CLIMATEMASTER®

A NIBE GROUP MEMBER

TRANQUILITY® LOW-PROFILE ⟨TRL⟩ SERIES

MODELS TRL 006 - 015
60HZ - HFC-410A

INSTALLATION, OPERATION & MAINTENANCE

97B0001N15

Revised: January 12, 2024

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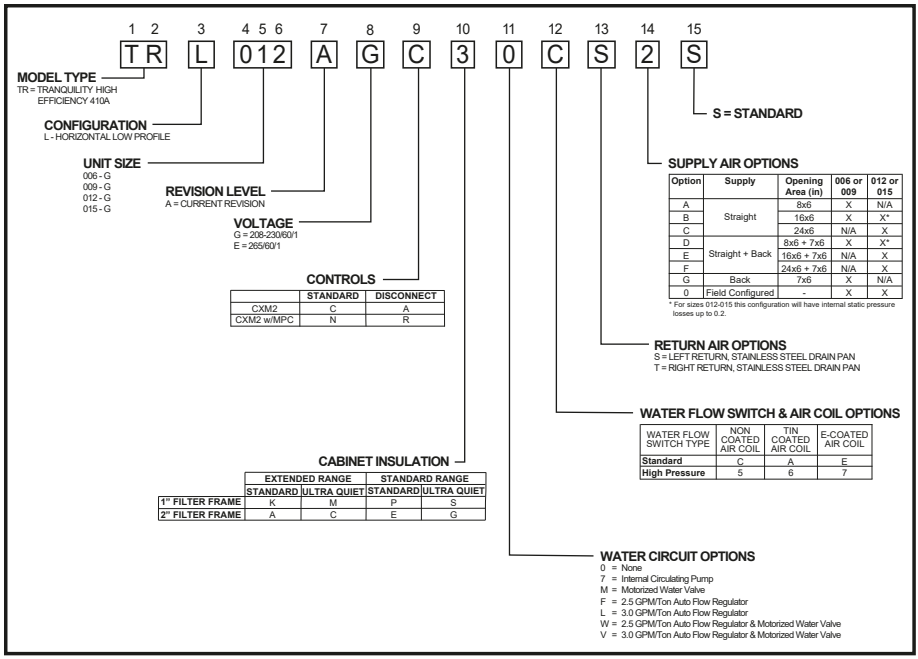
Table of Contents

Model Nomenclature – General Overview



Note: Above model nomenclature is a general reference. Not all configurations are available on all models. Consult selection software for detailed information.

General Information

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! ⚠

WARNING! The EarthPure® Application and Service Manual should be read and understood before attempting to service refrigerant circuits with HFC-410A.

⚠ WARNING! ⚠

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.

⚠ CAUTION! ⚠

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.

⚠ WARNING! ⚠

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! ⚠

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.

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 fifteen (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. Stack units a maximum of 3 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 start-up and may result in costly equipment clean-up.

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 start-up, 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. Confirm supply air configuration matches duct design plans.
7. Locate and verify the hanger kit and other provided field installed parts have been removed from the compressor and blower sections of the unit.
8. The unit is shipped with plastic plugs (hand-tightened) to protect the water lines from debris or contaminant agents that might affect the BPHE, remove before connecting the unit to the main water loop.

General Information

⚠ CAUTION! ⚠

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! ⚠

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.

⚠ WARNING! ⚠

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

Unit Physical Data

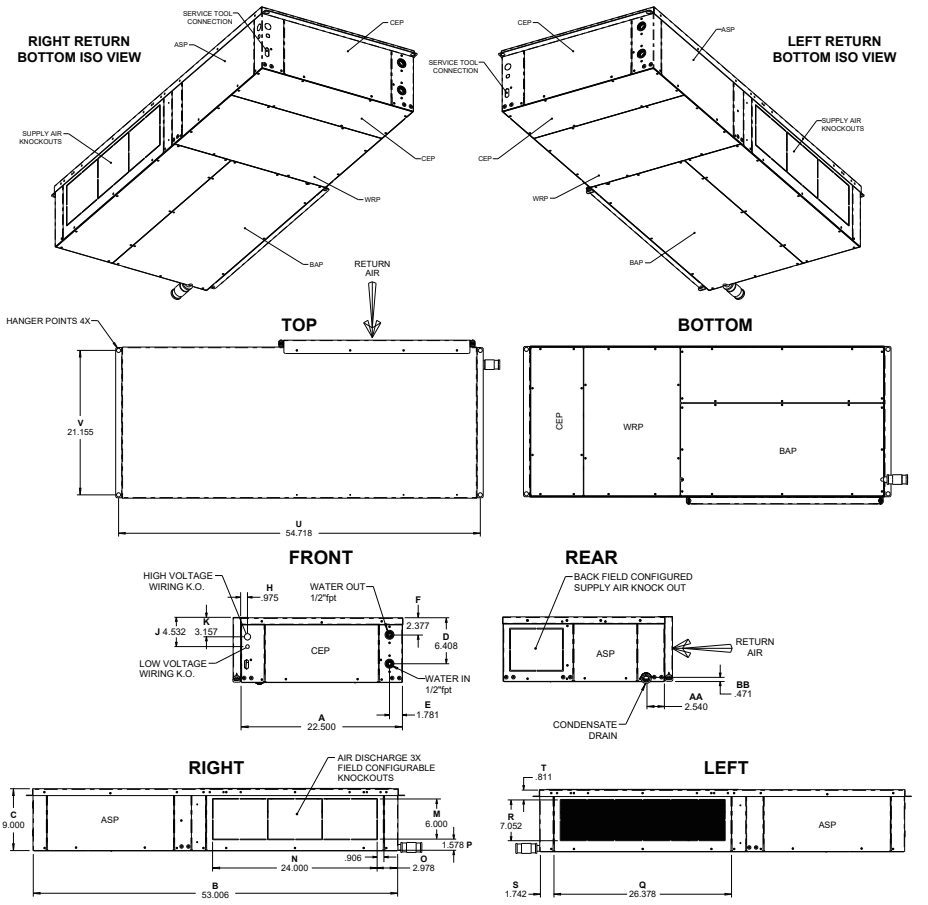
Tranquility® (TRL) Series (60 Hz)

Model	TRL006	TRL009	TRL012	TRL015
Factory Charge R410A - (oz.)	19	19	26	28
Motor & Blower				
ECM Constant Torque (HP) [W]	0.25 [186]			
Blower Wheel Size (Dia x W)	5.7 x 7.98 (1pc)		5.7 x 7.98 (2pc)	
Water Connection Size				
Water volume (gal)*	0.037	0.042		0.049
FPT - All Other	1/2" FPT			
Horizontal				
Filter Standard - 1" Throwaway	8.5 x 28 x 1			
Filter Standard - 2" Throwaway	8.5 x 28 x 2			
Weight - Operating (lbs.)	145	146	152	159
Weight - Packaged (lbs.)	185	186	192	199

*Volume for BPHE only

Unit Maximum Water Working Pressure	Max Pressure PSIG [kPa]
Base Unit	500 [3447]
Internal Secondary Pump (ISP)	200 [1379]
Internal Motorized Water Valve (MWV)	300 [2068]
Internal Auto Flow Valve	300 [2068]
20 Mesh Y Strainer Valve	600 [4137]
Flow switch - Low Pressure System	160 [1103]
Flow switch - High Pressure System	360 [2482]

TRL: Horizontal Dimensional Drawing



Notes:

1. 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.
2. Units shipped with filter frames with duct mounting collar for connection to return air duct connection.
3. Hanger brackets are designed into the top panel of the unit.
4. 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.
5. Blower service access can be from the bottom, side, or top.
6. Bottom blower access allows blower assembly to be dropped, disconnected, and removed for servicing.
7. An installation kit that includes the hanger hardware and condensate coupling is attached the unit side access panel. Remove before installing.

Legend:

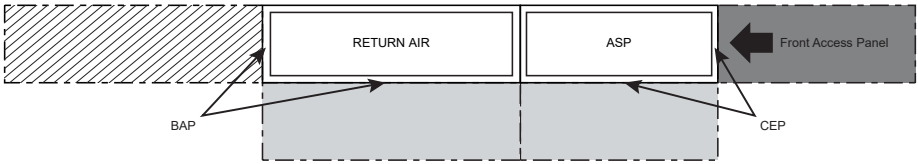
CEP = Controls & Electrical Service Panel
BAP = Blower, Air Coil & Drain Pan Service Panel
WRP = Water & Refrigerant Service Panel
*ASP = Additional Service Panel (not required)

Note:

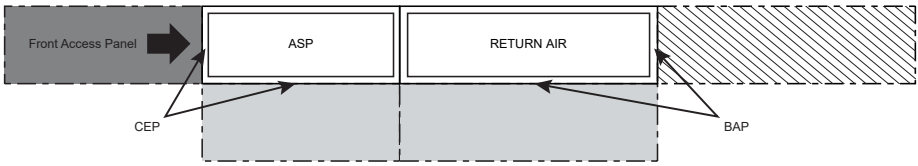
*ASP are removable panels that provide additional access to the units interior. Clear access to ASP panels is not required and they are not to be used in place of the mandatory CEP, WRP, or BAP panels.

TRL: Horizontal Service Access

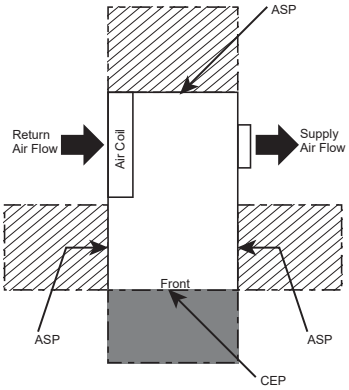
Ceiling Hung - Left Return Straight Discharge



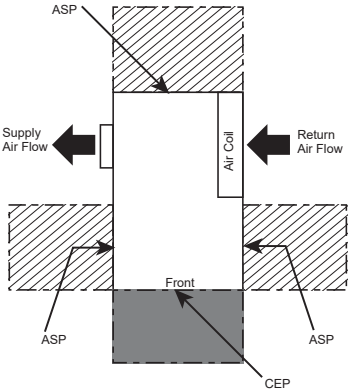
Ceiling Hung - Right Return Straight Discharge



Top View - Left Return Straight Discharge



Top View - Right Return Straight Discharge



= Mandatory 1' Service Access (front access service should be increased if external pumps, valves, etc. are applied)

= Mandatory 3' Service Access

= Optional 2' Service Access

Notes:

1. 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.
2. CEP and BAP requires 2' bottom service access. CEP requires 2' front service access as well. Ceiling mounted service access doors are acceptable. BAP side service access is optional.
3. 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 and BSP panels.
4. 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 available in back discharge only. Please see the Ductwork Installation section for details.
5. For back and straight combined discharge configurations, all blower service access is from the bottom.

Legend:

CEP = Controls & Electrical Service Panel
BAP = Blower, Air Coil, & Drain Pan Service Panel
WRP = Water & Refrigerant Service Panel
ASP = Additional Service Panel (not required)

Horizontal Installation

Horizontal 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 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). Consideration should be given to access for easy removal of the filter and access panels. Provide sufficient room to make water, electrical, and duct connection(s).

TRL units are designed to be accessed from the bottom for servicing. Sufficient clearance should be given underneath the unit for access to bottom service panels.

If the unit is located in a confined space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. Refer to Figure 3 for an illustration of a typical installation. Refer to unit submittal data for dimensional data.

