This manual ships with the cabinet. Following unit installation, keep the manual with the unit in the storage pouch located at the rear of the chassis.
IMPORTANT!
READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

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:

- **Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.**
- **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 are not followed.**
- **Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.**
- **Highlights additional information useful to the technician in completing the work being performed properly.**

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 [www.P65Warnings.ca.gov](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

Revisions made to this document are indicated in the following table. These revisions are to technical information, and any other changes in spelling, grammar, or formatting are not included.

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<td>Updated digit 10, riser arrangement options of Cabinet Nomenclature</td>
<td>June 2020</td>
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<td>6</td>
<td>10.0 USGPM auto-flow regulator option removed from digit 10 of Chassis Nomenclature</td>
<td>February 2020</td>
</tr>
<tr>
<td>6</td>
<td>Removed options from digit 9, water valve &amp; pump options of Chassis Nomenclature</td>
<td>June 2020</td>
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<td>12</td>
<td>Added information about the factory isolated anchor kits in Step 6 of Placing the Cabinet</td>
<td>June 2020</td>
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<td>13</td>
<td>Refrigerant charge data updated for each model in Table 1 - Single Riser Physical Data</td>
<td>February 2020</td>
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<tr>
<td>13</td>
<td>Added optional 2-inch MERV 13 filter data per model in Table 1 - Single Riser Physical Data</td>
<td>March 2020</td>
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<td>16</td>
<td>Added Steps 3 and 4, a warning, and Figure 5 in the Hoses section</td>
<td>February 2020</td>
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<td>22</td>
<td>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</td>
<td>May 2020</td>
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<tr>
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<td>Updated Figure 15 to match the VSCS High Efficiency VSHP IOM</td>
<td>February 2020</td>
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<tr>
<td>36-37</td>
<td>Start-Up Checklist added</td>
<td>February 2020</td>
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ASSOCIATED LITERATURE

<table>
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<th>MANUAL DESCRIPTION</th>
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<tr>
<td>Vertical Stacked Heat Pump Start-Up and Performance Checklist</td>
<td>145.18-CL1</td>
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RISER NOMENCLATURE

PRODUCT CATEGORY
- VBR = Vertical Stacked Heat Pump - Standard Cabinet Assembly
- VMR = Vertical Stacked Heat Pump - Master Cabinet Assembly
- VTR = Vertical Stacked Heat Pump - Single Riser Cabinet Assembly *
- VUR = Vertical Stacked Heat Pump - Single Riser Master Cabinet Assembly *

COPPER TYPE
- M = Type M
- L = Type L

UNIT CAPACITY
- 07 = 3/4 TON
- 09 = 1 TON
- 11 = 1-1/4 TON
- 13 = 1-1/2 TON
- 17 = 2 TON
- 21 = 2-1/2 TON
- 25 = 3 TON

VAVLE OPTIONS
- 0 = No Valve
- 3 = 1/2" Nexus Valve
- 5 = 1/2" JIC Valve
- 6 = 3/4" JIC Valve

SWAGE OPTIONS
- S = Swaged
- P = Plain End

INSULATION OPTIONS
- 00 = No insulation
- 3C = 3/8 inch
- 4C = 1/2 inch
- 6C = 3/4 inch

CABINET HEIGHT
- S = Standard (88 inches)
- R = Reduced (80 inches)

SATELLITE STUB-OUT OPTIONS
- 0 = No Stub-Out
- 1 = 1/2 inch Stub-Out
- 5 = 3/4 inch Stub-Out

RISER END OPTIONS
- 1 = Standard
- 2 = Reduce Up *
- 3 = Reduce Down *
- 4 = Cap Up
- 5 = Cap Down
- 6 = Extension / Express

RISER LENGTH (INCHES)

SHIPPING METHODS
- L = Ship Loose
- M = Factory Mount

* NOTE: VTR and VUR Single Risers are not available in reduce up or reduce down riser end options.
**CHASSIS NOMENCLATURE**

<table>
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<tr>
<th>PRODUCT CATEGORY</th>
<th>VSCS = Vertical Stacked Heat Pump Chassis R-410A</th>
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<tbody>
<tr>
<td>UNIT CAPACITY</td>
<td>09 = 0.75 TON</td>
</tr>
<tr>
<td></td>
<td>12 = 1 TON</td>
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<tr>
<td></td>
<td>15 = 1.25 TON</td>
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<td></td>
<td>18 = 1.5 TON</td>
</tr>
<tr>
<td></td>
<td>24 = 2 TON</td>
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<tr>
<td></td>
<td>30 = 2.5 TON</td>
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<tr>
<td></td>
<td>36 = 3 TON</td>
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<tr>
<td>DESIGN SERIES</td>
<td>C = Current Generation</td>
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<tr>
<td>VOLTAGE</td>
<td>1 = 208/230-60-1</td>
</tr>
<tr>
<td></td>
<td>6 = 265-60-1</td>
</tr>
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</table>

**MISCELLANEOUS OPTIONS**

| 0 = None |
| S = Quiet Chassis |
| C = Washerless Hose Connection |
| B = Quiet Chassis with Washerless Hose Connection |

**WATERSIDE OPTIONS**

| C = Standard Water Coil |
| N = Cupro-Nickel Water Coil |

**AIRSIDE OPTIONS**

| A = Standard Airside Coil |
| C = Dipped Electrofin Coating |

**AUTO-FLOW REGULATOR**

| 0 = No Flow Control Valve |
| B = 1.5 USGPM |
| C = 2.0 USGPM |
| D = 2.5 USGPM |
| E = 3.0 USGPM |
| F = 3.50 USGPM |
| H = 4.0 USGPM |
| J = 4.5 USGPM |
| K = 5.0 USGPM |
| L = 6.0 USGPM |
| M = 7.0 USGPM |
| N = 8.0 USGPM |
| P = 9.0 USGPM |

**WATER VALVE & PUMP OPTIONS**

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<tr>
<th>VALVE OPTIONS</th>
<th>PUMP*</th>
<th>Y-STRAINER &amp; PUMP*</th>
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<tbody>
<tr>
<td>No Water Control Valve</td>
<td>P</td>
<td>B</td>
</tr>
</tbody>
</table>

**AUTO-FLOW REGULATOR**

| 0 = No Flow Control Valve |
| B = 1.5 USGPM |
| C = 2.0 USGPM |
| D = 2.5 USGPM |
| E = 3.0 USGPM |
| F = 3.50 USGPM |
| H = 4.0 USGPM |
| J = 4.5 USGPM |
| K = 5.0 USGPM |
| L = 6.0 USGPM |
| M = 7.0 USGPM |
| N = 8.0 USGPM |
| P = 9.0 USGPM |
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SECTION 1 - INSTALLATION

After installing the unit, show the user how to turn off the electricity to the unit. Point out the 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.

