit access panels in place and secured ☐
- Thermostat in the OFF position ☐

NOTE: Design gallons per minute (GPM) will be recorded in the Water Loop section.

- Water flow established and circulating through all units ☐
- Ductwork (if required) correctly sized, ran, taped, and insulated ☐
- Hose connections checked for water leaks and kinking ☐
- Indoor blower turns freely without rubbing ☐
- Glycol fluid (if applicable) added in the proper mix to prevent freezing in closed system application ☐

START-UP AND PERFORMANCE CHECKLIST AND DATA

WARNING: Ensure the Prerequisite Checklist section has been properly evaluated. Failure to complete System Verification and Electrical and Physical Inspection prior to completing these checks could result in possible injuries or damage to equipment.

A. ELECTRICAL

Measured supply voltage unit: _____

Unit Disconnect operational ☐

Panel fuse/breaker size: _____ AMPS

Optional inline fuse size: _____ AMPS

Connections checked for tightness ☐

Circuit checked for shorts and ground faults ☐

Fan speed 1: _____ AMPS

Fan speed 2: _____ AMPS

Compressor: _____ AMPS

Control voltage: _____ VOLTS

B. AIRSIDE

NOTE: CFM measurements should be within the parameters listed in the associated tables in the IOM.

	HEATING	COOLING
Coil Inlet (Dry Bulb)	°F	°F
Coil Outlet (Dry Bulb)	°F	°F
Coil Inlet (Wet Bulb)	°F	°F
Coil Outlet (Wet Bulb)	°F	°F

Unit supply airflow properly balanced ☐

Chassis positioned so front gasket is engaged ☐

Air coil clean & unrestricted ☐

Properly-sized and recommended MERV rated filters in place ☐

Filters clean ☐

Secured all panels ☐

Checked chassis vibration ☐

Cleaned debris from cabinet ☐

C. WATER LOOP

CAUTION: Entering Water Temperature (EWT) should be within the Optimal Temperatures listed in the IOM. Out of range measurements indicate a water flow issue in the building's water system that may result in equipment damage and degraded performance.

	HEATING	COOLING
EWT:	°F	°F
LWT:	°F	°F

Verified Entering Water lines are connected to IN and Leaving Water lines are connected to OUT on chassis ☐

Verify water riser stub penetrations into cabinet are sealed to prevent air leaks from unconditioned space. ☐

Trapped condensate drain ☐

Inspected condensate drain for leaks or blockage by pouring water into drain ☐

Optional circulating pump operating ☐

Size of Auto-Flow Regulator _____ GPM

Actual flow measurement _____ GPM

D. CONTROLS

Non-heat pump thermostat setting checked ☐

Thermostat options operational: Fan ☐

Cooling ☐

Heating ☐

Optional continuous fan operational ☐

Service Technician's Signature: _____

Customer Rep's Signature: _____

Mailing Address: _____

_____

Telephone No.: _____

BEFORE LEAVING JOB

1. Warranty certificate filled out and given to owner? Yes ☐ No ☐
2. Operating & Maintenance Instructions given to owner? Yes ☐ No ☐
3. Owner instructed on System Operation? Yes ☐ No ☐

_____
Owner's Name

Upon completion of start-up, please either scan and e-mail this completed Start-Up Checklist to **BEAjaxOrders@jci.com** or mail a copy to: **Johnson Controls at 505 Finley Avenue, Ajax, ON Canada L1S 2E2**

Warranty on this equipment will depend on Johnson Controls receiving this completed sheet.

Operation

Once the installation is complete and the system is cleaned and flushed, begin unit start-up. Open the supply and return shut-off valves at each unit, refill the system, and bleed off all air.

Pre-start-up checklist

Before energizing the unit, perform the following checks and complete the Vertical Stacked Heat Pump Start-Up and Performance Checklist (*Form 145.18-CL1*) in compliance with warranty requirements.

- The high voltage power supply is correct and in accordance with the nameplate ratings.
- The field wiring and circuit protection are the correct size.
- The unit is electrically grounded.
- The low voltage control wiring is correct per the unit wiring diagram.
- There is vibration isolation (for example, unit isolation pad, flexible hoses).
- The low-side or high-side pressure temperature caps are secure and in place.
- All the unit access panels are secure and in place.
- The thermostat is in the OFF position.
- The water flow is established and circulating through all the units.
- The ductwork (if required) is correctly sized, run, taped, and insulated.
- The indoor blower turns freely without rubbing.
- If applicable, glycol fluid was added in the proper mix to prevent freezing in closed system application.
- Clean, properly sized air filters are in place.
- The condensate drain pipe is firmly secured to both the drain riser and the drain pan stub.

Initial unit start-up

About this task:

⚠ WARNING

During installation, testing, servicing, and troubleshooting of this product, it may be necessary to work with live electrical components. Failure to follow all electrical safety precautions when exposed to live electrical components could result in serious injury or death.

1. Close the disconnect switches on all units to provide line power.
2. Set the thermostat to the highest temperature setting.
3. Set the thermostat system switch to COOL and the fan control switch to AUTO. The compressor should NOT run.
4. Reduce the temperature control setting until the compressor and supply fan energize, with the following results:
   a. Water temperature leaving the heat exchanger is warmer than the entering water temperature (EWT) (approximately 9.0–12.0°F).
   b. The blower operation is smooth.

c. The compressor and blower amps are within the nameplate data values.
d. The suction line is cool with no frost observed in the refrigerant circuit.

5. Turn the thermostat switch to the OFF position. The compressor and fan stop running and the reversing valve de-energizes.
6. To allow for pressure equalization, leave the unit off for approximately 5 minutes.
7. Turn the thermostat to the lowest setting.
8. Set the thermostat system switch to the HEAT position. The compressor should NOT run.
9. Adjust the temperature setting upward until the compressor and supply fan energize, with the following results after several minutes:

   a. Warm air is detected at the supply register.
   b. The water temperature decreases approximately 5.0–9.0°F across the heat exchanger.
   c. The blower and compressor operation are smooth with no frost observed in the refrigerant circuit.

10. Set the thermostat to maintain the desired space temperature.
11. Check all water connections for any leaks, including condensate drain hose connections.

System loop temperature

Loop temperatures affect unit performance, power consumption (efficiency), maintenance and reliability, and noise levels. High EWT in cooling mode above rated conditions of 86.0°F EWT increases power consumption and compressor noise levels. Sustained operation above 100°F EWT can increase maintenance costs, and increased compressor noise can affect occupancy comfort. The unit is designed to operate up to 110.0°F EWT for intermittent periods when high load conditions elevate system loop temperatures.

It is not recommended to set system loop temperatures at 110.0°F in case high load conditions cause supply loop temperatures to exceed 110.0°F EWT. Unit sound performance can be negatively impacted at high EWT.

During heating season, the maximum operating loop temperature is 90.0°F EWT. For optimal unit performance, it is recommended to maintain system loop temperatures at or above the rated conditions of 68.0°F EWT. If system loop temperatures are low and freezing the coaxial is possible, the system loop must contain a glycol fluid mixture that is adequate to prevent freezing. The minimum loop temperature with glycol mixture is 20.0°F EWT. Lower loop temperatures result in lower efficiency and heating capacity.

ⓘ **Note:** High system loop temperatures may negatively affect unit performance, efficiency, maintenance and reliability, and noise levels.

Table 8: Operating limits

	Cooling	Heating
Minimum EWT	50.0°F / 30.0°F	50.0°F / 20.0°F
Maximum EWT	110.0°F	90.0°F

ⓘ **Note:** * Geothermal operation (antifreeze mixture)

Fan speed adjustment

Multi-speed direct drive motors are used in all units as standard. Permanent split capacitor (PSC) fan motors have a minimum of three selectable speeds. EC motors (ECMs) have five speeds, however only two speeds are recommended and available for selection.