Conform to the following guidelines when selecting unit location:

1. Provide a hinged access door in concealed-spline or plaster ceilings. Provide removable ceiling tiles in T-bar or lay-in ceilings. Refer to horizontal unit dimensions for specific series and model in unit submittal data. Size the access opening to accommodate the service technician during the removal or replacement of the compressor, control, or blower assembly.
2. Provide access to hanger brackets, water valves and fittings. Provide screwdriver clearance to access panels, discharge collars and all electrical connections.
3. DO NOT obstruct the space beneath the unit with piping, electrical cables and other items that prohibit future removal of components or the unit itself.
4. 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.

Horizontal Installation

Mounting Horizontal Units
Horizontal units have 4 hanger brackets designed into the top panel of the unit, one at each corner. Enclosed within the unit there is a hanger kit hardware bag containing vibration isolation grommets, washers and a hanger installation instruction page. See Figure 1. Refer to the hanger installation instruction page contained in the hardware bag for details of final hanger bracket attachment and unit suspension. See Figure 1a.

Use four (4) field supplied 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 4 all-thread rods, 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 Figure 2 to improve the condensate drainage. Ensure that unit pitch does not cause condensate leaks inside the cabinet. Cut any remaining all thread below the lower nut so that it does not interfere with any electrical or water connections on the front of the unit.

Figure 1: Hanger Bracket

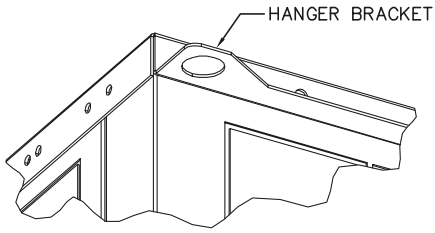
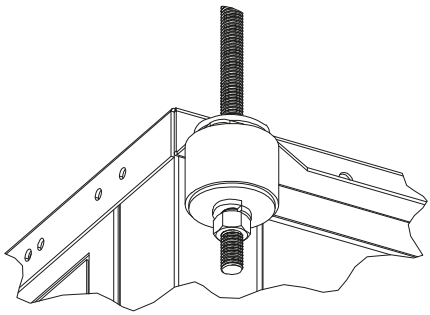


Figure 1a:



Horizontal Installation

Figure 2: Horizontal Unit Pitch

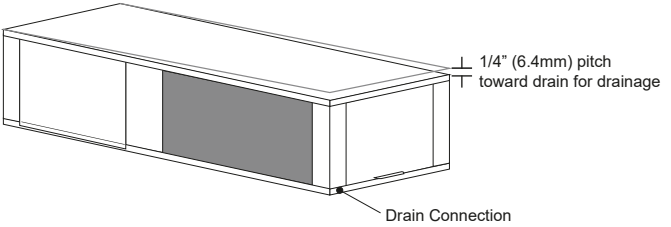
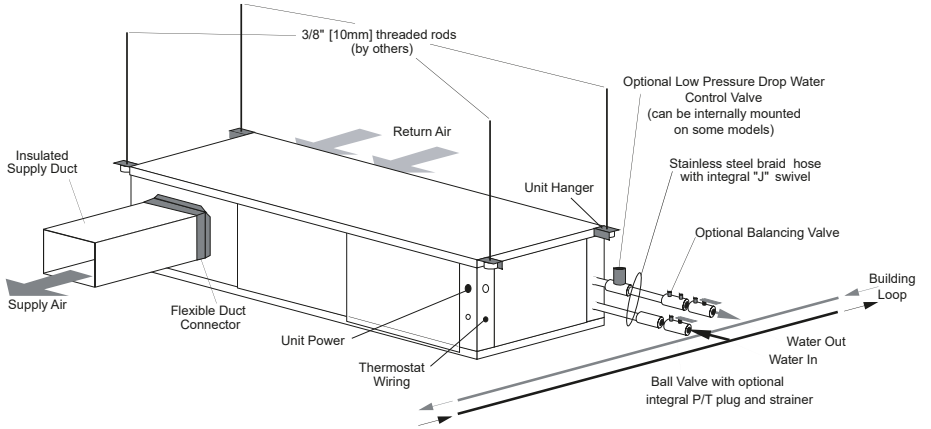


Figure 3: Typical Horizontal Unit Installation



Air Coil - To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. A thorough water rinse should follow. **UV based anti-bacterial systems may damage e-coated air coils.**

Notice! Installation Note - Ducted Return: Many horizontal WSHPs are installed in a return air ceiling plenum application (above ceiling). All TRL products are equipped with filter frames for ducted or non-ducted returns. Canvas or flexible connectors should also be used to minimize vibration between the unit and ductwork.

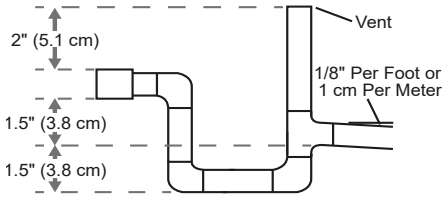
Condensate Installation

Condensate Piping - Horizontal Units - 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 Figure 2 to improve the condensate drainage. Ensure that unit pitch does not cause condensate leaks inside the cabinet.

Install condensate trap at each unit with the top of the trap positioned below the unit condensate drain connection as shown in Figure 4. As a general rule, the minimum depth for traps is 1-1/2 inches. 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.

Figure 4: Horizontal Condensate Connection



⚠ CAUTION! ⚠

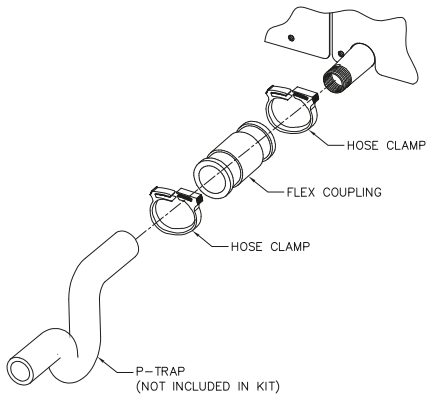
CAUTION! Ensure condensate line is pitched toward drain 1/8 inch per ft [11 mm per m] of run.

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.**

Some applications will require condensate pumping due to limited ceiling space or the need to connect to a main drain line higher in elevation. Condensate pumps are to be field provided and are mounted externally to 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. Dispose of kit if not used. See figure 5.

Figure 5: Condensate Kit



Duct Work Installation

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 stated airflow for the unit to avoid equipment damage. Duct systems should be designed for quiet operation. Refer to Figure 6 for horizontal duct system 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, the supply and return plenums should include internal fiberglass duct liner or be constructed from duct board for the first few feet. Application of the unit to uninsulated ductwork in an unconditioned space is not recommended, as the unit's performance may be adversely affected.

If air noise or excessive air flow is a problem, the blower speed can be changed. For airflow charts, consult submittal data for the series and model of the specific unit.

If the unit is connected to existing ductwork, a previous check should have been made 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, larger ductwork should be installed. All existing ductwork should be checked for leaks and repaired as necessary.

TRL products can be supplied 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. Back supply air can also be selected as field or factory configured but must be paired with left or right supply air openings on sizes 12 and 15. Please refer to Tables 1, 2, and 3 for minimum and maximum supply air openings by size.

Flanges for connection to the supply air are provided when factory configured supply air openings are ordered. When field configured supply air openings are selected, 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.

NOTES: Only TRL sizes 006-009 can be applied as back discharge supply air only. Sizes 012-015 must be applied as side discharge supply air with the option to be combined with back discharge supply air. Return air configurations can not be converted in the field.

Duct Work Installation

Figure 6: Side Discharge Supply Air Openings

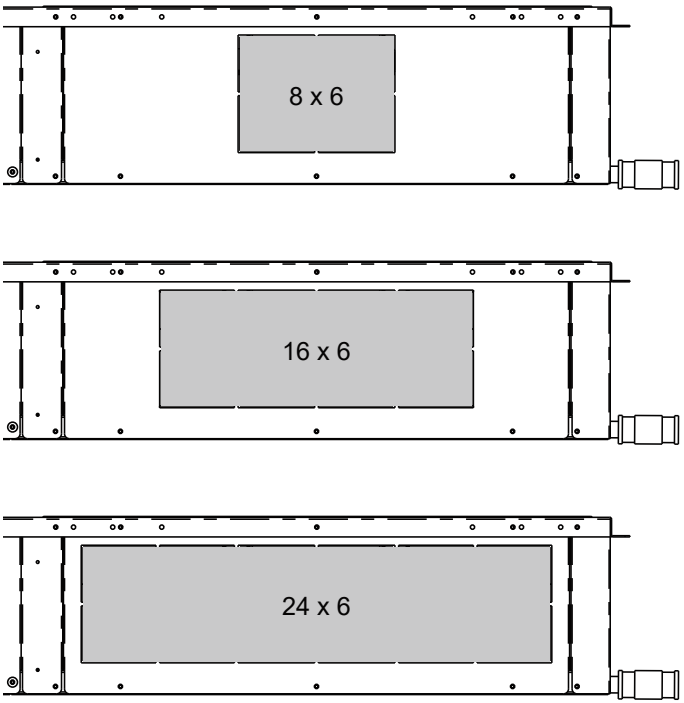
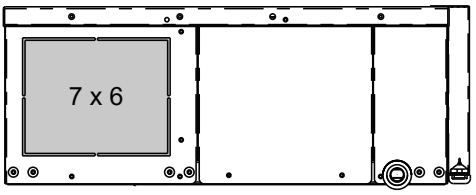


Figure 6a: Back Discharge Supply Air Opening



Duct Work Installation

Table 1: Supply Air (SA) Opening Dimensional Data

Size	Right/Left SA Opening Sizes	Back SA Opening
006-009	8 x 6 or 16 x 6	7 x 6
012-015	16 x 6 or 24 x 6	7 x 6

All dimensions shown in inches.

Table 2: Supply Air (SA) Square Inches

Size	Number of Openings	Minimum Sq. in. Opening*	Maximum Sq. in. Opening	Recommended Sq. in. Opening
006-009	1 or 2	42	96	48
012-015	1 or 2	90	186	144

All dimensions shown in inches.
* Less than minimum SA open area will cause unit to trip on safeties.

Table 3: Supply Air Options

Supply	Opening Area (in)	006 or 009	012 or 015
Straight	8x6	X	
	16x6	X	X*
	24x6		X
Straight + Back	8x6 + 7x6	X	X*
	16x6 + 7x6		X
	24x6 + 7x6		X
Back	7X6	X	
Field Configured	-	X	X

* For sizes 012-015 this configuration will have internal static pressure losses up to 0.2. ClimateMaster recommends field wiring to motor speed tap four for highest fan motor CFM performance.

Unit Access

The TRL series is unique to the ClimateMaster product line in the way installers and service technicians' interface with the product. Traditionally for horizontal products unit controls/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 TRL products the unit controls, electrical components, water components/ circuit, the 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 Figures 7 and 8). This greatly increases the installers and service technicians' ability to access and interface the water source heat pump while it is installed in the ceiling.

The product is also designed to be accessed in many of the traditional ways as well. The unique control box design ships from ClimateMaster facing down for bottom access but can be flipped up in the field for front access. This allows those who interface with the product to access the unit controls either from the bottom or from the front of the unit. See Figures 9 and 10 for details.

Alternatively, if the unit requires tabletop service on the control box, the TRL product is designed with a rotation feature to allow installer or service technician to interact with the control panel from the front of the unit. The user will need to remove the top and front access panels from the unit, remove the 2 screws that hold the control panel facing down, rotate the control panel and lock it at 45 degrees with the pivotal element on the right side of the panel control support. See Figure 11 for details.