PRE-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 can 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

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.

   \[
   \text{Rough handling may dislocate and damage internal components.}
   \]

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.

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.

   \[
   \text{DO NOT USE THE RISERS TO LIFT THE CABINET ASSEMBLY!}
   \]

   \[
   \text{DO NOT install this unit outdoors.}
   \]

   \[
   \text{A compressor/unit comprises a pressurized system. Never loosen threaded joints while the system is under pressure and never open pressurized system parts.}
   \]

   \[
   \text{Before servicing, open and tag all disconnect switches.}
   \]

   \[
   \text{Do not install units in a flammable environment due to the danger of an explosion.}
   \]

   \[
   \text{Safety guards, shields, barriers, covers, and protective devices must not be removed while the compressor/unit is operating.}
   \]

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

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

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

RIGGING

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

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

Spreader bars must be used and must be long enough to prevent rigging from contacting the unit. Use only the designated lift points according to the unit’s manual and use ALL lifting 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 the unit when lifted.

CABINET RISER INSTALLATION

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

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

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

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 the cabinet sheet metal.

Do not drag risers on 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 cabinet openings. Ensure that the risers cannot bottom out in swage (see Figure 1 on page 12).

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

Placing the Cabinet

The correct location of the cabinet in relation to the floor sleeve and risers is shown in Figure 3 on page 14. 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 (a total movement of 3 inches). If the total calculated riser expansion or contraction exceeds 1-1/2 inches, the field must provide expansion compensation.

The initial positioning of the riser stub-out is correct when the top of the riser pipe is 3 inches above the top of the cabinet (applies to standard riser models only: VTR/VUR)
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 ensure proper unit operation and condensate drainage.

6. When building construction codes or safety laws require securing the cabinets in order to prevent accidental tipping, the field must order and install factory isolated anchor kits (P/N VB-ANCHOR). The kit includes isolated anchor brackets (2X) and sheet metal screws (4X). Concrete screws used to fasten the anchors into the floor are field supplied.

   **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-outs in the cabinet opening to allow for expansion and contraction. Riser stub-outs must not contact any sheet metal opening. Otherwise, damage can occur to the stub-outs, resulting in water leaks and property damage.

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

   **Correct**
   ![Correct]

   **Incorrect**
   ![Incorrect]

   **FIGURE 2 - CORRECT/INCORRECT STUB-OUT POSITIONS IN CABINET RISER OPENING**

   *The riser system must be secured to the 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 the individual unit shut-off valves are closed until the circulating loop system is cleaned and flushed.

<table>
<thead>
<tr>
<th>TABLE 1 - SINGLE RISER PHYSICAL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODEL SERIES</td>
</tr>
<tr>
<td>Nominal Cooling (ton)</td>
</tr>
<tr>
<td>COMPRRESSOR TYPE</td>
</tr>
<tr>
<td>Refrigerant Charge (oz)</td>
</tr>
<tr>
<td>AIR COIL TYPE</td>
</tr>
<tr>
<td>Face Area (sq.ft)</td>
</tr>
<tr>
<td>WATER COIL TYPE</td>
</tr>
<tr>
<td>STANDARD BLOWER/MOTOR</td>
</tr>
<tr>
<td>Diameter x Width (in)</td>
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<td>Motor HP</td>
</tr>
<tr>
<td>HI-STATIC BLOWER/MOTOR</td>
</tr>
<tr>
<td>Diameter x Width (in)</td>
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<tr>
<td>Motor HP</td>
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<td>ECM BLOWER/MOTOR</td>
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<td>Motor HP</td>
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<td>HI-STATIC ECM BLOWER/MOTOR</td>
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<td>Diameter x Width (in)</td>
</tr>
<tr>
<td>Motor HP</td>
</tr>
<tr>
<td>CHASSIS WATER PUMP</td>
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<td>Pump HP</td>
</tr>
<tr>
<td>Water Connection (JIC) (in)</td>
</tr>
<tr>
<td>FILTER QUANTITY/SIZE (INCHES)</td>
</tr>
<tr>
<td>CABINET WEIGHT (LB)</td>
</tr>
<tr>
<td>CABINET WRIGHT (LB)</td>
</tr>
</tbody>
</table>

NOTES
1. Nominal Capacity calculated in accordance with AR/ISO Standard 13256-1 for Water Loop Application.
2. Optional 2-inch MERV 13 filters.
3. Cabinet weight is approximate and does not include weight of risers.
SECTION 1 - INSTALLATION

SINGLE RISER CABINET DIMENSIONS

TABLE 2 - CABINET DIMENSIONS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>A</th>
<th>B</th>
<th>RA FLANGE WIDTH (IN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09–12</td>
<td>17</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>15–24</td>
<td>20</td>
<td>20</td>
<td>19</td>
</tr>
<tr>
<td>30–36</td>
<td>24</td>
<td>24</td>
<td>23</td>
</tr>
</tbody>
</table>

FIGURE 3 - SINGLE RISER CABINET AND FLOOR SLEEVE DIMENSIONS

NOTES
1. The single riser and condensate riser openings are pre-punched on all sides and field convertible. Cut the tabs to remove the knock-out.
2. The single riser openings are 9.5 inches x 2.5 inches. During riser installation, ensure the stub-out is centered in the supply and return openings.
3. The condensate P-trap is accessible either from the front by removing the bottom cover plate or from the top by removing the drain pan.
4. The floor cutouts are given for reference only. The actual opening might be affected by site conditions.
5. For the master/satellite configuration (see Figure 4 on page 15), the satellite cabinet water and drain connections must be field extended to match the satellite cabinet location. The use of elbows and extension beyond 24 inches is not permitted on the water side because of the potential for a higher water pressure drop.
6. A shut-off valve is not provided with the satellite side of the riser stub. Field-install shut-off valve with field hose kit (ordered separately).
7. See Figure 9 on page 19 for more details about installation.
FIGURE 3 - SINGLE RISER CABINET AND FLOOR SLEEVE DIMENSIONS (CONT'D)

FIGURE 4 - MASTER/SATELLITE CONFIGURATION FOR SINGLE RISER CABINETS

NOTES
See notes 5, 6, and 7 on 14.
**RISER LOOP**

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

   When the loop water temperature is maintained between nominal operating limits of 60.0–90.0°F, the piping does not sweat or suffer undue heat loss at conditioned space temperatures.

4. Install vents in the piping loop as required to bleed residual air from the piping system during filling and servicing.