Optional ECMs increase operating efficiency by consuming fewer watts than standard PSC motors. Motors are factory programmed and cannot be re-programmed in the field. Each motor contains five low voltage speed taps. Two speed taps are used as standard.

Blower speed taps are factory set for optimum heating and cooling airflow ranges. See for factory blower speed settings and minimum operating airflow.

⚠ CAUTION

Operating the unit below the minimum airflow may result poor heating/cooling performance and periodic unit lockout.

A unit mounted two-speed fan switch located on the electrical box cover allows the fan speed to switch from LOW and HIGH. This enables the fan speed to meet site conditions such as increased ductwork static pressure or the use of higher efficient filters.

Perform a test run on the installed system to ensure operation with sufficient heating and cooling airflow. Excessive ductwork static pressure results in an improper volume of airflow. High airflow volumes result in elevated noise levels and can affect occupancy comfort.

⚠ WARNING

Lock all electrical power supply switches in the OFF position before servicing the unit. Failure to disconnect power supply may result in electrical shock or even death.

Refrigerant charge adjustment

All units are factory charged with R-410A at the nameplate charge listed in Table 1. Unit subcooling should be 6.0–20.0°F at design conditions. The subcooling temperature can be calculated as follows:

1. Record the temperature of the liquid line at the oulet of the condenser.
2. Subtract it from the saturation temperature for the corresponding discharge pressure.

Table 9: PSC blower performance (CFM)

Unit size	External static option	Motor speed	Rated CFM	Min. CFM	External static pressure (in W.G.)																
					0	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8
09	Low	High	340	220	340	330	320	310	300	285	270	255	240	225	-	-	-	-	-	-	-
		Low			255	250	240	230	220	210	-	-	-	-	-	-	-	-	-	-	-
	High	High			375	370	360	350	340	330	315	300	285	265	245	220	-	-	-	-	-
		Low			330	320	310	300	290	280	270	255	240	225	-	-	-	-	-	-	-
12	Low	High	430	290	445	435	425	415	400	385	370	355	340	320	295	-	-	-	-	-	-
		Low			350	345	335	325	315	305	290	-	-	-	-	-	-	-	-	-	-
	High	High			485	475	465	455	440	425	410	395	380	360	340	315	-	-	-	-	-
		Low			390	385	380	370	360	350	335	320	305	-	-	-	-	-	-	-	-
15	Low	High	550	335	580	570	560	550	535	520	505	485	465	445	425	-	-	-	-	-	-
		Low			385	380	375	370	365	355	345	335	-	-	-	-	-	-	-	-	-
	High	High			665	650	635	615	595	575	555	540	520	500	475	450	420	395	370	340	-
		Low			580	570	560	550	535	520	505	485	465	445	425	400	375	350	-	-	-

Table 9: PSC blower performance (CFM)

Unit size	External static option	Motor speed	Rated CFM	Min. CFM	External static pressure (in W.G.)																
					0	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8
18	Low	High	685	430	700	690	675	660	635	615	595	575	550	525	495	-	-	-	-	-	-
		Low			450	445	440	435	430	425	-	-	-	-	-	-	-	-	-	-	-
	High	High			750	735	715	695	675	655	630	605	580	555	525	495	465	435	-	-	-
		Low			670	655	640	625	605	585	560	535	510	485	460	435	-	-	-	-	-
24	Low	High	850	575	880	855	835	815	795	770	740	710	680	650	615	-	-	-	-	-	-
		Low			715	710	705	690	670	650	630	605	580	-	-	-	-	-	-	-	-
	High	High			990	970	950	930	910	890	865	845	820	795	770	740	710	680	650	615	575
		Low			795	785	775	760	745	730	715	695	675	655	630	605	580	-	-	-	-
30	Low	High	1075	700	1115	1100	1075	1050	1020	990	960	930	895	850	800	-	-	-	-	-	-
		Low			965	960	950	935	915	895	870	840	810	780	745	-	-	-	-	-	-
	High	High			1180	1170	1160	1145	1130	1110	1090	1070	1050	1025	1000	970	940	910	875	840	800
		Low			985	980	975	970	960	950	940	935	920	905	895	875	850	825	795	765	730
36	Low	High	1220	840	1230	1200	1170	1140	1110	1075	1040	1000	960	915	870	-	-	-	-	-	-
		Low			1115	1100	1075	1050	1020	990	960	930	895	855	805	-	-	-	-	-	-
	High	High			1340	1320	1295	1270	1245	1220	1190	1160	1130	1100	1070	1040	1010	980	945	910	870
		Low			1180	1170	1160	1145	1130	1110	1090	1070	1050	1025	1000	970	940	910	875	840	800

Note:

- All airflow ratings are at the lowest voltage rating of dual rating (for example, 208 V).
- Airflow ratings include resistance of wet coil and clean air filters.

Table 10: ECM blower performance (CFM)

Unit size	Motor speed	External static option	ECM TAP#	Rated CFM	Min. CFM	External static pressure (in W.G.)															
						0	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75
09	Optional fan only	-	1	340	180	278	252	226	212	198	189	180	-	-	-	-	-	-	-	-	-
	Low	Low	2			342	317	292	276	259	247	236	228	221	214	207	-	-	-	-	-
	High		3			411	382	354	334	315	300	286	279	272	263	254	242	231	220	-	-
	Low	High	4			463	431	399	378	356	340	324	317	310	299	290	-	-	-	-	-
	High		5			554	529	504	477	451	430	408	393	378	360	341	330	319	300	-	-
12	Optional fan only	-	1	430	236	278	252	226	212	198	189	180	-	-	-	-	-	-	-	-	-
	Low	Low	2			342	317	292	276	259	247	236	-	-	-	-	-	-	-	-	-
	High		3			411	382	354	334	315	300	286	279	272	263	254	242	231	220	-	-
	Low	High	4			463	431	399	378	356	340	324	317	310	299	289	-	-	-	-	-
	High		5			554	529	504	477	451	430	408	393	378	360	341	330	319	300	-	-
15	Optional fan only	-	1	550	268	495	447	399	372	346	307	268	-	-	-	-	-	-	-	-	-
	Low	Low	2			600	567	534	500	466	445	424	396	367	340	312	-	-	-	-	-
	High		3			659	623	587	564	541	511	482	462	441	419	397	372	346	320	-	-
	Low	High	4			760	726	693	667	642	615	587	574	561	529	497	469	441	412	-	-
	High		5			891	863	835	809	784	757	730	689	648	601	554	518	482	446	408	-
18	Optional fan only	-	1	685	396	495	447	399	372	346	307	268	-	-	-	-	-	-	-	-	-
	Low	Low	2			600	567	534	500	466	445	424	396	367	340	312	-	-	-	-	-
	High		3			659	623	587	564	541	511	482	462	441	419	397	372	346	320	-	-
	Low	High	4			760	726	693	667	642	615	587	574	561	529	497	469	441	412	-	-
	High		5			891	863	835	809	784	757	730	689	648	601	554	518	482	446	408	-

Table 10: ECM blower performance (CFM)