The complete blower assembly can be slid down from the bottom of the unit. The is a safety latch in place 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 assembly will rest on a service rail where the technician may service the motor or remove the whole assembly by disconnecting one electrical quick connector.

The TRL condensate drain pan can be accessed for service or removal from the bottom of the unit. After removing the external condensate line connection, remove the drain pan access panel. First, remove the condensate sensor clip from the pan and set it to the side. Next remove the drain pan set screw located next to the compressor side of the unit. Then 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. Lastly, 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 with out damaging the connection threads.

Bottom Service Access

- **Controls**
- **Electrical Components**
- **Water Circuit/Components**
- **Refrigerant Circuit/Components**
- **Power Disconnect (optional - not shown)**
- **Service Tool Connection**
- **Drain Pan**
- **Air Filter**
- **Air Coil**
- **Blower Motor Assembly**

Unit Access

Figure 7: ISO View (Left Return Configuration w/ Optional Power Disconnect Shown)

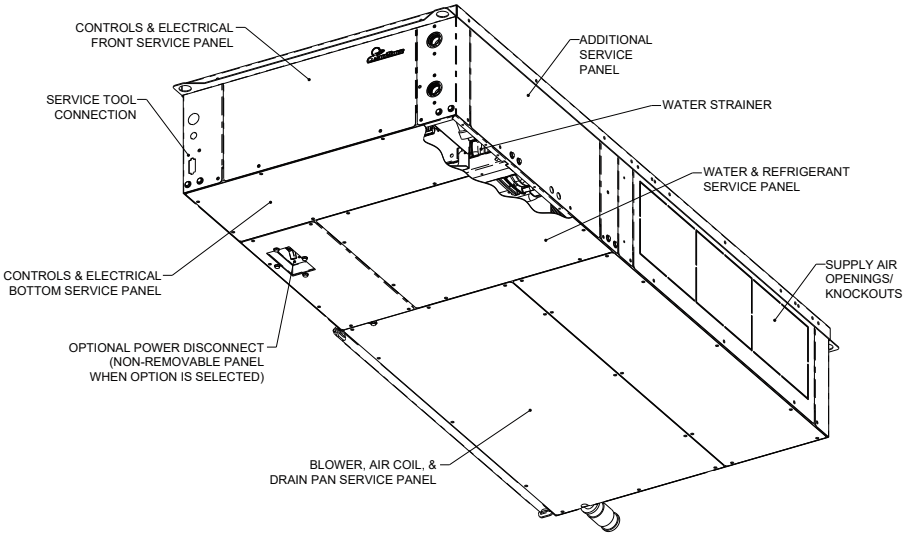
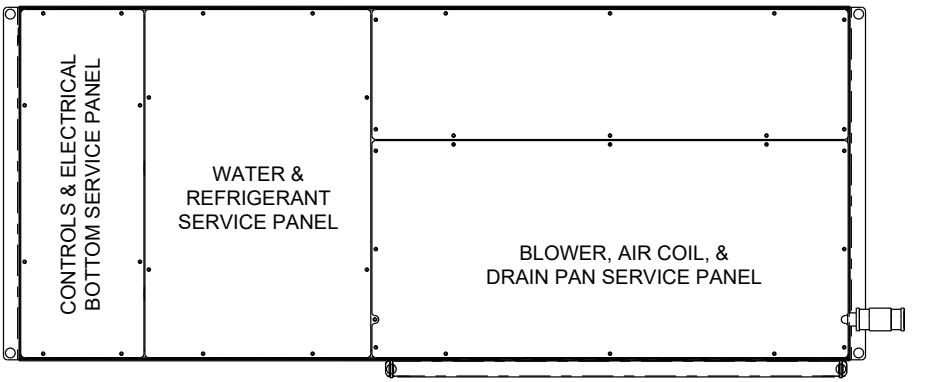


Figure 8: Bottom View (without Optional Power Disconnect Shown)



Unit Access

Figure 9: Unit Control Box Rotation - Side View

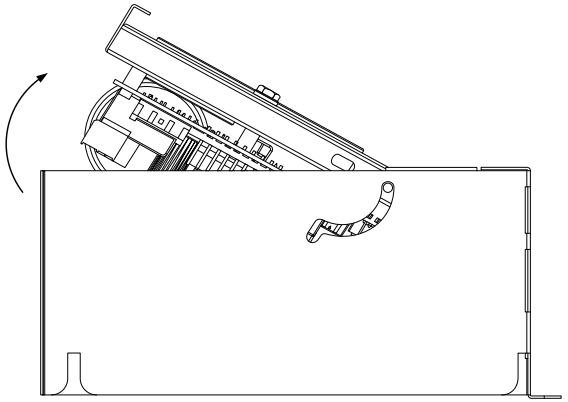


Figure 10: Unit Control Box Rotation - Front ISO View

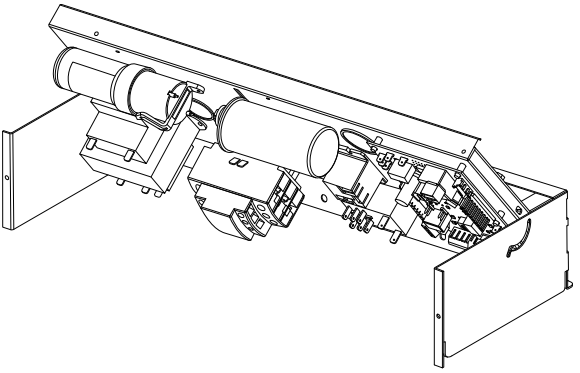
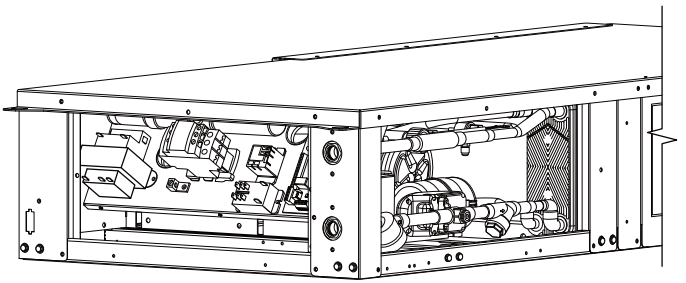


Figure 11: Unit Control Box Rotation - Table Top Service Position



Piping Installation

Installation of Supply and Return Piping
Follow these piping guidelines.

1. Install a drain valve at the base of each supply and return riser to facilitate system flushing.
2. Install shut-off / 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 Table 3. 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.

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. Braze plate heat exchangers contain small water cavities. Blockage of water flow cavities within the heat exchanger from water containing contaminants could cause a critical failure of the heat exchanger which could result in flooding.

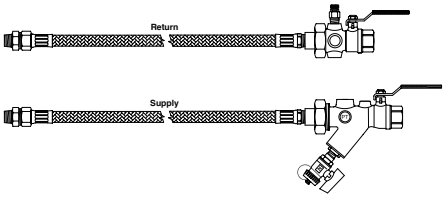
Table 3: Metal Hose Minimum Bend Radii

Hose Diameter	Minimum Bend Radii
1/2" [12.7 mm]	2-1/2" [6.4 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.

Piping Installation

Figure 12: Supply/Return Hose Kit



Refer to Figure 12 for an illustration of a typical supply/return 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.

⚠ WARNING! ⚠

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

⚠ WARNING! ⚠

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A 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 HFC-410A as system failures and property damage may result.

⚠ CAUTION! ⚠

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

⚠ CAUTION! ⚠

CAUTION! Do not bend or kink supply lines or hoses.

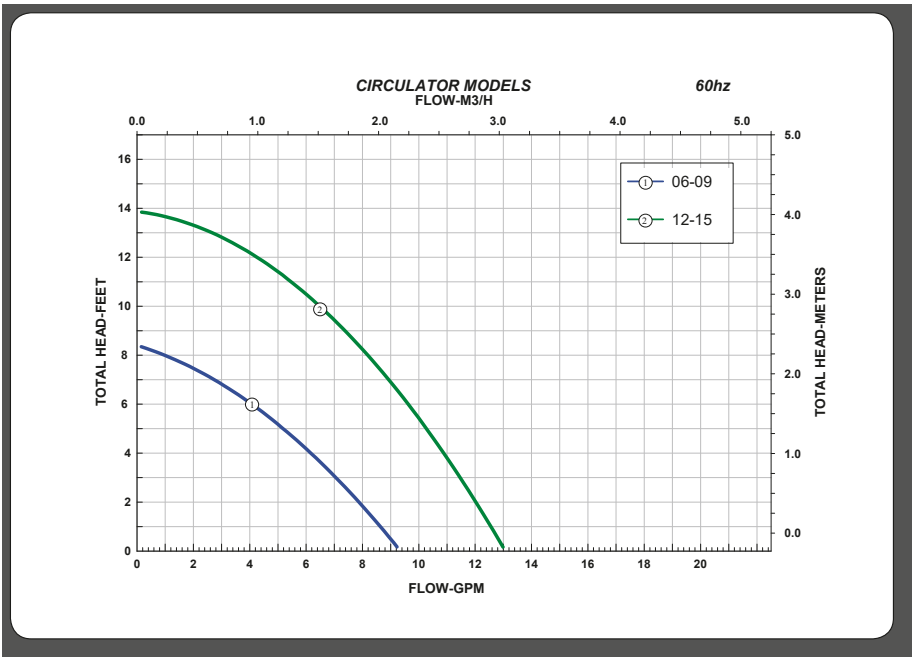
⚠ CAUTION! ⚠

CAUTION! Piping must comply with all applicable codes.

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 inside the unit are designed to provide the needed water flow through the unit heat exchanger. The chart below demonstrates the performance of this optional factory installed water pump.

Figure 13: Internal Water Pump Performance



Water-Loop Heat Pump Applications

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. Consideration should be given to insulating the piping surfaces to avoid condensation. If air is introduced to the TRL system, an air lock can get trapped in the braze plate heat exchanger causing freezing of the heat exchanger and potential flooding. ClimateMaster recommends unit insulation any time the water temperature is expected to be below 60°F (15.6°C). Metal to plastic threaded joints should never be used due to their tendency to leak over time.

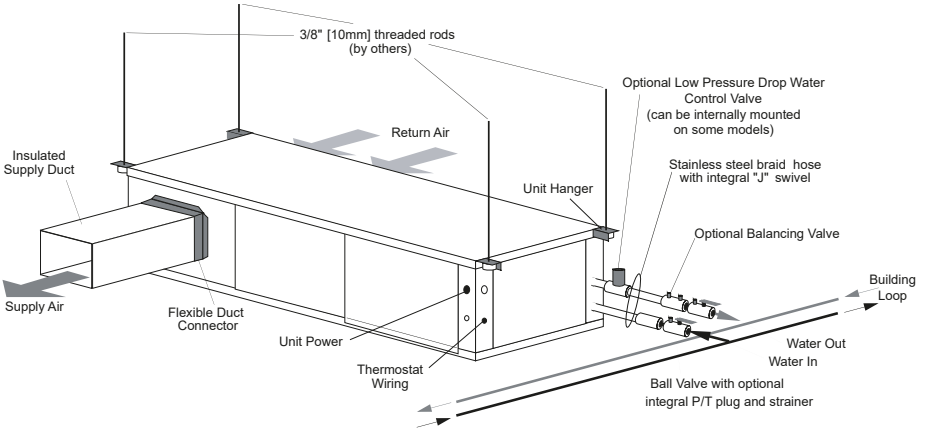
Plumbing pipe thread tape is recommended to minimize internal fouling of the heat exchanger. Do not over tighten connections and route piping so as not to interfere with service or maintenance access. Hose kits are available from ClimateMaster in different configurations as shown in Figure 14 for connection between the unit and the piping system. Depending upon selection, hose kits may include shut off valves, P/T plugs for performance measurement, high pressure stainless steel braided hose, "Y" type strainer with blow down valve, and/or "J" type swivel connection. Balancing valves and an external low pressure drop solenoid valve for use in variable speed pumping systems may also be included in the hose kit.

