

**COMMERCIAL**  
TRANQUILITY® (SL) LOW-PROFILE SERIES

# INSTALLATION, OPERATION & MAINTENANCE MANUAL

Part#: 97B0075N44 | Revised: October 3, 2025

Models: SL 06-15  
60Hz – R-454B



Models:  
SL  
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# Model Nomenclature

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1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |  
| S | L | A | L | O | 6 | A | G | C | P | O | S | P | T | S |

**MODEL**

S = R-454B Refrigerant

**MODEL TYPE**

L = Horizontal Low-Profile Series

**SUPPLY  
CONFIGURATION**

| Horizontal Configuration |                       |                |
|--------------------------|-----------------------|----------------|
| A                        |                       | 8 x 6          |
| B                        | Straight<br>+<br>Back | 12 x 6         |
| C                        |                       | 24 x 6         |
| D                        |                       | 8 x 7 + 7 x 6  |
| E                        |                       | 16 x 6 + 7 x 6 |
| F                        |                       | 24 x 6 + 7 x 6 |
| G                        | Back                  | 7 x 6          |
| O                        | Field Configured      | -              |

**RETURN  
CONFIGURATION**

L = Left  
R = Right

**SIZE**

06 12  
09 15

**REVISION**

A = Current

**VOLTAGE**

G = 208/230-1-60  
E = 265-1-60

**CONTROLS**

| Control              | Standard | MPC |
|----------------------|----------|-----|
| CXM2                 | C        | N   |
| CXM2 with Disconnect | W        | R   |

**STANDARD**

S = Standard

**BLOWER MOTOR**

T = Constant Torque  
Electronically Commuted (OT EC)

**FUTURE USE**

O = Standard

**FLOW SWITCH/HEAT EXCHANGER OPTIONS**

| Air Coil   | Standard Flow Switch | High Pressure E Flow Switch |
|------------|----------------------|-----------------------------|
| Non-Coated | S                    | 5                           |
| Tin-Coated | R                    | 6                           |
| E-Coated   | E                    | 7                           |

**WATER/HEAT EXCHANGER OPTIONS**

| Water Option                                               | ID |
|------------------------------------------------------------|----|
| None                                                       | 0  |
| Motorized Water Valve                                      | M  |
| Internal Secondary Pump                                    | 7  |
| Autoflow Regulator (2.5 GPM/ton)                           | A  |
| Autoflow Regulator (3.0 GPM/ton)                           | F  |
| Motorized Water Valve and Autoflow Regulator (2.5 GPM/ton) | W  |
| Motorized Water Valve and Autoflow Regulator (3.0 GPM/ton) | T  |

**CABINET**

| Cabinet        | UltraQuiet <sup>1</sup> | Frame |    |
|----------------|-------------------------|-------|----|
|                |                         | 1"    | 2" |
| Extended Range | No                      | K     | A  |
|                | Yes                     | M     | C  |
| Standard Range | No                      | P     | E  |
|                | Yes                     | S     | G  |

Use ClimateMaster's selection software at <https://ccgencompass.climatecontrolgroup.com/main> to configure your Tranquility SL model.

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## Attentions, Cautions, and Warnings

### SAFETY

Warnings, cautions, and notices appear throughout this manual. Read these items carefully before attempting any installation, service, or troubleshooting of the equipment.

**DANGER:** Indicates an immediate hazardous situation, which if not avoided will result in death or serious injury. DANGER labels on unit access panels must be observed.

**WARNING:** Indicates a potentially hazardous situation, which if not avoided could result in death or serious injury.

**CAUTION:** Indicates a potentially hazardous situation or an unsafe practice, which if not avoided could result in minor or moderate injury or product or property damage.

**NOTICE:** Notification of installation, operation, or maintenance information, which is important, but which is not hazard-related.

#### ⚠ WARNING



Disconnect power supply(ies) before servicing. Refer servicing to qualified service personnel. Electric shock hazard. May result in injury or death!

#### ⚠ WARNING

To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must be serviced only by technicians who meet local, state, and federal proficiency requirements.

#### ⚠ WARNING

The installation of water-source heat pumps and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

#### ⚠ WARNING

The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).

#### ⚠ WARNING

An unventilated area where the appliance using FLAMMABLE REFRIGERANTS is installed shall be so constructed that should any refrigerant leak, it will not stagnate so as to create a fire or explosion hazard.

#### ⚠ WARNING

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

#### ⚠ WARNING

Auxiliary devices which may be a POTENTIAL IGNITION SOURCE shall not be installed in the duct work. Examples of such POTENTIAL IGNITION SOURCES are hot surfaces with a temperature exceeding 1,292°F (700°C).

#### ⚠ WARNING

An unventilated area where a water-source heat pump is installed and surpasses a R-454B refrigerant charge of 62 oz (1.76 kg), shall be without continuously operating open flames (for example an operating gas appliance) or other POTENTIAL IGNITION SOURCES (for example, an operating electric heater, hot surfaces).

#### ⚠ WARNING

Only auxiliary electric heaters approved by ClimateMaster shall be installed in connecting ductwork. The installation of any other auxiliary devices is beyond ClimateMaster's responsibility.

#### ⚠ WARNING

For mechanical ventilation, the lower edge of the air extraction opening where air is exhausted from the room shall not be more than 3.94 inches (100 mm) above the floor. The location where the mechanical ventilation air extracted from the space is discharged shall be separated by a sufficient distance, but not less than 9.84 feet (3 m), from mechanical ventilation air intake openings, to prevent recirculation to the space.

#### ⚠ WARNING

Children being supervised are NOT to play with the appliance.

#### ⚠ WARNING

If unit connected via an air duct system to one or more rooms with R-454B is installed in a room with an area less than Amin or has an Effective Dispersal Volume less than minimum, that room shall be without continuously operating open flames or other POTENTIAL IGNITION SOURCES. A flame-producing device may be installed in the same space if the device is provided with an effective flame arrest.

#### ⚠ WARNING

All refrigerant discharged from this unit must be recovered WITHOUT EXCEPTION. Technicians must follow industry accepted guidelines and all local, state, and federal statutes for the recovery and disposal of refrigerants. If a compressor is removed from this unit, refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, refrigerant lines of the compressor must be sealed after it is removed.

#### ⚠ WARNING

Do not pierce or burn.

#### ⚠ WARNING

Be aware that refrigerants may not contain odor.

## Attentions, Cautions, and Warnings

### CAUTION

DO NOT store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move and store units in an upright position. Tilting units on their sides will cause equipment damage.

### CAUTION

CUT HAZARD - Failure to follow this caution may result in personal injury. Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing heat pumps.

### CAUTION

To avoid equipment damage, DO NOT use these units as a source of heating or cooling during the construction process. The mechanical components and filters can quickly become clogged with construction dirt and debris, which may cause system damage and void product warranty.

### CAUTION

All three phase scroll compressors must have direction of rotation verified at startup. Verification is achieved by checking compressor Amp draw. Amp draw will be substantially lower compared to nameplate values. Additionally, reverse rotation results in an elevated sound level compared to correct rotation. Reverse rotation will result in compressor internal overload trip within several minutes. Verify compressor type before proceeding.

### NOTICE

Servicing shall be performed only as recommended by the manufacturer.

### NOTICE

REFRIGERANT SENSORS for REFRIGERANT DETECTION SYSTEMS shall only be replaced with sensors specified by the appliance manufacturer.

### NOTICE

An unconditioned attic is not considered natural ventilation.

### NOTICE

This unit is equipped with electrically powered safety measures. To be effective, the unit must be electrically powered at all times after installation, other than when servicing.

### NOTICE

For installation only in locations not accessible to the general public.

### NOTICE

LEAK DETECTION SYSTEM installed. Unit must be powered except for service.

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## General Information

### INSPECTION

Upon receipt of the equipment, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the packaging of each unit, and inspect each unit for damage. Ensure that the carrier makes proper notation of any shortages or damage on all copies of the freight bill and completes a common carrier inspection report. Concealed damage not discovered during unloading must be reported to the carrier within 15 days of receipt of shipment. If not filed within 15 days, the freight company can deny the claim without recourse.

**NOTE: It is the responsibility of the purchaser to file all necessary claims with the carrier. Notify your equipment supplier of all damage within 15 days of shipment.**

### STORAGE

Equipment should be stored in its original packaging in a clean, dry area. Store units in an upright position at all times. You may stack vertical configurations a maximum of two units high and horizontal configurations a maximum of three units high.

### UNIT PROTECTION

Cover units on the job site with either the original packaging or an equivalent protective covering. Cap the open ends of pipes stored on the job site. In areas where painting, plastering, and/or spraying has not been completed, all due precautions must be taken to avoid physical damage to the units and contamination by foreign material. Physical damage and contamination may prevent proper startup and may result in costly equipment cleanup.

Examine all pipes, fittings, and valves before installing any of the system components. Remove any dirt or debris found in or on these components.

### PRE-INSTALLATION

Installation, Operation, and Maintenance instructions are provided with each unit. Horizontal equipment is designed for installation above false ceiling or in a ceiling plenum. Other unit configurations are typically installed in a mechanical room. The installation site chosen should include adequate service clearance around the unit. Before unit startup, read all manuals and become familiar with the unit and its operation. Thoroughly check the system before operation.

### PREPARE UNITS FOR INSTALLATION AS FOLLOWS:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped
2. Keep the cabinet covered with the original packaging until installation is complete and all plastering, painting, etc. is finished
3. Verify refrigerant tubing is free of kinks or dents and that it does not touch other unit components
4. Inspect all electrical connections. Connections must be clean and tight at the terminals
5. Remove any blower support packaging (water-to-air units only)
6. Some airflow patterns are field convertible (horizontal units only). Locate the airflow conversion section of this IOM
7. Locate and verify any hot water generator (HWG) hanger, or other accessory kit located in the compressor section or blower section

### CHECKS TO THE AREA

Prior to beginning work on systems containing FLAMMABLE REFRIGERANTS, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the REFRIGERATING SYSTEM, these steps shall be completed prior to conducting work on the system.

#### Work Procedure

Work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.

#### General Work Area

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

#### Checking for Presence of Refrigerant

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.

## General Information

### Presence of Fire Extinguisher

If any hot work is to be conducted on the refrigeration equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO<sub>2</sub> fire extinguisher adjacent to the charging area.

### No Ignition Sources

No person carrying out work in relation to a REFRIGERATION SYSTEM which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. "No Smoking" signs shall be displayed.

### Ventilated Area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

### Checks to the Refrigeration Equipment

The following checks shall be applied to installations using FLAMMABLE REFRIGERANTS:

- The actual REFRIGERANT CHARGE is in accordance with the room size within which the refrigerant containing parts are installed
- The ventilation machinery and outlets are operating adequately and are not obstructed
- If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant

- Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected
- Refrigerant piping or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded

### Checks to Electrical Devices

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.

Initial safety checks shall include:

- Capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking
- That no live electrical components and wiring are exposed while charging, recovering, or purging the system
- That there is continuity of earth bonding

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## General Information

### REPAIR TO INTRINSICALLY SAFE COMPONENTS

Intrinsically safe components must be replaced.

### CABLING

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

### REQUIRED AREA FOR INSTALLATION

The minimum room area of the space ( $A_{min}$ ) or a minimum room area of conditioned space ( $TA_{min}$ ) shall be corrected for unit's location altitude by multiplying  $A_{min}$  or  $TA_{min}$  by the applicable altitude adjustment factor (AF) for building ground-level altitude ( $H_{air}$ ) in feet or meters, as shown in the **Altitude Adjustment** table.

**NOTE:**

- You can use Imperial or Metric measurements to calculate  $A_{min}$  or  $TA_{min}$ .
- The maximum allowable altitude of installation for this product is 6,561 ft (2,000 m).

**Table 1: Altitude Adjustment**

| $H_{air}$ ft (m) | AF   |
|------------------|------|
| 0 (0)            | 1.00 |
| 656 (200)        | 1.00 |
| 1,312 (400)      | 1.00 |
| 1,968 (600)      | 1.00 |
| 2,624 (800)      | 1.02 |
| 3,280 (1,000)    | 1.05 |
| 3,937 (1,200)    | 1.07 |
| 4,593 (1,400)    | 1.10 |
| 5,249 (1,600)    | 1.12 |
| 5,905 (1,800)    | 1.15 |
| 6,561 (2,000)    | 1.18 |

# Refrigerant System Servicing

## REFRIGERANT SYSTEM

To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Reference the operating charts for pressures and temperatures. Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

### Removal and Evacuation

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

- Safely remove refrigerant following local and national regulations
- Evacuate
- Purge the circuit with Inert gas
- Evacuate
- Continuously flush or purge with Inert gas when using flame to open circuit
- Open the circuit

The refrigerant charge shall be recovered into the correct recovery cylinders. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, refrigerant purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for FLAMMABLE REFRIGERANT). This process shall be repeated until no refrigerant is remains in the system (optional for FLAMMABLE REFRIGERANT). When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

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

### Charging Procedures

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

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

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

### Leak Detection

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

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

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

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

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## Refrigerant System Servicing

### NOTE:

Examples of leak detection fluids are:

- Bubble method
- Fluorescent method agents

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

If a refrigerant leak that requires brazing is identified, all of the refrigerant shall be recovered from the system, or isolated (by means of shutoff valves) in a part of the system remote from the leak. Removal of refrigerant shall be according to Removal and Evacuation section.

### DECOMMISSIONING

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

1. Become familiar with the equipment and its operation
2. Isolate system electrically
3. Before attempting the procedure, ensure that:
  - Mechanical handling equipment is available, if required, for handling refrigerant cylinders
  - All personal protective equipment is available and being used correctly
  - The recovery process is supervised at all times by a competent person
  - Recovery equipment and cylinders conform to the appropriate standards

4. Pump down refrigerant system, if possible
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system
6. Make sure that cylinder is situated on the scales before recovery takes place
7. Start the recovery machine and operate in accordance with instructions
8. Do not overfill cylinders (no more than 80% volume liquid charge)
9. Do not exceed the maximum working pressure of the cylinder, even temporarily
10. When the cylinders have been filled correctly and the process completed, ensure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off
11. Recovered refrigerant shall not be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked

**Labeling** - Upon decommissioning, equipment shall be labeled stating that it has been decommissioned and emptied of refrigerant. The label shall be dated and signed.

## Refrigerant System Servicing

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### RECOVERY

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shutoff valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.

The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

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

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# Physical Data

## Tranquility (SL) Series

| Model                          | SL06         | SL09  | SL12 | SL15  |
|--------------------------------|--------------|-------|------|-------|
| Number of refrigerant circuits | 1            | 1     | 1    | 1     |
| Factory Charge R-454B (oz)     | 15           | 16    | 21   | 26    |
| Water Connection Size          |              |       |      |       |
| FPT                            | 1/2"         |       |      |       |
| Water Volume (gallons)         | 0.037        | 0.042 |      | 0.049 |
| Horizontal                     |              |       |      |       |
| Filter Standard - 1" Throwaway | 8.5 x 28 x 1 |       |      |       |
| Filter Standard - 1" Throwaway | 8.5 x 28 x 2 |       |      |       |
| Weight - Operating (lbs.)      | 145          | 146   | 152  | 159   |
| Weight - Packaged (lbs.)       | 185          | 186   | 192  | 199   |

**Notes:**

- All dimensions displayed above are in inches unless otherwise marked.
- All units have TXV and ½-inch and ¾-inch electrical knockouts.
- The standard Condensate Drain Connection is a rubber coupling that couples to ¾-inch schedule 40/80 PVC.
- The stainless steel condensate drain connection is 1/2-inch FPT.
- FPT=Female Pipe Thread
- O = Optional, R = Required

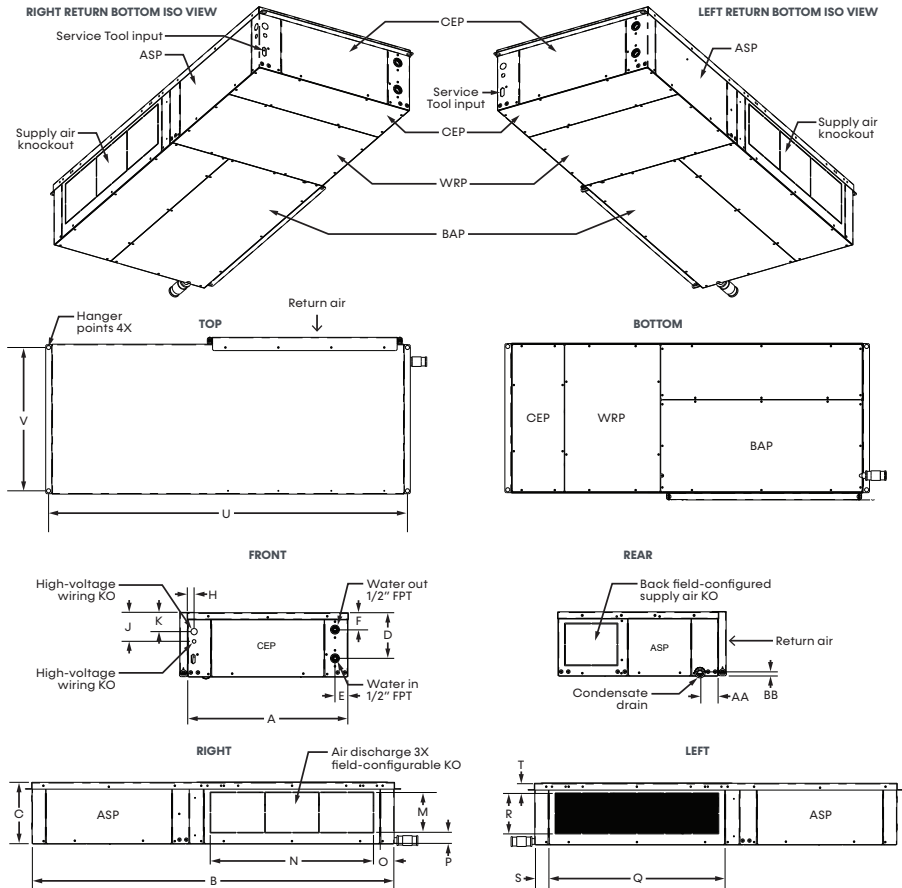
1. Packaged weight is based on a standard unit without water options with a single pallet.

## Maximum Working Water Pressure

| Option                               | Max Pressure PSIG [kPa] |
|--------------------------------------|-------------------------|
| Base Unit                            | 300 [2,068]             |
| Internal Secondary Pump (ISP)        | 200 [1,379]             |
| Internal Motorized Water Valve (MWV) | 300 [2,068]             |
| Internal Auto Flow Valve             | 300 [2,068]             |
| 20 Mesh Y Strainer Valve             | 300 [2,068]             |
| Flow switch - Low Tier               | 145 [1,000]             |
| Flow switch - High Tier              | 300 [2,068]             |

# Installation Dimensions

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## NOTES

- While clear access to all removable panels is not required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
- Units shipped with filter frames with duct mounting collar for connection to return air duct connection.
- Hanger brackets are designed into the top panel of the unit. Units are provided with a 1/2-inch MPT condensate connection. There is also a condensate connection kit provided in the unit which contains a flexible coupling that can be used to connect to 3/4-inch PVC or 1-inch Copper.
- Blower service access can be from the bottom, side, or top. Bottom blower access allows blower assembly to be dropped, disconnected, and removed for servicing.
- An installation kit that includes the hanger hardware and condensate coupling is attached the unit side access panel. Remove before installing.
- ASP are removable panels that provide additional access to the units interior. Clear access to ASP panels is not required and they are not to be used in place of the mandatory CEP, WRP, or BAP panels.