5. 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 Joint Industrial Committee (JIC) type fittings (see Figure 6 on page 17).
   b. For field supplied risers, it is recommended to order the appropriate 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 7 on page 18).
   c. For satellite side cabinets, it is recommended ordering the appropriate 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 7 on page 18).

**HOSES**

Ensure the correct hose type is matched with the compatible chassis model (see Table 3 on page 17). Install the JIC factory-provided hoses by completing the following steps:

1. Tighten by hand the screw connections to the male JIC fitting on the shut-off valve. Hold the ferrule stationary when tightening.
2. Tighten using backup wrench 1/4 turn further. Do not overtighten.
3. Remove the plastic caps on the pump inlet and outlet fittings.

   **WARNING**

   **Before running water through the chassis, the riser and condenser outlet hoses must be connected.**

4. Connect the riser return, riser supply, and condenser outlet hoses as detailed in Figure 5.

---

**FIGURE 5 - CHASSIS HOSE CONNECTIONS (VSCS09 MODEL SHOWN)**

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

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

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.

Hoses must be hand tightened then further tightened no more than 1/4 turn. DO NOT APPLY EXCESSIVE FORCE!

ALWAYS USE A BACKUP WRENCH WHEN TIGHTENING HOSES TO VALVES! Otherwise, valve solder joint may fail, which could lead to property damage or serious injury!

**TABLE 3 - CHASSIS HOSES**

<table>
<thead>
<tr>
<th>CHASSIS MODEL</th>
<th>HOSE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/12/15/18</td>
<td>1/2 inch JIC Female-Female</td>
</tr>
<tr>
<td>24/30/36</td>
<td>3/4 inch JIC Female-Female</td>
</tr>
</tbody>
</table>

Factory Supplied in Each Hose Kit:
- Two Flexible (Washer-Less) Hoses

**FIGURE 6 - STANDARD FACTORY SUPPLIED JIC FLARE HOSE KITS AND RISERS**
SECTION 1 - INSTALLATION

**FIGURE 7 - OPTIONAL FIELD SUPPLIED RISERS WITH FACTORY SUPPLIED JIC FLARE HOSE KITS AND SHUT-OFF VALVES**

1. Prior to fabrication, communicate the main riser water flow direction to the factory.
2. Factory marked riser connections use color tags and labels.
3. The blue color indicates the chassis supply and the red color indicates the return connection.
4. The chassis water connections are marked using color labels indicating the correct water connections.
5. The factory satellite stub-out connection is 5-1/2 inches. The field can extend it up to 24 inches. The shut-off valve is field-installed.

**FIGURE 8 - RISER CONNECTIONS - STANDARD STYLE SINGLE RISER**
NOTES
1. Prior to fabrication, communicate the main riser water flow direction to the factory.
2. Factory marked riser connections use color tags and labels.
3. The blue color indicates the chassis supply and the red color indicates the return connection.
4. The chassis water connections are marked using color labels indicating the correct water connections.
5. The factory satellite stub-out connection is 5-1/2 inches. The field can extend it up to 24 inches. The shut-off valve is field-installed.

FIGURE 9 - RISER CONNECTIONS - MASTER STYLE SINGLE RISER

ELECTRICAL WIRING

- 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 death.

Field-Installed Power Wiring

- Use copper conductors only!

- 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 hand side of the cabinet at the 7/8-inch power entrance knock-out.
SECTION 1 - INSTALLATION

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

Install thermostat by connecting the remote thermostat wiring to the microprocessor board low voltage terminal strip. See Figure 10 on page 20 for typical wiring connections.

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

**TABLE 4 - TYPICAL WIRING CONNECTIONS**

<table>
<thead>
<tr>
<th>RECOMMENDED WIRE SIZE (GAUGE)</th>
<th>MAXIMUM LOW VOLTAGE WIRE LENGTH (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>18</td>
<td>75</td>
</tr>
<tr>
<td>16</td>
<td>125</td>
</tr>
</tbody>
</table>

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

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

*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.*

**Optional Surface Mount Thermostat Connection Wiring**

For applications where a 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 the thermostat terminals, and the Molex connector clips to the mating panel-mounted Molex connector on the unit cabinet, located 7 inches above the electrical box. See optional 24V surface mount connection in Figure 3 on page 14.

**Optional Remote Mounted Thermostat Wiring**

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

Use a low voltage 7/8-inch knock-out on either side of the unit at the electrical box to field wire the low voltage thermostat wiring. Use a field provided bushing to pass the harness inside the electrical box to the factory wired mating Molex harness. See Figure 11 on page 20.

*NOTE:* PAULUS-PLAEX 16/3 2C 208-230V/1Ph/60Hz POWER SUPPLY PER LOCAL CODES

**FIGURE 10 - FIELD WIRING DIAGRAM**

**FIGURE 11 - REMOTE THERMOSTAT WIRING**
Optional ADA Door Mounted Thermostat

For units ordered with ADA thermostat option, to meet the requirements of the Americans with Disabilities Act (ADA), the thermostat is located on the RA panel door at a height of 48 inches from the base of the cabinet. The unit is supplied with a custom RA door panel with thermostat mounting holes, a unit switch plate with a Molex connector, and an ADA Molex pigtail harness. See Figure 15 on page 23.

Wire leads from the ADA thermostat harness are field wired to the thermostat terminals. The Molex end of the ADA thermostat harness is field connected to the surface mounted Molex connector at the 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 in behind the RA door. For chassis servicing, unclip the harness from the unit switch plate.

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 a 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 the energy recovery ventilator (ERV) or room occupancy control. See Appendix on page 52 for electrical schematics.

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 the RA panel frame and cabinet!

CLOSET AND DRYWALL INSTALLATION

Build a closet enclosure for the cabinet that incorporates the RA panel size while maintaining a sufficient gap between the closet and the cabinet. This prevents the cabinet from contacting the RA panel and closet enclosure. See Acoustic RA Panel on page 21, Figure 13 on page 22, and Figure 14 on page 23.

1. Cover the supply and return openings with plastic or cardboard before installing drywall around the 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 outlets. See Figure 13 on page 22 and Figure 14 on page 23.

3. Install sheetrock around the cabinet by securing the drywall to the building construction studs.

4. Cut holes around the supply air and RA openings to allow access to the unit chassis, unit controls, and the supply air connection.

5. Vacuum all the dust and construction debris from the unit drain pan, electrical box, and discharge plenum after cutting out the supply/return openings.

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 RA PANEL

RA panels are painted standard appliance white. Carefully unpack RA panels from shipping box. RA panels with optional key locks require 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 to the unit is shipped loose with the thermostats.