The piping system should be flushed to remove dirt, piping chips, and other foreign material prior to operation (see "Piping System Cleaning and Flushing Procedures" in this manual). The flow rate is usually set between 2 and 3 gpm per ton [2.9 and 4.5 l/m per kW] of cooling capacity. ClimateMaster recommends 2.5-3 gpm per ton [3.9 l/m per kW] for most applications of water loop heat pumps. To ensure proper maintenance and servicing, P/T ports are imperative for temperature and flow verification, as well as 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 will be necessary.

Water-Loop Heat Pump Applications

Figure 14: Typical Water-Loop Application



Ground-Loop Heat Pump Applications

⚠ CAUTION! ⚠

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! ⚠

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

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
All earth loop piping materials should be limited to polyethylene fusion only for in-ground sections of the loop. Galvanized or steel fittings should not be used at any time due to their tendency to corrode. All plastic to metal threaded fittings should be avoided due to their potential to leak in earth coupled applications. A flanged fitting should be substituted. P/T plugs should be used so that flow can be measured using the pressure drop of the unit heat exchanger.

Earth 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.

⚠ WARNING! ⚠

WARNING! TRL Series products contain braze plate heat exchangers and should never be applied to a ground water application. Applying the TRL product to a ground water application will void the warranty.

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

Flushing the Earth 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 will be routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze; however your local sales office should be consulted to determine the antifreeze best suited to your area. Freeze protection should be maintained to 15°F [9°C] below the lowest expected entering loop temperature. For example,

Ground-Loop Heat Pump Applications

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°F - 15°F = 15°F [-1°C - 9°C = -10°C].

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced under the water level to prevent fumes. Calculate the total volume of fluid in the piping system. Then use the percentage by volume shown in Table 4 for the amount of antifreeze needed. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

⚠ WARNING! ⚠

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.

Table 4: Antifreeze Percentages by Volume

Type	Minimum Temperature for Low Temperature Protection			
	10°F [-12.2°C]	15°F [-9.4°C]	20°F [-6.72°C]	25°F [-3.92°C]
Methanol	25%	21%	16%	10%
100% USP food grade inhibited Propylene Glycol	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

* Must not be denatured with any petroleum based product

Electrical – Line Voltage

Electrical - Line Voltage - All field installed wiring, including electrical ground, must comply with the National Electrical Code as well as all applicable local codes. Refer to the unit electrical data for fuse sizes. Consult 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.

General Line Voltage Wiring - Be sure 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 and the National Electric Code, as applicable.

Transformer - All 208/230 voltage units are factory wired for 208 volt. If supply voltage is 230 volt, installer must rewire transformer. See wire diagram for connections.

⚠ WARNING! ⚠

WARNING! To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

⚠ CAUTION! ⚠

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

Electrical Data

Standard Unit

Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor			ECM FLA	Total Unit FLA	Min Circ AMP	Max Fuse AMP	Max Fuse/ HACR
				MCC	RLA	LRA					
TRL006	G	208-230/60/1	187.2 / 253	5.2	2.5	17.7	2.3	4.8	5.4	7.9	15A
	E	265/60/1	238.5 / 291.5	3.6	2.2	10.5	2.3	4.6	5.2	7.5	15A
TRL009	G	208-230/60/1	187.2 / 253	7.0	3.6	22.2	2.3	6.8	7.9	12.4	15A
	E	265/60/1	238.5 / 291.5	5.1	3.1	13.5	2.3	5.6	6.5	9.8	15A
TRL012	G	208-230/60/1	187.2 / 253	7.9	5.6	32.5	2.3	9.0	10.7	17.4	15A
	E	265/60/1	238.5 / 291.5	5.9	4.0	23.0	2.3	6.1	7.0	10.8	15A
TRL015	G	208-230/60/1	187.2 / 253	10.3	5.6	29.0	2.3	8.9	10.5	17.1	15A
	E	265/60/1	238.5 / 291.5	7.5	4.6	20.0	2.3	7.1	8.3	13.1	15A

w/Internal Pump

Model	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor			ECM FLA	ISP Pump FLA	Total Unit FLA	Min Circ AMP	Max Fuse AMP	Max Fuse/ HACR
				MCC	RLA	LRA						
TRL006	G	208-230/60/1	187.2 / 253	5.2	2.5	17.7	2.3	0.39	5.2	5.8	8.3	15A
	E	265/60/1	238.5 / 291.5	3.6	2.2	10.5	2.3	0.22	4.8	5.4	7.7	15A
TRL009	G	208-230/60/1	187.2 / 253	7.0	3.6	22.2	2.3	0.39	7.2	8.3	12.8	15A
	E	265/60/1	238.5 / 291.5	5.1	3.1	13.5	2.3	0.22	5.9	6.7	10.0	15A
TRL012	G	208-230/60/1	187.2 / 253	7.9	5.6	32.5	2.3	0.51	9.5	11.2	17.9	15A
	E	265/60/1	238.5 / 291.5	5.9	4.0	23.0	2.3	0.33	6.4	7.4	11.1	15A
TRL015	G	208-230/60/1	187.2 / 253	10.3	5.6	29.0	2.3	0.51	9.4	11.1	17.6	15A
	E	265/60/1	238.5 / 291.5	7.5	4.6	20.0	2.3	0.33	7.4	8.6	13.4	15A

Electrical – Power Wiring

⚠ WARNING! ⚠

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

⚠ CAUTION! ⚠

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 the National Electrical Code as well as all applicable local codes. Refer to the unit electrical data for fuse sizes. Consult 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.

General Line Voltage Wiring - Be sure 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 and the National Electric Code, as applicable.

Power Connection - Line voltage connection is made by connecting the incoming line voltage wires to the "L" side of the contactor as shown in Figure 15. Consult electrical data tables for correct fuse size.

Transformer - All 208/230 voltage units are factory wired for 208 volt. If supply voltage is 230 volt, installer must rewire transformer. See wire diagram for connections.

Blower Speed Selection – CT ECM - Constant Torque (CT) ECM blower fan speeds can be changed at the thermostat. Please see Table 6 for blower speed settings. Consult the TRL submittal and wire diagrams for reference to AHRI rated air flow and factory default wiring.

Special Note for AHRI Testing: To achieve rated airflow for AHRI testing purposes on all CT ECM products is necessary to be wired to the correct fan motor tap. When the heat pump has experienced less than 100 operational hours and the coil has not had sufficient time to be "seasoned", it is necessary to clean the coil with a mild surfactant such as Calgon to remove the oils left by manufacturing processes and enable the condensate to properly "sheet" off of the coil.

Electrical – Power Wiring

Table 5: LED and Alarm Relay Output Table

CXM2 CONTROLLER FAULT CODES			
CXM2 Status LED Operation with Test Mode Not Active	**Fault LED (Red)**	**Status LED (Green)**	**Alarm Relay**
CXM2 is non-functional	Off	Off	Open
Normal operation - No active communication	On	On	Open
Normal operation - With active communication	Very Slow Flash	On	Open
Control is currently in fault retry mode	Slow Flash	–	Open
Control is currently locked out	Fast Flash	–	Closed
Control is currently in an over / under voltage condition	Slow Flash	–	Open (Closed after 15 min.)
(ESD) Emergency shutdown condition recognized	–	Flashing Code 3	Closed
Invalid thermostat input combination	–	Flashing Code 4	Open (Closed after 15 min.)
CXM2 Status LED Operation with Test Mode Not Active	**Fault LED (Red)**	**Status LED (Green)**	**Alarm Relay**
No fault since power up in memory	Flashing Code 1	–	Cycling Code 1
High pressure fault in memory	Flashing Code 2	–	Cycling Code 2
Low pressure fault in memory	Flashing Code 3	–	Cycling Code 3
Low temperature protection 1 fault in memory	Flashing Code 4	–	Cycling Code 4
Low temperature protection 2 fault in memory	Flashing Code 5	–	Cycling Code 5
Condensate overflow fault in memory	Flashing Code 6	–	Cycling Code 6
Over / Under voltage fault in memory	Flashing Code 7	–	Cycling Code 7
UPS warning in memory	Flashing Code 8	–	Cycling Code 8
UPT fault in memory	Flashing Code 9	–	Cycling Code 9
Low water flow fault	Flashing Code 13	–	Cycling Code 13
Leaving water temperature low fault	Flashing Code 14	–	Cycling Code 14
Test mode active	–	Fast Flash	–

- Fast Flash = 2 flashes every 1 second
- Slow Flash = 1 flash every 2 seconds
- Very Slow Flash = 1 flash every 5 seconds
- Numeric Codes = On pulse 1/3 second; Off pulse 1/3 second followed by a 10 second delay
- Alarm Relay Open = alarm signal off; Alarm Relay Closed = alarm signal on

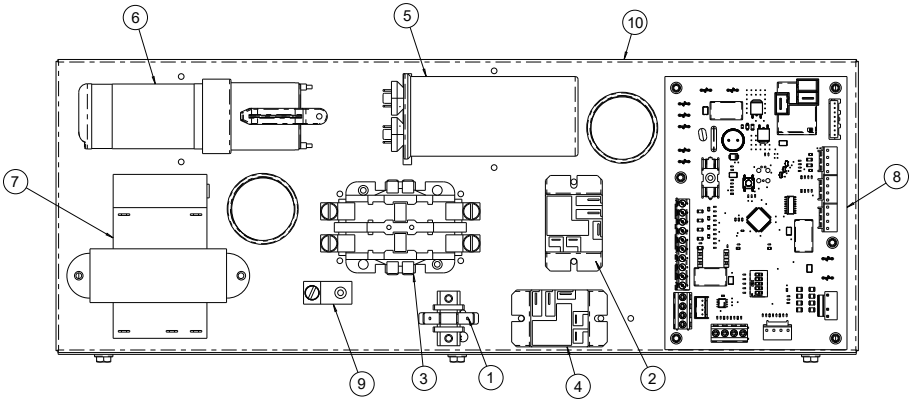
Electrical – Power Wiring

Table 6: Thermostat and Fan Speed Sequence of Operations

Conventional T-stat signal (Non-Communicating)	Operating Mode	ECM Fan Speed Setting	Speed Tap	Blower Motor 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

Figure 15: 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 CONTROL BOARD
9	GROUND LUG
10	CONTROL BOX

Electrical – Power & Low Voltage Wiring

Thermostat Connections - The thermostat should be wired directly to the CXM2 board. See "Electrical – Thermostat" for specific terminal connections. Review the appropriate AOM (Application, Operation and Maintenance) manual for units with DDC controls.