Unit size	Motor speed	External static option	ECM TAP#	Rated CFM	Min. CFM	External static pressure (in W.G.)															
						0	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75
24	Optional fan only	-	1	850	574	659	623	587	564	541	511	482	462	441	419	397	372	346	320	-	-
	Low	Low	2			760	726	693	667	642	615	587	574	-	-	-	-	-	-	-	-
	High		3			866	827	789	762	735	708	682	659	636	612	587	571	-	-	-	-
	Low	High	4			891	863	835	809	784	757	730	689	648	601	554	-	-	-	-	-
	High		5			1002	971	940	912	883	854	826	800	774	749	724	698	671	643	615	586
30	Optional fan only	-	1	1075	718	918	894	870	852	835	808	781	762	743	718	-	-	-	-	-	-
	Low	Low	2			1065	1037	1009	987	965	949	934	910	886	874	861	-	-	-	-	-
	High		3			1131	1105	1079	1058	1037	1016	994	972	949	934	918	-	-	-	-	-
	Low	High	4			1265	1235	1206	1184	1163	1141	1118	1085	1051	1008	965	913	861	808	756	701
	High		5			1462	1418	1375	1331	1287	1241	1194	1153	1112	1053	994	964	934	903	872	840
36	Optional fan only	-	1	1220	861	918	894	870	852	835	808	781	762	743	718	-	-	-	-	-	-
	Low	Low	2			1065	1037	1009	987	965	949	934	910	886	874	861	-	-	-	-	-
	High		3			1131	1105	1079	1058	1037	1016	994	972	949	934	918	-	-	-	-	-
	Low	High	4			1265	1235	1206	1184	1163	1141	1118	1085	1051	1008	965	913	861	808	756	701
	High		5			1462	1418	1375	1331	1287	1241	1194	1153	1112	1053	994	964	934	903	872	840

Note:

- All airflow ratings are at the lowest voltage rating of dual rating (for example, 208 V).
- Airflow ratings include resistance of wet coil and clean air filters.

Unit controls

The control system microprocessor board is specifically designed for water source heat pump operation. The control system interfaces with a conventional type thermostat.

- The unit is complete with a self-contained low-voltage control circuit.
- The unit incorporates a lockout circuit that provides reset capability from a hard lockout at the space thermostat or base unit if any of the following standard safety devices trip and shut off the compressor:
  - Low pressure limit switch (loss of charge)
  - High pressure limit switch
  - Freeze protection switch (unit shutdown on low water temperature)
  - Condensate overflow switch
- The unit operates with conventional thermostat designs and has a low voltage terminal strip for easy hook-up.

- Unit control board has on-board diagnostics and fault code display.
- Standard controls include anti-short cycle and low voltage protection.
- The control board monitors each refrigerant safety switch independently.
- The control board has a random start feature.
- The control board retains the last five fault codes in nonvolatile memory that cannot be lost in the event of a power loss.

Sequence of operation

The room thermostat makes a circuit between R and Y1 for cooling.

The call passes to the unit microprocessor control that determines whether the requested operation is available and if so, which components to energize.

For heating, the room thermostat makes a circuit between R and W1. The microprocessor control energizes the compressor and fan, enabling the unit to run in heating mode.

If at any time there is a call for both heating and cooling, the heating operation is performed. Heating always takes priority. If cooling mode is operating, it halts and ends the call for cooling.

Continuous blower

With the room thermostat fan switch set to AUTO and the system switch set to either AUTO or HEAT, the blower energizes whenever a cooling or heating operation is requested. The blower energizes after any specified delay associated with the operation.

The indoor blower energizes for a minimum runtime of 30 seconds. Additionally, the indoor blower delays for 10 seconds between operations.

When the room thermostat calls for cooling, the low-voltage control circuit completes from R to Y1 and G. The compressor and fan motor energize. After completing the specified fan on delay for cooling, the microprocessor control energizes the blower motor.

Once the room thermostat has been satisfied, it de-energizes Y1. If the compressor satisfies its minimum runtime, the compressor and fan de-energize. Otherwise, the unit operates the cooling system until the minimum runtime for the compressor completes. After the compressor de-energizes and the fan off delay for cooling elapses, the blower stops.

To be available, a compressor must not be locked-out because of a high pressure limit switch, low pressure limit switch, condensate overflow switch, or a freeze-stat trip. The anti-short cycle delay (ASCD) must elapse.

Safety control reset

All VPCS heat pumps are furnished with a high pressure limit switch, a low pressure limit switch, low water temperature freeze protection switch, and condensate overflow switch to prevent compressor operation during abnormal conditions.

If any of these safety devices activate, a lockout relay circuit engages. The circuit interrupts heating and cooling operation even if the control contacts automatically re-close.

This microprocessor driven lockout circuit must be manually reset. Reset by momentarily moving the thermostat control (system) switch to OFF, then back to HEAT or COOL (or AUTO).

The lockout circuit can also be reset by opening and closing the unit mounted disconnect switch.

ⓘ **Note:** If the unit must be reset more than twice on consecutive operating cycles, check the unit for a dirty filter, abnormal EWT, inadequate or excessive water flow, or refrigerant circuit malfunction. If the unit continues to cutout, contact a trained service technician.

Operation errors

Each refrigerant system is monitored for operation outside of the intended parameters. Errors are handled as described below. All system errors override minimum runtimes for compressors.

High pressure limit switch

If a high pressure limit switch opens, the microprocessor control de-energizes the compressor, initiates the ASCD, and stops the unit fans (soft lockout). If a call for cooling or heating is still present at the conclusion of the ASCD, the microprocessor control re-energizes the compressor and unit fan.

If a high pressure limit switch opens three times within 2 hours of operation, the microprocessor control permanently locks out the system compressor, requiring a manual reset of the system (a hard lockout). To manually reset, either de-energize the 24-volt power to the unit or turn the room thermostat to OFF, then back to either HEAT or COOL as required. The microprocessor control flashes a fault code indicating the high pressure lockout (see Table 11).

Low pressure limit switch

The microprocessor does not monitor the low pressure limit switch during the initial 30 seconds of compressor operation. For the following 30 seconds, the microprocessor control monitors the low pressure limit switch to ensure it closes. If the low pressure limit switch fails to close after the 30 second monitoring phase, the microprocessor control de-energizes the compressor, initiates the ASCD, and stops the fan (a soft lockout).

Once the low pressure limit switch is proven (closes during the 30 second monitor period), the microprocessor control monitors the low pressure limit switch for any openings. If the low pressure limit switch opens for more than 5 seconds, the microprocessor control de-energizes the compressor, initiates the ASCD, and stops the compressor (a soft lockout).

If the call for cooling is still present after the ASCD, the microprocessor control re-energizes the compressor.

If a low pressure limit switch opens three times within 1 hour of operation, the microprocessor control board locks out the compressor (a hard lockout) and flashes a fault code (see Table 11).

Freeze-stat

If a freeze-stat opens, the microprocessor control de-energizes the compressor and initiates the ASCD. If a call for cooling or heating is still present after the ASCD, the microprocessor control re-energizes the halted compressor.

Condensate overflow switch

A condensate overflow fault occurs if the condensate overflow switch opens continuously for 30 seconds. The compressor shuts down regardless of the minimum runtime, and alarm 15 sets. The fan continues operating in its current state.

The microprocessor control logs the first incident per compressor request. Lockout occurs on the second fault occurrence within a request cycle, requiring reset or power cycling. If the compressor request is removed, the fault occurrence counter resets to zero. When lockouts are removed, the alarm resets.

Safety controls

The microprocessor control monitors the following inputs:

1. A suction line freeze-stat to protect against low leaving water temperatures (LWTs) (opens at 34.0°F and resets at 48.0°F).
2. A high pressure limit switch to protect against excessive discharge pressures (opens at 600 psig ± 25 psig).

3. A low pressure limit switch to protect against loss of refrigerant charge (opens at 68 psig ± 5 psig).
4. A condensate overflow switch to protect against condensate overflow.