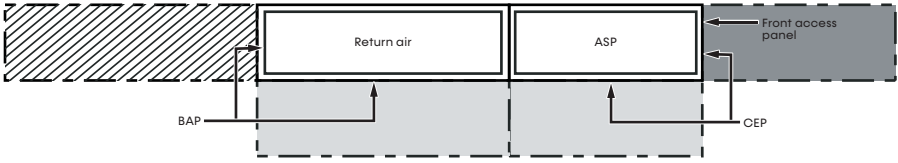
## LEGEND

CEP = Controls and electrical service panel  
BAP = Blower, air coil, and drain service panel  
WRP = Water and refrigerant service panel  
ASP = Additional service panel (not required)\*

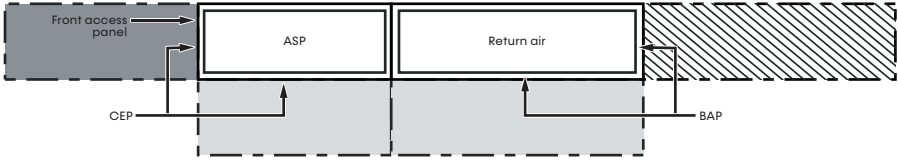
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## Installation Service Access

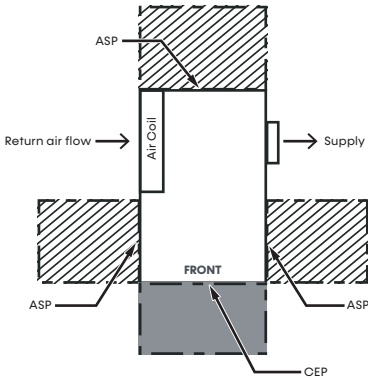
CEILING HUNG - LEFT RETURN STRAIGHT DISCHARGE



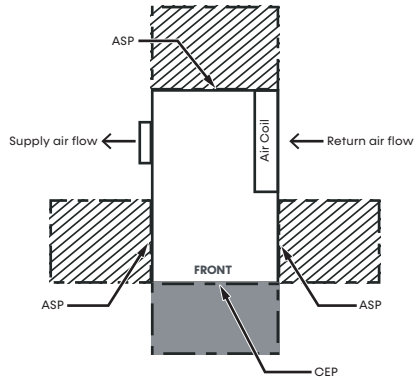
CEILING HUNG - RIGHT RETURN STRAIGHT DISCHARGE



TOP VIEW - LEFT RETURN STRAIGHT DISCHARGE



TOP VIEW - RIGHT RETURN STRAIGHT DISCHARGE



### NOTES

- While clear access to all removable panels is not required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
- CEP and BAP requires 2-foot bottom service access. CEP requires 2-foot front service access as well. Ceiling mounted service access doors are acceptable. BAP side service access is optional.
- ASP are removable panels that provide additional access to the units interior. Clear access to ASP panels is not required and they are not in place of the mandatory CEP and BSP panels.
- For back discharge configurations, supply air is delivered to the back of the unit (side opposite of the controls) and all blower service access is from the bottom. Not all sizes are available in back discharge only. Please see the Ductwork Installation section for details.
- For back and straight combined discharge configurations, all blower service access panels are on the bottom.

### LEGEND

CEP = Controls and electrical service panel  
BAP = Blower, air coil, and drain service panel  
WRP = Water and refrigerant service panel  
ASP = Additional service panel (not required)\*

- Mandatory 1-foot service access (front access service should be increased if external pumps, valves, etc. are applied)
- Mandatory 1-foot service access
- Optional 2-foot service access

## Service Access

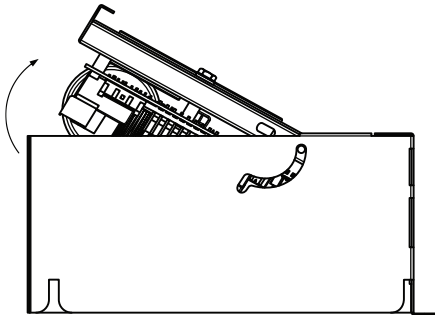
Models:  
SL  
06-15

The SL series is unique to ClimateMaster products in the way installers and service technicians interface with the unit. Traditionally for horizontal products, unit controls and electrical connections are accessed from the unit's front access panel, blowers are accessed through the side or back panel, and water/refrigerant circuit repairs require the unit to be brought down from the ceiling installation.

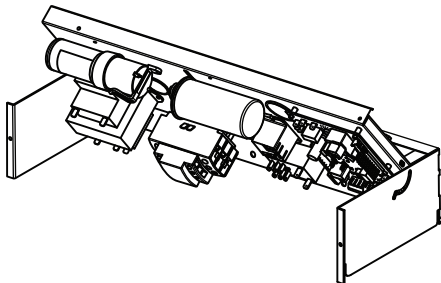
On SL products the unit controls, electrical components, water components/circuit, refrigeration components/circuit, optional power disconnect, service tool connection, drain pan, air coil, air filter, and blower motor can be accessed from the bottom of the unit. See the **Control Box Rotation - Side View** and **Control Box Rotation - Front ISO View** figures for reference. This greatly increases accessibility to internal components for maintenance and troubleshooting while the unit is installed in the ceiling.

The product is also designed for traditional access. The unique control box design ships from ClimateMaster facing down for bottom access. You can reposition the control box in the field for front access. This allows those who interface with the product to access the unit controls from the bottom or the front of the unit. See the following figures for details.

**Figure 1: Control Box Rotation - Side View**



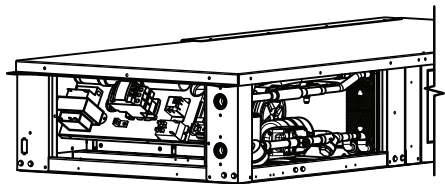
**Figure 2: Control Box Rotation - Front ISO View**



If the unit requires tabletop service on the control box, the Tranquility SL is designed with a rotation feature that enables installers or service technicians to interact with the control panel from the front of the unit. Use the following steps to convert the control box for tabletop service:

1. Remove the top and front access panels from the unit
2. Remove the two screws that secure the control panel
3. Rotate the control panel then lock it at 45 degrees with the pivotal element on the right side of the panel control support

**Figure 3: Control Box - Tabletop Position**



The entire blower assembly can be removed from the bottom of the unit. The unit includes a built-in safety latch to prevent the blower assembly from dropping when the bottom blower access panel is removed. Remove the screw and pull back on the latch to slide the blower assembly down. The design permits the assembly to rest on a service rail where the technician may service the motor or remove the whole assembly by disconnecting one electrical quick connector.

You can access the condensate drain pan for service or removal from the bottom of the unit. Use the following steps to remove the condensate drain pan:

4. Remove the external condensate line connection
5. Remove the drain pan access panel
6. Remove the condensate sensor clip from the pan and set it to the side
7. Remove the drain pan set screw located next to the compressor side of the unit
8. Hold the drain pan and slide it towards the back of the unit until the condensate pan is pushed all the way against the back access panel
9. Allow the opposite side of the pan to drop down and then slowly slide the drain pan down allowing the drain pan nipple to be pulled through the access panel opening without damaging the connection threads.

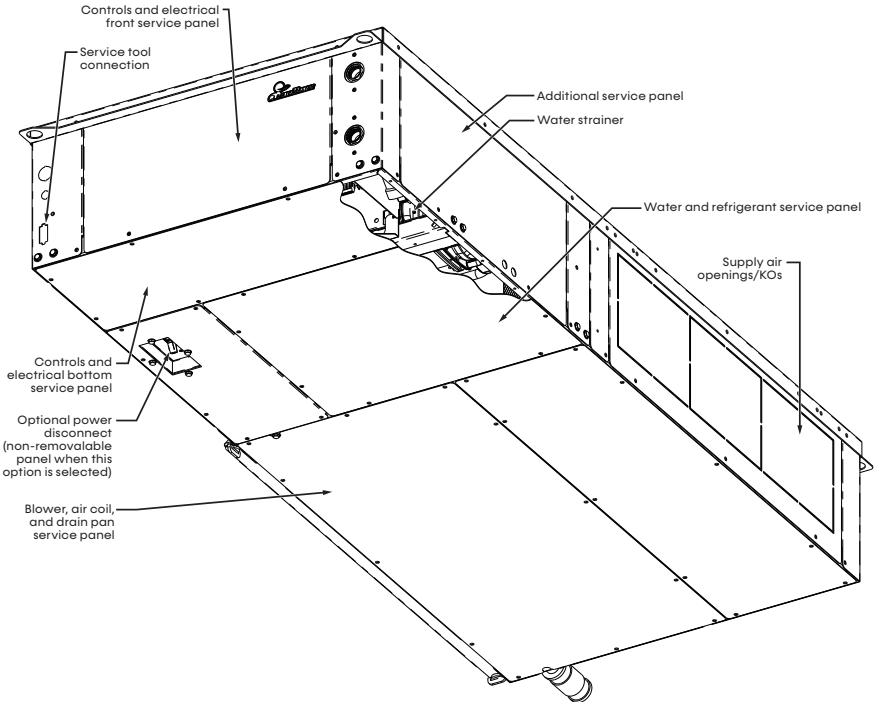
Models:  
SL  
06-15

## Service Access

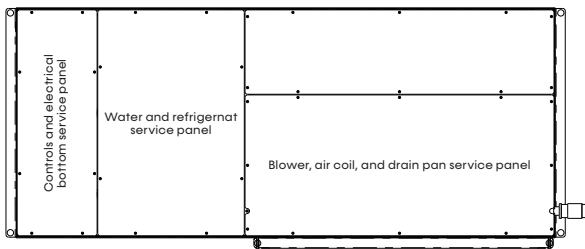
The Tranquility SL includes bottom service access for the following:

- Controls
- Electrical components
- Water circuit/components
- Refrigerant circuit/components
- Power disconnect (optional)
- Service tool input
- Drain pan
- Air filter
- Air coil
- Blower motor assembly

**Figure 4: Unit Access ISO View (Left Return with Optional Power Disconnect Shown)**



**Figure 5: Bottom View (without Optional Power Disconnect Shown)**



## Installation

Models:  
SL  
06-15

### UNIT LOCATION

Units are not designed for outdoor installation. Locate the unit in an INDOOR area that allows enough space for service personnel to perform typical maintenance or repairs without removing the unit from the ceiling. Horizontal units are typically installed above a false ceiling or in a ceiling plenum. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air). Position the unit easy filter and access panel removal. Provide sufficient room to make water, electrical, and duct connection(s).

SL units are designed to be accessed from the bottom for servicing. Provide sufficient clearance beneath the unit for access to bottom service panels.

If the unit is located in a confined space, such as a closet, make provisions for return air to freely enter the space by means of a louvered door or other means. Remove any access panel screws that may be difficult to remove after the unit is installed prior to setting the unit. Use the **Typical Unit Installation** figure for an example of a typical installation. Refer to unit submittal data for dimensional data.

Conform to the following guidelines when selecting unit location:

- Provide a hinged access door in concealed-spline or plaster ceilings. Provide removable ceiling tiles in T-bar or lay-in ceilings. Refer to the unit dimensions for specific series and model in unit product catalog data. Size the access opening to accommodate the service technician during the removal or replacement of the compressor, control, or blower assembly.
- Provide access to hanger brackets, water valves, and fittings. Provide sufficient screwdriver clearance to access panels, discharge collars, and all electrical connections.
- DO NOT obstruct the space beneath the unit with piping, electrical cables, and other items that prohibit future removal of components or the unit.
- Use a manual portable jack/lift to lift and support the weight of the unit during installation and servicing.

The installation of water source heat pump units and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

### MOUNTING HORIZONTAL UNITS

Horizontal units have four hanger brackets designed into the top panel of the unit, one at each corner. A hanger kit hardware bag is enclosed within the unit containing vibration isolation grommets, washers, and a hanger installation instruction page. Refer to the hanger installation instruction page contained in the hardware bag for details of final hanger bracket attachment and unit suspension.

Use four field-supplied  $\frac{3}{8}$ -inch diameter threaded rods and factory-provided vibration isolators to suspend the unit. Safely lift the unit into position supporting the bottom of the unit. Ensure the top of the unit is not in contact with any external objects. Connect the top end of the four all-thread rods then slide rods through the brackets and grommet then assemble washers and double nuts at each rod. Ensure that the unit is approximately level and that the threaded rod extends past the nuts.

Pitch the unit toward the drain as shown in the **Unit Pitch** figure to improve the condensate drainage. Ensure that unit pitch does not cause condensate leaks inside the cabinet. Cut any remaining all-thread rods below the lower nut so that it does not interfere with any electrical or water connections on the front of the unit.

Figure 6: Hanger Bracket Housing

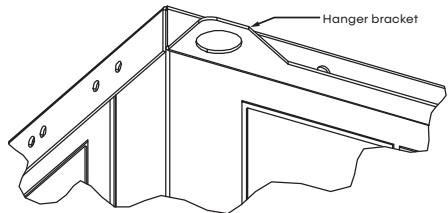
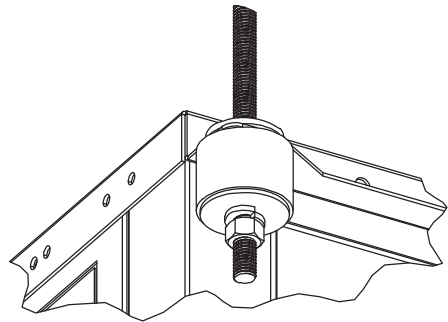


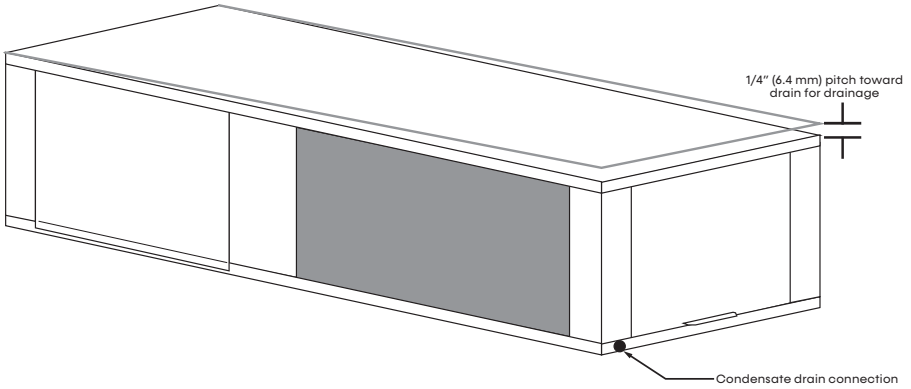
Figure 7: Mounted Unit



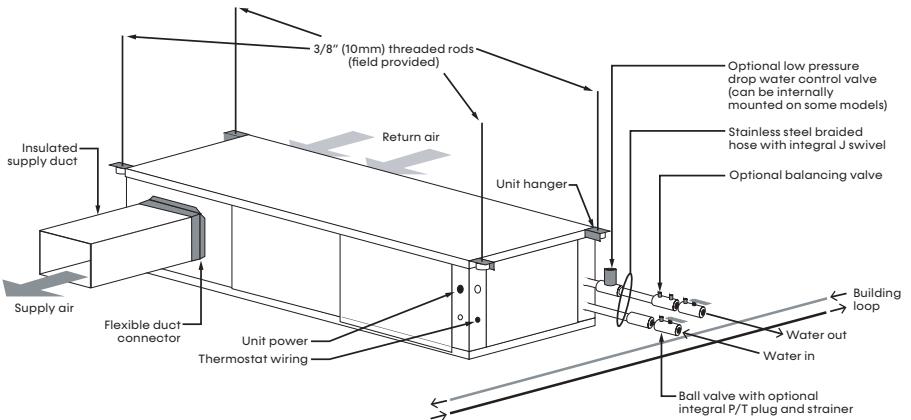
Models:  
SL  
06-15

## Installation

**Figure 8: Unit Pitch**



**Figure 9: Typical Unit Installation**



### AIR COIL

Clean the air coil before startup to obtain maximum performance. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. After this, thoroughly the air coil using water.

**NOTE: Do not use ultraviolet-based antibacterial systems.**

#### **⚠ NOTICE**

Installation Note - Ducted Return: Many horizontal WSHPs are installed in a return air ceiling plenum application (above ceiling). Vertical WSHPs are commonly installed in a mechanical room with free return (e.g. louvered door). Filter rails are the industry standard and are included on commercial heat pumps only for holding the filter. For ducted return applications, the filter rail must be removed and replaced with a duct flange or filter frame. Canvases or flexible connectors should also be used to minimize vibration between the unit and ductwork.

## Installation Condensate

Models:  
SL  
06-15

### CONDENSATE PIPING

A condensate drain line must be installed and pitched away for the unit to allow for proper drainage. This connection must meet all local plumbing/building codes.

Pitch the unit toward the drain as shown in the **Unit Pitch** figure to improve the condensate drainage. On small units (less than 2.5 tons/8.8 kW), ensure that unit pitch does not cause condensate leaks inside the cabinet.

Install condensate traps at each unit with the top of the trap positioned below the unit condensate drain connection as shown the **Horizontal Condensate Connection** figure. Design the depth of the trap (water-seal) based upon the amount of ESP capability of the blower (where 2-inches [51 mm] of ESP capability requires 2-inches [51 mm] of trap depth). As a general rule, 1½-inch (38 mm) trap depth is the minimum.

Each unit must be installed with its own individual trap and connection to the condensate line (main) or riser. Provide a means to flush or blow out the condensate line. DO NOT install units with a common trap and/or vent.

Always vent the condensate line when dirt or air can collect in the line or a long horizontal drain line is required. Also vent when large units are working against higher external static pressure than other units connected to the same condensate main since this may cause poor drainage for all units on the line. **WHEN A VENT IS INSTALLED IN THE DRAIN LINE, IT MUST BE LOCATED AFTER THE TRAP IN THE DIRECTION OF THE CONDENSATE FLOW.**

### POLYMER DRAIN PANS

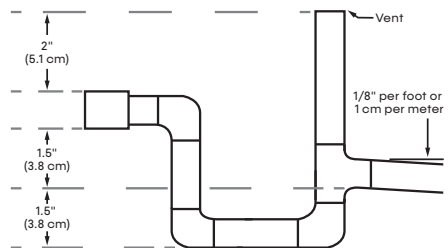
Condensate drain connection is a rubber coupling that connects to ¾-inch schedule 40/80 PVC. Use hose clamps to secure the pipe inside the coupling. If the connection is not secure, the connection may leak.

Instructions for coupling the condensate drain to the trap are included in the bag that includes the coupling and hose clamps.

### STAINLESS STEEL DRAIN PANS

The condensate connection is male pipe thread. Field-provided female adapter required for condensate drain connection.

**Figure 10: Horizontal Condensate Connection**



#### CAUTION

Ensure condensate line is pitched toward drain 1/8 inch per foot (11 mm per m) of run.

Models:  
SL  
06-15

## Installation Duct System

Proper duct sizing and design is critical to the performance of the unit. The duct system should be designed to allow adequate and even airflow through the unit during operation. Air flow through the unit **MUST** be at or above the minimum rated airflow for a given unit size to avoid equipment damage. Duct systems should be designed for quiet operation. Refer to the **Supply Air Openings** figure for details.

A flexible connector is recommended for both discharge and return air duct connections on metal duct systems to eliminate the transfer of vibration to the duct system. To maximize sound attenuation of the unit blower, include internal fiberglass duct liner in the supply and return plenums or construct them using ductboard for the first few feet. Using the unit with uninsulated ductwork in an unconditioned space is not recommended, as the unit's performance may be adversely affected.

Include at least one 90-degree elbow in the supply duct to reduce air noise. If air noise or excessive air flow is a problem, adjust the blower speed. For airflow charts, consult the product catalog for the series and model of the specific unit.

Before a unit is connected to existing ductwork, check to ensure that the ductwork has the capacity to handle the airflow required for the unit. If ducting is too small, as in the replacement of a heating only system, install larger ductwork. Check all existing ductwork for leaks and repair as necessary.