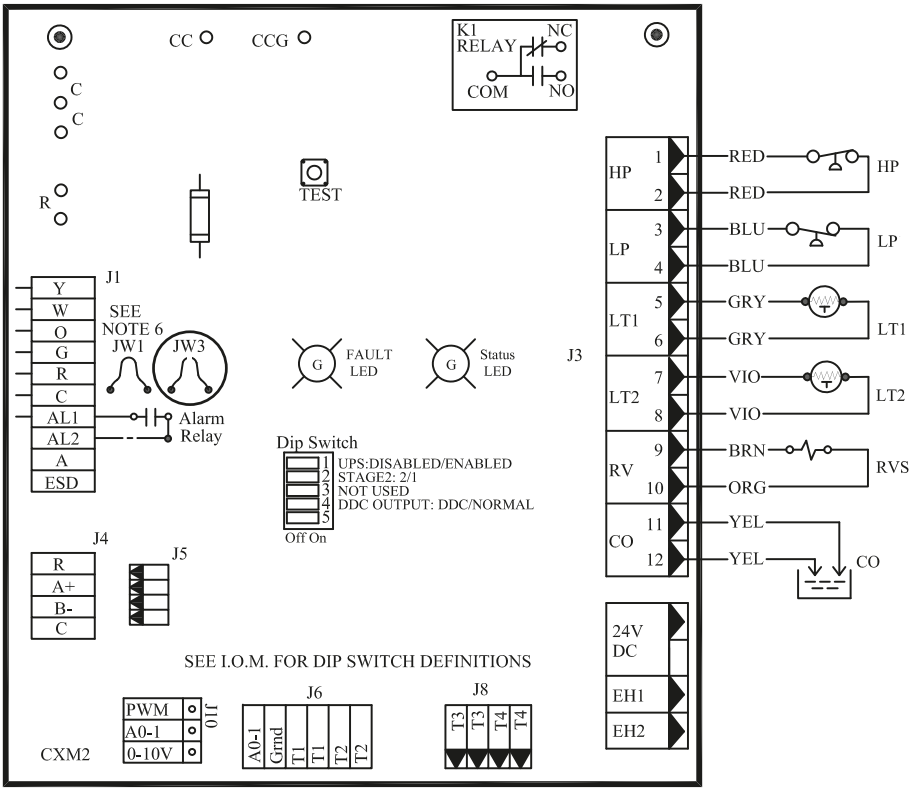
Low Water Temperature Cutout Selection - Do not clip the JW3 jumper, which lowers the sensing temperature associated with thermistor LT1 and LWT connected to the board, unless the unit is working with a minimum of 20% brine solution, in which case, the jumper can be clipped. Entering water temperatures below the products operational range will damage the braze plate heat exchanger and cause critical failure. Note that the LT1 thermistor is located on the refrigerant line between the braze plate heat exchanger and expansion device (TXV). LWT thermistor is located on the water line leaving the braze plate heat exchanger. 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.

Low Pressure Switch Cutout Selection - TRL units are equipped with two low pressure switches which are monitored by the CXM2 unit controller. If the JW3 jumper is not clipped, the board will look for the pressure switch wired on the LP-J3 input and ignore the T4-J8 input. If JW3 jumper is clipped, the board will look for the pressure switch wired on T4-J8 and ignore the LP-J3 input.

Pump or Motorized Water Valve Relay - If an internal pump or mwv is selected as one of the options, it will be controlled by a 24 VDC relay connected to EH1 on the CXM2 board, allowing independent control from CC.

Electrical – Power & Low Voltage Wiring

Figure 16: LT1 Limit Setting



Electrical – Low Voltage Wiring

Accessory Connections

When water valves or circulating pumps are applied as field installed external to the unit, a field accessory kit is required. The accessory relay kit for pumps or motorized water valves (P/N ARK01PMV) includes a relay, wires, and installation instructions. See figures 17 and 18 for wiring details.

Low Voltage VA Ratings

Component	VA
Typical Blower Relay	6 - 7
Typical Reversing Valve Solenoid	4 - 6
30A Compressor Contactor	6 - 9
Subtotal	**16 - 22**
+ CXM2 board (5 - 9 VA)*	21 - 31
Remaining VA for Accessories**	19 - 29

* Standard transformer for CXM2 board is 75 VA. Optional DDC controls.
** Add accessory relay for pump or mwv (optional) - 1.4 VA

Figure 17: CXM2 Connection

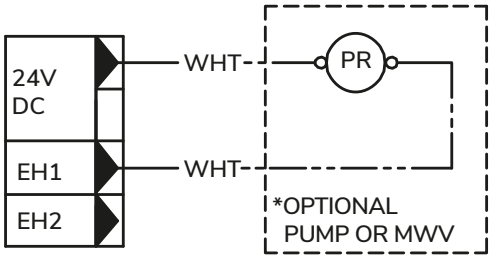
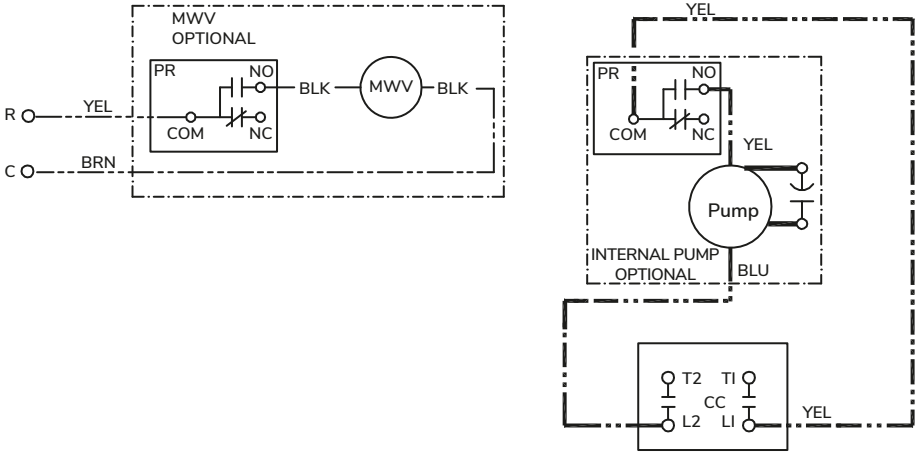


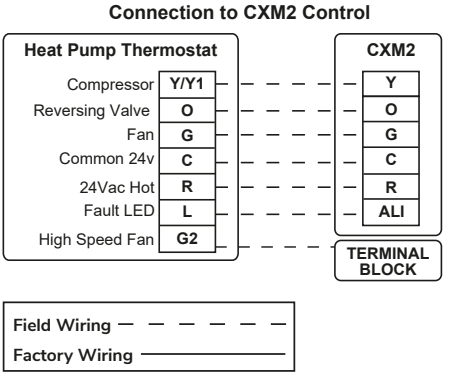
Figure 18: Field Installed Accessory Relay Connection



Electrical – Thermostat Wiring

Thermostat Installation - The thermostat should be located 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 in certain cases 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. Representative thermostat wiring is shown in Figures 19 however, actual wiring connections should be determined from the thermostat IOM and or unit wiring diagram. Practically any heat pump thermostat will work with ClimateMaster heat pump units, provided it has the correct number of heating and cooling stages.

Figure 19: Typical Thermostat Wiring Illustrations



Blower Performance Data – TRL

Size	Rated CFM	Max CFM	Min CFM	Motor Speed Tap	Value	External Static Pressure (in. wg)								
						0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
006	225	275	150	1	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	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	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	Power (W)							62	65	67
					CFM							275	266	257
					Power/CFM							0.23	0.24	0.26
009	325	425	200	1	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	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	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	Power (W)						104	101	97	92
					CFM						428	412	391	370
					Power/CFM						0.24	0.25	0.25	0.25
012	400	525	300	1	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	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	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	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
015	500	550	375	1	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	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	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	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			

Black areas denote ESP where operation is not recommended.
CT ECM: Units factory shipped on Speed Tap 2 for Fan-Only and Speed Tap 3 for Heating/Cooling.
All airflow is rated and shown above at the lower voltage if unit is dual voltage rated, e.g. 208 V for 208-230 V units.
Performance stated is at the rated power supply. Performance may vary as the power supply varies from the rated.
All data is shown wet coil with clean 1-inch filter. All data is ran at 80 °F DB and 67 °F WB.
CFM Tolerance is +/-10%. Watt Tolerance +/-10%.
Blower performance tested with a 8" x 6" side discharge supply air opening for sizes 006 and 009.
Blower performance tested with a 24" x 6" side discharge supply air opening for sizes 012 and 015.

TRL Series Wiring Diagram Matrix

All current diagrams can be located online at climatemaster.com. Click 'Commercial Professional'.

1. Click 'Products' in the main navigation
2. Select 'Small Packaged Units'
3. Select the TRL product series
4. Click the Wire Diagrams tab in the middle of the page
5. Select your voltage and controls

Control Type	Blower Type	TRL 006-015
		Wiring Diagram Part Number
CXM2	Constant Torque ECM	96B1001N01
CXM2/MPC		96B1001N02

Controls – CXM2

CXM2 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 4 of this manual.

Operating and Commissioning Limits

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 – A voltage variation of ± 10% of nameplate utilization voltage is acceptable.

Determination of operating limits is dependent primarily upon three factors: 1) return air temperature. 2) water temperature, and 3) 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 will adversely affect unit performance, reliability, and service life. Consult Table 7 for operating limits.

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

Notes:
1. Conditions in Table 8 are not normal or continuous operating conditions. Minimum/maximum limits are start-up conditions to bring the building space up to occupancy temperatures. Units are not designed to operate under these conditions on a regular basis.
2. Voltage utilization range complies with AHRI Standard 110.

Table 7: Operating Limits

Operating Limits	TRL	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45°F [7°C]	39°F [4°C]
Rated ambient air, DB	80.6°F [27°C]	68°F [20°C]
Max. ambient air, DB	130°F [54.4°C]	85°F [29°C]
Min. entering air, DB/WB	65/50°F [18/10°C]	45°F [7.2°C]
Rated entering air, DB/WB	80.6/66.2°F [27/19°C]	68°F [20°C]
Max. entering air, DB/WB	95/75°F [35/24°C]	80°F [27°C]
Water Limits		
Min. entering water	30°F [-1°C]	20°F [-6.7°C]
Normal entering water	50-110°F [10-43°C]	30-70°F [-1 to 21°C]
Max. entering water	120°F [49°C]	90°F [32°C]
Normal Water Flow*	2.25 to 4.5 gpm/ton [1.6 to 3.2 l/m per kW]	

* Except when identified on model-specific performance envelop

Unit Starting and Operating Limits

Table 8: Building Commissioning Limits

Commissioning Limits	Cooling	Heating
Air Limits		
Min. ambient air, DB	45°F [7°C]	39°F [4°C]
Rated ambient air, DB	80.6°F [27°C]	68°F [20°C]
Max. ambient air, DB	130°F [54.4°C]	85°F [29°C]
Min. entering air, DB/WB	50/45°F [10/7°C]	40°F [4.5°C]
Rated entering air, DB/WB	80.6/66.2°F [27/19°C]	68°F [20°C]
Max. entering air, DB/WB	110/83°F [43/28°C]	80°F [27°C]
Water Limits		
Min. entering water	30°F [-1°C]	20°F [-6.7°C]
Normal entering water	50-110°F [10-43°C]	30-70°F [-1 to 21°C]
Max. entering water	120°F [49°C]	90°F [32°C]
Normal Water Flow	2.25 to 4.5 gpm/ton [1.6 to 3.2 l/m per kW]	

Water Quality Requirements

Water Quality Requirements

Clean water is essential to the performance and life span of water source heat pumps. Contaminants, chemicals, and minerals all have the potential to cause damage to the water heat exchanger if not treated properly. All closed water loop systems should undergo water quality testing and be maintained to the water quality requirements listed in this table.