1. Locate the drywall opening at a distance from the unit. This prevents the RA panel from touching the unit sleeve. See Figure 13 on page 22 and Figure 14 on page 23.

2. Center the RA panel throat opening to the cabinet RA flange opening.
3. Fasten the RA panel to the frame opening using the screws provided. See Figure 13 on page 22. Figure 16 on page 24 shows the opening for mounting an ADA compliant thermostat at 48 inches above the floor. Note that the 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.

<table>
<thead>
<tr>
<th>UNIT MODEL</th>
<th>(A) PANEL WIDTH</th>
<th>(B) SLEEVE WIDTH</th>
<th>(C) RA PANEL OPENING</th>
<th>(D) ROUGH IN WIDTH</th>
<th>(E) UNIT WIDTH</th>
<th>(F) UNIT DEPTH</th>
<th>(G) NO OA OPTION</th>
<th>(G) OA OPTION, NO DAMPER</th>
<th>(G) OA OPTION, WITH DAMPER</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/12</td>
<td>22.75</td>
<td>16</td>
<td>16.25</td>
<td>20.75 ± 0.125</td>
<td>17</td>
<td>17</td>
<td>20.25 MIN</td>
<td>21.75 MIN</td>
<td>23.50 MIN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20.50 MAX</td>
<td>22.00 MAX</td>
<td>23.75 MAX</td>
</tr>
<tr>
<td>15/18/24</td>
<td>25.75</td>
<td>19</td>
<td>19.25</td>
<td>23.75 ± 0.125</td>
<td>20</td>
<td>20</td>
<td>23.25 MIN</td>
<td>24.75 MIN</td>
<td>26.50 MIN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>23.50 MAX</td>
<td>25.00 MAX</td>
<td>26.75 MAX</td>
</tr>
<tr>
<td>30/36</td>
<td>29.75</td>
<td>23</td>
<td>23.25</td>
<td>27.75 ± 0.125</td>
<td>24</td>
<td>24</td>
<td>27.25 MIN</td>
<td>28.75 MIN</td>
<td>30.50 MIN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27.50 MAX</td>
<td>29.00 MAX</td>
<td>30.75 MAX</td>
</tr>
</tbody>
</table>

**NOTE:** All dimensions are in inches.
RA flange must not contact door frame

**NOTES:**
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 13 on page 22 for additional RA panel and cabinet installation information.

**Figure 14 on page 23** shows a cutaway view for a standard cabinet with no stand. Add the stand height to the cabinet height to obtain the correct dimension of the RA panel from the floor.

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

---

**Figure 14 - RA Panel Cross Section Installation (Floor Level)**

**Figure 15 - RA Panel Dimensions**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>ROUGH-IN WIDTH</th>
<th>ROUGH-IN HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSCS09–12</td>
<td>22.75</td>
<td>20.50</td>
<td>16.25</td>
<td>18.50</td>
<td>20.75</td>
<td>52.75</td>
</tr>
<tr>
<td>VSCS15–24</td>
<td>25.75</td>
<td>23.50</td>
<td>19.25</td>
<td>21.50</td>
<td>23.75</td>
<td>52.75</td>
</tr>
<tr>
<td>VSCS30–36</td>
<td>29.75</td>
<td>27.50</td>
<td>23.25</td>
<td>25.50</td>
<td>27.75</td>
<td>52.75</td>
</tr>
</tbody>
</table>
FIGURE 16 - OPTIONAL RA PANEL WITH ADA MOUNTED THERMOSTAT

NOTES:
- Powder coated in appliance white
- Inside panel lined with 1/2 inch acoustical insulation
- Hinged panel complete with magnetic latches
- Panel comes either left or right hand opening
SUPPLY AIR DUCTWORK

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

NOTE

Horizontal Supply Air

A 2-inch duct flange (field provided) can 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 1/4 inch around the perimeter to fit inside the unit supply flange. Other grille manufacturers could have different clearances which 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 will fit inside the cabinet supply flange. It is not recommended to apply the 1/8-inch neoprene tape around the perimeter of the volume damper prior to inserting into the supply opening (see Figure 17 on page 25). 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 5 on page 27 and Table 6 on page 27. Recommended face velocity at the outlet supply grille is 300–500 FPM. These tables give face velocity at the unit supply openings in relation to Table 5 on page 27. To calculate the face velocity at the supply grille, take the FPM (Table 5 on page 27 and Table 6 on page 27) and divide by the supply grille free area factor.

FIGURE 17 - SUPPLY GRILLE WITH VOLUME DAMPER AND 1/8-INCH NEOPRENE TAPE APPLIED TO ITS PERIMETER
SECTION 1 - INSTALLATION

FIGURE 18 - UNIT-MOUNTED SUPPLY GRILLE INSTALLATION DIMENSIONS

1. All dimensions are in inches and typical dimensions for supplied grilles only.
2. Check the dimensions for field supplied grilles because dimensions can be different.
### TABLE 5 - UNIT SUPPLY OPENING SIZES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>NO TOP OPENING</th>
<th>TOP OPENING</th>
<th>NO TOP OPENING</th>
<th>TOP OPENING</th>
<th>NO TOP OPENING</th>
<th>TOP OPENING</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>14W x 12H</td>
<td>14W x 6H</td>
<td>14W x 8H</td>
<td>Consult Application Engineer</td>
<td>12 x 8</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>14W x 14H</td>
<td>14W x 6H</td>
<td>14W x 10H</td>
<td>Consult Application Engineer</td>
<td>12 x 8</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>16W x 14H</td>
<td>14W x 6H</td>
<td>14W x 10H</td>
<td>Consult Application Engineer</td>
<td>14W x 8H</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Consult Application Engineer</td>
<td>14W x 6H</td>
<td>14W x 12H</td>
<td>14W x 8H</td>
<td>14W x 12</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Consult Application Engineer</td>
<td>14W x 10H</td>
<td>16W x 14H</td>
<td>14W x 10H</td>
<td>14W x 12</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Consult Application Engineer</td>
<td>14W x 6H</td>
<td>20W x 14H</td>
<td>14W x 6H</td>
<td>16W x 12</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Consult Application Engineer</td>
<td>14W x 10H</td>
<td>Consult Application Engineer</td>
<td>14W x 6H</td>
<td>16W x 14</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**
1. Manufacturer supplied supply grilles are 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 ship 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 the horizontal opening grille size.
6. Openings marked ‘N/A’ result in face velocities outside the recommended 300-500 FPM range.
7. The Hi-Static Blower option or single horizontal discharge openings with unit-mounted supply grille are not recommended.