You can order Tranquility SLs with factory or field-configured supply air openings. If factory-configured supply air openings are desired, the configurations can be either left or right return air with right or left supply air. You can also choose back supply air as field or factory configured, but this configuration requires left or right supply air openings on sizes 12 and 15. Refer to the following tables for minimum and maximum supply air openings by size:

- **Supply Air Opening Dimensions**
- **Supply Air Square Inches (in<sup>2</sup>)**
- **Supply Air Options**

Flanges for connection to the supply air are provided when factory-configured supply air openings are ordered. If you select field-configured supply air openings, supply air flanges are integrated into the cabinet design. Perforated supply air openings are knocked out and then the supply air flanges are bent back for connection to supply air plenum or duct work.

**NOTE: Only SL sizes 06-09 can be applied as back discharge supply air. Sizes 12-15 must be applied as side discharge supply air with the option to be combined with back discharge supply air. You cannot field convert return air configurations.**

An unventilated area where water source heat pump is installed and surpasses a R-454B refrigerant charge of 62 oz (1.76 kg), shall be without continuously operating open flames (for example an operating gas appliance) or other **POTENTIAL IGNITION SOURCES** (for example an operating electric heater, hot surfaces).

Only auxiliary electric heaters approved by ClimateMaster shall be installed in connecting ductwork. The installation of any other auxiliary devices is beyond ClimateMaster's responsibility.

For duct-connected units, false ceilings or drop ceilings may be used as a return air plenum as long as ClimateMaster's RDS is installed as shown in the **RDS Installation** figure in the *Electrical Refrigerant Detection System* section.

### **WARNING**

Ducts connected to an appliance shall not contain a **POTENTIAL IGNITION SOURCE**.

### **WARNING**

Keep any required ventilation openings clear of obstruction.

### **WARNING**

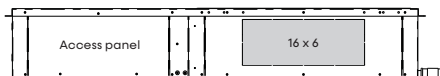
For mechanical ventilation, the lower edge of the air extraction opening where air is exhausted from the room shall not be more than 3.94 inches (100 mm) above the floor. The location where the mechanical ventilation air extracted from the space is discharged shall be separated by a sufficient distance, but not less than 9.84 feet (3 m), from mechanical ventilation air intake openings, to prevent recirculation to the space.

**Figure 11: Supply Air Openings**

**SIDE DISCHARGE SUPPLY AIR OPENING (SIZES 006-009)**



**SIDE DISCHARGE SUPPLY AIR OPENING (SIZES 006-015)**



**SIDE DISCHARGE SUPPLY AIR OPENING (SIZES 012-015)**



**BACK DISCHARGE SUPPLY AIR OPENING (SIZES 012-015)**



# Installation Duct System

Models:  
SL  
06-15

**Table 2: Supply Air Opening Dimensions**

| Size  | Right/Left Supply Air Dimensions | Back Supply Air Dimensions |
|-------|----------------------------------|----------------------------|
| 06-09 | 8 x 6 or 16 x 6                  | 7 x 6                      |
| 12-15 | 16 x 6 or 24 x 6                 | 7 x 6                      |

• All dimensions are shown in inches

**Table 3: Supply Air Square Inches (in²)**

| Size  | Number of Openings | Minimum in² Opening¹ | Maximum in² Opening | Recommended in² Opening |
|-------|--------------------|----------------------|---------------------|-------------------------|
| 06-09 | 1 or 2             | 42                   | 96                  | 48                      |
| 12-15 | 1 or 2             | 90                   | 186                 | 144                     |

• All dimensions are shown in inches

1. Less than minimum supply air opening area activates the unit's safeties

**Table 4: Supply Air Options**

| Size             | Number of Openings | Minimum in² Opening¹ | Maximum in² Opening |
|------------------|--------------------|----------------------|---------------------|
| Straight         | 8 x 6              | X                    |                     |
|                  | 16 x 6             | X                    | X¹                  |
|                  | 24 x 6             |                      | X                   |
| Straight+Back    | 8 x 6 + 7 x 6      | X                    | X¹                  |
|                  | 16 x 6 + 7 x 6     |                      | X                   |
|                  | 24 x 6 + 7 x 6     |                      | X                   |
| Back             | 7 x 6              | X                    |                     |
| Field Configured | -                  | X                    | X                   |

1. Sizes 12-15 in this configuration experience internal static pressure losses up to 0.2. ClimateMaster recommends field wiring to motor speed tap four to use the highest fan motor CFM performance.

Models:  
SL  
06-15

## Installation Piping

### INSTALL SUPPLY AND RETURN PIPING

Follow these piping guidelines.

1. Install a drain valve at the base of each supply and return line to facilitate system flushing.
2. Install shutoff valves, balancing valves, and unions at each unit to permit unit removal for servicing.
3. Place strainers at the inlet of each system circulating pump.
4. Select the proper hose length to allow slack between connection points. Hoses may vary in length by +2% to -4% under pressure.
5. Refer to the **Metal Hose Minimum Bend Radius** table. Do not exceed the minimum bend radius for the hose selected. Exceeding the minimum bend radius may cause the hose to collapse, which reduces water flow rate.
6. Before connecting the hose kits to the supply and return water connections, remove the threaded pipe caps and dispose

Insulation is not required on loop water piping except where the piping runs through unheated areas, outside the building, or when the loop water temperature is below the minimum expected dew point of the pipe ambient conditions. Insulation is required for ground loop applications in most climates.

Pipe-joint compound is not necessary when plumbing pipe thread tape is pre-applied to hose assemblies or when flared-end connections are used. If pipe-joint compound is preferred, use compound only in small amounts on the external pipe threads of the fitting adapters. Prevent sealant from reaching the flared surfaces of the joint.

**NOTE: When antifreeze is used in the loop, ensure that it is compatible with the plumbing pipe tape or pipe-joint compound that is applied.**

The maximum allowable torque for brass fittings is 30 ft-lbs (41 N-m). If a torque wrench is not available, tighten finger-tight plus one-quarter turn. Tighten steel fittings as necessary.

Optional pressure-rated hose assemblies designed specifically for use with ClimateMaster units are available. Similar hoses can be obtained from alternate suppliers. Supply and return hoses are fitted with swivel-joint fittings at one end to prevent kinking during installation.

**All units come standard with and require a minimum 20 mesh water strainer located on the water inlet side. Installations not using a minimum 20 mesh water strainer will void all warranties. Brazed-plate heat exchangers contain small water cavities.**

Blocking water flow cavities within the heat exchanger with water containing contaminants may cause a critical failure of the heat exchanger, which can result in flooding.

**Table 5: Metal Hose Minimum Bend Radius**

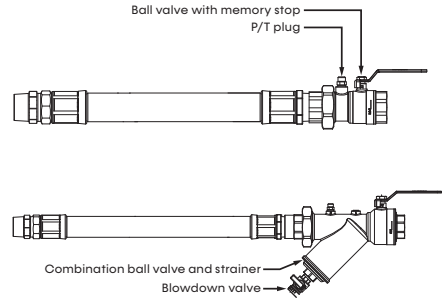
| Hose Diameter    | Minimum Bend Radius |
|------------------|---------------------|
| 1/2" [12.7 mm]   | 2-1/2" [6.4 cm]     |
| 3/4" [19.1 mm]   | 4" [10.2 cm]        |
| 1" [25.4 mm]     | 5-1/2" [14 cm]      |
| 1-1/4" [31.8 mm] | 6-3/4" [17.1 cm]    |

#### NOTICE

Do not allow hoses to rest against structural building components. Compressor vibration may be transmitted through the hoses to the structure, causing unnecessary noise complaints.

Refer to the **Supply/Return Hose Kit** figure for an example of a typical hose kit. Adapters secure hose assemblies to the unit and risers. Install hose assemblies properly and check regularly to avoid system failure and reduced service life.

**Figure 12: Supply/Return Hose Kit**



#### WARNING

A minimum 20 mesh water strainer is required for all units.

#### WARNING

Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with R-454B refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water source heat pump products containing R-454B as system failures and property damage may result.

#### CAUTION

Corrosive system water requires corrosion resistant fittings and hoses, and may require water treatment.

#### CAUTION

Do not bend or kink supply lines or hoses.

#### CAUTION

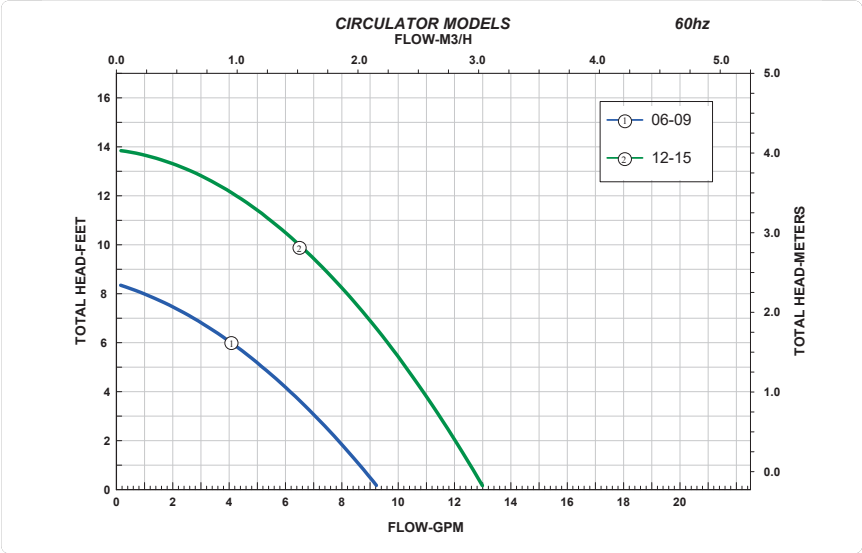
Piping must comply with all applicable codes.

Models:  
SL  
06-15

# Internal Water Pump Performance

Internal water pumps are utilized for single-pipe applications. A single-pipe loop designs combines the supply and return water lines into one pipe saving money on installation labor and material costs. Not only is there reduced piping material, internal pumps remove the need for motorized water valves and auto flow regulators (sometimes called balancing valves). Internal factory-installed water pumps are designed to provide the required water flow through the unit heat exchanger. The chart below demonstrates the performance of this optional factory installed water pump.

Figure 13: 60Hz Performance Curves



Models:  
SL  
06-15

# Applications Water-Loop Heat Pump

## COMMERCIAL WATER-LOOP APPLICATIONS

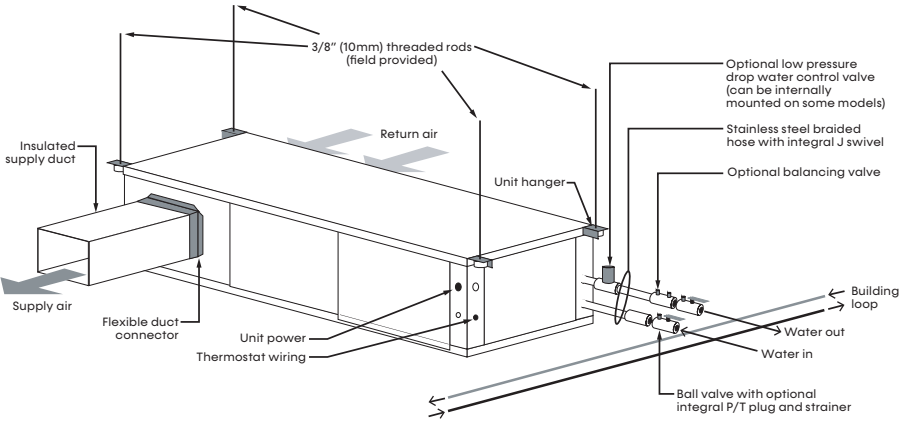
Commercial systems typically include a number of units connected to a common piping system. Any unit plumbing maintenance work can introduce air into the piping system; therefore air elimination equipment is a major portion of the mechanical room plumbing. To avoid condensation, consider insulating the piping surfaces. The manufacturer recommends piping insulation any time the water temperature is below 60°F (15.6°C). Do not use metal to plastic threaded joints due to their tendency to leak over time.

Water thread-sealant tape or thread sealant is recommended to minimize internal fouling of the heat exchanger. Do not over tighten connections and route piping so as not to interfere with service or maintenance access. Hose kits are available from the manufacturer in different configurations for connection between the unit and the piping system. Depending on selection, hose kits may include shutoff valves, P/T plugs for performance measurement, high pressure stainless-steel braided hose, "Y" type strainer with blow down valve, and/or with blow down valve, auto-flow valve and swivel connections.

Flush the piping system to remove dirt, piping chips, and other foreign material prior to operation (see Piping System Cleaning and Flushing in this manual). The flow rate is usually set between 2.25 and 3.5 GPM per ton (2.9 and 4.5 l/m per kW) of cooling capacity. The manufacturer recommends 3 GPM per ton (3.9 l/m per kW) for most water-loop heat pump applications. To ensure proper maintenance and servicing, P/T ports are imperative for temperature, flow verification, and performance checks.

Water-loop heat pump (cooling tower/boiler) systems typically utilize a common loop maintained between 60 - 90°F (16 - 32°C). The use of a closed-circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop is recommended. If an open type cooling tower is used continuously, chemical treatment and filtering is necessary.

**Figure 14: Typical Water-Loop Application**



# Applications Ground-Loop Heat Pump

Models:  
SL  
06-15

### CAUTION

The following instructions represent industry accepted installation practices for closed loop earth coupled heat pump systems. Instructions are provided to assist the contractor in installing trouble free ground loops. These instructions are recommendations only. State/provincial and local codes MUST be followed and installation MUST conform to ALL applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

### CAUTION

Ground loop applications require extended range equipment and optional refrigerant/water circuit insulation.

### WARNING

SL Series products contain brazed plate heat exchangers and should never be applied to a ground water application. Applying the SL to a ground-water application will void the warranty.

### WARNING

In the event of a power outage generator powered backup water pumping must be used to insure the water loop temperature does not drop below freezing. If motorized water valves are used in the system they must be set to fail (normally) open which will allow water to flow through the heat exchanger in the event there is power loss in the building.

## PRE-INSTALLATION

Prior to installation, locate and mark all existing underground utilities, piping, etc. Install loops for new construction before sidewalks, patios, driveways, and other construction has begun. During construction, accurately mark all ground loop piping on the plot plan as an aid in avoiding potential future damage to the installation.

## PIPING INSTALLATION

Limit all ground-loop piping materials to polyethylene fusion only for in-ground sections of the loop. Do not use galvanized or steel fittings at any time due to their tendency to corrode. Avoid all plastic-to-metal threaded fittings due to their potential to leak in ground-coupled applications. The manufacturer recommends using flanged fittings. Use P/T plugs to allow for flow measurement using the pressure drop of the unit heat exchanger.

Ground-loop temperatures can range between 25 and 110°F (-4 to 43°C). Flow rates between 2.25 and 3 GPM (2.41 to 3.23 l/m per kW) of cooling capacity is recommended in these applications.

Test individual horizontal loop circuits before backfilling. Test vertical U-bends and pond loop assemblies prior to installation. Use pressures of at least 100 psi (689 kPa) when testing. Do not exceed the pipe pressure rating. Test entire system when all loops are assembled.

## FLUSHING THE GROUND LOOP

Upon completion of system installation and testing, flush the system to remove all foreign objects and purge to remove all air.

## ANTIFREEZE

In areas where minimum entering loop temperatures drop below 40°F (5°C) or where piping is routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze; however, consult your local sales office to determine the antifreeze best suited to your area. Maintain freeze protection to 15°F (9°C) below the lowest expected entering loop temperature. For example, if 30°F (-1°C) is the minimum expected entering loop temperature, the leaving loop temperature would be 22 to 25°F (-6 to -4°C) and freeze protection should be at 15°F (-10°C).

Calculation is as follows:

$$30^{\circ}\text{F} - 15^{\circ}\text{F} = 15^{\circ}\text{F} \quad [-1^{\circ}\text{C} - 9^{\circ}\text{C} = -10^{\circ}\text{C}]$$

To prevent fumes, premix and pump alcohols from a reservoir outside of the building. If alcohols cannot be from outside the building, introduce them under the water level. Calculate the total volume of fluid in the piping system then use the **Antifreeze Percentages by Volume** table to determine the amount of antifreeze needed. Confirm antifreeze concentration in a homogeneous sample using a hydrometer or refractometer to measure specific gravity.

Table 6: Antifreeze Percentages by Volume

| Type                                 | Minimum Antifreeze Concentration % for Low Temperature Protection |               |               |               |
|--------------------------------------|-------------------------------------------------------------------|---------------|---------------|---------------|
|                                      | 10°F [-12.2°C]                                                    | 15°F [-9.4°C] | 20°F [-6.7°C] | 25°F [-3.9°C] |
| Methanol                             | 21%                                                               | 17%           | 13%           | 9%            |
| 100% USP food grade Propylene Glycol | 29%                                                               | 24%           | 19%           | 12%           |
| Ethanol <sup>1</sup>                 | 28%                                                               | 24%           | 18%           | 12%           |