Coaxial freeze protection setpoint

The field can select the coaxial freeze protection setpoint. The unit uses a suction line freeze-stat factory setpoint for compressor lockout when the LWT drops below 35.0°F (resets at 48.0°F). To lower the setpoint for low temperature heating applications with an adequate water-antifreeze solution, unplug the freeze-stat sensor located at P6 on the microprocessor control board, and plug in the (pink) jumper attached to the existing harness.

Installing the jumper bypasses the freeze-stat, enabling heating operation with a leaving glycol fluid mixture temperature below 35.0°F. Use the jumper only in low water applications with adequate antifreeze protection, otherwise damage can occur.

Random start

The random start function upon power up imposes time delay of 4 minutes plus a random delay of 1–64 seconds. A combination of the following determine the random number generator seed:

- A fixed seed programmed at the factory
- The serial number
- The model number
- The hours of the unit's compressor runtime

Compressor protection

In addition to the external pressure switches, the compressor also has inherent internal protection. If there is an abnormal temperature rise in a compressor, the protector opens to shut down the compressor. The microprocessor control incorporates features to minimize compressor wear and damage. The control uses an ASCD to prevent compressor operation too soon after its previous run. Additionally, a minimum runtime is imposed any time a compressor is energized. The ASCD initiates on unit start-up and on any compressor reset or lockout.

Microprocessor control unit flash codes

The microprocessor control uses various flash codes to aid in troubleshooting. The flash codes are distinguished by a short on and off cycle (approximately 200ms on and 200ms off).

During normal operation, to show that the microprocessor correctly functions, the control boards flash for 1 second on, 1 second off, also known as a heart beat. Do not confuse this with an error flash code. To prevent confusion, a 1-flash fault code is not used. For a list of all flash codes, see Table 11.

Current alarms or active restrictions are flashed on the microprocessor control LED.

Last error

When this button is pressed and released one time within 5 seconds, it flashes the last five fault codes on the board’s LED. The most recent alarm is shown first and the oldest alarm is shown last.

Test reset

When this button is pressed and released one time within 5 seconds, any ASCD is bypassed for one cycle.

Comm setup

If the board is to be networked with other units, this button is used to set the network address.

The first time the button is pressed within 5 seconds, it scans the bus, assigns itself the first available address (starts at 2), and then flashes that address once.

Pressing the button two times within 5 seconds causes the control to flash the address.

Table 11: Flash codes

Flash codes	Description
On steady	Control failure – replace control
Heart beat	Normal operation
2 flashes	Control waiting on ASCD
3 flashes	HPS1 - Compressor lockout
5 flashes	LPS1 - Compressor lockout
13 flashes	Compressor held off due to low voltage
14 flashes	EEPROM storage failure (control failure)
15 flashes	Condensate overflow switch - compressor lockout
16 flashes	Coaxial freeze thermostat - compressor lockout

Note: * These flash codes do not represent alarms.

Communication

The communication protocol is Modbus™ using the RTU method of packet framing at 19200-baud rate.

Maintenance

Unit maintenance is simplified by the following preventive suggestions:

1. At least once a month, visually inspect the unit. Pay special attention to hose assemblies. Note any signs of hose deterioration or cracking. Immediately attend to any sign of minor leakage.
2. At least once every three months, perform filter maintenance to ensure proper operation of the equipment. Inspect the filters and replace when visible dirt buildup is evident.

⚠ CAUTION

To avoid fouled machinery and extensive unit clean up, DO NOT operate units without filters in place or use the unit as a temporary cooling/heating source during construction.

3. Every three months, inspect the condensate drain pan for algae growth and mineral buildup. Excessive algae or mineral deposits in the drain pan or drain line can result in condensate overflow and unpleasant mildew odors.
4. Annually check the fan motor and blower assembly. All units employ permanently lubricated fan motors. DO NOT OIL FAN MOTORS. Vacuum any accumulation of dirt from the motor ventilation slots and the blower wheel.
5. Annually check the contactors and relays within the control panel. Inspect the panel for any signs of damage caused by overheated contacts or temperature change to the wiring. Check the terminals for tightness.
6. Annually conduct an amperage check on the compressor and fan motor. An amperage draw more than 10% higher than the nameplate values can indicate heat exchanger fouling, low water flow, or premature physical motor failure.
7. At least once a year, inspect the air-to-refrigerant heat exchanger surface. A dirty or partially clogged coil can significantly reduce operating capacity and can result in serious equipment problems. If the coils appear dirty, clean them using mild detergent or a commercial coil-cleaning agent.
8. Inspect hoses, valves, and connections for water leaks. For hose connection leaks, inspect rubber hose gaskets and replace them as required.