WATER QUALITY REQUIREMENTS

For Closed-Loop and Open-Loop Systems

				Heat Exchanger Type			
				Closed Loop Recirculating	Open Loop, Tower, Ground Source Well		
	Description	Symbol	Units	All Heat Exchanger Types	COAXIAL HX Copper Tube in Tube	COAXIAL HX Cupronickel	Brazed Plate HX 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 - Heated Water >85°F			8.0 to 10.0	8.0 to 10.0	8.0 to 10.0	8.0 to 10.0
	Alkalinity	($HCO3^-$)	ppm - $CaCO_3$ equiv.	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	(CaCO3)	ppm - CaCO3 equiv.	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 - $CaCO_3$ equiv.	<1000	<1000	<1000	<1500
	Sulfate	(SO_4^{2-})	ppm	<200	<200	<200	<200
	Nitrate	(NO_3^-)	ppm	<100	<100	<100	<100
	Chlorine (free)	(Cl)	ppm	<0.5	<0.5	<0.5	<0.5
	Chloride (water < 80°F)	(Cl^-)	ppm	<20	<20	<150	<150
	Chloride (water > 120°F)		ppm	<20	<20	<125	<125
	Hydrogen Sulfide[a]	(H_2S)	ppb	<0.5	<0.5	<0.5	<0.5
	Carbon Dioxide	(CO_2)	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_3)	ppm	<0.05	<0.1	<0.1	<0.1
	Chloramine	(NH_2CL)	ppm	0	0	0	0
Fouling & 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[g]	(TSS)	ppm	<10	<10	<10	<10
Electrolysis All HX types	Earth Ground Resistance[x]		Ohms	0	Consult NEC & local electrical codes for grounding requirements		
	Electrolysis Voltage[δ]		mV	<300	Measure voltage internal water loop to HP ground		
	Leakage Current[δ]		mA	<15	Measure current in water loop pipe		

Building Primary Electrical Ground to unit, must meet local diameter and penetration length requirements

Do not connect heat pump to steel pipe unless dissimilar materials are separated by using Di-electric unions. Galvanic corrosion of heat pump water pipe will occur.

Water Quality Requirements

1. The ClimateMaster Water Quality Table provides water quality requirements for coaxial & 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, antifreeze is required. Refer to the heat pump IOM for the correct solution ratios to prevent freezing.

α Hydrogen Sulfide has an odor of rotten eggs. If one detects this smell, a test for H2S must be performed. If H2S is detected above the limit indicated, remediation is necessary (Consult with your Water Testing/Treatment Professional) or a secondary heat exchanger is required using 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 in.) 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 An electrical grounding system using a dedicated ground rod meeting NEC and Local Electrical codes must be installed. Building Ground must not be connected the WSHP piping system or other plumbing pipes.

δ Refer to IOM for instructions on measuring resistance and leakage currents within water loops.

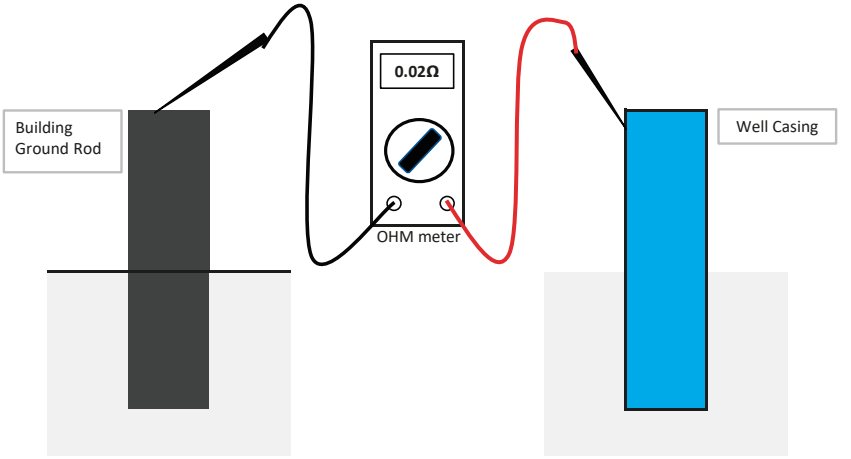
Do not use PVC pipe for water loop (compressor POE oil and glycols damage PVC) use of HDPE pipe is recommended.

Water Quality Requirements

Strainer / Filter Sizing			
Mesh Size	Particle Size		
	Microns	MM	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

Measuring Earth Ground Resistance



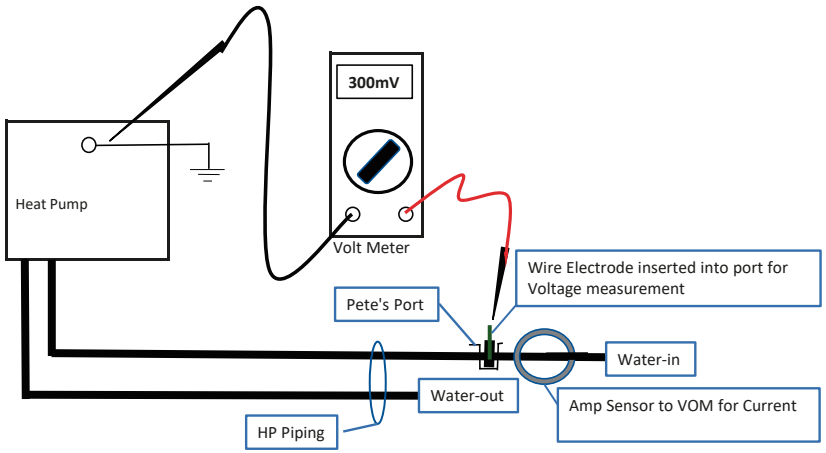
Measure the earth ground bond using an Ohm meter between the building's ground rod and the steel well casing.

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.

Water Quality Requirements

Measuring Electrolysis Voltage and Current



Measure the electrolysis voltage using a volt meter between the heat pump ground and #14 AWG solid copper wire electrode inserted into the water using a Pete's style access port.

The HP must be operating and the water stream flowing.

The voltage measured should be less than 300 mV (0.300 V). If higher than 500 mV, 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 HP 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.

Pipe 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 start-up 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 (ClimateMaster requires a strainer with a #20 stainless steel wire mesh for each unit). 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 (.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. Remove system and unit strainers. Clean strainers free of any dirt or blockages. Reinstall strainers.
10. Test the system pH with litmus paper. The system water should be in the range of pH 7.0 - 9.0 (see water quality table). Add chemicals, as appropriate to maintain neutral pH levels.
11. 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.

⚠ CAUTION! ⚠

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.

Piping System Cleaning and Flushing

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.

Unit and System Checkout

⚠ WARNING! ⚠

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A 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 HFC-410A as system failures and property damage may result.

Unit and System Checkout
BEFORE POWERING SYSTEM, please 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 Tables 7 and 8.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out on the CXM2 control is not clipped.
- ❑ 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 start-up. Fan motors are pre-oiled 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 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 (see water quality 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.

Unit and System Checkout

- ❑ 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.
- ❑ 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! ⚠

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

⚠ CAUTION! ⚠

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.

Unit Start-Up Procedure

Unit Start-up Procedure

1. Turn the thermostat fan position to "ON". Blower should start.
2. Balance air flow at registers.
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 Tables 7 and 8. During start-up checks, loop water temperature entering the heat pump should be between 60°F [16°C] and 95°F [35°C].
5. Two factors determine the operating limits of ClimateMaster heat pumps, (a) return air temperature/flow, and (b) water temperature/flow. 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 control board as shown below in Figure 18. See controls description for details.
   c. 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 & comparing to Table 9. The unit must have enough flow as per the flow switch setpoint in order for the compressor to start.
   d. 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.
   e. Refer to Table 7 and 8. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in Table 9. 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 (Btuh) = TD x GPM x 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 Table 9. In S-I units, the formula is as follows: HR (kW) = TD x l/s x 4.18.
   f. 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].
   g. 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

Unit Start-Up Procedure

a higher temperature until the compressor activates.

c. Check for warm air delivery within a few minutes after the unit has begun to operate.

d. Refer to Tables 7 and 8. 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 and compare to Table 10. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in Table 9. 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 (kW) = TD xGPM x 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 Table 9. In S-I units, the formula is as follows: HE (kW) = TD x l/s x 4.18.

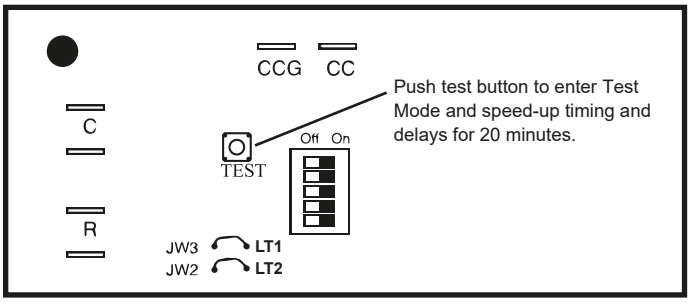
e. Check air temperature rise across the air coil when compressor is operating. Air temperature rise should be between 20°F and 30°F [11°C and 17°C].

f. Check for vibration, noise, and water leaks.

7. If unit fails to operate, perform troubleshooting analysis (see troubleshooting section). If the check 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 system to maintain 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 start-up. A 10% solution of dishwasher detergent and water is recommended.

Figure 21: Test Mode Button



Unit Start-Up Procedure

Motorized Water Valve Option Corrections

Model	Flow Coefficient (2Way) Cv	Max. Close-Off Pressure (MOPD)	WPD Adders		
			GPM	PSI	FT
TRL006	4.9	0 - 125 psi	1.50	0.09	0.21
			1.88	0.15	0.35
			2.25	0.21	0.49
TRL009			1.69	0.12	0.28
			2.25	0.21	0.49
			2.81	0.33	0.76
TRL012			2.25	0.21	0.49
			3.00	0.37	0.85
			3.75	0.59	1.36
TRL015			2.81	0.33	0.76
			3.75	0.59	1.36
			4.69	0.92	2.13

Table 9: TRL Braze Plate Water Pressure Drop

Model	U.S. GPM	l/s	Pressure Drop, psi [kPa]			
			30°F [-1°C]	50°F [10°C]	70°F [21°C]	90°F [32°C]
006	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
009	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
012	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
015	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

⚠ WARNING! ⚠

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! ⚠

CAUTION! Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the braze plate or water lines can permanently damage the heat pump.