1. Must not be denatured with any petroleum based product

Models:  
SL  
06-15

## Water Quality Requirements

| Water Quality Requirements<br>For Closed-Loop and Open-Loop Systems |                                                                                                                                                                                                                                                                                     |                                  |                                    |                                                                   |                                         |                                         |                               |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------|-------------------------------------------------------------------|-----------------------------------------|-----------------------------------------|-------------------------------|
|                                                                     | Description                                                                                                                                                                                                                                                                         | Symbol                           | Units                              | Heat Exchanger Type                                               |                                         |                                         |                               |
|                                                                     |                                                                                                                                                                                                                                                                                     |                                  |                                    | Closed Loop<br>Recirculating                                      |                                         | Open Loop, Tower, Ground<br>Source Well |                               |
|                                                                     |                                                                                                                                                                                                                                                                                     |                                  |                                    | All Heat<br>Exchanger<br>Types                                    | Coaxial HX<br>Copper<br>Tube in<br>Tube | Coaxial HX<br>Cupronickel               | Brazed-<br>Plate HX<br>316 SS |
| Scaling Potential                                                   | pH - Chilled Water <85°F                                                                                                                                                                                                                                                            |                                  |                                    | 7.0 to 9.0                                                        | 7.0 to 9.0                              | 7.0 to 9.0                              | 7.0 to 9.0                    |
|                                                                     | pH - Chilled Water >85°F                                                                                                                                                                                                                                                            |                                  |                                    | 8.0 to 10.0                                                       | 8.0 to 10.0                             | 8.0 to 10.0                             | 8.0 to 10.0                   |
|                                                                     | Alkalinity                                                                                                                                                                                                                                                                          | (HCO3 <sup>-</sup> )             | ppm - CaCO <sub>3</sub> equivalent | 50 to 500                                                         | 50 to 500                               | 50 to 500                               | 50 to 500                     |
|                                                                     | Calcium                                                                                                                                                                                                                                                                             | [Ca]                             | ppm                                | <100                                                              | <100                                    | <100                                    | <100                          |
|                                                                     | Magnesium                                                                                                                                                                                                                                                                           | [Mg]                             | ppm                                | <100                                                              | <100                                    | <100                                    | <100                          |
|                                                                     | Total Hardness                                                                                                                                                                                                                                                                      | (CaCO <sub>3</sub> )             | ppm - CaCO <sub>3</sub> equivalent | 30 to 150                                                         | 150 to 450                              | 150 to 450                              | 150 to 450                    |
|                                                                     | Langelier Saturation Index                                                                                                                                                                                                                                                          | LSI                              |                                    | -0.5 to +0.5                                                      | -0.5 to +0.5                            | -0.5 to +0.5                            | -0.5 to +0.5                  |
| Ryznar Stability Index                                              | RSI                                                                                                                                                                                                                                                                                 |                                  | 6.5 to 8.0                         | 6.5 to 8.0                                                        | 6.5 to 8.0                              | 6.5 to 8.0                              |                               |
| Corrosion Prevention                                                | Total Dissolved Solids                                                                                                                                                                                                                                                              | (TDS)                            | ppm - CaCO <sub>3</sub> equivalent | <1000                                                             | <1000                                   | <1000                                   | <1000                         |
|                                                                     | Sulfate                                                                                                                                                                                                                                                                             | (SO <sub>4</sub> <sup>2-</sup> ) | ppm                                | <200                                                              | <200                                    | <200                                    | <200                          |
|                                                                     | Nitrate                                                                                                                                                                                                                                                                             | (NO <sub>3</sub> <sup>-</sup> )  | ppm                                | <100                                                              | <100                                    | <100                                    | <100                          |
|                                                                     | Chlorine (free)                                                                                                                                                                                                                                                                     | [Cl]                             | ppm                                | <0.5                                                              | <0.5                                    | <0.5                                    | <0.5                          |
|                                                                     | Chloride (water < 80°F)                                                                                                                                                                                                                                                             | [Cl <sup>-</sup> ]               | ppm                                | <20                                                               | <20                                     | <150                                    | <150                          |
|                                                                     | Chloride (water > 120°F)                                                                                                                                                                                                                                                            | [Cl <sup>-</sup> ]               | ppm                                | <20                                                               | <20                                     | <125                                    | <125                          |
|                                                                     | Hydrogen Sulfide <sup>a</sup>                                                                                                                                                                                                                                                       | (H <sub>2</sub> S)               | ppb                                | <0.5                                                              | <0.5                                    | <0.5                                    | <0.5                          |
|                                                                     | Carbon Dioxide                                                                                                                                                                                                                                                                      | (CO <sub>2</sub> )               | ppm                                | 0                                                                 | <50                                     | 10 to 50                                | 10 to 50                      |
|                                                                     | Iron Oxide                                                                                                                                                                                                                                                                          | (Fe)                             | ppm                                | <1.0                                                              | <1.0                                    | <1.0                                    | <0.2                          |
|                                                                     | Manganese                                                                                                                                                                                                                                                                           | [Mn]                             | ppm                                | <0.4                                                              | <0.4                                    | <0.4                                    | <0.4                          |
|                                                                     | Ammonia                                                                                                                                                                                                                                                                             | (NH <sub>3</sub> )               | ppm                                | <0.05                                                             | <0.1                                    | <0.1                                    | <0.1                          |
|                                                                     | Chloramine                                                                                                                                                                                                                                                                          | (NH <sub>2</sub> Cl)             | ppm                                | 0                                                                 | 0                                       | 0                                       | 0                             |
| Fouling<br>& Biological                                             | Iron bacteria                                                                                                                                                                                                                                                                       |                                  | cells/mL                           | 0                                                                 | 0                                       | 0                                       | 0                             |
|                                                                     | Slime-forming bacteria                                                                                                                                                                                                                                                              |                                  | cells/mL                           | 0                                                                 | 0                                       | 0                                       | 0                             |
|                                                                     | Sulfate-reducing bacteria                                                                                                                                                                                                                                                           |                                  | cells/mL                           | 0                                                                 | 0                                       | 0                                       | 0                             |
|                                                                     | Suspended Solids <sup>b</sup>                                                                                                                                                                                                                                                       | (TSS)                            | ppm                                | <10                                                               | <10                                     | <10                                     | <10                           |
| Electrolysis<br>All HX types                                        | Earth Ground Resistance <sup>c</sup>                                                                                                                                                                                                                                                |                                  | Ohms                               | Consult NEC and local electrical codes for grounding requirements |                                         |                                         |                               |
|                                                                     | Electrolysis Voltage <sup>d</sup>                                                                                                                                                                                                                                                   |                                  | mV                                 | Measure voltage and internal water loop to HP ground              |                                         |                                         |                               |
|                                                                     | Leakage Current <sup>e</sup>                                                                                                                                                                                                                                                        |                                  | mA                                 | Measure current in water loop pipe                                |                                         |                                         |                               |
|                                                                     | Building Primary Electrical Ground to unit, must meet local diameter and penetration length requirements.<br>Do not connect heat pump to steel pipe unless dissimilar materials are separated by using Di-electric unions.<br>Galvanic corrosion of heat pump water pipe will occur |                                  |                                    |                                                                   |                                         |                                         |                               |

# Water Quality Requirements

- 1. The **Water Quality Requirements** table provides water quality requirements for coaxial and brazed-plate heat exchangers.
- 2. The water must be evaluated by an independent testing facility comparing site samples against this table. When water properties are outside of these parameters, the water must either be treated by a professional water treatment specialist to bring the water quality within the boundaries of this specification, or an external secondary heat exchanger must be used to isolate the heat pump water system from the unsuitable water. Failure to do so will void the warranty of the heat pump system and will limit liability for damage caused by leaks or system failure.
- 3. Regular sampling, testing and treatment of the water is necessary to assure that the water quality remains within acceptable levels thereby allowing the heat pump to operate at optimum levels.
- 4. If closed-loop systems are turned off for extended periods, water samples must be tested prior to operating the system.
- 5. For optimal performance, it is recommended that the closed-loop piping systems are initially filled with de-ionized water.
- 6. Well water with chemistry outside of these boundaries, and salt water or brackish water requires an external secondary heat exchanger. Surface/Pond water should not be used.
- 7. If water temperature is expected to fall below 40°F (4.4°C), antifreeze is required. Refer to the heat pump IOM for the correct solution ratios to prevent freezing.

| Strainer / Filter Sizing |               |            |        |
|--------------------------|---------------|------------|--------|
| Mesh Size                | Particle Size |            |        |
|                          | Microns       | Millimeter | Inch   |
| 20                       | 840           | 0.840      | 0.0340 |
| 30                       | 533           | 0.533      | 0.0210 |
| 60                       | 250           | 0.250      | 0.0100 |
| 100                      | 149           | 0.149      | 0.0060 |
| 150                      | 100           | 0.100      | 0.0040 |
| 200                      | 74            | 0.074      | 0.0029 |

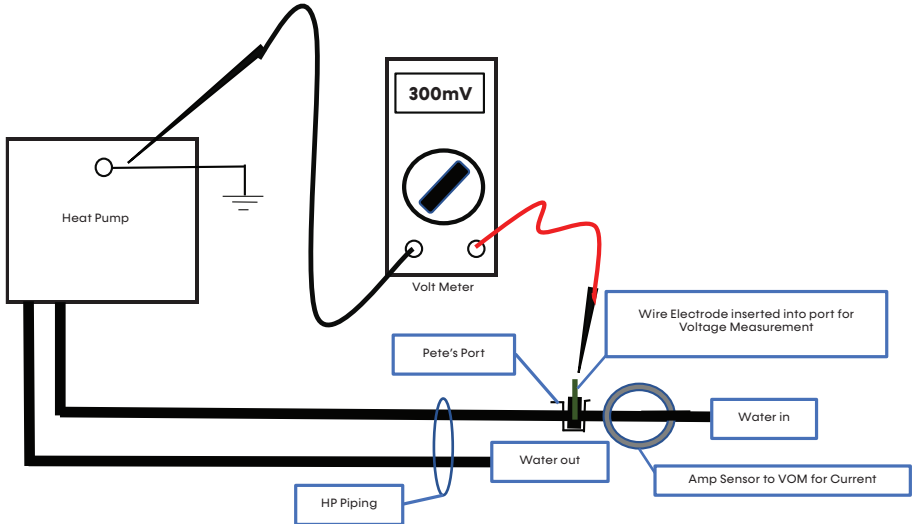
- ppm = parts per million
- ppb = parts per billion

- α Hydrogen sulfide has an odor of rotten eggs. If one detects this smell, a test for H<sub>2</sub>S must be performed. If H<sub>2</sub>S is detected above the limit indicated, remediation is necessary. Consult with your water testing/treatment professional. If a secondary heat exchanger is required, use appropriate materials as recommended by the heat exchanger supplier.
- β Suspended solids and particulates must be filtered to prevent fouling and failure of heat exchangers. Strainers or particulate filters must be installed to provide a maximum particle size of 600 micron (0.60 mm, 0.023 inch) using a 20 to 30 mesh screen size. When a loop is installed in areas with fine material such as sand or clay, further filtration is required to a maximum of 100 micron. Refer to the Strainer / Filter Sizing Chart to capture the particle sizes encountered on the site.
- χ The WSHP piping system or other plumbing pipes must not be used as the building ground. An electrical grounding system using a dedicated ground rod meeting NEC and local electrical codes must be installed.
- δ Refer to the **Antifreeze Percentages by Volume** table for instructions on measuring resistance and leakage currents within water loops.

Models:  
SL  
06-15

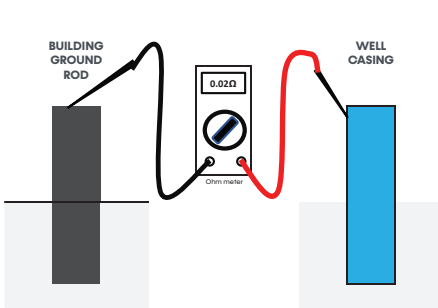
## Water Quality Requirements

### Measuring Electrolysis, Voltage, and Current for Ground-Water Applications



- Measure the electrolysis voltage using a volt meter between the heat pump ground and a #14 AWG solid copper wire electrode inserted into the water using a Pete's style access port.
- The heat pump must be operating and the water stream flowing.
- The voltage measured should be less than 300mV (0.300V). If the voltage is higher than 500mV, electrolysis will occur and corrosion will result.
- If voltage is measured, the cause is a high-resistance earth ground or current on the neutral conductor. Remedial measures should be performed.
- Measure the current flowing through the piping system by using an amp clamp probe on the water-in line. The heat pump must be operating and the water stream flowing.
- There should be zero amps measured. If current is present, there is leakage current to the plumbing system and it must be rectified to prevent pipe corrosion.

### Measuring Earth Ground Resistance



- Measure the earth ground bond using an Ohm meter between the building's ground rod and the steel well casing.
- The resistance measured should be zero Ohms. The NEC allows a resistance to ground up to 20 Ohms. Any resistance above zero indicates a poor earth ground, which may be the result of a hot neutral line or that conductive water is present. Both of these may lead to electrolysis and corrosion of the heat pump piping. A check for both should be performed and resolved.

**NOTE:** If the well casing is plastic, a conductive path can be achieved by inserting a #6 AWG bare copper wire into the well water. Remove the temporary conductor when finished.

Electrical Data

Models:  
SL  
06-15

Standard Unit

| Model | Voltage Code | Voltage      | Voltage Min/Max | Compressor |     |      | Fan Motor FLA | Total Unit FLA | Min Circuit AMP | Fuse/HACR AMP |
|-------|--------------|--------------|-----------------|------------|-----|------|---------------|----------------|-----------------|---------------|
|       |              |              |                 | QTY        | RLA | LRA  |               |                |                 |               |
| SL06  | G.J.         | 208/230-1-60 | 187/252         | 1          | 3.3 | 17.7 | 2.3           | 5.6            | 6.4             | 15            |
|       | E.D.         | 265-1-60     | 249/291         | 1          | 2.3 | 10.5 | 2.3           | 4.6            | 5.2             | 15            |
| SL09  | G.J.         | 208/230-1-60 | 187/252         | 1          | 4.5 | 22.2 | 2.3           | 6.8            | 7.9             | 15            |
|       | E.D.         | 265-1-60     | 249/291         | 1          | 3.3 | 13.5 | 2.3           | 5.6            | 6.4             | 15            |
| SL12  | G.J.         | 208/230-1-60 | 187/252         | 1          | 5.1 | 32.5 | 2.3           | 7.4            | 8.7             | 15            |
|       | E.D.         | 265-1-60     | 249/291         | 1          | 3.8 | 23.0 | 2.3           | 6.1            | 7.1             | 15            |
| SL15  | G.J.         | 208/230-1-60 | 187/252         | 1          | 6.6 | 29.0 | 2.3           | 8.9            | 10.6            | 15            |
|       | E.D.         | 265-1-60     | 249/291         | 1          | 4.8 | 20.0 | 2.3           | 7.1            | 8.3             | 15            |

Standard Unit with Internal Secondary Pump (ISP)

| Model | Voltage Code | Voltage      | Voltage Min/Max | Compressor |     |      | Electrical Options |              | Total Unit FLA | Min Circuit AMP | Fuse/HACR AMP |
|-------|--------------|--------------|-----------------|------------|-----|------|--------------------|--------------|----------------|-----------------|---------------|
|       |              |              |                 | QTY        | RLA | LRA  | Fan Motor FLA      | Pump ISP FLA |                |                 |               |
| SL06  | G.J.         | 208/230-1-60 | 187/252         | 1          | 3.3 | 17.7 | 2.3                | 0.28         | 5.9            | 6.7             | 15            |
| SL09  | G.J.         | 208/230-1-60 | 187/252         | 1          | 4.5 | 22.2 | 2.3                | 0.28         | 7.1            | 8.2             | 15            |
| SL12  | G.J.         | 208/230-1-60 | 187/252         | 1          | 5.1 | 32.5 | 2.3                | 0.49         | 7.9            | 9.2             | 15            |
| SL15  | G.J.         | 208/230-1-60 | 187/252         | 1          | 6.6 | 29.0 | 2.3                | 0.49         | 9.4            | 11.0            | 15            |

Models:  
SL  
06-15

## Electrical Power Wiring

### ⚠ WARNING

Disconnect electrical power source to prevent injury or death from electrical shock.

### ⚠ CAUTION

Use only copper conductors for field installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

## ELECTRICAL

**Line Voltage** - All field installed wiring, including electrical ground, must comply with NFPA 70: National Electrical Code (NEC), CSA C22.1: Canadian Electrical Code (CE Code), as well as applicable local codes. Refer to the unit electrical data for fuse sizes. Consult the wiring diagram for field connections that must be made by the installing (or electrical) contractor. All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

**Disconnects** - Units with a factory-installed disconnect switch will provide full separation of **all poles** and disconnection from main line voltage. For units where factory disconnect is not selected as an option, the installer must incorporate the means to fully disconnect the line voltage in the fixed wiring in accordance with wiring rules and local electrical codes.

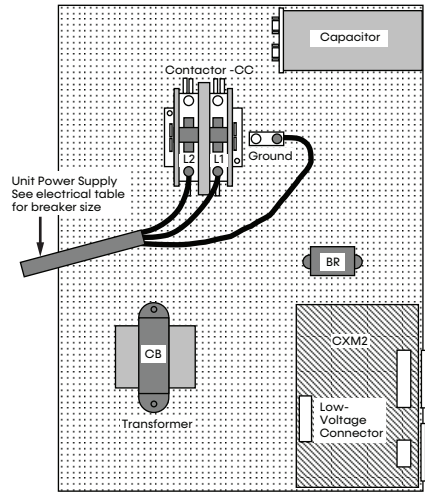
## POWER CONNECTION

The line voltage connection is made by connecting the incoming line voltage wires to the “L” side of the contactor. Consult electrical data tables for maximum fuse size.

## GENERAL LINE VOLTAGE WIRING

Ensure the available power is the same voltage and phase shown on the unit serial plate. Line- and low-voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

Figure 15: Single Phase Line Voltage Field Wiring



**NOTE:** 460V units with a CV EC motor or Internal Secondary Pump require a neutral wire. Three-phase wiring is similar except that all three power wires are directly connected to the contactor.

## TRANSFORMER

All 208/230V units are factory wired for 208V. If supply voltage is 230V, installer must rewired transformer. See wire diagram for connections.

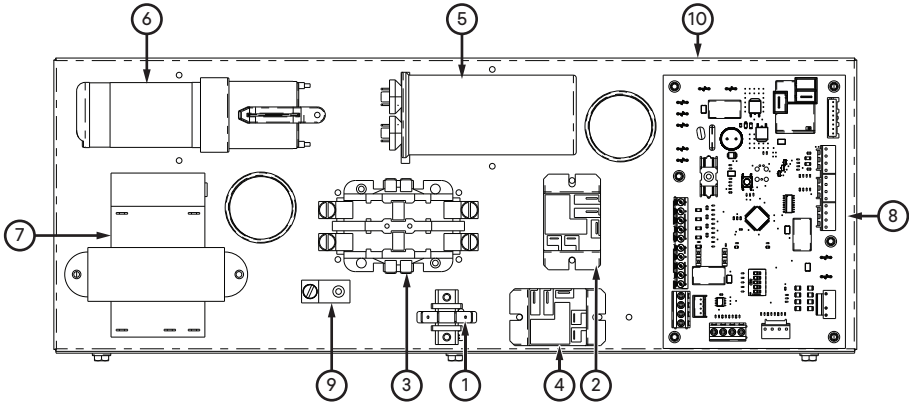
Table 7: Thermostat and Fan Speed Sequence of Operations

| Conventional Thermostat Signal<br>(Non-Communicating) | Operating Mode  | ECM Fan Speed Setting | Speed Tap | Blower Motor<br>Connection Pin |
|-------------------------------------------------------|-----------------|-----------------------|-----------|--------------------------------|
| G                                                     | Fan Only        | Low Speed Fan         | 2         | 9                              |
| G2                                                    | Fan Only        | High Speed Fan        | 4         | 1                              |
| G, Y1                                                 | Compressor Heat | Medium Speed Fan      | 3         | 2                              |
| G, Y1, O                                              | Compressor Cool | Medium Speed Fan      | 3         | 2                              |
| G2, Y1                                                | Compressor Heat | High Speed Fan        | 4         | 1                              |
| G2, Y1, O                                             | Compressor Cool | High Speed Fan        | 4         | 1                              |

## Electrical Power Wiring

Models:  
SL  
06-15

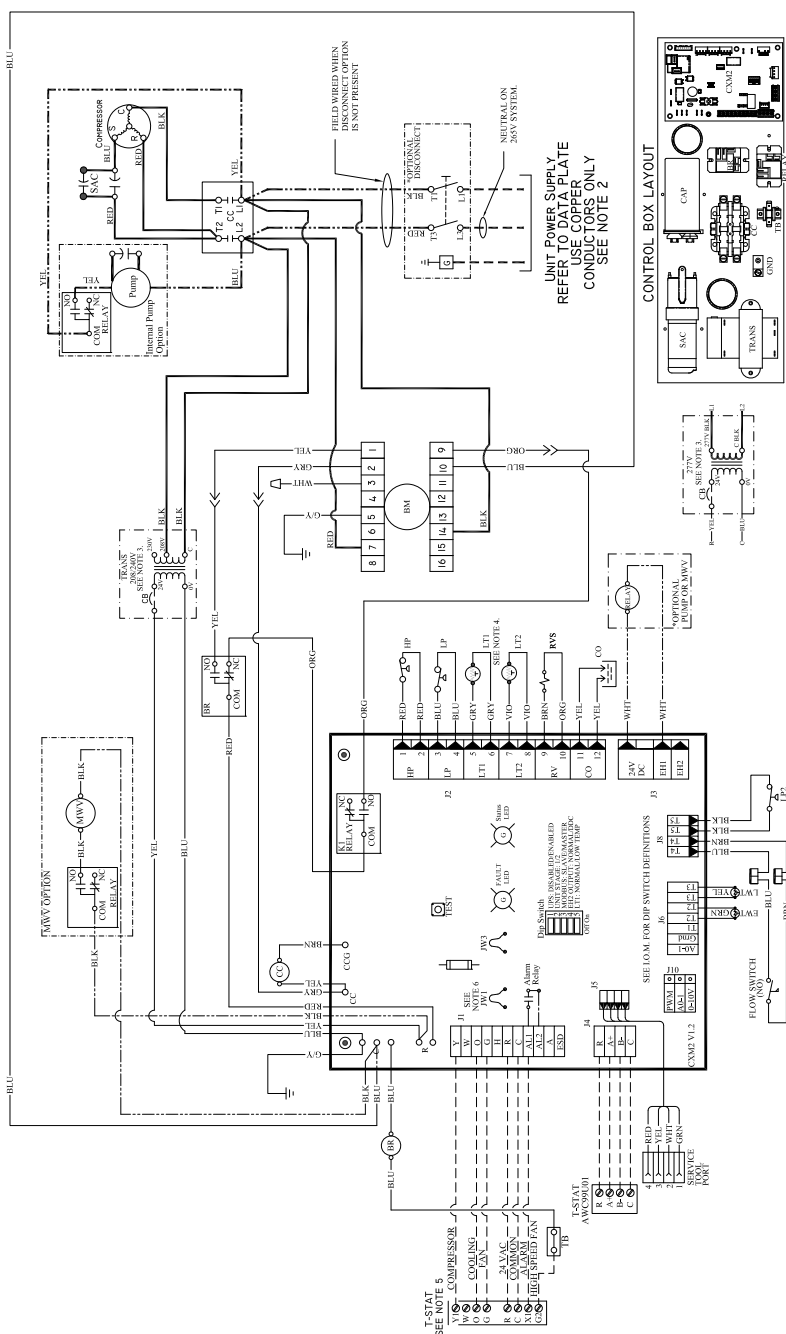
**Figure 17: Single Phase Line Voltage Field Wiring**



| ID # | DESCRIPTION       |
|------|-------------------|
| 1    | Terminal Block    |
| 2    | Blower Relay      |
| 3    | Contactor         |
| 4    | Pump/MWV Relay    |
| 5    | Run Capacitor     |
| 6    | Start Capacitor   |
| 7    | Transformer 75 VA |
| 8    | CXM2              |
| 9    | Ground Lug        |
| 10   | Control Box       |