Appendix

Figure 31: PSC motor wiring diagram

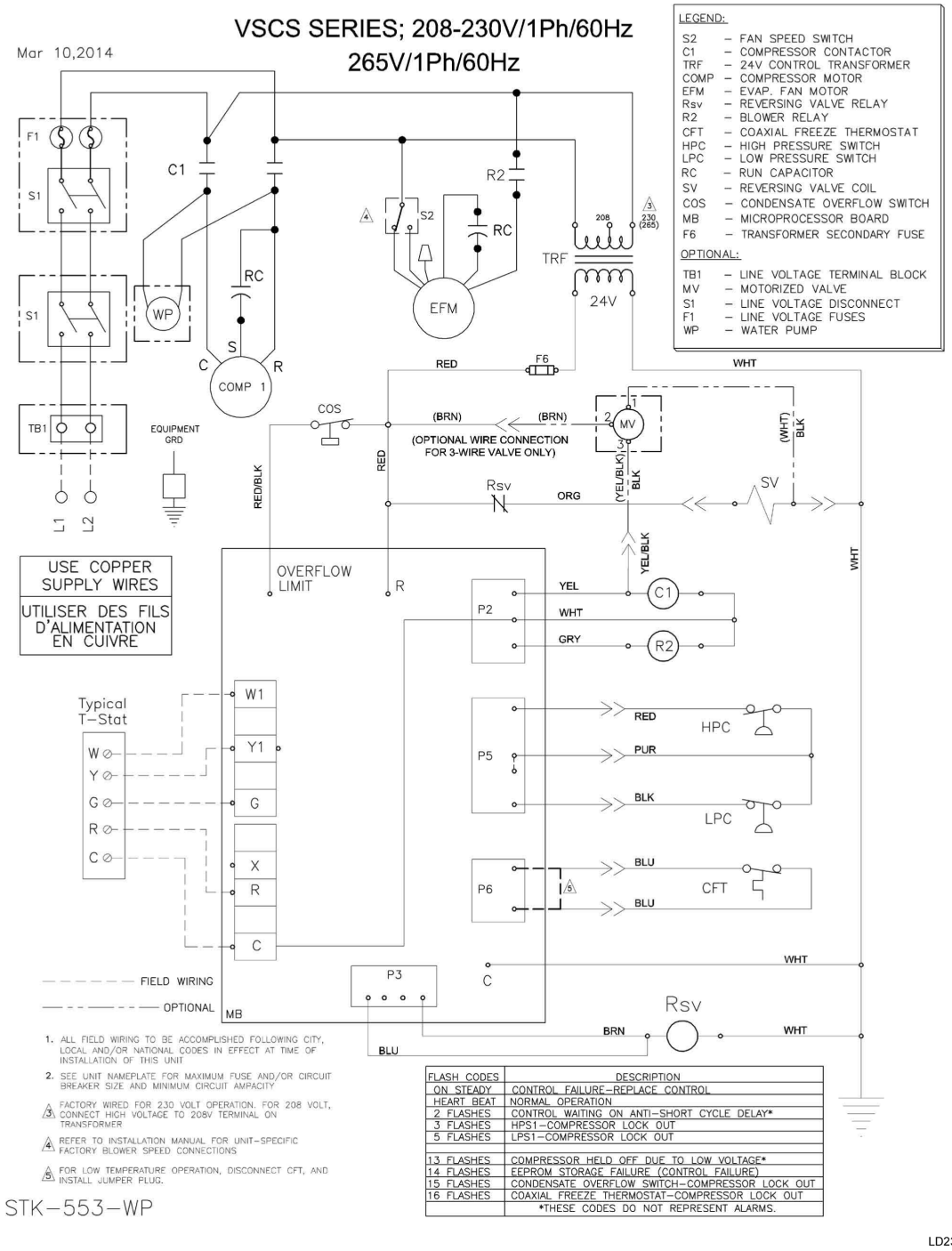


Figure 32: ECM wiring diagram

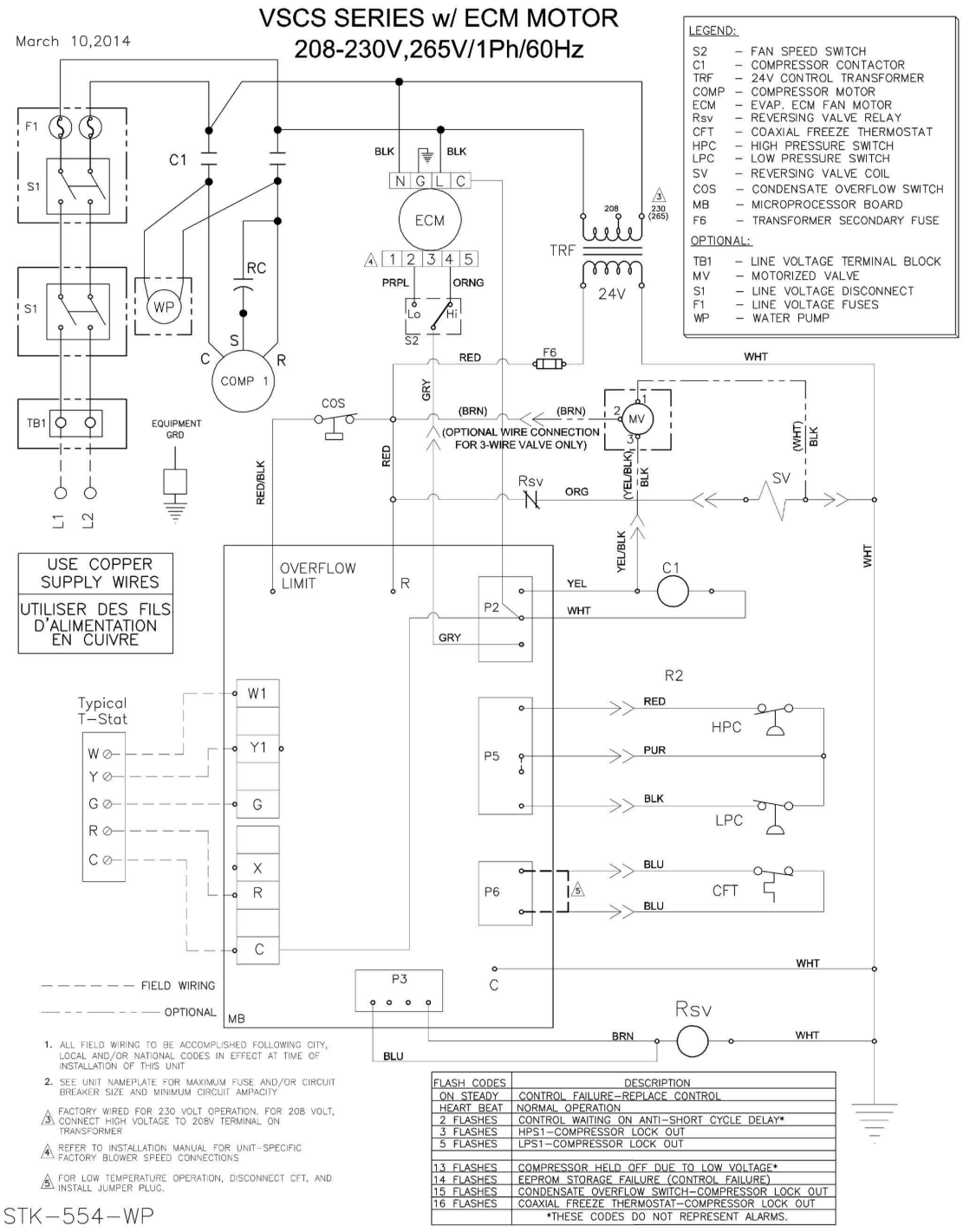


Figure 33: continuous fan with ECM wiring diagram