Unit 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 10: TRL Series Typical Unit Operating Pressures and Temperatures

006			Full Load Cooling - EAT: 80/67°F [27/19°C]					Full Load Heating - EAT: 70°F [21°C]				
Airflow (CFM)	Entering Water Temp F	Water Flow GPM	Suction Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB	Suction Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB
225	30*	1.5	117 - 127	20 - 33	10 - 14	11 - 13	20 - 26	82 - 88	9 - 12	3 - 5	1 - 3	17 - 21
		1.88	117 - 127	20 - 33	10 - 13	9 - 10	20 - 26	83 - 90	9 - 12	3 - 5	3 - 4	17 - 21
		2.25	117 - 127	20 - 34	9 - 13	7 - 8	20 - 27	83 - 90	9 - 12	4 - 5	3 - 3	18 - 22
	40	1.5	121 - 131	16 - 26	10 - 14	11 - 13	20 - 26	98 - 106	8 - 10	3 - 5	5 - 7	20 - 24
		1.88	121 - 131	16 - 27	10 - 13	9 - 10	20 - 26	100 - 108	8 - 11	3 - 5	4 - 5	20 - 24
		2.25	121 - 131	17 - 28	9 - 13	7 - 8	20 - 27	100 - 108	8 - 11	4 - 5	3 - 4	20 - 25
	50	1.5	125 - 135	12 - 20	10 - 14	11 - 13	20 - 26	115 - 125	7 - 9	3 - 5	6 - 8	23 - 28
		1.88	125 - 135	12 - 21	10 - 13	9 - 10	20 - 26	118 - 127	7 - 9	3 - 5	5 - 6	23 - 28
		2.25	125 - 135	13 - 21	9 - 13	7 - 8	20 - 27	118 - 127	7 - 9	4 - 5	4 - 5	23 - 28
	60	1.5	129 - 139	9 - 15	10 - 14	11 - 13	20 - 26	133 - 145	7 - 9	2 - 4	6 - 8	25 - 31
		1.88	129 - 139	9 - 15	10 - 13	9 - 10	20 - 26	136 - 147	7 - 9	2 - 4	5 - 6	25 - 31
		2.25	129 - 139	9 - 16	9 - 13	7 - 8	20 - 27	136 - 147	7 - 9	3 - 4	4 - 5	26 - 32
	70	1.5	132 - 144	7 - 11	10 - 14	10 - 12	19 - 25	152 - 164	8 - 10	2 - 4	7 - 9	28 - 34
		1.88	132 - 144	7 - 12	10 - 13	8 - 9	19 - 25	155 - 168	8 - 11	2 - 4	6 - 7	28 - 34
		2.25	132 - 144	7 - 12	9 - 13	6 - 7	19 - 26	155 - 168	8 - 11	3 - 4	4 - 5	29 - 35
	80	1.5	135 - 147	6 - 10	10 - 14	10 - 12	19 - 25	170 - 184	9 - 12	2 - 4	8 - 10	31 - 37
		1.88	135 - 147	6 - 10	10 - 13	8 - 9	19 - 25	173 - 188	9 - 12	2 - 4	6 - 8	31 - 38
		2.25	135 - 147	6 - 11	9 - 13	6 - 7	19 - 26	173 - 188	9 - 12	3 - 4	5 - 6	32 - 39
	90	1.5	138 - 150	5 - 9	10 - 14	10 - 12	18 - 24	189 - 205	9 - 13	2 - 2	9 - 11	33 - 41
		1.88	138 - 150	5 - 9	10 - 13	8 - 9	18 - 24	193 - 209	10 - 13	2 - 2	7 - 8	34 - 41
		2.25	138 - 150	6 - 9	9 - 13	6 - 7	18 - 24	193 - 209	10 - 13	2 - 3	6 - 7	34 - 42
	100	1.5	141 - 153	5 - 9	10 - 14	9 - 11	18 - 24	209 - 227	11 - 15	1 - 3	10 - 12	35 - 43
		1.88	141 - 153	5 - 9	10 - 13	7 - 8	18 - 24	213 - 231	11 - 15	1 - 3	8 - 9	35 - 43
		2.25	141 - 153	6 - 9	9 - 13	6 - 6	18 - 24	213 - 231	11 - 15	1 - 3	6 - 7	36 - 44
	110	1.5	144 - 156	6 - 10	10 - 14	9 - 11	17 - 23					
		1.88	144 - 156	6 - 10	10 - 13	7 - 8	17 - 23					
		2.25	144 - 156	6 - 11	9 - 13	6 - 6	17 - 23					

* Based on 15% Methanol antifreeze solution.

Unit Operating Conditions

Table 10, continued: TRL Series Typical Unit Operating Pressures and Temperatures

009			Full Load Cooling - EAT: 80/67°F [27/19°C]					Full Load Heating - EAT: 70°F [21°C]				
Airflow (CFM)	Entering Water Temp F	Water Flow GPM	Suction Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB	Suction Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB
300	30*	1.69	120 - 130	15 - 25	3 - 5	14 - 16	20 - 26	77 - 83	11 - 15	2 - 4	1 - 2	17 - 21
		2.25	109 - 119	23 - 38	6 - 8	10 - 12	19 - 25	80 - 86	11 - 15	2 - 4	4 - 4	18 - 22
		2.8	109 - 119	23 - 39	6 - 8	8 - 9	19 - 25	81 - 88	11 - 15	2 - 4	3 - 3	18 - 22
	40	1.69	121 - 131	14 - 23	5 - 7	14 - 16	19 - 25	94 - 102	10 - 14	2 - 4	6 - 8	21 - 25
		2.25	114 - 124	18 - 30	6 - 8	10 - 12	19 - 25	97 - 105	10 - 14	2 - 4	5 - 6	21 - 25
		2.8	114 - 124	19 - 31	6 - 8	8 - 9	19 - 25	99 - 107	11 - 14	2 - 4	3 - 4	21 - 26
	50	1.69	122 - 132	11 - 19	7 - 9	13 - 15	19 - 25	110 - 120	9 - 13	2 - 4	7 - 9	23 - 29
		2.25	118 - 128	14 - 24	7 - 9	10 - 12	19 - 25	114 - 124	10 - 14	2 - 4	5 - 7	23 - 29
		2.8	118 - 128	15 - 24	7 - 9	8 - 9	19 - 25	117 - 126	11 - 14	2 - 4	4 - 5	24 - 29
	60	1.69	124 - 134	11 - 18	8 - 10	13 - 15	18 - 24	128 - 138	9 - 13	2 - 4	8 - 10	25 - 31
		2.25	123 - 133	11 - 18	7 - 9	10 - 12	19 - 25	132 - 142	10 - 14	2 - 4	6 - 8	26 - 32
		2.8	123 - 133	11 - 18	7 - 9	8 - 9	19 - 25	134 - 145	11 - 14	2 - 4	5 - 6	26 - 32
	70	1.69	126 - 136	9 - 15	9 - 12	13 - 15	18 - 24	144 - 156	10 - 14	2 - 4	9 - 11	28 - 34
		2.25	127 - 137	8 - 14	7 - 9	9 - 11	18 - 24	149 - 161	11 - 15	2 - 4	6 - 8	28 - 34
		2.8	127 - 137	8 - 14	7 - 9	7 - 8	18 - 24	152 - 164	11 - 15	2 - 4	5 - 6	28 - 34
	80	1.69	129 - 139	8 - 14	9 - 13	13 - 15	17 - 23	160 - 174	11 - 15	2 - 4	10 - 12	30 - 36
		2.25	131 - 141	7 - 11	8 - 10	9 - 11	18 - 24	166 - 180	12 - 16	2 - 4	7 - 9	30 - 36
		2.8	131 - 141	7 - 12	7 - 10	7 - 8	18 - 24	169 - 184	12 - 17	2 - 4	6 - 7	30 - 37
	90	1.69	132 - 144	8 - 13	9 - 13	12 - 14	16 - 22	177 - 191	13 - 17	2 - 4	10 - 12	32 - 39
		2.25	134 - 146	6 - 10	7 - 9	9 - 11	17 - 23	183 - 199	14 - 18	2 - 4	8 - 10	32 - 39
		2.8	134 - 146	6 - 10	7 - 9	7 - 8	17 - 23	187 - 203	14 - 19	2 - 4	6 - 8	32 - 39
	100	1.69	136 - 148	8 - 13	9 - 12	12 - 14	15 - 21	192 - 208	14 - 20	2 - 4	11 - 13	33 - 41
		2.25	137 - 149	6 - 10	7 - 9	9 - 11	17 - 23	202 - 218	15 - 21	2 - 4	9 - 11	33 - 41
		2.8	137 - 149	6 - 10	7 - 9	7 - 8	17 - 23	206 - 223	16 - 21	2 - 4	7 - 8	34 - 41
	110	1.69	140 - 152	8 - 13	8 - 10	11 - 13	15 - 21					
		2.25	140 - 152	7 - 11	7 - 9	8 - 10	16 - 22					
		2.8	140 - 152	7 - 12	7 - 9	6 - 7	16 - 22					

* Based on 15% Methanol antifreeze solution.

012			Full Load Cooling - EAT: 80/67°F [27/19°C]					Full Load Heating - EAT: 70°F [21°C]				
Airflow (CFM)	Entering Water Temp F	Water Flow GPM	Suction Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB	Suction Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB
400	30*	2.25	127 - 137	11 - 18	2 - 4	15 - 17	20 - 26	75 - 81	7 - 9	2 - 4	1 - 2	18 - 22
		3	112 - 122	24 - 40	9 - 13	10 - 12	19 - 25	78 - 84	8 - 10	2 - 4	5 - 6	19 - 23
		3.75	112 - 122	25 - 41	9 - 12	8 - 9	19 - 25	79 - 86	8 - 11	2 - 4	3 - 4	19 - 23
	40	2.25	128 - 138	10 - 16	4 - 6	15 - 17	20 - 26	89 - 97	8 - 10	2 - 4	6 - 8	21 - 25
		3	118 - 128	18 - 30	8 - 10	11 - 13	19 - 25	92 - 100	8 - 10	2 - 4	5 - 6	22 - 26
		3.75	118 - 128	19 - 31	7 - 10	9 - 10	19 - 25	94 - 102	8 - 11	2 - 4	3 - 4	22 - 27
	50	2.25	129 - 139	8 - 14	6 - 8	14 - 16	20 - 26	105 - 113	9 - 12	2 - 4	7 - 9	23 - 29
		3	124 - 134	13 - 21	7 - 9	11 - 13	19 - 25	108 - 116	9 - 12	2 - 4	5 - 7	23 - 29
		3.75	124 - 134	13 - 22	7 - 9	9 - 10	19 - 25	110 - 119	9 - 12	2 - 4	4 - 5	24 - 29
	60	2.25	130 - 140	8 - 13	8 - 10	14 - 16	19 - 25	119 - 129	9 - 13	2 - 2	8 - 10	26 - 32
		3	129 - 139	9 - 15	7 - 9	10 - 12	19 - 25	124 - 134	9 - 13	2 - 4	6 - 8	26 - 32
		3.75	129 - 139	9 - 15	7 - 9	8 - 9	19 - 25	126 - 137	10 - 13	2 - 4	5 - 6	26 - 32
	70	2.25	132 - 142	7 - 11	9 - 12	14 - 16	19 - 25	134 - 146	10 - 14	2 - 4	9 - 11	28 - 34
		3	132 - 144	7 - 11	7 - 9	10 - 12	19 - 25	140 - 152	10 - 14	2 - 4	7 - 9	29 - 35
		3.75	132 - 144	7 - 12	7 - 9	8 - 9	19 - 25	143 - 155	11 - 14	2 - 4	6 - 7	29 - 36
	80	2.25	134 - 146	6 - 10	10 - 14	13 - 15	18 - 24	150 - 162	11 - 15	2 - 4	10 - 12	30 - 36
		3	135 - 147	5 - 8	8 - 10	10 - 12	18 - 24	157 - 171	11 - 15	2 - 4	8 - 10	31 - 37
		3.75	135 - 147	5 - 8	7 - 10	8 - 9	18 - 24	161 - 174	11 - 15	2 - 4	6 - 8	31 - 38
	90	2.25	136 - 148	5 - 9	11 - 15	13 - 15	17 - 23	165 - 179	12 - 16	2 - 4	11 - 13	32 - 39
		3	138 - 150	4 - 6	9 - 12	10 - 12	18 - 24	175 - 189	13 - 17	2 - 4	9 - 11	32 - 40
		3.75	138 - 150	4 - 6	8 - 11	8 - 9	18 - 24	178 - 193	13 - 18	2 - 4	7 - 8	33 - 40
	100	2.25	139 - 151	5 - 9	12 - 16	12 - 14	17 - 23	181 - 197	13 - 17	2 - 4	12 - 14	33 - 41
		3	140 - 152	4 - 6	10 - 14	9 - 11	17 - 23	194 - 210	14 - 18	2 - 4	9 - 11	34 - 42
		3.75	140 - 152	4 - 6	10 - 13	7 - 8	17 - 23	198 - 214	14 - 19	2 - 4	7 - 8	35 - 42
	110	2.25	143 - 155	5 - 9	13 - 17	12 - 14	16 - 22					
		3	142 - 154	5 - 9	12 - 16	9 - 11	16 - 22					
		3.75	142 - 154	5 - 9	11 - 15	7 - 8	16 - 22					

* Based on 15% Methanol anitfreeze solution.