Models:  
SL  
06-15

## Electrical Example Wiring Diagram



## Electrical Low-Voltage Wiring

Models:  
SL  
06-15

### THERMOSTAT CONNECTIONS

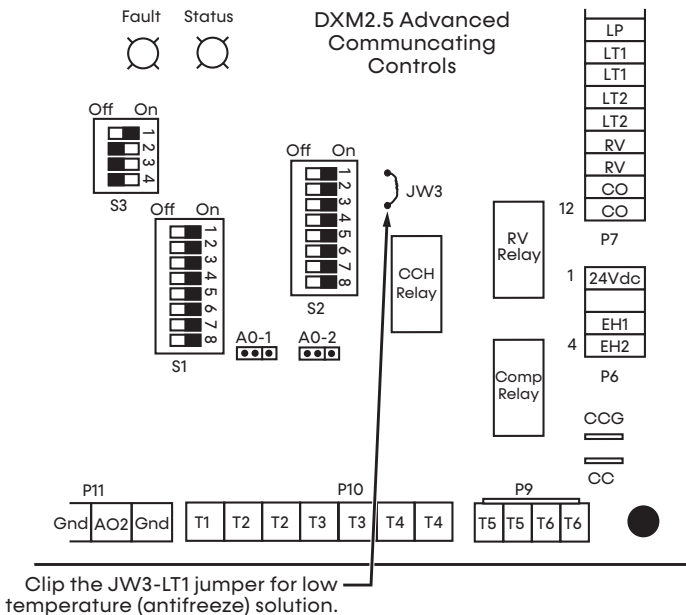
Wire the thermostat directly to the unit control. See the *Electrical: Thermostat Wiring* section for specific terminal connections. Review the appropriate AOM (Application, Operation and Maintenance) manual for units with DDC controls.

### LOW WATER TEMPERATURE CUTOUT SELECTION

The unit control allows the field selection of low water (or water-antifreeze solution) temperature limit by clipping jumper JW3 (see the **LT1 Limit Setting** figure), which changes the sensing temperature associated with thermistor LT1. Note that the LT1 thermistor is located on the refrigerant line between the brazed-plate heat exchanger and expansion device (TXV). Therefore, LT1 is sensing refrigerant temperature, not water temperature, which is a better indication of how water flow rate/temperature is affecting the refrigeration circuit.

The factory setting for LT1 is for systems using water (30°F [-1.1°C] refrigerant temperature). In low water temperature (extended range) applications with antifreeze (most ground loops), jumper JW3 should be clipped, as shown in the **LT1 Limit Setting** figure, to change the setting to 10°F (-12.2°C) refrigerant temperature, which is a more suitable temperature when using an antifreeze solution. All units operating with entering water temperatures below 60°F (15.6°C) must include the optional water/refrigerant circuit insulation package to prevent internal condensation.

Figure 18: LT1 Limit Setting



Models:  
SL  
06-15

## Electrical Low-Voltage Wiring

### ACCESSORY CONNECTIONS

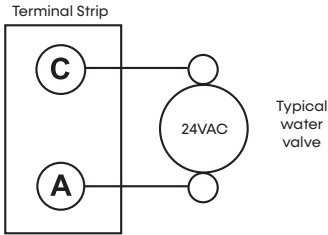
A terminal paralleling the compressor contactor coil is provided on the CXM2/DXM2.5. Terminal "A" is designed to control accessory devices, such as water valves. **NOTE: This terminal should be used only with 24V signals and not line voltage.** Terminal "A" is energized with the compressor contactor. See the **Accessory Wiring** figure or the specific unit wiring diagram for details.

Table 8: Low Voltage VA Ratings

| Component                        | VA      |
|----------------------------------|---------|
| Typical Blower Relay             | 6 - 7   |
| Typical Reversing Valve Solenoid | 4 - 6   |
| 30 A Compressor Contactor        | 6 - 9   |
| Subtotal                         | 16 - 22 |
| + CXM2 (5 - 9VA) <sup>1</sup>    | 21 - 31 |
| Remaining VA for Accessories     | 19 - 29 |
| + DXM2.5 (8 - 12VA) <sup>2</sup> | 24 - 34 |
| Remaining VA for Accessories     | 41 - 51 |

- Standard transformer for CXM2 is 50VA.
- Optional DXM2.5 and/or DDC controls include a 75VA transformer.

Figure 19: Accessory Wiring



### WATER SOLENOID VALVES

An external solenoid valve(s) should be used on ground water installations to shut off flow to the unit when the compressor is not operating. A slow closing valve may be required to help reduce water hammer. The **Accessory Wiring** figure shows typical wiring for a 24VAC external solenoid valve. The **Accessory Motorized Water Valve – Typical Wiring Example #1 and #2** figures illustrate a slow-closing water control valve wiring for two styles of typical accessory water valves. Slow closing valves take approximately 60 seconds to open (very little water will flow before 45 seconds).

Once fully open, an end switch allows the compressor to be energized. Only use relay or triac-based electronic thermostats with slow-closing valves. When wired as shown, the slow-closing valve will operate properly with the following notations:

- The valve remains open during a unit lockout.
- The valve draws approximately 25-35VA through the "Y" signal of the thermostat.

**NOTE: This valve can overheat the anticipator of an electromechanical thermostat. Therefore, only relay or triac-based thermostats should be used.**

Figure 20: Accessory Motorized Water Valve – Typical Wiring Example #1

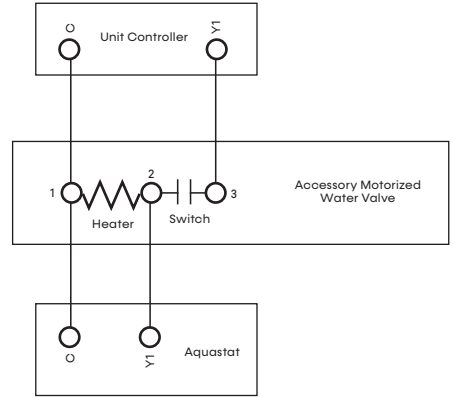


Figure 21: Accessory Motorized Water Valve - Typical Wiring Example #2

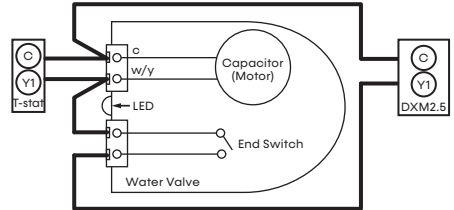
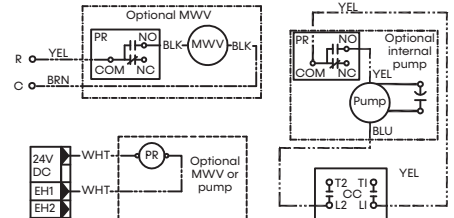


Figure 22: Motorized Water Valve and Pump Wiring



# Electrical Thermostat Wiring

Models:  
SL  
06-15

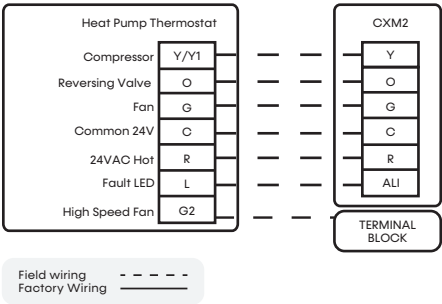
## THERMOSTAT INSTALLATION

Install the thermostat on an interior wall in a larger room, away from supply duct drafts. DO NOT locate the thermostat in areas subject to sunlight, drafts or on external walls. The wire access hole behind the thermostat may need to be sealed to prevent erroneous temperature measurement.

Position the thermostat back plate against the wall so that it appears level and so the thermostat wires protrude through the middle of the back plate. Mark the position of the back plate mounting holes and drill holes with a 3/16-inch (5 mm) bit. Install supplied anchors and secure plate to the wall. Thermostat wire must be 18 AWG wire.

Use the Thermostat Wiring Example figure as an example, however, you must determine actual wiring connections from the thermostat IOM and unit wiring diagram. Most heat pump thermostats are compatible with the manufacturer's heat pump units, provided it has the correct number of heating and cooling stages.

**Figure 23: Thermostat Wiring Example**



Models:  
SL  
06-15

## Electrical CXM2 and Wireless Service Tool



### **CXM2 Communicating Controls**

For detailed controller information, see the CXM2 Application, Operation, and Maintenance (AOM) manual (part # 97B0137N01). To confirm the controller type of your particular unit, refer to digit 9 on the unit model number and the unit nomenclature diagram found on page 3 of this manual.



### **Wireless Service Tool**

For detailed controller information, see the Wireless Service Tool Application, Operation, and Maintenance (AOM) manual (part # 97B0169N01). The Wireless Service Tool port is located on the corner post of most models.

Blower Performance  
SL06-09

Models:  
SL  
06-15

| Size | Rated CFM | Max CFM | Min CFM | Speed Tap | Unit      | External Static Pressure (In. wg) |       |       |       |       |       |       |       |       |       |       |       |
|------|-----------|---------|---------|-----------|-----------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|      |           |         |         |           |           | 0.10                              | 0.15  | 0.20  | 0.25  | 0.30  | 0.35  | 0.40  |       |       |       | 0.45  | 0.50  |
| SL06 | 250       | 275     | 150     | 1         | RPM       | 1,070                             | 1,129 | 1,188 | 1,251 | 1,314 | 1,343 | 1,372 |       |       |       |       |       |
|      |           |         |         |           | Power (W) | 24                                | 25    | 27    | 28    | 30    | 31    | 31    |       |       |       |       |       |
|      |           |         |         |           | CFM       | 230                               | 216   | 202   | 188   | 174   | 164   | 153   |       |       |       |       |       |
|      |           |         |         |           | Power/CFM | 0.1                               | 0.12  | 0.13  | 0.15  | 0.17  | 0.19  | 0.2   |       |       |       |       |       |
|      |           |         |         | 2         | RPM       | 1,177                             | 1,217 | 1,258 | 1,322 | 1,386 | 1,440 | 1,494 | 1,525 | 1,555 |       |       |       |
|      |           |         |         |           | Power (W) | 32                                | 33    | 34    | 36    | 38    | 40    | 42    | 43    | 43    |       |       |       |
|      |           |         |         |           | CFM       | 268                               | 258   | 247   | 233   | 220   | 208   | 197   | 188   | 179   |       |       |       |
|      |           |         |         |           | Power/CFM | 0.12                              | 0.13  | 0.14  | 0.16  | 0.17  | 0.19  | 0.21  | 0.23  | 0.24  |       |       |       |
|      |           |         |         | 3         | RPM       |                                   |       |       |       |       |       | 1,462 | 1,514 | 1,566 | 1,614 | 1,661 |       |
|      |           |         |         |           | Power (W) |                                   |       |       |       |       |       | 48    | 50    | 52    | 54    | 56    |       |
|      |           |         |         |           | CFM       |                                   |       |       |       |       |       | 263   | 253   | 242   | 232   | 223   |       |
|      |           |         |         |           | Power/CFM |                                   |       |       |       |       |       | 0.18  | 0.2   | 0.21  | 0.23  | 0.25  |       |
|      |           |         |         | 4         | RPM       |                                   |       |       |       |       |       |       |       |       | 1,628 | 1,683 | 1,737 |
|      |           |         |         |           | Power (W) |                                   |       |       |       |       |       |       |       |       | 62    | 65    | 67    |
|      |           |         |         |           | CFM       |                                   |       |       |       |       |       |       |       |       | 275   | 266   | 257   |
|      |           |         |         |           | Power/CFM |                                   |       |       |       |       |       |       |       |       | 0.23  | 0.24  | 0.26  |
| SL09 | 300       | 425     | 200     | 1         | RPM       | 1,168                             | 1,199 | 1,230 | 1,284 | 1,339 | 1,420 | 1,502 | 1,534 | 1,566 |       |       |       |
|      |           |         |         |           | Power (W) | 34                                | 35    | 35    | 37    | 39    | 42    | 45    | 46    | 47    |       |       |       |
|      |           |         |         |           | CFM       | 300                               | 290   | 279   | 265   | 251   | 235   | 219   | 212   | 206   |       |       |       |
|      |           |         |         |           | Power/CFM | 0.11                              | 0.12  | 0.13  | 0.14  | 0.16  | 0.18  | 0.21  | 0.22  | 0.23  |       |       |       |
|      |           |         |         | 2         | RPM       | 1,375                             | 1,398 | 1,421 | 1,441 | 1,460 | 1,504 | 1,548 | 1,595 | 1,641 |       |       |       |
|      |           |         |         |           | Power (W) | 55                                | 56    | 57    | 58    | 59    | 62    | 64    | 66    | 68    |       |       |       |
|      |           |         |         |           | CFM       | 376                               | 366   | 355   | 345   | 335   | 321   | 307   | 295   | 283   |       |       |       |
|      |           |         |         |           | Power/CFM | 0.15                              | 0.15  | 0.16  | 0.17  | 0.18  | 0.19  | 0.21  | 0.22  | 0.24  |       |       |       |
|      |           |         |         | 3         | RPM       |                                   |       |       |       | 1,553 | 1,573 | 1,596 | 1,618 | 1,643 | 1,667 | 1,707 | 1,745 |
|      |           |         |         |           | Power (W) |                                   |       |       |       | 79    | 81    | 82    | 83    | 84    | 86    | 87    | 89    |
|      |           |         |         |           | CFM       |                                   |       |       |       | 422   | 412   | 403   | 394   | 386   | 378   | 363   | 348   |
|      |           |         |         |           | Power/CFM |                                   |       |       |       | 0.19  | 0.2   | 0.2   | 0.21  | 0.22  | 0.23  | 0.24  | 0.26  |
|      |           |         |         | 4         | RPM       |                                   |       |       |       |       |       | 1,769 | 1,770 | 1,770 | 1,769 |       |       |
|      |           |         |         |           | Power (W) |                                   |       |       |       |       |       | 104   | 101   | 97    | 92    |       |       |
|      |           |         |         |           | CFM       |                                   |       |       |       |       |       | 428   | 412   | 391   | 370   |       |       |
|      |           |         |         |           | Power/CFM |                                   |       |       |       |       |       | 0.24  | 0.25  | 0.25  | 0.25  |       |       |

- Blower performance data is based on the lowest nameplate voltage setting.
- Blower performance is based on a wet coil with clean 1-inch filter.
- Blower performance is based on operating conditions of 80°F DB and 67°F WB.
- CFM Tolerance is ±7%.
- Cells in grey - option not available.
- The maximum allowable altitude of installation for this product is 6,561 ft (2,000 m).

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# Blower Performance SL12-15

| Size | Rated CFM | Max CFM | Min CFM | Speed Tap | Unit      | External Static Pressure (in. wg) |       |       |       |       |       |       |       |       |       |
|------|-----------|---------|---------|-----------|-----------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|      |           |         |         |           |           | 0.10                              | 0.15  | 0.20  | 0.25  | 0.30  | 0.35  | 0.40  | 0.45  | 0.50  |       |
| SL12 | 400       | 500     | 300     | 1         | RPM       | 1,332                             | 1,358 | 1,384 | 1,458 | 1,532 | 1,572 | 1,612 |       |       |       |
|      |           |         |         |           | Power (W) | 61                                | 64    | 67    | 69    | 72    | 75    | 78    |       |       |       |
|      |           |         |         |           | CFM       | 406                               | 387   | 368   | 352   | 335   | 326   | 317   |       |       |       |
|      |           |         |         |           | Power/CFM | 0.15                              | 0.17  | 0.18  | 0.2   | 0.21  | 0.23  | 0.24  |       |       |       |
|      |           |         |         | 2         | RPM       | 1,340                             | 1,378 | 1,416 | 1,458 | 1,500 | 1,547 | 1,594 | 1,647 | 1,698 |       |
|      |           |         |         |           | Power (W) | 71                                | 73    | 75    | 77    | 79    | 82    | 85    | 88    | 91    |       |
|      |           |         |         |           | CFM       | 451                               | 432   | 413   | 393   | 374   | 354   | 333   | 323   | 313   |       |
|      |           |         |         |           | Power/CFM | 0.16                              | 0.17  | 0.18  | 0.2   | 0.21  | 0.23  | 0.25  | 0.27  | 0.29  |       |
|      |           |         |         | 3         | RPM       |                                   |       | 1,492 | 1,528 | 1,561 | 1,594 | 1,633 | 1,672 | 1,716 | 1,760 |
|      |           |         |         |           | Power (W) |                                   |       | 96    | 98    | 100   | 102   | 104   | 107   | 110   | 113   |
|      |           |         |         |           | CFM       |                                   |       | 495   | 478   | 461   | 443   | 426   | 408   | 389   | 369   |
|      |           |         |         |           | Power/CFM |                                   |       | 0.19  | 0.21  | 0.22  | 0.23  | 0.25  | 0.26  | 0.28  | 0.31  |
|      |           |         |         | 4         | RPM       |                                   |       |       |       |       | 1,688 | 1,720 | 1,753 | 1,787 | 1,820 |
|      |           |         |         |           | Power (W) |                                   |       |       |       |       | 127   | 129   | 131   | 133   | 134   |
|      |           |         |         |           | CFM       |                                   |       |       |       |       | 503   | 487   | 471   | 450   | 430   |
|      |           |         |         |           | Power/CFM |                                   |       |       |       |       | 0.25  | 0.27  | 0.28  | 0.3   | 0.31  |
| SL15 | 500       | 575     | 375     | 1         | RPM       | 1,388                             | 1,419 | 1,451 | 1,476 | 1,501 | 1,534 |       |       |       |       |
|      |           |         |         |           | Power (W) | 75                                | 77    | 79    | 80    | 81    | 83    |       |       |       |       |
|      |           |         |         |           | CFM       | 450                               | 432   | 413   | 397   | 380   | 363   |       |       |       |       |
|      |           |         |         |           | Power/CFM | 0.17                              | 0.18  | 0.19  | 0.2   | 0.21  | 0.23  |       |       |       |       |
|      |           |         |         | 2         | RPM       | 1,520                             | 1,546 | 1,572 | 1,596 | 1,621 | 1,646 |       |       |       |       |
|      |           |         |         |           | Power (W) | 99                                | 101   | 103   | 104   | 106   | 108   |       |       |       |       |
|      |           |         |         |           | CFM       | 517                               | 500   | 483   | 467   | 451   | 435   |       |       |       |       |
|      |           |         |         |           | Power/CFM | 0.19                              | 0.2   | 0.21  | 0.22  | 0.24  | 0.25  |       |       |       |       |
|      |           |         |         | 3         | RPM       | 1,619                             | 1,644 | 1,668 | 1,694 | 1,719 | 1,739 |       |       |       |       |
|      |           |         |         |           | Power (W) | 125                               | 127   | 129   | 130   | 132   | 133   |       |       |       |       |
|      |           |         |         |           | CFM       | 567                               | 555   | 543   | 528   | 512   | 495   |       |       |       |       |
|      |           |         |         |           | Power/CFM | 0.22                              | 0.23  | 0.24  | 0.25  | 0.26  | 0.27  |       |       |       |       |
|      |           |         |         | 4         | RPM       |                                   |       | 1,697 | 1,718 | 1,741 | 1,763 | 1,783 |       |       |       |
|      |           |         |         |           | Power (W) |                                   |       | 140   | 142   | 144   | 145   | 146   |       |       |       |
|      |           |         |         |           | CFM       |                                   |       | 578   | 562   | 550   | 538   | 521   |       |       |       |
|      |           |         |         |           | Power/CFM |                                   |       | 0.24  | 0.25  | 0.26  | 0.27  | 0.28  |       |       |       |

- Blower performance data is based on the lowest nameplate voltage setting.
- Blower performance is based on a wet coil with clean 1-inch filter.
- Blower performance is based on operating conditions of 80°F DB and 67°F WB.
- CFM Tolerance is ±7%.
- Cells in grey - option not available.
- The maximum allowable altitude of installation for this product is 6,561 ft (2,000 m).