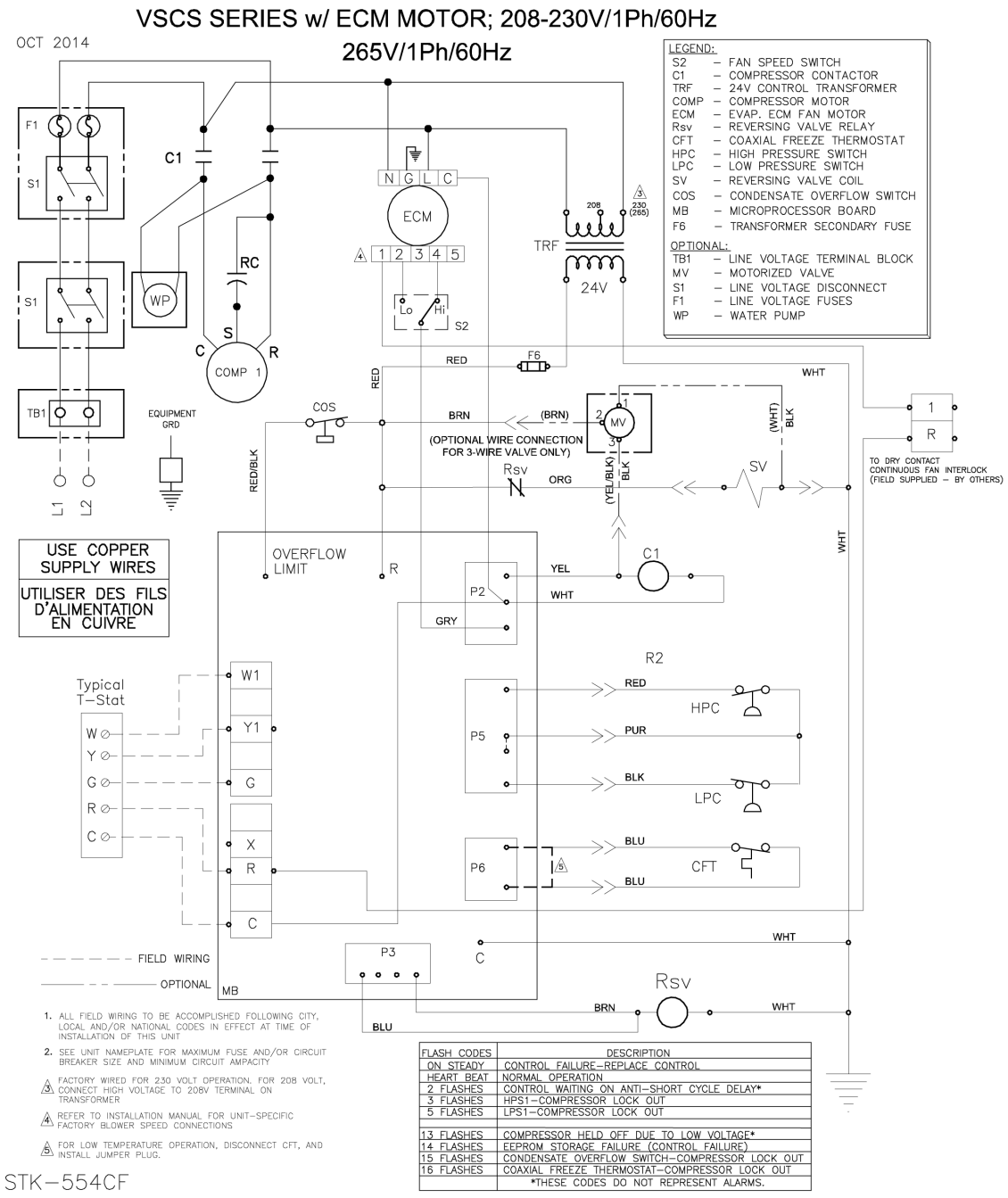


Figure 34: Motorized damper ECM wiring diagram

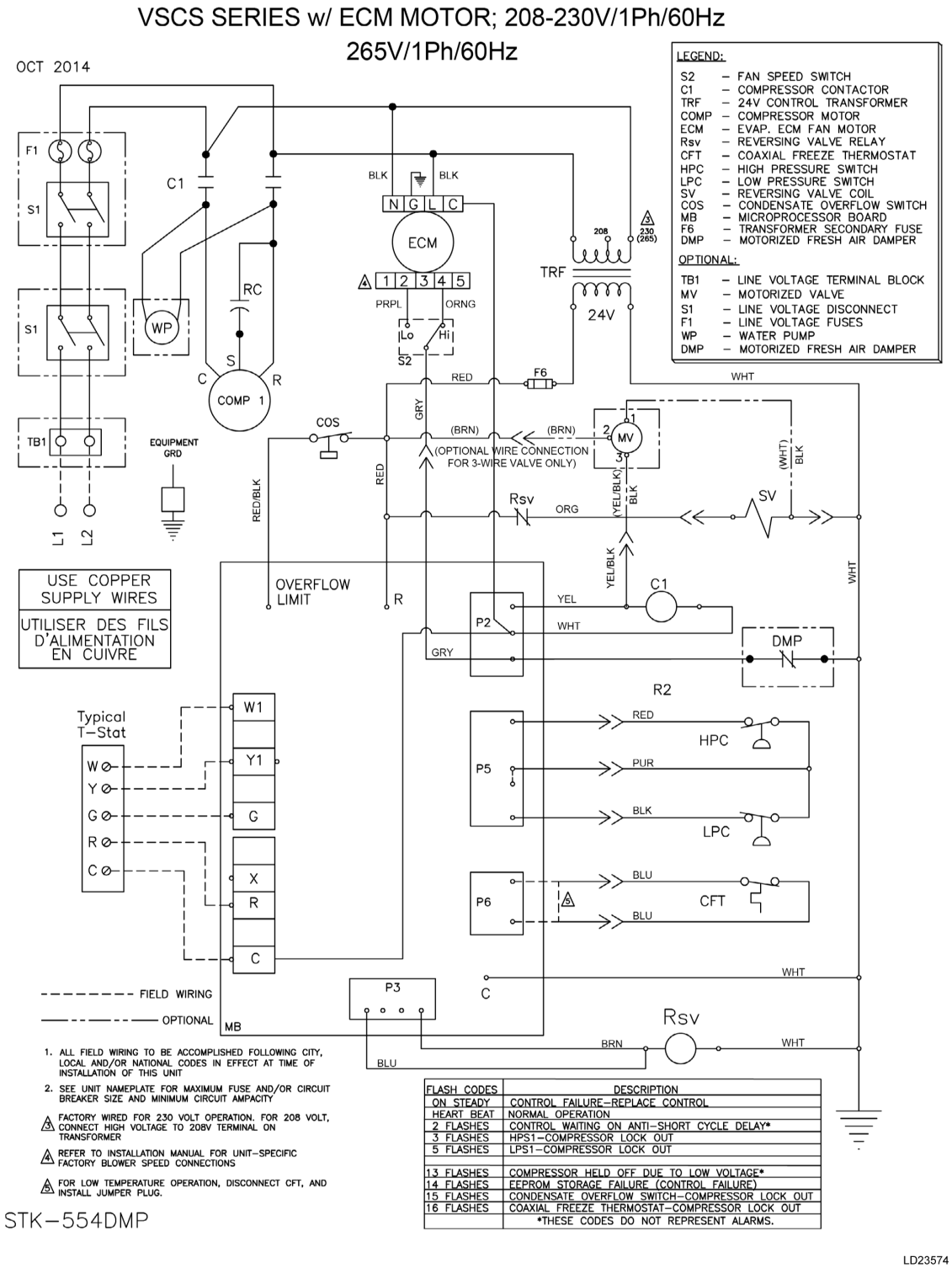
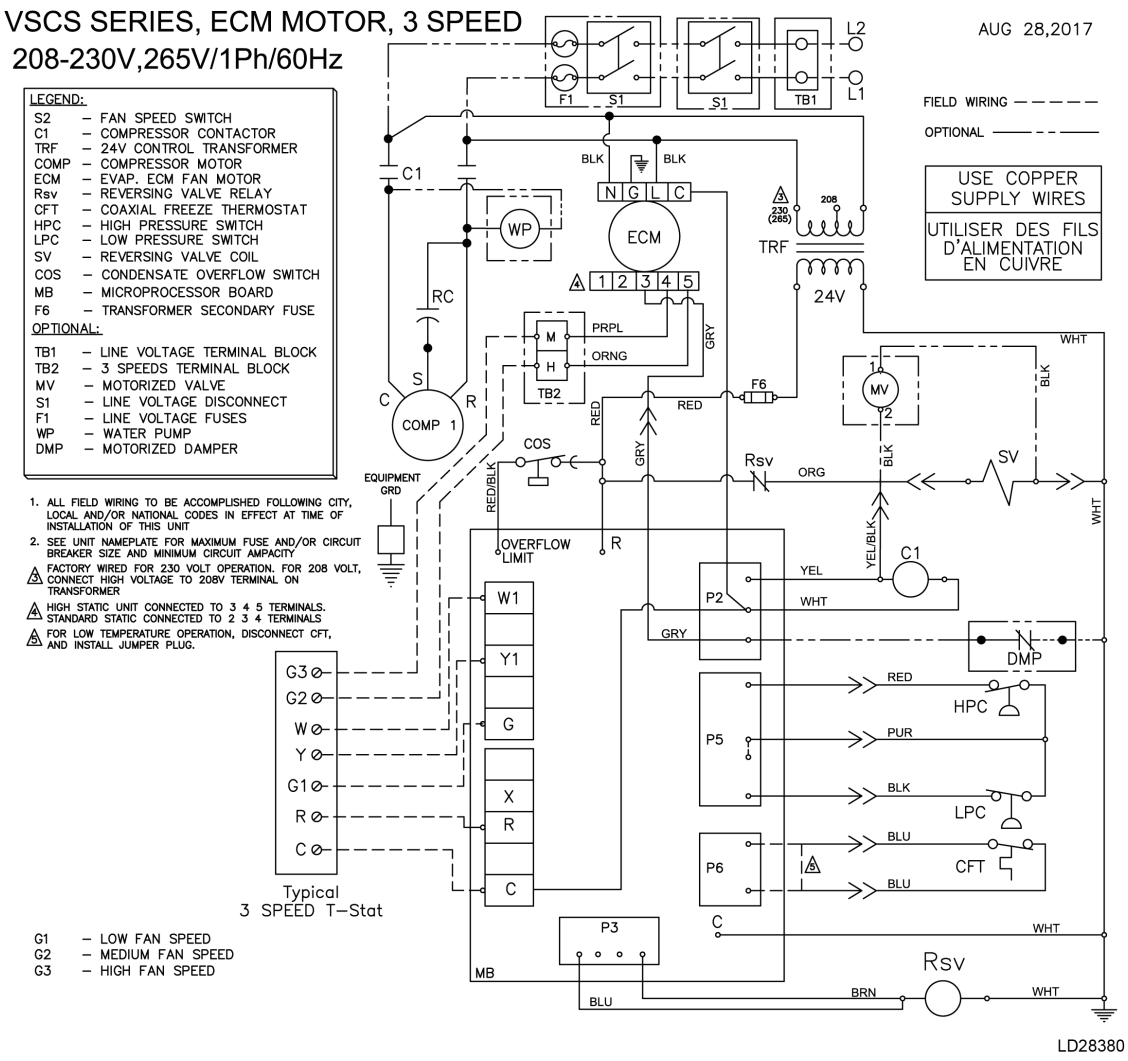