### TABLE 6 - UNIT SUPPLY FACE VELOCITY (FPM)

<table>
<thead>
<tr>
<th>MODEL</th>
<th>NO TOP OPENING</th>
<th>TOP OPENING</th>
<th>NO TOP OPENING</th>
<th>TOP OPENING</th>
<th>NO TOP OPENING</th>
<th>TOP OPENING</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>291</td>
<td>272</td>
<td>219</td>
<td>Consult Application Engineer</td>
<td>Consult Application Engineer</td>
<td>510</td>
</tr>
<tr>
<td>12</td>
<td>316</td>
<td>344</td>
<td>221</td>
<td>Consult Application Engineer</td>
<td>Consult Application Engineer</td>
<td>645</td>
</tr>
<tr>
<td>15</td>
<td>354</td>
<td>314</td>
<td>283</td>
<td>Consult Application Engineer</td>
<td>236</td>
<td>471</td>
</tr>
<tr>
<td>18</td>
<td>Consult Application Engineer</td>
<td>391</td>
<td>294</td>
<td>294</td>
<td>235</td>
<td>587</td>
</tr>
<tr>
<td>24</td>
<td>Consult Application Engineer</td>
<td>397</td>
<td>273</td>
<td>364</td>
<td>291</td>
<td>729</td>
</tr>
<tr>
<td>30</td>
<td>Consult Application Engineer</td>
<td>416</td>
<td>276</td>
<td>339</td>
<td>269</td>
<td>538</td>
</tr>
<tr>
<td>36</td>
<td>Consult Application Engineer</td>
<td>410</td>
<td>Consult Application Engineer</td>
<td>385</td>
<td>261</td>
<td>610</td>
</tr>
</tbody>
</table>

**NOTES**
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 in 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 24 on page 32 for right and left hand version). The fresh air discharges upstream of the direct expansion (DX) coil through the discharge collector box.

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

Units can be selected with the fresh air opening located on 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 the unit or closet.

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 energy recovery ventilators (ERV) or make-up air units.

Unit comes with 4-1/4 inch RA sleeve. Front supply openings will come with 4-1/4 inch supply plaster flange.

Top Mounted Fresh Air Intake with Motorized Damper

This includes the same features as the top mounted fresh air intake option with the addition of a motorized damper assembly inside the discharge collector box (see Figure 24 on page 32).

The damper assembly can be easily removed for servicing (see Removing the Actuator on page 28). The motorized damper assembly opens during FAN ON operation. See Appendix on page 52 for electrical schematic. For other control options, please contact the factory.

During transportation, handling, or installation of the cabinet, excessive handling can cause the 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 the 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 observe the damper assembly.
   b. Remove the seven fasteners holding the damper plate (see Figure 19 on page 28).
   c. Drop down the plate and disconnect the quick-connect terminals from the harness.

2. Remove the red cover from the actuator body (see Figure 20 on page 28).
3. If the black cover is loose, position it in place and slide it back onto the actuator (see Figure 21 on page 29).

Flushing the System

1. Ensure that the supply and return riser shut-off valves are closed for each unit.

2. 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.

3. Ensure that all air is bled from the system by cracking each air vent.

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

4. When all the air is vented and the water is circulating under pressure, check the entire system for leaks. Repair the leaks as required.

5. To raise the temperature to approximately 85.0°F, set the loop temperature controls. Visually check for any leaks that may have occurred due to the increased heat. Repair the leaks as required.

6. Connect hoses to each unit's supply and return riser shutoff valve.

   a. Hold these hoses over the cabinet drain pan (verify the cabinet p-trap is connected to the building drain) or suitable building drain.

   b. Flush each return and supply shutoff valve separately until water runs clear.

   c. Close each shutoff valve.

7. Open the drain at the lowest point in the system.

   The make-up water flow rate must be equal to the rate of drain bleed.

8. Continue to bleed the system for at least two hours. If the water leaving the drain has not yet cleared, continue bleeding.

9. Completely drain the piping system.

FIGURE 21 - POSITION THE BLACK COVER

4. Secure the red cover back over the actuator assembly.

5. Ensure the plastic tabs are secured to the metal body bracket.

6. Connect the quick-connect terminals and insert the damper assembly into the discharge collector box.

7. 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. Flushing the risers ensures a proper start-up and a continued efficient operation of the system (see Figure 22 on page 30).
Cleaning the System

1. After the initial flushing, chemically clean the system. Repeat the method in *Flushing the System on page 29* to re-fill 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.

   It is recommended that a professional water treatment company perform ongoing maintenance of 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.
### CABINET DIMENSIONS IN INCHES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>09–12</td>
<td>17</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>15–24</td>
<td>20</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>30–36</td>
<td>24</td>
<td>16</td>
<td>18</td>
</tr>
</tbody>
</table>

**NOTE:**

1. All measurements are in inches.
2. Optional Fresh Air option comes with 2-1/2 inch RA flange.
3. Optional front supply opening comes with 2-1/2 inch duct flange.
4. All other openings come with standard 1-inch duct flange.
5. Left and right hand versions shown.

**FIGURE 23 - FRESH AIR OPENING WITHOUT MOTORIZED DAMPER- LEFT HAND AND RIGHT HAND UNIT SHOWN**
SECTION 1 - INSTALLATION

CABINET DIMENSIONS IN INCHES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>09–12</td>
<td>17</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>15–24</td>
<td>20</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>30–36</td>
<td>24</td>
<td>16</td>
<td>18</td>
</tr>
</tbody>
</table>

1. All measurements are in inches.
2. Optional Fresh Air option comes with 4-1/4 inch RA flange.
3. Optional front supply opening comes with 4-1/4 inch duct flange.
4. All other openings come with standard 1-inch duct flange.
5. Left and right hand versions shown.

FIGURE 24 - FRESH AIR OPENING WITH MOTORIZED DAMPER- LEFT HAND AND RIGHT HAND UNIT SHOWN
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 on page 29.

Always use a backup wrench when installing hoses!

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

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). Previous-generation hose kits are NPT type (tapered thread). For more information, see Hoses on page 16.

HOSES MUST BE HAND TIGHTENED THEN FURTHER TIGHTENED NO MORE THAN 1/4 TURN. DO NOT APPLY EXCESSIVE FORCE!

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!

Installing Units with JIC Style (37° Flare) Valve Connection and Hoses

Factory supplied JIC flexible connection hoses come with a tapered end connection. No thread sealing tape should be required. Connect the hoses to the JIC fitting on the shut-off valves. Always use a backup wrench when tightening the hose to the valve fitting. Enable the hoses to hang free inside the cabinet.

Slide the chassis into place using the following steps. No thread sealant should be required.