# Operating and Commissioning Limits

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## OPERATING LIMITS

**Environment** – Units are designed for indoor installation only. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air).

**Power Supply** – Voltage utilization shall comply with AHRI Standard 110 or values provided in the *Electrical Data* section.

Three factors determine the operating limits of water-source heat pumps: return air temperature, water temperature, and ambient temperature. When any one of these factors is at minimum or maximum levels, the other two factors should be at normal levels to ensure proper unit operation. Extreme variations in temperature and humidity and/or corrosive water or air adversely affects unit performance, reliability, and service life.

**Table 9: Operating Limits**

| Operating Limits          | Cooling                                                    | Heating                   |
|---------------------------|------------------------------------------------------------|---------------------------|
| Air Limits                |                                                            |                           |
| Min. ambient air, DB      | 45°F [7.2°C] <sup>1</sup>                                  | 39°F [3.8°C] <sup>1</sup> |
| Max. ambient air, DB      | 130°F [54.4°C]                                             | 130°F [54.4°C]            |
| Min. entering air, DB/WB  | 65/45°F [18.3/7.2°C]                                       | 50°F [10°C]               |
| Max. entering air, DB/WB  | 90/72°F [32.2/22.2°C]                                      | 80°F [26.7°C]             |
| Min/Max Airflow (CFM/Ton) | 300 to 500 CFM/Ton <sup>2</sup>                            |                           |
| Water Limits              |                                                            |                           |
| Min. entering water       | 30°F [-1°C] <sup>3</sup>                                   | 20°F [-6.6°C]             |
| Max. entering water       | 120°F [48.8°C]                                             | 90°F [32.2°C]             |
| Water Flow Range          | 1.5 to 3.0 gpm/ton<br>[1.6 to 3.2 l/m per kW] <sup>4</sup> |                           |

**Notes:**

- To prevent unit damage, the water loop should contain antifreeze to prevent freezing when not in operation.
- Refer to specific blower tables for each model size
- With unit flow-control automation.
- Unless specified different on performance table for any model size

## Maximum Working Water Pressure

| Option                               | Max Pressure PSIG [kPa] |
|--------------------------------------|-------------------------|
| Base Unit                            | 300 [2,068]             |
| Internal Secondary Pump (ISP)        | 200 [1,379]             |
| Internal Motorized Water Valve (MWV) | 300 [2,068]             |
| Internal Auto Flow Valve             | 300 [2,068]             |
| 20 Mesh Y Strainer Valve             | 300 [2,068]             |
| Flow switch - Low Tier               | 145 [1,000]             |
| Flow switch - High Tier              | 300 [2,068]             |

- Use the lowest maximum pressure rating when multiple options are combined.
- Optional hoses have a pressure rating of 400 PSIG [2,758 kPa]

## COMMISSIONING CONDITIONS

Starting conditions vary depending upon model and are based upon the following notes:

**NOTES:**

- Commissioning Conditions are not normal or continuous operating conditions. Minimum/maximum limits are startup conditions to bring the building space up to occupancy temperatures. Units are not designed to operate under these conditions on a regular basis.
- Voltage utilization range complies with AHRI Standard 110.

**Table 10: Commissioning Limits**

| Commissioning Conditions  | Cooling                                                                          | Heating                   |
|---------------------------|----------------------------------------------------------------------------------|---------------------------|
| Air Limits                |                                                                                  |                           |
| Min. ambient air, DB      | 45°F [7.2°C] <sup>1</sup>                                                        | 39°F [3.8°C] <sup>1</sup> |
| Max. ambient air, DB      | 130°F [54.4°C]                                                                   | 130°F [54.4°C]            |
| Min. entering air, DB/WB  | 65/45°F [18.7°C]                                                                 | 40°F [4.4°C] <sup>4</sup> |
| Max. entering air, DB/WB  | 100/75°F [37.8/23.9°C] <sup>1</sup>                                              | 80°F [26.6°C]             |
| Min/Max Airflow (CFM/Ton) | 300 to 500 CFM/Ton <sup>2</sup>                                                  |                           |
| Water Limits              |                                                                                  |                           |
| Min. entering water       | 30°F [-1.1°C] <sup>3</sup>                                                       | 20°F [-6.6°C]             |
| Max. entering water       | 120°F [48.8°C]                                                                   | 90°F [32.2°C]             |
| Water Flow Range          | 1.5 to 3.0 gpm/ton<br>[1.6 to 3.2 m <sup>3</sup> /m <sup>2</sup> h] <sup>4</sup> |                           |

**Notes:**

- To prevent unit damage, the water loop should contain antifreeze to prevent freezing when not in operation.
- Refer to specific blower tables for each model size
- With unit flow-control automation.
- Unless specified different on performance table for any model size
- Commission units for cooling at entering air temperatures of 100/75°F (37.8/23.9°C) only at rated water flow or 3 gpm/ton.
- Commission units for heating at entering air temperature of 40°F (4.4°C) only at rated water flow or 3 gpm/ton.

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## Piping System Cleaning and Flushing

### PIPING SYSTEM CLEANING AND FLUSHING

Cleaning and flushing the WLHP piping system is the single most important step to ensure proper startup and continued efficient operation of the system.

Follow the instructions below to properly clean and flush the system:

1. Ensure that electrical power to the unit is disconnected.
2. Install the system with the supply hose connected directly to the return riser valve. Use a single length of flexible hose.
3. Open all air vents. Fill the system with water. DO NOT allow system to overflow. Bleed all air from the system. Pressurize and check the system for leaks and repair as appropriate.
4. Verify that all strainers are in place. A strainer with a #20 stainless steel wire mesh is recommended. Start the pumps, and systematically check each vent to ensure that all air is bled from the system.
5. Verify that make-up water is available. Adjust make-up water as required to replace the air which was bled from the system. Check and adjust the water/air level in the expansion tank.
6. Set the boiler to raise the loop temperature to approximately 85°F (29°C). Open a drain at the lowest point in the system. Adjust the make-up water replacement rate to equal the rate of bleed.
7. Refill the system and add trisodium phosphate in a proportion of approximately one pound per 150 gallons (0.8 kg per 1000 l) of water (or other equivalent approved cleaning agent). Reset the boiler to raise the loop temperature to 100°F (38°C). Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
8. When the cleaning process is complete, remove the short-circuited hoses. Reconnect the hoses to the proper supply, and return the connections to each of the units. Refill the system and bleed off all air.
9. Test the system pH with litmus paper. The system water should be in the range of pH 6.0 - 8.5 (see the **Water Quality Requirements** table). Add chemicals, as appropriate to maintain neutral pH levels.
10. When the system is successfully cleaned, flushed, refilled and bled, check the main system panels, safety cutouts and alarms. Set the controls to properly maintain loop temperatures.

**NOTE: The manufacturer strongly recommends all piping connections, both internal and external to the unit, be pressure tested by an appropriate method prior to any finishing of the interior space or before access to all connections is limited. Test pressure may not exceed the maximum allowable pressure for the unit and all components within the water system. The manufacturer will not be responsible or liable for damages from water leaks due to inadequate or lack of a pressurized leak test, or damages caused by exceeding the maximum pressure rating during installation.**

#### CAUTION

DO NOT use Stop Leak or similar chemical agent in this system. Addition of chemicals of this type to the loop water will foul the heat exchanger and inhibit unit operation.

## Unit and System Checkout

### WARNING

Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with R-454B refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water-source heat pump products containing R-454B as system failures and property damage may result.

### UNIT AND SYSTEM CHECKOUT

BEFORE POWERING THE SYSTEM, check the following:

#### UNIT FEATURES

- ☐ **Balancing/shutoff valves:** Ensure that all isolation valves are open and water control valves are wired.
- ☐ **Line voltage and wiring:** Verify that voltage is within an acceptable range for the unit and wiring and fuses/breakers are properly sized. Verify that low voltage wiring is complete.
- ☐ **Unit control transformer:** Ensure that transformer has the properly selected voltage tap.
- ☐ **Entering water and air:** Ensure that entering water and air temperatures are within operating limits of the **Operating Limits** and **Commissioning Conditions** tables.
- ☐ **Low water temperature cutout:** Verify that low water temperature cut-out on the CXM2/DXM2.5 is properly set.
- ☐ **Unit fan:** Manually rotate fan to verify free rotation and ensure that blower wheel is secured to the motor shaft. Be sure to remove any shipping supports if needed. DO NOT oil motors upon startup. Fan motors are lubricated at the factory. Check unit fan speed selection and compare to design requirements.
- ☐ **Condensate line:** Verify that condensate line is open and properly pitched toward drain.
- ☐ **Water flow balancing:** Record inlet and outlet water temperatures for each heat pump upon startup. This check can eliminate nuisance trip outs and high velocity water flow that could erode heat exchangers.
- ☐ **Unit air coil and filters:** Ensure that filter is clean and accessible. Clean air coil of all manufacturing oils.
- ☐ **Unit controls:** Verify that CXM2 or DXM2.5 field selection options are properly set.

### SYSTEM CHECKOUT

- ☐ **System water temperature:** Check water temperature for proper range and also verify heating and cooling set points for proper operation.
- ☐ **System pH:** Check and adjust water pH if necessary to maintain a level between 6 and 8.5. Proper pH promotes longevity of hoses and fittings. Verify these requirements using the **Water Quality Requirements** table.
- ☐ **System flushing:** Verify that all hoses are connected end to end when flushing to ensure that debris bypasses the unit heat exchanger, water valves and other components. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Verify that all air is purged from the system. Air in the system can cause poor operation or system corrosion.
- ☐ **Cooling tower/boiler:** Check equipment for proper setpoints and operation.
- ☐ **Standby pumps:** Verify that the standby pump is properly installed and in operating condition.
- ☐ **System controls:** Verify that system controls function and operate in the proper sequence.
- ☐ **Low water temperature cutout:** Verify that low water temperature cut-out controls are provided for the outdoor portion of the loop. Otherwise, operating problems may occur.
- ☐ **System control center:** Verify that the control center and alarm panel have appropriate setpoints and are operating as designed.
- ☐ **Miscellaneous:** Note any questionable aspects of the installation.

### CAUTION

Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing the brazed-plate heat exchanger or water lines can permanently damage the heat pump.

### CAUTION

To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless antifreeze is added to the water loop. Heat exchangers never fully drain by themselves and will freeze unless winterized with antifreeze.

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## Startup Procedure

1. Turn the thermostat fan position to "ON". The blower should start.
2. Balance air flow at diffusers.
3. Adjust all valves to their full open positions. Turn on the line power to all heat pumps.
4. Room temperature should be within the minimum-maximum ranges of the **Commissioning Condition** table during startup checks, loop water temperature entering the heat pump should be within the minimum-maximum ranges of the **Commissioning Condition** table.
5. Two factors determine the operating limits of water-source heat pumps, (a) return air temperature, and (b) water temperature. When any one of these factors is at a minimum or maximum level, the other factor must be at normal level to ensure proper unit operation.

- A. Adjust the unit thermostat to the warmest setting. Place the thermostat mode switch in the "COOL" position. Slowly reduce thermostat setting until the compressor activates.
- B. Check for cool air delivery at the unit grille within a few minutes after the unit has begun to operate.

**NOTE: Units have a five minute time delay in the control circuit that can be eliminated on the CXM2/DXM2.5 as shown in the Test Mode button figure. See controls description for details.**

- C. Run the unit for 15 minutes before recording performance data in the Startup Log Sheet.
- D. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using the P/T plugs and comparing to the **Brazed-Plate Water Pressure Drop** table.
- E. Check the elevation and cleanliness of the condensate lines. Dripping may be a sign of a blocked line. Check that the condensate trap is filled to provide a water seal.
- F. Refer to the Typical Unit **Operating Pressures and Temperatures** tables. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. Heat of rejection (HR) can be calculated and compared to submittal data capacity pages. The formula for HR for systems with water is as follows:

$$HR \text{ (Btu/h)} = TD \times GPM \times 500$$

where TD is the temperature difference between the entering and leaving water, and GPM is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to the **Brazed-Plate Water Pressure Drop** table. In S-I units, the formula is as follows:

$$HR \text{ (kW)} = TD \times l/s \times 4.18.$$

- G. Check air temperature drop across the air coil when compressor is operating. Air temperature drop should be between 15°F and 25°F (8°C and 14°C).
- H. Turn thermostat to "OFF" position. A hissing noise indicates proper functioning of the reversing valve.
6. Allow five (5) minutes between tests for pressure to equalize before beginning heating test.
  - A. Adjust the thermostat to the lowest setting. Place the thermostat mode switch in the "HEAT" position.
  - B. Slowly raise the thermostat to a higher temperature until the compressor activates.
  - C. Check for warm air delivery within a few minutes after the unit begins to operate.
  - D. Run the unit for 15 minutes before recording performance data in the Startup Log Sheet.
  - E. Refer to the Typical Unit Operating Pressures and Temperatures tables. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. If temperature is outside of the operating range, check refrigerant pressures. Heat of extraction (HE) can be calculated and compared to submittal data capacity pages. The formula for HE for systems with water is as follows:

$$HE \text{ (kW)} = TD \times GPM \times 500$$

where TD is the temperature difference between the entering and leaving water, and l/s is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to the **Brazed-Plate Water Pressure Drop** table. In S-I units, the formula is as follows:

$$HE \text{ (kW)} = TD \times l/s \times 4.18$$

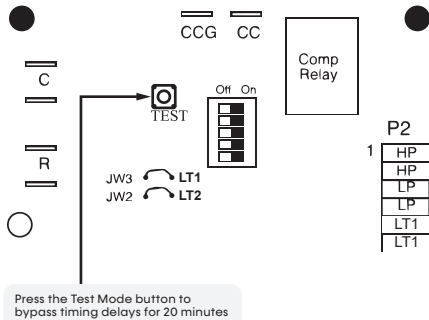
## Startup Procedure

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- F. Check air temperature rise across the air coil when compressor is operating. Air temperature rise should be between 20°F and 30°F (11°C and 17°C).
  - G. Check for vibration, noise, and water leaks.
7. If the unit fails to operate, perform troubleshooting analysis (see Functional Troubleshooting). If the check procedure described fails to reveal the problem, and the unit still does not operate, contact a trained service technician to ensure proper diagnosis and repair of the equipment.
  8. When testing is complete, set the system to maintain the desired comfort level.

**NOTE:** If performance during any mode appears abnormal, refer to the CXM2 section or troubleshooting section of this manual. To obtain maximum performance, the air coil should be cleaned before startup. A 10% solution of dishwasher detergent and water is recommended.

### Figure 24: Test Mode Button



**⚠ WARNING**

When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with energized equipment.

**CAUTION**

Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing the brazed-plate heat exchanger or water lines can permanently damage the heat pump.

**CAUTION**

Many units are installed with a factory or field supplied manual or electric shutoff valve. **DAMAGE WILL OCCUR** if shutoff valve is closed during unit operation. A high pressure switch must be installed on the heat pump side of any field provided shutoff valves and connected to the heat pump controls in series with the built-in refrigerant circuit high pressure switch to disable compressor operation if water pressure exceeds pressure switch setting. The field installed high pressure switch shall have a cut-out pressure of 300 psig and a cut-in pressure of 250 psig.

### Table 11: Motorized Water Valve Corrections

| Model | Flow Coefficient (Two Way) Cv | Max. Close-Off Pressure (MOPD) | WPD Adders |     |     |
|-------|-------------------------------|--------------------------------|------------|-----|-----|
|       |                               |                                | GPM        | PSI | FT  |
| SL06  | 4.9                           | 0 - 125 psi                    | 1.5        | 0.1 | 0.2 |
|       |                               |                                | 1.9        | 0.1 | 0.3 |
|       |                               |                                | 2.3        | 0.2 | 0.5 |
| SL09  |                               |                                | 1.7        | 0.1 | 0.3 |
|       |                               |                                | 2.3        | 0.2 | 0.5 |
|       |                               |                                | 2.8        | 0.3 | 0.8 |
| SL12  |                               |                                | 2.3        | 0.2 | 0.5 |
|       |                               |                                | 3.0        | 0.4 | 0.9 |
|       |                               |                                | 3.8        | 0.6 | 1.4 |
| SL15  |                               |                                | 2.8        | 0.3 | 0.8 |
|       |                               |                                | 3.8        | 0.6 | 1.4 |
|       |                               |                                | 4.7        | 0.9 | 2.1 |

### Table 12: Brazed-Plate Water Pressure Drop

| Model | GPM  | l/s  | Pressure Drop, psi [kPa] |                |                |                |
|-------|------|------|--------------------------|----------------|----------------|----------------|
|       |      |      | 30°F<br>[-1°C]           | 50°F<br>[10°C] | 70°F<br>[21°C] | 90°F<br>[32°C] |
| SL06  | 1.5  | 0.09 | 1.4                      | 0.6            | 0.4            | 0.5            |
|       | 1.88 | 0.12 | 2.0                      | 0.9            | 0.6            | 0.7            |
|       | 2.25 | 0.14 | 2.5                      | 1.1            | 0.8            | 1.0            |
| SL09  | 1.69 | 0.11 | 1.9                      | 1.4            | 1.3            | 1.3            |
|       | 2.25 | 0.14 | 2.9                      | 2.5            | 2.3            | 2.3            |
|       | 2.8  | 0.18 | 4.0                      | 3.6            | 3.3            | 3.3            |
| SL12  | 2.25 | 0.14 | 2.6                      | 2.2            | 2.0            | 1.9            |
|       | 3    | 0.19 | 4.3                      | 3.8            | 3.5            | 3.4            |
|       | 3.8  | 0.24 | 6.0                      | 5.4            | 5.0            | 4.9            |
| SL15  | 2.8  | 0.18 | 3.3                      | 2.7            | 2.5            | 2.5            |
|       | 3.8  | 0.24 | 5.6                      | 5.0            | 4.8            | 4.7            |
|       | 4.7  | 0.30 | 7.8                      | 7.1            | 6.9            | 6.8            |

Models:  
SL  
06-15

## Operating Conditions

Operating Pressure/Temperature tables include the following notes:

- Airflow is at nominal (rated) conditions
- Entering air is based upon 70°F (21°C) DB in heating and 80/67°F (27/19°C) in cooling
- Subcooling is based upon head pressure at compressor service port
- Cooling air and water values can vary greatly with changes in humidity level