Figure 35: ECM with 3 speed fan motor



Vertical stack water loop verification

The water loop is a primary building system which supports all the secondary systems (heat pumps) in the building. If the primary system is not set up, balanced, and working properly then the secondary systems attached to it will NOT run properly. For any site having performance issues, the FIRST step is to verify the building's primary systems. There are three key systems that enable the heat pump to operate properly: water, air, and electrical.

Information needed for water loop verification.

- Building blueprints to understand infrastructure of the base system, (i.e., heat exchangers, pumps, filters, strainers, make up water, heat exchanger sequence IR: tower OR what? How are they getting rid of the heat, etc.).
- System water loop preparation.
- Water treatment, system cleaning, and flushing report.
- Water balance standard operating procedure.
- Balance and pressure report.
- Startup sheets for each unit.

Air and water balancing usually uncovers a number of issues that can result in a negative effect on system performance. Many of the most common problems uncovered in these analyses can be corrected easily and inexpensively. Buildings and facilities that undergo professional air and water balancing can expect to see significant improvements in occupant comfort, increased energy efficiency, and lowered utility bills.

Check all motors, fans, pumps, chillers, compressors, boilers, etc. (as applicable) are mechanically and electrically ready. Below it a general item checklist for waterside verification.

Waterside

1. Strainers and piping free from debris, cleaned and flushed.
2. Construction strainer baskets replaced with permanent baskets.
3. System filled to the proper level and the pressure-reducing valve set.
4. Automatic and manual air vents properly installed and functional.
5. All air purged from the system.
6. Water in the expansion tanks at the proper level.
7. All valves, flow meters, and temperature/pressure taps installed correctly, accessible and functional.
8. Terminal coils installed and piped correctly and accessible.
9. Pumps properly aligned, grouted and anchored.
10. Vibration isolators properly installed and adjusted.
11. Flexible connections installed properly.

Boiler

1. All operating and safety settings for temperature and pressure are correct.
2. Pressure relief valve functional.
3. Boiler started and operating properly.

Chiller and Condenser

1. All operating and safety settings for temperature and pressure are correct.
2. Chiller and condenser started and operating correctly.

Vertical stacked water source heat pump heating and cooling data record sheet

JOB NAME: _____
JOB ADDRESS: _____
_____
INSTALLER: _____
SPECIAL QUOTES/OPTIONS (YES/NO): _____

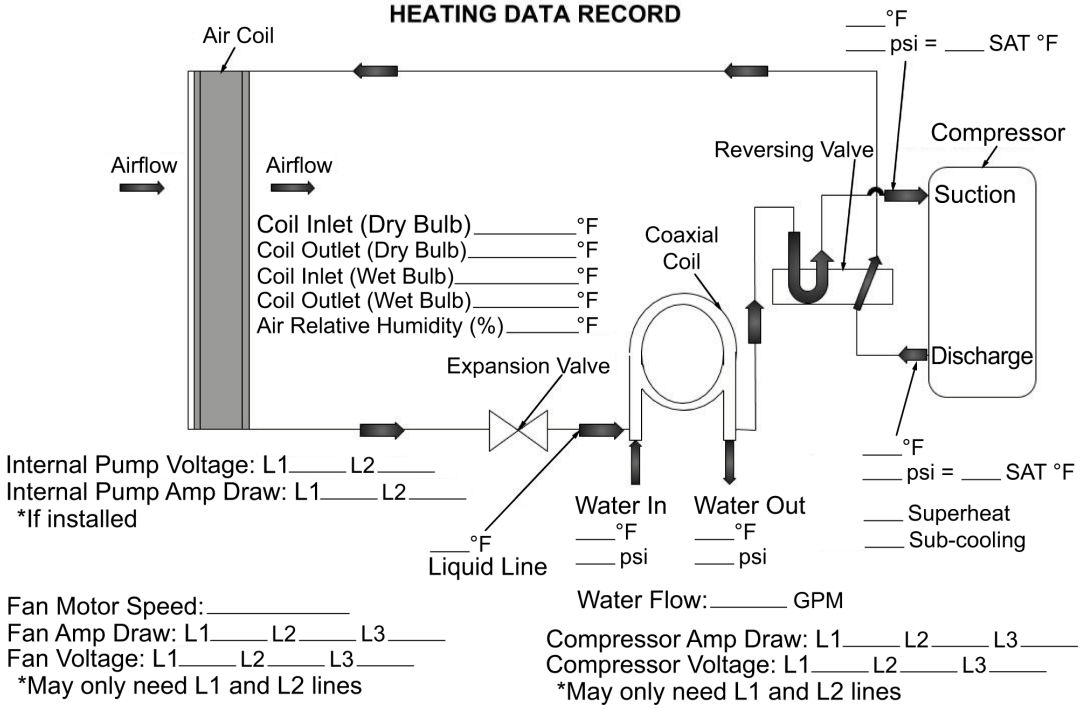
JOB #: _____
DATE: _____
INSTALLER'S ADDRESS: _____
_____
SERVICE TECHNICIAN: _____