1. Thread the swivel adapters into the JIC 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.

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

   2. Lift the front of the chassis. (See Figure 25.)

FIGURE 25 - LIFT THE CHASSIS FRONT
SECTION 1 - INSTALLATION

3. Align the 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 below.)

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 below.)

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

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 does not tip forward before removing the dolly. (See Figure 29 on page 35.)

![Figure 26 - Tilt the Chassis](LD23565)

![Figure 27 - Insert the Chassis](LD23566)

![Figure 28 - Pivot the Chassis](LD23567)
FIGURE 29 - SLIDE THE CHASSIS

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

7. Connect the supply hose to the chassis ‘Water In’ and supply riser shut-off. Connect the return hose to the chassis only and point the other end of the hose into the cabinet drain pan.

8. To allow water to fill and circulate through the chassis system, open the supply riser shut-off slightly. Improper priming of the circulation pump can result in pump damage.

9. Close the air vents and run the circulating pump to flush the loop.

10. Observe the stream of leaving water. Once a solid stream of water is established and there is no air remaining in the system, close the supply riser shut-off and connect the return hose to the riser shut-off. Ensure the hoses cannot be pinched before sliding the chassis into place.

When bleeding air from chassis system, ensure that return hose is inserted in cabinet drain pan properly. Do not fully open the supply riser. A steady stream of water is sufficient to force air through the chassis.

FIGURE 30 - CHECK THE CHASSIS ALIGNMENT

11. Without touching the flanges on either side, ensure the chassis’ alignment in the cabinet is centered in the cabinet opening. (See Figure 30 above.)

12. To complete the electrical connections to the chassis, use the two quick-connect mating plugs. The unit-mounted plug ends are located on the bottom of the control box.

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

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

15. If necessary, pull the chassis forward slightly. This ensures an adequate seal between the chassis and the service panel.

16. 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.

17. Install the service panel.

18. Install the RA panel into the drywall opening if not already installed. See Acoustic RA Panel on page 21. Secure the panel into the drywall with six screws.
START-UP CHECKLIST

VERTICAL STACKED HEAT PUMPS

VSCS SERIES HIGH EFFICIENCY
START-UP & PERFORMANCE CHECKLIST

JOB NAME: _____________________________________
JOB ADDRESS: _________________________________
INSTALLER: ____________________________________
CABINET MODEL #:  _____________________________
CHASSIS MODEL #:  _____________________________
CABINET SERIAL #:  _____________________________
CHASSIS SERIAL #:  _____________________________
LOCATION / ROOM # OF HEAT PUMP:  ______________
JOB #:  _________________________________________
DATE:  _________________________________________
INSTALLER'S ADDRESS:  _________________________
SERVICE TECHNICIAN:  __________________________

UNIT INFORMATION

CABINET MODEL #:  _____________________________
CABINET SERIAL #:  _____________________________
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
   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

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

<table>
<thead>
<tr>
<th>HEATING</th>
<th>COOLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coil Inlet (Dry Bulb)</td>
<td>°F</td>
</tr>
<tr>
<td>Coil Outlet (Dry Bulb)</td>
<td>°F</td>
</tr>
<tr>
<td>Coil Inlet (Wet Bulb)</td>
<td>°F</td>
</tr>
<tr>
<td>Coil Outlet (Wet Bulb)</td>
<td>°F</td>
</tr>
</tbody>
</table>

- 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.

<table>
<thead>
<tr>
<th>HEATING</th>
<th>COOLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>EWT:</td>
<td>°F</td>
</tr>
<tr>
<td>LWT:</td>
<td>°F</td>
</tr>
</tbody>
</table>

- 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.
SECTION 3 - 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 remaining 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, by a unit isolation pad or 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.
- 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 START-UP

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:
   - Water temperature leaving the heat exchanger is warmer than the entering water temperature (approximately 9.0–12.0°F).
   - The blower operation is smooth.
   - The compressor and blower amps are within the nameplate data values.
   - 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 five 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:
   - Warm air is detected at the supply register.
   - The water temperature decreases by approximately 5.0–9.0°F across the heat exchanger.
   - The blower and compressor operations are smooth with no frost observed in the refrigerant circuit.
10. Set the thermostat to maintain the space temperature.

11. Check all water connections for any leaks, including the condensate drain hose connections.

**SYSTEM LOOP TEMPERATURES**

Loop temperatures affect unit performance, power consumption (efficiency), maintenance and reliability, and noise levels. High entering water temperatures (EWT) in cooling mode above the rated conditions of 86.0°F EWT increase the power consumption and increase the compressor noise levels. A sustained operation above 100.0°F EWT can increase maintenance costs. Increased compressor noise can affect the occupancy comfort. The unit is designed to operate up to 110.0°F EWT for intermittent periods when high load conditions elevate the system loop temperatures.

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

During heating season, the maximum operating loop temperature is 90.0°F EWT. For optimal unit performance, it is recommended to maintain the system loop temperatures at or above the rated conditions of 68.0°F EWT. Lower loop temperatures result in lower efficiency and heating capacity. The minimum loop temperature is 40.0°F EWT.

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

Operating the unit below 40.0°F EWT can result in damage to the chassis circulation pump.

**TABLE 7 - OPERATING LIMITS**

<table>
<thead>
<tr>
<th></th>
<th>COOLING</th>
<th>HEATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINIMUM EWT</td>
<td>40.0°F</td>
<td>50.0°F</td>
</tr>
<tr>
<td>MAXIMUM EWT</td>
<td>110.0°F</td>
<td>90.0°F</td>
</tr>
</tbody>
</table>

**TABLE 8 - NOMINAL OPERATING GPM**

<table>
<thead>
<tr>
<th>CHASSIS</th>
<th>PUMP FLA (208-230/1)</th>
<th>PUMP FLOW RATE (WITH STRAINER)</th>
<th>PUMP FLOW RATE (NO STRAINER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSCS09</td>
<td>1/40</td>
<td>0.36 gpm</td>
<td>1.8 gpm</td>
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<td></td>
<td></td>
<td></td>
<td>1.9 gpm</td>
</tr>
<tr>
<td>VSCS12</td>
<td>1/25</td>
<td>0.46 gpm</td>
<td>2.7 gpm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.8 gpm</td>
</tr>
<tr>
<td>VSCS15</td>
<td>1/25</td>
<td>0.46 gpm</td>
<td>2.8 gpm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.9 gpm</td>
</tr>
<tr>
<td>VSCS18</td>
<td>1/25</td>
<td>0.46 gpm</td>
<td>3.0 gpm</td>
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<td></td>
<td></td>
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<td>5.6 gpm</td>
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<tr>
<td>VSCS30</td>
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<td>VSCS36</td>
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<td>7.9 gpm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8.1 gpm</td>
</tr>
</tbody>
</table>

**NOTES**

1. Published GPM rates are nominal values taken at 68.0°F, standard hose lengths, and chassis piping configuration. Actual flow rates are affected by water temperature and possible field alterations to the chassis piping system.