**Table 13: Typical Unit Operating Pressures and Temperatures**

| SL06                   |                | Cooling                 |                       |              |               |                    |                     | Heating                 |                       |              |               |                    |                     |
|------------------------|----------------|-------------------------|-----------------------|--------------|---------------|--------------------|---------------------|-------------------------|-----------------------|--------------|---------------|--------------------|---------------------|
| Entering Water Temp °F | Water Flow GPM | Discharge Pressure PSIG | Suction Pressure PSIG | Superheat °F | Subcooling °F | Water Temp Rise °F | Air Temp Drop °F DB | Discharge Pressure PSIG | Suction Pressure PSIG | Superheat °F | Subcooling °F | Water Temp Drop °F | Air Temp Rise °F DB |
| 30'                    | 1.0            | 127-137                 | 105-115               | 30-34        | 7-11          | 13-17              | 14-18               | 272-282                 | 69-79                 | 8-12         | 5-9           | 4-8                | 14-18               |
|                        | 1.5            | 118-128                 | 103-113               | 31-35        | 6-10          | 8-12               | 15-19               | 273-283                 | 72-82                 | 8-12         | 4-8           | 2-6                | 14-18               |
|                        | 2.0            | 109-119                 | 102-112               | 32-36        | 6-10          | 6-10               | 15-19               | 274-284                 | 74-84                 | 8-12         | 4-8           | 1-5                | 15-19               |
| 50                     | 1.0            | 175-185                 | 125-135               | 12-16        | 6-10          | 15-19              | 18-22               | 294-304                 | 101-111               | 8-12         | 4-8           | 7-11               | 20-24               |
|                        | 1.5            | 166-176                 | 124-134               | 13-17        | 6-10          | 9-13               | 18-22               | 296-306                 | 104-114               | 8-12         | 4-8           | 4-8                | 21-25               |
|                        | 2.0            | 157-167                 | 123-133               | 14-18        | 5-9           | 7-11               | 18-22               | 297-307                 | 106-116               | 8-12         | 3-7           | 3-7                | 21-25               |
| 70                     | 1.0            | 235-245                 | 134-144               | 5-9          | 6-10          | 14-18              | 18-22               | 321-331                 | 132-142               | 11-15        | 3-7           | 10-14              | 24-28               |
|                        | 1.5            | 225-235                 | 133-143               | 7-11         | 6-10          | 9-13               | 18-22               | 322-332                 | 135-145               | 11-15        | 3-7           | 6-10               | 25-29               |
|                        | 2.0            | 217-227                 | 131-141               | 8-12         | 5-9           | 6-10               | 18-22               | 324-334                 | 137-147               | 11-15        | 3-7           | 4-8                | 25-29               |
| 90                     | 1.0            | 309-319                 | 138-148               | 5-9          | 6-10          | 13-17              | 16-20               | 341-351                 | 156-166               | 18-22        | 4-8           | 11-15              | 26-30               |
|                        | 1.5            | 299-309                 | 136-146               | 6-10         | 6-10          | 8-12               | 16-20               | 342-352                 | 159-169               | 17-21        | 4-8           | 7-11               | 27-31               |
|                        | 2.0            | 291-301                 | 135-145               | 7-11         | 5-9           | 6-10               | 16-20               | 343-353                 | 161-171               | 17-21        | 4-8           | 5-9                | 27-31               |
| 120                    | 1.0            | 455-465                 | 150-160               | 4-8          | 6-10          | 12-16              | 13-17               |                         |                       |              |               |                    |                     |
|                        | 1.5            | 446-456                 | 148-158               | 5-9          | 6-10          | 7-11               | 13-17               |                         |                       |              |               |                    |                     |
|                        | 2.0            | 437-447                 | 147-157               | 6-10         | 5-9           | 5-9                | 13-17               |                         |                       |              |               |                    |                     |

1. Based on 20% methanol antifreeze solution

| SL09                   |                | Cooling                 |                       |              |               |                    |                     | Heating                 |                       |              |               |                    |                     |
|------------------------|----------------|-------------------------|-----------------------|--------------|---------------|--------------------|---------------------|-------------------------|-----------------------|--------------|---------------|--------------------|---------------------|
| Entering Water Temp °F | Water Flow GPM | Discharge Pressure PSIG | Suction Pressure PSIG | Superheat °F | Subcooling °F | Water Temp Rise °F | Air Temp Drop °F DB | Discharge Pressure PSIG | Suction Pressure PSIG | Superheat °F | Subcooling °F | Water Temp Drop °F | Air Temp Rise °F DB |
| 30'                    | 1.4            | 128-138                 | 103-113               | 26-30        | 9-13          | 12-22              | 15-25               | 286-296                 | 67-77                 | 9-13         | 4-8           | 1-11               | 14-24               |
|                        | 2.1            | 120-130                 | 101-111               | 28-32        | 9-13          | 6-16               | 15-25               | 289-299                 | 69-79                 | 9-13         | 4-8           | 1-9                | 15-25               |
|                        | 2.8            | 110-120                 | 100-110               | 29-33        | 8-12          | 3-13               | 15-25               | 292-302                 | 72-82                 | 9-13         | 4-8           | 1-8                | 15-25               |
| 50                     | 1.4            | 179-189                 | 117-127               | 14-18        | 10-14         | 12-22              | 17-27               | 313-323                 | 95-105                | 12-16        | 4-8           | 4-14               | 21-31               |
|                        | 2.1            | 170-180                 | 115-125               | 15-19        | 9-13          | 7-17               | 17-27               | 315-325                 | 98-108                | 12-16        | 4-8           | 1-11               | 21-31               |
|                        | 2.8            | 161-171                 | 114-124               | 16-20        | 8-12          | 4-14               | 17-27               | 318-328                 | 100-110               | 13-17        | 4-8           | 1-10               | 21-31               |
| 70                     | 1.4            | 240-250                 | 124-134               | 6-10         | 10-14         | 12-22              | 17-27               | 344-354                 | 126-136               | 13-17        | 4-8           | 6-16               | 26-36               |
|                        | 2.1            | 232-242                 | 122-132               | 8-12         | 9-13          | 6-16               | 17-27               | 346-356                 | 129-139               | 13-17        | 4-8           | 3-13               | 26-36               |
|                        | 2.8            | 223-233                 | 121-131               | 9-13         | 8-12          | 3-13               | 17-27               | 349-359                 | 132-142               | 13-17        | 4-8           | 1-11               | 27-37               |
| 90                     | 1.4            | 316-326                 | 128-138               | 3-7          | 10-14         | 11-21              | 15-25               | 377-387                 | 156-166               | 17-21        | 4-8           | 8-18               | 30-40               |
|                        | 2.1            | 307-317                 | 126-136               | 4-8          | 9-13          | 6-16               | 15-25               | 379-389                 | 159-169               | 17-21        | 4-8           | 4-14               | 30-40               |
|                        | 2.8            | 298-308                 | 125-135               | 6-10         | 8-12          | 3-13               | 15-25               | 382-392                 | 162-172               | 17-21        | 4-8           | 2-12               | 31-41               |
| 120                    | 1.4            | 462-472                 | 138-148               | 3-7          | 10-14         | 10-20              | 12-22               |                         |                       |              |               |                    |                     |
|                        | 2.1            | 453-463                 | 136-146               | 4-8          | 9-13          | 5-15               | 12-22               |                         |                       |              |               |                    |                     |
|                        | 2.8            | 444-454                 | 135-145               | 5-9          | 8-12          | 2-12               | 12-22               |                         |                       |              |               |                    |                     |

2. Based on 20% methanol antifreeze solution

## Operating Conditions

Models:  
SL  
06-15

| SL12                   |                | Cooling                 |                       |              |               |                    |                     | Heating                 |                       |              |               |                    |                     |
|------------------------|----------------|-------------------------|-----------------------|--------------|---------------|--------------------|---------------------|-------------------------|-----------------------|--------------|---------------|--------------------|---------------------|
| Entering Water Temp °F | Water Flow GPM | Discharge Pressure PSIG | Suction Pressure PSIG | Superheat °F | Subcooling °F | Water Temp Rise °F | Air Temp Drop °F DB | Discharge Pressure PSIG | Suction Pressure PSIG | Superheat °F | Subcooling °F | Water Temp Drop °F | Air Temp Rise °F DB |
| 30'                    | 1.5            | 134-144                 | 106-116               | 29-33        | 6-10          | 16-26              | 15-25               | 270-280                 | 64-74                 | 10-14        | 3-7           | 3-13               | 14-24               |
|                        | 2.3            | 122-132                 | 105-115               | 31-35        | 6-10          | 9-19               | 15-25               | 274-284                 | 67-77                 | 11-15        | 3-7           | 1-11               | 15-25               |
|                        | 3.0            | 110-120                 | 103-113               | 33-37        | 5-9           | 5-15               | 15-25               | 278-288                 | 70-80                 | 11-15        | 3-7           | 1-9                | 16-26               |
| 50                     | 1.5            | 187-197                 | 123-133               | 12-16        | 7-11          | 17-27              | 17-27               | 294-304                 | 92-102                | 12-16        | 3-7           | 6-16               | 20-30               |
|                        | 2.3            | 176-186                 | 121-131               | 14-18        | 6-10          | 10-20              | 17-27               | 298-308                 | 95-105                | 12-16        | 3-7           | 3-13               | 21-31               |
|                        | 3.0            | 164-174                 | 120-130               | 16-20        | 5-9           | 6-16               | 17-27               | 301-311                 | 97-107                | 12-16        | 3-7           | 1-11               | 22-32               |
| 70                     | 1.5            | 251-261                 | 129-139               | 6-10         | 7-11          | 16-26              | 17-27               | 317-327                 | 115-125               | 15-19        | 3-7           | 9-19               | 25-35               |
|                        | 2.3            | 240-250                 | 128-138               | 8-12         | 7-11          | 9-19               | 17-27               | 321-331                 | 117-127               | 16-20        | 3-7           | 4-14               | 25-35               |
|                        | 3.0            | 228-238                 | 127-137               | 10-14        | 6-10          | 6-16               | 17-27               | 325-335                 | 120-130               | 16-20        | 3-7           | 2-12               | 26-36               |
| 90                     | 1.5            | 329-339                 | 133-143               | 5-9          | 8-12          | 15-25              | 15-25               | 347-357                 | 143-153               | 18-22        | 3-7           | 11-21              | 29-39               |
|                        | 2.3            | 317-327                 | 131-141               | 7-11         | 7-11          | 9-19               | 15-25               | 351-361                 | 146-156               | 19-23        | 3-7           | 6-16               | 29-39               |
|                        | 3.0            | 305-315                 | 130-140               | 9-13         | 6-10          | 5-15               | 15-25               | 355-365                 | 149-159               | 19-23        | 3-7           | 3-13               | 30-40               |
| 120                    | 1.5            | 476-486                 | 143-153               | 3-7          | 7-11          | 14-24              | 12-22               |                         |                       |              |               |                    |                     |
|                        | 2.3            | 465-475                 | 142-152               | 5-9          | 6-10          | 8-18               | 12-22               |                         |                       |              |               |                    |                     |
|                        | 3.0            | 453-463                 | 140-150               | 7-11         | 5-9           | 5-15               | 12-22               |                         |                       |              |               |                    |                     |

3. Based on 20% methanol antifreeze solution

| SL15                   |                | Cooling                 |                       |              |               |                    |                     | Heating                 |                       |              |               |                    |                     |
|------------------------|----------------|-------------------------|-----------------------|--------------|---------------|--------------------|---------------------|-------------------------|-----------------------|--------------|---------------|--------------------|---------------------|
| Entering Water Temp °F | Water Flow GPM | Discharge Pressure PSIG | Suction Pressure PSIG | Superheat °F | Subcooling °F | Water Temp Rise °F | Air Temp Drop °F DB | Discharge Pressure PSIG | Suction Pressure PSIG | Superheat °F | Subcooling °F | Water Temp Drop °F | Air Temp Rise °F DB |
| 30'                    | 2.0            | 128-138                 | 104-114               | 34-38        | 7-11          | 13-23              | 14-24               | 260-270                 | 64-74                 | 6-10         | 2-6           | 2-12               | 13-23               |
|                        | 3.0            | 117-127                 | 102-112               | 37-41        | 7-11          | 7-17               | 14-24               | 262-272                 | 67-77                 | 7-11         | 2-6           | 1-10               | 13-23               |
|                        | 4.0            | 107-117                 | 101-111               | 40-44        | 6-10          | 4-14               | 14-24               | 264-274                 | 69-79                 | 7-11         | 2-6           | 1-9                | 13-23               |
| 50                     | 2.0            | 181-191                 | 126-136               | 9-13         | 5-9           | 14-24              | 17-27               | 284-294                 | 93-103                | 7-11         | 2-6           | 5-15               | 19-29               |
|                        | 3.0            | 171-181                 | 124-134               | 13-17        | 5-9           | 8-18               | 17-27               | 286-296                 | 96-106                | 8-12         | 2-6           | 2-12               | 19-29               |
|                        | 4.0            | 161-171                 | 123-133               | 16-20        | 4-8           | 5-15               | 17-27               | 287-297                 | 99-109                | 8-12         | 2-6           | 1-10               | 20-30               |
| 70                     | 2.0            | 244-254                 | 134-144               | 1-5          | 5-9           | 14-24              | 17-27               | 312-322                 | 125-135               | 10-14        | 2-6           | 8-18               | 24-34               |
|                        | 3.0            | 234-244                 | 133-143               | 4-8          | 4-8           | 8-18               | 17-27               | 314-324                 | 128-138               | 11-15        | 2-6           | 4-14               | 24-34               |
|                        | 4.0            | 224-234                 | 131-141               | 7-11         | 4-8           | 5-15               | 17-27               | 316-326                 | 131-141               | 11-15        | 2-6           | 2-12               | 25-35               |
| 90                     | 2.0            | 320-330                 | 137-147               | 1-5          | 6-10          | 13-23              | 15-25               | 330-340                 | 147-157               | 18-22        | 2-6           | 9-19               | 26-36               |
|                        | 3.0            | 310-320                 | 135-145               | 4-8          | 5-9           | 7-17               | 15-25               | 331-341                 | 150-160               | 18-22        | 2-6           | 5-15               | 26-36               |
|                        | 4.0            | 300-310                 | 134-144               | 7-11         | 4-8           | 4-14               | 15-25               | 333-343                 | 153-163               | 19-23        | 2-6           | 2-12               | 27-37               |
| 120                    | 2.0            | 465-475                 | 148-158               | 1-2          | 6-10          | 12-22              | 13-23               |                         |                       |              |               |                    |                     |
|                        | 3.0            | 455-465                 | 146-156               | 1-5          | 5-9           | 6-16               | 13-23               |                         |                       |              |               |                    |                     |
|                        | 4.0            | 445-455                 | 145-155               | 4-8          | 4-8           | 3-13               | 13-23               |                         |                       |              |               |                    |                     |

4. Based on 20% methanol antifreeze solution

## Preventative Maintenance

### BRAZED-PLATE HEAT EXCHANGER MAINTENANCE

**NOTE: Do not apply the SL to ground-water applications.**

Brazed-plate heat exchanger maintenance for all other water-loop applications. Generally brazed-plate heat exchanger (BPHX) maintenance is not needed for closed-loop systems. If the piping is known to have high dirt or debris content, establish a periodic maintenance schedule with the owner with the owner so the BPHX water strainer can be checked regularly. Dirty installations are typically the result of deterioration of iron or galvanized piping or components in the system. Open cooling towers requiring heavy chemical treatment due to mineral buildup through water use can also contribute to higher maintenance. Do not apply the SL to these systems unless an intermediate heat exchanger is used in the water loop system. Periodically clean the unit's water strainer. Water loop systems with poor water quality/dirt/debris in the system require the strainer be cleaned out more frequently. If periodic coil cleaning is necessary, use standard coil cleaning procedures, which are compatible with both the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. Flow rates over 3 gpm per ton (3.9 l/m per kW) can produce water (or debris) velocities that erode the heat exchanger wall and ultimately produce leaks.

### FILTERS

Filters must be clean to obtain maximum performance. Inspect filters every month under normal operating conditions and be replace them when necessary. Never operate units without a filter.

Washable, high-efficiency, electrostatic filters, when dirty, can exhibit a very high pressure drop for the fan motor and reduce air flow resulting in poor performance. It is especially important to consistently wash these filters (in the opposite direction of the normal air flow) once per month using a high pressure wash similar to those found at self-service car washes.

### CONDENSATE DRAIN

In areas where airborne bacteria may produce a slimy substance in the drain pan, it may be necessary to treat the drain pan chemically with an algacide approximately every three months to minimize the problem. You may need to clean the condensate pan periodically to ensure indoor air quality. The condensate drain can collect lint and dirt, especially with dirty filters. Inspect the drain twice a year to avoid the possibility of plugging and eventual overflow.

### COMPRESSOR

Conduct annual amperage checks to ensure that amp draw is no more than 10% greater than indicated on the serial plate data.

### FAN MOTORS

All units have lubricated fan motors. Never lubricate fan motors unless obvious, dry operation is suspected. Periodic maintenance oiling is not recommended as it will result in dirt accumulating in the excess oil and cause eventual motor failure. Conduct annual dry operation check and amperage check to ensure amp draw is no more than 10% greater than indicated on serial plate data.

### AIR COIL

Air coil cleaning is required to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Take care to avoid damaging the aluminum fins while cleaning.

#### CAUTION

Fin edges are sharp.

### CABINET

Do not permit water to stay in contact with the cabinet for long periods of time to prevent corrosion of the cabinet sheet metal. You can clean the cabinet using a mild detergent.