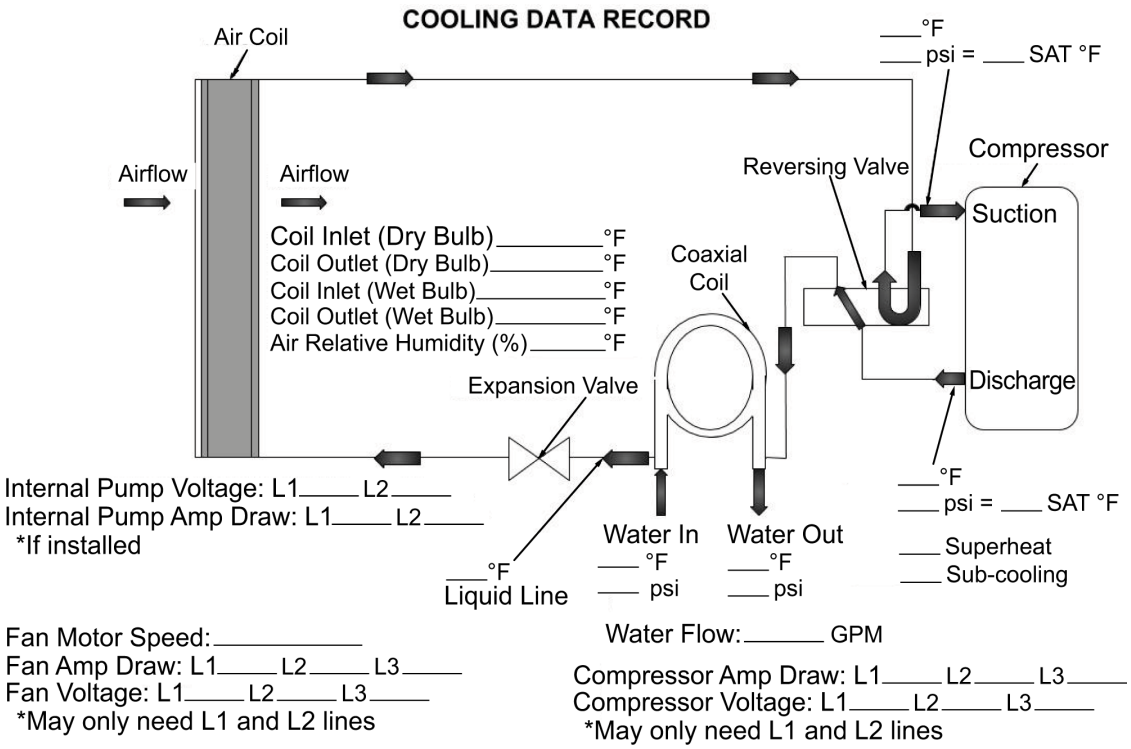
UNIT INFORMATION

CABINET MODEL #: _____
CHASSIS MODEL #: _____
OPERATING MODE (HEATING/COOLING): _____
DUCTED/FREE DISCHARGE: _____
LENGTH, WIDTH, HEIGHT OF DUCT(S): _____
_____
SUPPLY DUCT EXTERNAL STATIC PRESSURE (iwg):
_____

CABINET SERIAL #: _____
CHASSIS SERIAL #: _____
LOCATION / ROOM # OF HEAT PUMP: _____
FLASH CODES OR FAULTS FROM CONTROL BOARD:
_____
DOES UNIT HAVE AN INTERNAL PUMP: (YES/NO): ____
SUPPLY AIRFLOW MEASUREMENT (CFM): _____
Please attach a sketch of the duct(s) run with this form when returned to the Applied Ducted Systems PTS team.

HEATING DATA RECORD




COOLING DATA RECORD
Air Coil
___°F
___ psi = ___ SAT °F
Compressor
Airflow
Airflow
Reversing Valve
Suction
Coil Inlet (Dry Bulb)_____°F
Coil Outlet (Dry Bulb)_____°F
Coil Inlet (Wet Bulb)_____°F
Coil Outlet (Wet Bulb)_____°F
Air Relative Humidity (%)_____°F
Coaxial Coil
Expansion Valve
Discharge
___°F
___ psi = ___ SAT °F
___ Superheat
___ Sub-cooling
Internal Pump Voltage: L1____ L2____
Internal Pump Amp Draw: L1____ L2____
*If installed
Water In
___ °F
___ psi
Water Out
___°F
___ psi
___°F
Liquid Line
Water Flow:_____ GPM
Fan Motor Speed:_____
Fan Amp Draw: L1____ L2____ L3____
Fan Voltage: L1____ L2____ L3____
*May only need L1 and L2 lines
Compressor Amp Draw: L1____ L2____ L3____
Compressor Voltage: L1____ L2____ L3____
*May only need L1 and L2 lines

NOTES

Limited warranty

Johnson Controls warrants this product to be free from defects in workmanship or material for a period of 1 year from date of original installation or 18 months from date of shipment, whichever comes first.

Johnson Controls' obligation under this warranty is LIMITED to repairing or replacing at our sole option, at our factory, any part thereof which shall be returned to our factory, transportation charges prepaid and which on examination proves to have been thus defective under normal domestic use not exceeding the fuel rating. The defective part should be returned through a qualified servicing dealer. Upon warranty determination, the replacement part will be shipped freight collect and assumes the unexpired portion of this Limited Warranty.

When a defective part can be repaired or replaced, Johnson Controls shall not be obligated to repair the entire unit or any part thereof other than the defective part.

This warranty applies only to the original homeowner and is subject to the terms and conditions hereof.

Compressor - five year limited warranty

In addition to the 1 year Limited Warranty, Johnson Controls warrants the compressor to be free from defects in workmanship or material for a period of 5 years from the date of original installation. If a compressor fails during this five year period, a new compressor will be supplied. The customer will be responsible for freight costs from our factory for delivery of the replacement compressor and also for the return of the defective compressor which may be required under the terms of the Warranty. Labor and any other expense involved in replacing the compressor is not covered by this warranty.

Labor and cost not covered

This Limited Warranty provides only replacement parts or credits and does not provide for or cover any labor, shipping, handling, or other costs for service travel, servicing, removing, or installing any parts.

Exclusions

This Limited Warranty shall be void if:

1. The unit is not installed by a licensed or otherwise qualified or contractor and in compliance with the installation manual, applicable installation, and good trade practices.
2. The defect or damage is caused by accident, abuse, negligence of any person or company, misuse, riot, flood, fire, or Acts of God.
3. The unit is not operated and regularly serviced and maintained as called for in the Installation, Operation, and Maintenance (IOM) Manual.
4. Damages are caused by operating the unit in a commercial or corrosive atmosphere containing any damaging or dangerous chemicals.
5. The unit is modified or serviced in a manner not in accordance with the IOM Manual.
6. Components, replacement parts, or other accessories not compatible with the unit or not approved by Johnson Controls have been used with or attached to the unit.
7. The defect or damage is not caused by Johnson Controls, or it arises from circumstances beyond the control of Johnson Controls.
8. The unit is installed outside the United States or Canada or has been removed from the place where it was originally installed.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, OBLIGATIONS OR LIABILITIES, EXPRESSED OR IMPLIED BY EMPLOYEES OR REPRESENTATIVES OF JOHNSON CONTROLS. ALL STATUTORY,

EXPRESSED OR IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY NEGATED AND EXCLUDED. ANY CLAIMS FOR INCIDENTAL AND CONSEQUENTIAL DAMAGES, OR ANY OTHER DAMAGES OR EXPENSES BEYOND THE TERMS OF THIS LIMITED WARRANTY ARE HEREBY EXPRESSLY NEGATED AND EXCLUDED.

R-410A quick reference guide

See Installation for specific installation requirements.

- R-410A refrigerant operates at 50–70% higher pressures than R-22 refrigerant. Ensure that servicing equipment and replacement components are designed to operate with R-410A refrigerant.
- R-410A refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig (DOT 4BA400 or DOT BW400).
- Recovery equipment must be rated for R-410A refrigerant.
- Do not use R-410A service equipment on R-22 systems. All hoses, gauges, recovery cylinders, charging cylinders, and recovery equipment must be dedicated for use on R-410A systems only.
- Manifold sets must be at least 700 psig high side and 180 psig low side with a 550 psig retard.
- All hoses must have a service pressure rating of 800 psig.
- Leak detectors, must be designed to detect HFC refrigerants.
- Systems must be charged with refrigerant. Use a commercial type metering device in the manifold hose.
- R-410A refrigerant can only be used with polyester (POE) type oils.
- POE type oils rapidly absorb moisture from the atmosphere.
- Vacuum pumps cannot remove moisture from POE type oils.
- Do not use liquid line driers with a working pressure rating less than 600 psig.
- Do not install suction line driers in the liquid line.
- A liquid line drier is required on every unit.
- Do not use an R-22 TXV. If a TXV is necessary, it must be an R-410A TXV.
- Never open the system to atmosphere when under vacuum.
- If the system must be opened for service, evacuate the system, then break the vacuum with dry nitrogen and replace the filter driers.