2. Limit the stub-out extensions on the satellite side riser to a maximum of 24 inches and no 90° elbows.

3. Adding excessive pressure drop by means of field alterations to the piping system results in lower water flow of the pump.
FAN SPEED ADJUSTMENT

Multi-speed direct drive motors are used in all units as standard. PSC fan motors have a minimum of three selectable speeds and EC motors (ECMs) have five speeds. However, only two speeds are recommended and selected for use.

Optional ECMs increase operating efficiency by consuming fewer watts than standard PSC motors. Motors are factory programmed and cannot be reprogrammed 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. For factory blower speed settings and minimum operating airflow, see Table 9 on page 41, Table 10 on page 41, Table 11 on page 42, Table 12 on page 42, and Table 13 on page 43.

![CAUTION]

Operating 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 enables 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 an operation with sufficient heating and cooling airflow. Excessive ductwork static pressure will result in an improper volume of airflow. High airflow volumes will result in elevated noise levels and may affect occupancy comfort.

![DANGER]

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 on page 13. 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 outlet of the condenser.

2. Subtract it from the saturation temperature for the corresponding discharge pressure.
### Table 9 - PSC Standard Blower Performance (CFM)

<table>
<thead>
<tr>
<th>CFM</th>
<th>0.0</th>
<th>0.5</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIN.</td>
<td>0.05</td>
<td>0.1</td>
<td>0.15</td>
<td>0.2</td>
<td>0.25</td>
<td>0.3</td>
<td>0.35</td>
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<tr>
<td>RATED</td>
<td>0.4</td>
<td>0.5</td>
<td>0.6</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>UNIT</td>
<td>CFM</td>
<td>CFM</td>
<td>CFM</td>
<td>CFM</td>
<td>CFM</td>
<td>CFM</td>
<td>CFM</td>
</tr>
</tbody>
</table>

### Table 10 - PSC High Static Blower Performance (CFM)

<table>
<thead>
<tr>
<th>CFM</th>
<th>0.0</th>
<th>0.5</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIN.</td>
<td>0.05</td>
<td>0.1</td>
<td>0.15</td>
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**NOTE:**
- CFM: Cubic Feet per Minute
- MOTOR: Motor Size
- ECM: External Motor Characteristics
- STANDARD BLOWER PERFORMANCE (CFM): Standard Blower Performance (CFM)
- LOW STATIC BLOWER PERFORMANCE (CFM): Low Static Blower Performance (CFM)

**ISSUE DATE:** 06/17/2020
### TABLE 14 - PSC - STANDARD BLOWER

<table>
<thead>
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### TABLE 15 - PSC - OPTIONAL HI-STATIC BLOWER

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### TABLE 16 - PSC - STANDARD BLOWER (265 VOLT)

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### TABLE 17 - PSC - OPTIONAL HI-STATIC BLOWER (265 VOLT)

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### TABLE 19 - ECM - OPTIONAL HI-STATIC BLOWER

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### TABLE 20 - ECM - STANDARD BLOWER (265 VOLT)

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### TABLE 21 - ECM - OPTIONAL HI-STATIC BLOWER (265 VOLT)

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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. The lockout circuit provides a 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.
  - Loss-of-charge/low pressure limit switch
  - High pressure limit switch
  - Freeze protection thermostat, unit shutdown on low leaving water temperature
  - Condensate overflow protection switch
- The unit operates with conventional thermostat designs and has a low voltage terminal strip for easy hook-up.
- The unit control board has an onboard diagnostics and fault code display.
- The standard controls include an 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 are not lost in the event of a power loss.

Sequence of Operation

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

A 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 & 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 operating, the cooling system halts and ends the call for cooling.

Continuous Blower

With the room thermostat fan switch set to AUTO and the system switch is 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 met, it de-energizes Y1. If the compressor meets 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 time for fan off delay 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, a freeze-stat trip. The anti-short cycle delay (ASCD) must elapse.

Safety Control Reset

All VSCS heat pumps include the following:

- A high pressure protection switch
- A low pressure control switch
- A low water temperature protection switch
- A 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 the 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.

If the unit must be reset more than twice on consecutive operating cycles, check the unit for a dirty filter, an abnormal entering water temperature, an inadequate or excessive water flow, or a refrigerant circuit malfunction. If the unit continues to fail, 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 (a soft lockout). At the conclusion of the ASCD, if a call for cooling or heating is still present, 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 the OFF position, then back to either heating or cooling as required. The microprocessor control flashes a fault code indicating the high pressure lockout (see Table 22 on page 48).

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 (closed during the 30 second monitoring 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 at the end of 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 22 on page 48).

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 at the conclusion of 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:

- A suction line freeze-stat to protect against low leaving water temperatures (opens at 34.0°F and resets at 48.0°F).
- A high pressure limit switch to protect against excessive discharge pressures (opens at 600 psig ±25 psig).
- A low pressure limit switch to protect against loss of refrigerant charge (opens at 68 psig ±5 psig).
- A condensate overflow switch to protect against condensate overflow.
**Coaxial Freeze Protection Set Point**

The field can select the coaxial freeze protection set point. The unit uses a suction line freeze-stat factory set for compressor lockout when the leaving water temperature drops below 35.0°F (resets at 48.0°F). To lower the set point for low temperature heating applications with an adequate water-antifreeze solution, unplug the freeze-stat sensor (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 a heating operation with a leaving water 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 a time delay of 4 minutes and a random delay of 1 to 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 compressor's 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 energizes. 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 heartbeat. 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 22 on page 48.

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

1. **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.

2. **Test Reset:** When this button is pressed and released one time with five seconds, any ASCD is bypassed for one cycle.

3. **Comm Set UP:** If the board is to be networked with other units, this button sets the network address.

   The first time the button is pressed within 5 seconds, it scans the bus, assigns itself the first available address (starting at 2), then flashes that address once. Pressing the button twice in 5 seconds causes the control to flash the address.