### REFRIGERANT SYSTEM

To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Reference the operating charts for pressures and temperatures. Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

## Troubleshooting Troubleshooting Table

Models:  
SL  
06-15

| Fault LED/Fault/Symptom                                                  | HT | CL | Possible Cause                                                    | Solution                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------|----|----|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Main power problems</b>                                               | X  | X  | Green Status LED off                                              | <ul style="list-style-type: none"> <li>Check the line voltage circuit breaker and disconnect.</li> <li>Check for line voltage between L1 and L2 on the contactor.</li> <li>Check for 24VAC between R and C on the unit control.</li> <li>Check primary/secondary voltage on transformer.</li> </ul> |
| <b>Flash Code 2<br/>HP Fault<br/>High Pressure</b>                       |    | X  | Reduced or no water flow in cooling                               | <ul style="list-style-type: none"> <li>Check pump operation or valve operation/setting.</li> <li>Check water flow adjust to proper flow rate.</li> </ul>                                                                                                                                            |
|                                                                          |    | X  | Water temperature out of range in cooling                         | Bring water temp within design parameters.                                                                                                                                                                                                                                                          |
|                                                                          | X  |    | Reduced or no airflow in heating                                  | <ul style="list-style-type: none"> <li>Check for dirty air filter and clean or replace.</li> <li>Check fan motor operation and airflow restrictions.</li> <li>Dirty air coil. Clean out construction dust etc.</li> <li>Too high of external static? Check static vs blower table.</li> </ul>       |
|                                                                          | X  |    | Air temperature out of range in heating                           | Bring return air temp within design parameters.                                                                                                                                                                                                                                                     |
|                                                                          | X  | X  | Non-condensables in system                                        | Vacuum system and re-weigh in charge.                                                                                                                                                                                                                                                               |
|                                                                          | X  | X  | Restricted metering device                                        | Check superheat and subcooling per chart. Replace.                                                                                                                                                                                                                                                  |
|                                                                          | X  | X  | Unit overcharged                                                  | Check superheat/subcooling vs typical operating condition table.                                                                                                                                                                                                                                    |
|                                                                          | X  | X  | Bad HP switch                                                     | Check switch continuity and operation. Replace.                                                                                                                                                                                                                                                     |
| <b>Flash Code 3<br/>LP/LOC Fault<br/>Low Pressure<br/>Loss of Charge</b> | X  | X  | Insufficient charge                                               | Check for refrigerant leaks.                                                                                                                                                                                                                                                                        |
|                                                                          | X  | X  | Bad LP switch                                                     | Check switch continuity and operation. Replace                                                                                                                                                                                                                                                      |
|                                                                          | X  |    | Reduced water flow in heating                                     | <ul style="list-style-type: none"> <li>Check pump operation or water valve operation/setting.</li> <li>Plugged strainer or filter? Clean or replace.</li> <li>Check water flow. Adjust to proper flow rate.</li> </ul>                                                                              |
|                                                                          | X  |    | Water temperature out of range                                    | Bring water temperature within design parameters.                                                                                                                                                                                                                                                   |
|                                                                          |    | X  | Reduced airflow in cooling                                        | <ul style="list-style-type: none"> <li>Check for dirty air filter then clean or replace.</li> <li>Check fan motor operation and airflow restrictions.</li> <li>Is external static too high? Check static against blower table.</li> </ul>                                                           |
|                                                                          |    | X  | Air temperature out of range                                      | Is there too much cold vent air? Bring air temperature within design parameters.                                                                                                                                                                                                                    |
|                                                                          | X  |    | Compressor pump down at startup                                   | Check charge and startup water flow.                                                                                                                                                                                                                                                                |
|                                                                          |    |    |                                                                   |                                                                                                                                                                                                                                                                                                     |
| <b>Flash Code 4<br/>LT1 Fault<br/>Water Coil Low Temperature Limit</b>   | X  |    | Reduced or no water flow in heating                               | <ul style="list-style-type: none"> <li>Check pump operation or water valve operation/setting.</li> <li>Plugged strainer or filter? Clean or replace.</li> <li>Check water flow. Adjust to proper flow rate.</li> </ul>                                                                              |
|                                                                          | X  |    | Inadequate antifreeze level                                       | Check antifreeze density with hydrometer.                                                                                                                                                                                                                                                           |
|                                                                          | X  |    | Improper temperature limit setting (30°F vs 10°F [-1°C vs -2°C])  | Clip JW3 jumper for antifreeze (10°F [-12°C]) use.                                                                                                                                                                                                                                                  |
|                                                                          | X  |    | Water temperature out of range                                    | Bring water temp within design parameters.                                                                                                                                                                                                                                                          |
|                                                                          | X  | X  | Bad thermistor                                                    | Check temp and impedance correlation per chart.                                                                                                                                                                                                                                                     |
| <b>Flash Code 5<br/>LT2 Fault<br/>Air Coil Low Temperature Limit</b>     |    | X  | Reduced or no airflow in cooling                                  | <ul style="list-style-type: none"> <li>Check for dirty air filter and clean or replace.</li> <li>Check fan motor operation and airflow restrictions.</li> <li>Too high of external static? Check static against blower table.</li> </ul>                                                            |
|                                                                          |    | X  | Air temperature out of range                                      | Too much cold vent air? Bring entering air temp within design parameters.                                                                                                                                                                                                                           |
|                                                                          |    | X  | Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C]) | Normal air side applications require 30°F (-1°C) only.                                                                                                                                                                                                                                              |
|                                                                          | X  | X  | Bad thermistor                                                    | Check temp and impedance correlation per chart.                                                                                                                                                                                                                                                     |

TABLE CONTINUED ON NEXT PAGE.

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## Troubleshooting Troubleshooting Table

TABLE CONTINUED FROM PREVIOUS PAGE.

| Fault LED/Fault/Symptom                                           | HT | CL | Possible Cause                                                   | Solution                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------|----|----|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Flash Code 6</b><br><b>Condensate Fault</b>                    | X  | X  | Blocked drain                                                    | Check for blockage and clean drain.                                                                                                                                                                                                                                                                  |
|                                                                   | X  | X  | Improper trap                                                    | Check trap dimensions and location ahead of vent.                                                                                                                                                                                                                                                    |
|                                                                   |    | X  | Poor drainage                                                    | <ul style="list-style-type: none"> <li>Check for piping slope away from unit.</li> <li>Check slope of unit toward outlet.</li> <li>Poor venting? Check vent location.</li> </ul>                                                                                                                     |
|                                                                   |    | X  | Moisture on sensor                                               | Check for moisture shorting to air coil.                                                                                                                                                                                                                                                             |
|                                                                   | X  | X  | Plugged air filter                                               | Replace air filter.                                                                                                                                                                                                                                                                                  |
|                                                                   | X  | X  | Restricted return airflow                                        | Find and eliminate restriction. Increase return duct and/or grille size.                                                                                                                                                                                                                             |
| <b>Flash Code 7</b><br><b>Over/Under Voltage (Auto Resetting)</b> | X  | X  | Under voltage                                                    | <ul style="list-style-type: none"> <li>Check power supply and 24VAC voltage before and during operation.</li> <li>Check power supply wire size.</li> <li>Check compressor starting. Need hard start kit?</li> <li>Check 24VAC and unit transformer. Tap for correct power supply voltage.</li> </ul> |
|                                                                   | X  | X  | Over voltage                                                     | <ul style="list-style-type: none"> <li>Check power supply voltage and 24VAC before and during operation.</li> <li>Check 24VAC and unit transformer. Tap for correct power supply voltage.</li> </ul>                                                                                                 |
| <b>Flash Code 8</b><br><b>Unit Performance Sentinel</b>           | X  |    | Heating mode LT2>125°F (52°C)                                    | Check for poor airflow or overcharged unit.                                                                                                                                                                                                                                                          |
|                                                                   |    | X  | Cooling Mode LT1>125°F (52°C)<br>OR LT2< 40°F (4°C)              | Check for poor water flow or airflow.                                                                                                                                                                                                                                                                |
| <b>Flash Code 9</b><br><b>Swapped Thermistor</b>                  | X  | X  | LT1 and LT2 swapped                                              | Reverse position of thermistors                                                                                                                                                                                                                                                                      |
| <b>Flash Code 13</b><br><b>Low Water Flow</b>                     | X  | X  | Reduced or no water flow                                         | <ul style="list-style-type: none"> <li>Check pump or valve operation setting.</li> <li>Check water flow and adjust to proper flow rate.</li> <li>Clogged Y strainer, replace mesh.</li> </ul>                                                                                                        |
|                                                                   | X  |    | Inadequate antifreeze level                                      | Check antifreeze density with hydrometer.                                                                                                                                                                                                                                                            |
|                                                                   | X  | X  | Bad flow switch                                                  | Confirm applied flow to looks vs minimum flow switch setpoint on label.                                                                                                                                                                                                                              |
| <b>Flash Code 14</b><br><b>Leaving Water Temperature Low</b>      | X  |    | Reduced or no water flow in heating                              | <ul style="list-style-type: none"> <li>Check pump or valve operation setting.</li> <li>Check water flow and adjust to proper flow rate.</li> </ul>                                                                                                                                                   |
|                                                                   | X  |    | Inadequate antifreeze level                                      | Check antifreeze density with hydrometer.                                                                                                                                                                                                                                                            |
|                                                                   | X  |    | Improper temperature limit setting (30°F vs 15°F [-1°C vs -9°C]) | Clip JW3 jumper for antifreeze (15°F [-9°C]) use.                                                                                                                                                                                                                                                    |
|                                                                   | X  |    | Water temperature out of range                                   | Bring water temperature within design parameters.                                                                                                                                                                                                                                                    |
|                                                                   | X  | X  | Bad thermistor                                                   | Check temperature impedance correlation per chart.                                                                                                                                                                                                                                                   |
| <b>Flash Code 15</b><br><b>Refrigerant and RDS</b>                | X  | X  | Refrigerant leak                                                 | Check the refrigerant charge. If the charge is low, identify and repair the leak.                                                                                                                                                                                                                    |
|                                                                   |    |    | Faulty RDS sensor                                                | Check the refrigerant charge. If the charge is not low, replace the RDS sensor.                                                                                                                                                                                                                      |
| <b>No Fault Code Shown</b>                                        | X  | X  | No compressor operation                                          | See the <i>Only Fan Runs</i> symptom.                                                                                                                                                                                                                                                                |
|                                                                   | X  | X  | Compressor overload                                              | Check and replace, if necessary.                                                                                                                                                                                                                                                                     |
|                                                                   | X  | X  | Control board                                                    | Reset power and check operation.                                                                                                                                                                                                                                                                     |
| <b>Unit Short Cycles</b>                                          | X  | X  | Dirty air filter                                                 | Check and clean air filter.                                                                                                                                                                                                                                                                          |
|                                                                   | X  | X  | Unit in Test mode                                                | Reset power or wait 30 minutes for auto exit.                                                                                                                                                                                                                                                        |
|                                                                   | X  | X  | Unit selection                                                   | Unit may be oversized for space. Check sizing for actual load of space.                                                                                                                                                                                                                              |
|                                                                   | X  | X  | Compressor overload                                              | Check and replace, if necessary.                                                                                                                                                                                                                                                                     |

TABLE CONTINUED ON NEXT PAGE.

# Troubleshooting Troubleshooting Table

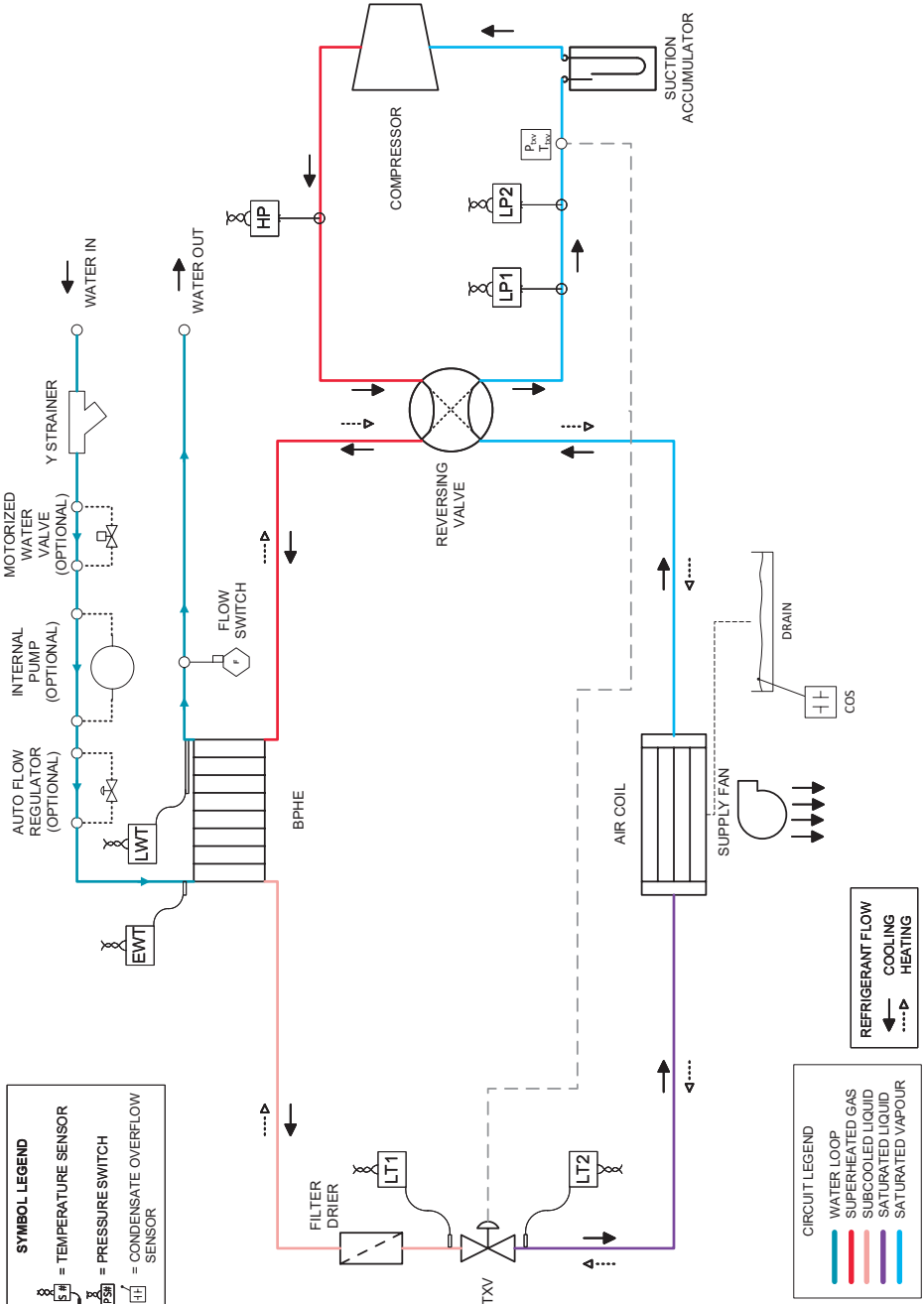
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TABLE CONTINUED FROM PREVIOUS PAGE.

| Fault LED/Fault/Symptom         | HT | CL | Possible Cause      | Solution                                                                                                                                                                                                                                        |
|---------------------------------|----|----|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Only Fan Runs                   | X  | X  | Thermostat position | Ensure thermostat set for heating or cooling operation.                                                                                                                                                                                         |
|                                 | X  | X  | Unit locked out     | Check for lockout codes. Reset power.                                                                                                                                                                                                           |
|                                 | X  | X  | Compressor overload | Check compressor overload. Replace if necessary.                                                                                                                                                                                                |
|                                 | X  | X  | Thermostat wiring   | Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.                                                                                                                                                     |
| Only Compressor Runs            | X  | X  | Thermostat wiring   | • Check G wiring at heat pump. Jumper G and R for fan operation.                                                                                                                                                                                |
|                                 | X  | X  |                     | • Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.                                                                                                                                                   |
|                                 | X  | X  | Fan motor relay     | • Jumper G and R for fan operation. Check for line voltage across BR contacts.                                                                                                                                                                  |
|                                 | X  | X  |                     | • Check fan power enable relay operation (if present).                                                                                                                                                                                          |
|                                 | X  | X  | Fan motor           | Check for line voltage at motor. Check capacitor.                                                                                                                                                                                               |
| Unit Doesn't Operate in Cooling |    | X  | Reversing valve     | Set for cooling demand and check 24VAC on RV coil and at the unit control.                                                                                                                                                                      |
|                                 |    | X  |                     | If RV is stuck, increase high pressure by reducing water flow and while operating engage and disengage RV coil voltage to push valve.                                                                                                           |
|                                 |    | X  | Thermostat setup    | Check for 'O' RV setup not 'B'.                                                                                                                                                                                                                 |
|                                 |    | X  | Thermostat wiring   | Check O wiring at heat pump. Jumper O and R for RV coil 'click'.                                                                                                                                                                                |
|                                 |    | X  |                     | Put thermostat in cooling mode. Check 24VAC on O (check between C and O); check for 24VAC on W (check between W and C). There should be voltage on O, but not on W. If voltage is present on W, the thermostat may be bad or wired incorrectly. |

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# Troubleshooting Refrigeration Troubleshooting Flow



Troubleshooting  
Refrigeration Troubleshooting Form

Models:  
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7300 S.W. 44th Street, Oklahoma City, OK 73179 • Phone: 1-800-299-9747

**Installer:** Complete *Unit and System Checkout* and follow *Unit Startup Procedures* in the IOM. Use this form to record unit information, temperatures, and pressures during startup. Keep this form for reference.

Customer:

Street Address:

Model Number:Serial Number:

Loop Type:Antifreeze:

Complant:Date:

Heat of Extraction (Absorption) or Heat of Rejection =

flow rate (GPM) x

temperature differential (°F) x

fluid factor<sup>1</sup> =

Superheat = Suction temperature - suction saturation temperature =

Supercooling = Discharge saturation temperature - liquid line temperature =

**NOTES:**  
• <sup>1</sup> Use 500 water for water, 485 for antifreeze.

| Location                          | Measurement Type | Value |
|-----------------------------------|------------------|-------|
| Entering Water Temperature Sensor | Temperature      |       |
|                                   | Pressure         |       |
| LWT Sensor                        | Temperature      |       |
|                                   | Pressure         |       |
| Air Coil Entering Air Temperature | Temperature      |       |
| Air Coil Leaving Air Temperature  | Temperature      |       |
| LT1 Sensor                        | Temperature      |       |
| LT2 Sensor                        | Temperature      |       |
| Flash Gas Line                    | Temperature      |       |
| Unit Power                        | Voltage          |       |
|                                   | Amps             |       |
| Compressor                        | Temperature      |       |
| Heating Liquid Line               | Temperature      |       |
| Compressor Discharge              | Temperature      |       |
| Compressor Suction                | Pressure         |       |
| Compressor Saturation             | Temperature      |       |
| Cooling Liquid Line               | Temperature      |       |

- NOTES:**
1. Allow unit to run 15 minutes in each mode before taking data.
  2. Never connect refrigerant gauges during startup procedures.
  3. Conduct water-side analysis using P/T ports to determine water flow and temperature difference.
  4. If water-side analysis shows poor performance, refrigerant troubleshooting may be required.
  5. Connect refrigerant gauges as a last resort.

Models:  
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Startup Log

7300 S.W. 44th Street, Oklahoma City, OK 73179 • Phone: 1-800-299-9747

**Installer:** Complete *Unit and System Checkout* and follow *Unit Startup Procedures* in the IOM. Use this form to record unit information, temperatures, and pressures during startup. Keep this form for reference.

Job Name:

Street Address:

Model Number:

Serial Number:

Unit Location in Building:

Date:

Sales Order Number:

To minimize troubleshooting and costly system failures, complete the following checks and data entries before the system is put into full operation.

| Fan Motor | Description | Value |
|-----------|-------------|-------|
| PSC       | Speed Tap   |       |
| CT EC     | Speed Tap   |       |
| CV EC     | CFM Setting |       |

Temperatures (check one)

☐ °F

☐ °C

Antifreeze

%

Pressures (check one)

☐ PSIG

☐ kPa

Type

|                                                | Cooling Mode |    | Heating Mode |  |  |  |
|------------------------------------------------|--------------|----|--------------|--|--|--|
| Entering Fluid Temperature                     |              |    |              |  |  |  |
| Leaving Fluid Temperature                      |              |    |              |  |  |  |
| Fluid Temperature Differential                 |              |    |              |  |  |  |
| Return-Air Temperature                         | DB           | WB | DB           |  |  |  |
| Supply-Air Temperature                         | DB           | WB | DB           |  |  |  |
| Air Temperature Differential                   |              |    |              |  |  |  |
| Water Coil Heat Exchanger (Water Pressure IN)  |              |    |              |  |  |  |
| Water Coil Heat Exchanger (Water Pressure OUT) |              |    |              |  |  |  |
| Pressure Differential                          |              |    |              |  |  |  |
| Flow Rate GPM (l/s)                            |              |    |              |  |  |  |
| Compressor                                     |              |    |              |  |  |  |
| Amps                                           |              |    |              |  |  |  |
| Volts                                          |              |    |              |  |  |  |
| Discharge Line Temperature                     |              |    |              |  |  |  |
| Motor                                          |              |    |              |  |  |  |
| Amps                                           |              |    |              |  |  |  |
| Volts                                          |              |    |              |  |  |  |

- NOTES:**
1. Allow unit to run 15 minutes in each mode before taking data.
  2. Never connect refrigerant gauges during startup procedures.
  3. Conduct water-side analysis using P/T ports to determine water flow and temperature difference.
  4. If water-side analysis shows poor performance, refrigerant troubleshooting may be required.
  5. Connect refrigerant gauges as a last resort.



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Notes

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Notes

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Revision History

| Date     | Section | Description |
|----------|---------|-------------|
| 10/03/25 | All     | Created     |



A NIBE GROUP MEMBER

7300 SW 44<sup>th</sup> St | Oklahoma City, OK 73179  
Phone: 800.299.9747  
www.climatemaster.com

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