<table>
<thead>
<tr>
<th>TABLE 22 - FLASH CODES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Steady</td>
<td>Control Failure – Replace Control</td>
</tr>
<tr>
<td>Heartbeat</td>
<td>Normal Operation</td>
</tr>
<tr>
<td>2 Flashes</td>
<td>Control Waiting on Anti-Short Cycle Delay (ASCD)¹</td>
</tr>
<tr>
<td>3 Flashes</td>
<td>HPS1 – Compressor Lockout</td>
</tr>
<tr>
<td>5 Flashes</td>
<td>LPS1 – Compressor Lockout</td>
</tr>
<tr>
<td>13 Flashes</td>
<td>Compressor Held OFF Due to Low Voltage¹</td>
</tr>
<tr>
<td>14 Flashes</td>
<td>EEPROM Storage Failure (Control Failure)</td>
</tr>
<tr>
<td>15 Flashes</td>
<td>Condensate Overflow Switch – Compressor Lockout</td>
</tr>
<tr>
<td>16 Flashes</td>
<td>Coaxial Freeze Thermostat – Compressor Lockout</td>
</tr>
</tbody>
</table>

**NOTE**

1. These flash codes do not represent alarms.

**Communication**

The communication protocol is Modbus™ using the RTU method of packet framing at 19200-baud rate.
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SECTION 4 - MAINTENANCE

Unit maintenance is simplified by the following preventive suggestions:

- At least once a month, visually inspect the unit. Pay special attention to the hose assemblies. Note any signs of hose deterioration or cracking. Immediately attend to any sign of minor leakage.

- At least every three months, to ensure proper operation of the equipment, inspect the filters. Replace the filters when there is a visible buildup of dirt.

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

- 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.

- Annually check the fan motor and blower assembly. All units employ permanently lubricated fan motors. DO NOT OIL THE FAN MOTORS. Vacuum any accumulation of dirt from the motor ventilation slots and the blower wheel.

- Annually, check the contactors and relays within the control panel. Inspect the panel for any visible signs of overheated contacts or temperature damage to the wiring. Check the terminals for tightness.

- 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 a premature physical motor failure.

- At least once a year, inspect the air-to-refrigerant heat exchanger surface. A dirty or partially clogged coil can significantly reduce the 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.

- Inspect hoses, valves, and connections for water leaks. For hose connection leaks, inspect the rubber hose gaskets and replace them as required.

### TABLE 23 - WATER QUALITY TABLE

<table>
<thead>
<tr>
<th>POTENTIAL PROBLEM</th>
<th>CONTROLLED CHEMICAL/CONDITION</th>
<th>COPPER COAXIAL HEAT EXCHANGERS RANGE</th>
<th>CUPRO-NICKEL COAXIAL HEAT EXCHANGERS RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EROSION</td>
<td>Cleaning</td>
<td>Proper surface cleaning required</td>
<td>Proper surface cleaning required</td>
</tr>
<tr>
<td></td>
<td>Filtration</td>
<td>Best practice filtration</td>
<td>Best practice filtration</td>
</tr>
<tr>
<td></td>
<td>Suspended Solids</td>
<td>Less than 10 ppm</td>
<td>Less than 10 ppm</td>
</tr>
<tr>
<td></td>
<td>Water Velocity</td>
<td>Less than 8 ft/s</td>
<td>Less than 12 ft/s</td>
</tr>
<tr>
<td>BACTERIA/ MOLD</td>
<td>Iron Bacteria</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Iron Oxide</td>
<td>Less than 1 ppm</td>
<td>Less than 1 ppm</td>
</tr>
<tr>
<td>SCALING</td>
<td>Calcium &amp; Magnesium Carbonate</td>
<td>Less than 350 ppm</td>
<td>Less than 350 ppm</td>
</tr>
<tr>
<td>CORROSION</td>
<td>pH Range</td>
<td>7 to 9</td>
<td>5 to 9</td>
</tr>
<tr>
<td></td>
<td>TDS (Total Dissolved Solids)</td>
<td>Less than 1000 ppm</td>
<td>Less than 1500 ppm</td>
</tr>
<tr>
<td></td>
<td>Ammonia, Ammonium Hydroxide</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
</tr>
<tr>
<td></td>
<td>Ammonium Nitrate, Ammonium Chloride</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
</tr>
<tr>
<td></td>
<td>Calcium Chloride/Sodium Chloride</td>
<td>Less than 125 ppm</td>
<td>Less than 125 ppm</td>
</tr>
<tr>
<td></td>
<td>Chlorine</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
</tr>
<tr>
<td></td>
<td>Hydrogen Sulfide</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
APPENDIX

VSCS SERIES: 208-230V/1Ph/60Hz
265V/1Ph/60Hz

FIGURE 33 - PSC MOTOR WIRING DIAGRAM
VSCS SERIES w/ ECM MOTOR
208-230V, 265V/1Ph/60Hz

LEGEND:
S2 = FAN SPEED SWITCH
C1 = COMPRESSOR CONTACOR
TRF = 24V CONTROL TRANSFORMER
COMP = COMPRESSOR MOTOR
ECM = EVAP. ECM FAN MOTOR
Rev = REVERSING VALVE RELAY
CFT = COAXIAL FREEZE THERMOSTAT
HPC = HIGH PRESSURE SWITCH
LPC = LOW PRESSURE SWITCH
SV = REVERSING VALVE COIL
COS = CONDENSATE OVERFLOW SWITCH
MB = MICROPROCESSOR BOARD
F6 = TRANSFORMER SECONDARY FUSE

OPTIONAL:
TB1 = LINE VOLTAGE TERMINAL BLOCK
MV = MOTORIZED VALVE
S1 = LINE VOLTAGE DISCONNECT
F1 = LINE VOLTAGE FUSES
WP = WATER PUMP

FIGURE 34 - ECM WIRING DIAGRAM

STK-554-WP

LD23572
VSCS SERIES w/ ECM MOTOR; 208-230V/1Ph/60Hz
265V/1Ph/60Hz

FIGURE 35 - CONTINUOUS FAN WITH ECM WIRING DIAGRAM
FIGURE 36 - MOTORIZED DAMPER ECM WIRING DIAGRAM
FIGURE 37 - ECM WITH 3 SPEED FAN MOTOR

APPENDIX

208-230V, 265V, 1Ph/60Hz
VS6 SERIES ECM MOTOR 3 SPEED
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.
See Section 1 - Installation for specific installation requirements.

- R-410A refrigerant operates at 50–70% higher pressures than R-22. Ensure that servicing equipment and replacement components are designed to operate with R-410A.
- 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.
- Do not use R-410A service equipment on R-22 systems. All hoses, gages, 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 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 can only be used with POE type oils.
- POE type oils rapidly absorb moisture from the atmosphere.
- Vacuum pumps will not remove moisture from POE type oils.
- Do not use liquid line driers with a rated 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 system to atmosphere when under vacuum.
- If system must be opened for service, evacuate system then break the vacuum with dry nitrogen and replace filter driers.