Unit Operating Conditions

Table 10, continued: TRL Series Typical Unit Operating Pressures and Temperatures

015			Full Load Cooling - EAT: 80/67°F [27/19°C]					Full Load Heating - EAT: 70°F [21°C]				
Airflow (CFM)	Entering Water Temp F	Water Flow GPM	Suction Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB	Suction Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise F	Air Temp Drop F DB
500	30*	2.81	126 - 136	8 - 14	8 - 10	14 - 16	19 - 25	75 - 81	9 - 12	2 - 4	1 - 2	15 - 19
		3.75	114 - 124	17 - 28	14 - 18	10 - 12	20 - 26	80 - 86	9 - 13	2 - 4	4 - 4	13 - 15
		4.7	114 - 124	17 - 28	13 - 18	8 - 9	20 - 26	81 - 88	10 - 13	2 - 4	3 - 3	13 - 16
	40	2.81	128 - 138	8 - 13	7 - 9	14 - 16	19 - 25	92 - 100	9 - 12	2 - 4	1 - 2	17 - 21
		3.75	120 - 130	14 - 23	11 - 15	10 - 12	19 - 25	95 - 103	9 - 12	2 - 4	5 - 6	16 - 20
		4.7	120 - 130	14 - 23	11 - 14	8 - 9	19 - 25	97 - 105	9 - 12	2 - 4	3 - 4	16 - 20
	50	2.81	131 - 141	7 - 11	8 - 10	13 - 15	18 - 24	108 - 116	8 - 10	2 - 4	2 - 2	19 - 23
		3.75	126 - 136	11 - 18	9 - 13	10 - 12	18 - 24	110 - 120	9 - 12	2 - 4	5 - 7	20 - 24
		4.7	126 - 136	11 - 18	9 - 12	8 - 9	18 - 24	113 - 122	9 - 12	2 - 4	4 - 5	20 - 24
	60	2.81	133 - 145	7 - 11	8 - 10	13 - 15	18 - 24	122 - 132	8 - 10	2 - 4	3 - 3	21 - 25
		3.75	131 - 141	8 - 14	8 - 10	9 - 11	18 - 24	124 - 134	9 - 12	2 - 4	5 - 7	22 - 26
		4.7	131 - 141	8 - 14	7 - 10	7 - 8	18 - 24	126 - 137	9 - 12	2 - 4	4 - 5	22 - 27
	70	2.81	135 - 147	6 - 10	9 - 12	13 - 15	17 - 23	134 - 146	8 - 10	2 - 4	4 - 4	22 - 26
		3.75	135 - 147	6 - 10	7 - 9	9 - 11	17 - 23	137 - 149	9 - 12	2 - 4	6 - 8	23 - 29
		4.7	135 - 147	6 - 10	7 - 9	7 - 8	17 - 23	140 - 152	9 - 12	2 - 4	5 - 6	24 - 29
	80	2.81	138 - 150	6 - 10	9 - 13	12 - 14	16 - 22	146 - 158	9 - 12	2 - 4	5 - 6	23 - 28
		3.75	138 - 150	5 - 9	8 - 10	9 - 11	16 - 22	149 - 161	9 - 13	2 - 4	6 - 8	23 - 29
		4.7	138 - 150	5 - 9	7 - 10	7 - 8	16 - 22	152 - 164	10 - 13	2 - 4	5 - 6	24 - 29
	90	2.81	140 - 152	5 - 9	11 - 15	12 - 14	16 - 22	156 - 168	9 - 13	2 - 4	5 - 7	23 - 28
		3.75	141 - 153	5 - 8	9 - 12	8 - 10	16 - 22	159 - 173	10 - 14	2 - 4	7 - 9	23 - 29
		4.7	141 - 153	5 - 8	8 - 11	6 - 7	16 - 22	163 - 176	11 - 14	2 - 4	6 - 7	24 - 29
	100	2.81	143 - 155	5 - 9	12 - 16	11 - 13	15 - 21	164 - 178	10 - 14	2 - 4	5 - 7	23 - 28
		3.75	144 - 156	5 - 8	10 - 14	8 - 10	15 - 21	170 - 184	12 - 16	2 - 4	7 - 9	22 - 26
		4.7	144 - 156	5 - 8	10 - 13	6 - 7	15 - 21	173 - 188	12 - 17	2 - 4	6 - 7	22 - 27
	110	2.81	145 - 157	5 - 9	14 - 18	11 - 13	14 - 20					
		3.75	145 - 157	5 - 9	13 - 17	8 - 8	15 - 21					
		4.7	145 - 157	5 - 9	12 - 17	6 - 6	15 - 21					

* Based on 15% Methanol antifreeze solution.

Table 11: Water Temperature Change Through Heat Exchanger

Water Flow, gpm [l/m]	Rise, Cooling °F, [°C]	Drop, Heating °F, [°C]
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton [3.2 l/m per kW]	8 - 20 [4.4 - 11.1]	3 - 18 [1.7 - 10]

Preventive Maintenance

Brazed Plate Heat Exchanger Maintenance - TRL should not be applied to ground water applications.

Brazed Plate Heat Exchanger Maintenance - (All other water loop applications) Generally brazed plate heat exchanger (BPHX) maintenance is not needed for closed loop systems. However, if the piping is known to have high dirt or debris content, it is best to establish a periodic maintenance schedule 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 and mineral buildup through water use can also contribute to higher maintenance and should never be paired with TRL systems unless an indeterminate heat exchanger is used in the water loop system. The unit water strainer should be periodically cleaned. **Water loop systems with poor water quality/dirt/debris in the system will require the strainer be cleaned out more frequently.** Should periodic coil cleaning be 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. However, flow rates over 3 gpm per ton (3.9 l/m per kW) can produce water (or debris) velocities that can erode the heat exchanger wall and ultimately produce leaks.

Filters - Filters must be clean to obtain maximum performance. Filters should be inspected every month under normal operating conditions and be replaced when necessary. Units should never be operated 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 provide consistent washing of 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-serve 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 algaecide approximately every three months to minimize the problem. The condensate pan may also need to be cleaned periodically to ensure indoor air quality. The condensate drain can pick up 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. Fan motors should never be lubricated 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.

Preventive Maintenance

Air Coil - The air coil must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Care must be taken not to damage the aluminum fins while cleaning.
CAUTION: Fin edges are sharp.

Cabinet - Do not allow water to stay in contact with the cabinet for long periods of time to prevent corrosion of the cabinet sheet metal. The cabinet can be cleaned 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.

Functional Troubleshooting

Fault	Htg	Clg	Possible Cause	Solution
Main power problems	X	X	Green Status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24 VAC between R and C on CXM2.
				Check primary/secondary voltage on transformer.
HP Fault Code 2 **High Pressure**		X	Reduced or no water flow in cooling	Check pump operation or valve operation/ setting.
				Check water flow adjust to proper flow rate.
				Check flow switch is operating correctly.
		X	Water Temperature out of range in cooling	Bring water temp within design parameters.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace. Check flow switch is operating correctly.
				Check fan motor operation and airflow restrictions.
				Dirty Air Coil- construction dust etc.
				Too high of external static? Check static vs blower table.
				Confirm wire harness connection to correct taps.
	X		Air temperature out of range in heating	Bring return air temp within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table.
	X	X	Bad HP Switch	Check switch continuity and operation. Replace. Confirm wire harness connection to correct taps.
LP/LOC Fault Code 3 **Low Pressure / Loss of Charge**	X	X	Insufficient charge	Check for refrigerant leaks.
	X	X	Bad LP switch	Check switch continuity and operation. Replace.
				Check if JW3 is cut on CXM2 to avoid system looking for the incorrect LP switch.
	X		Compressor pump down at start-up	Check charge and start-up water flow.
LT1 Fault Code 4 **Water coil low temperature limit**	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter? Clean or replace.
				Check water flow adjust to proper flow rate.
				Check flow switch is operating correctly.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper temperature limit setting (25°F vs 10°F [-4°C vs -12°C])	Clip JW3 jumper for antifreeze (10°F [-12°C]) use. Check flow switch is operating correctly.
	X		Water Temperature out of range	Bring water temp within design parameters.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.

Table continued on next page.

Functional Troubleshooting

Table continued from previous page.

Fault	Htg	Clg	Possible Cause	Solution
LT2 Fault Code 5 **Air coil low temperature limit**		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs blower table.
		X	Air Temperature out of range	Too much cold vent air? Bring entering air temp within design parameters.
		X	Improper temperature limit setting (25°F vs 10°F [-4°C vs -12°C])	Normal airside applications will require 25°F [-4°C] only.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
Condensate Fault Code 6	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	Check for piping slope away from unit.
				Check slope of unit toward outlet.
				Poor venting? Check vent location.
		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.
Over/Under Voltage Code 7 **(Auto resetting)**	X	X	Under Voltage	Check power supply and 24 VAC voltage before and during operation.
				Check power supply wire size.
				Check 24 VAC and unit transformer tap for correct power supply voltage.
	X	X	Over Voltage	Check power supply voltage and 24 VAC before and during operation.
				Check 24 VAC and unit transformer tap for correct power supply voltage.
Unit Performance Sentinel Code 8	X		Heating mode LT2>125°F [52°C]	Check for poor airflow or overcharged unit.
		X	Cooling Mode LT1>125°F [52°C] OR LT2< 40ºF [4ºC])	Check for poor water flow, or airflow.
Swapped Thermistor Code 9	X	X	LT1 and LT2 swapped	Reverse position of thermistors.
Low Water Flow Code 13	X	X	Reduced or no water flow	Check pump operation or valve operation/ setting.
				Check water flow adjust to proper flow rate.
				Clogged Y strainer, replace mesh.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X	X	Bad flow switch	Confirm applied flow to loops vs min. flow switch setpoint on label.

Table continued on next page.

Functional Troubleshooting

Table continued from previous page.

Fault	Htg	Clg	Possible Cause	Solution
Leaving Water Temperature Low Code 14	X		Reduced or no water flow in heating	Check pump operation or valve operation/ setting.
				Check water flow adjust to proper flow rate.
				Check water flow adjust to proper flow rate.
	X		In adequate 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 temp within design parameters.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
No Fault Code Shown	X	X	No compressor operation	See "Only Fan Operates".
	X	X	Compressor overload	Check and replace if necessary.
	X	X	Control board	Reset power and check operation.
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in "test mode"	Reset power or wait 20 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
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.
				Running on low temperature below LT1 and LWT limits.
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
				Not enough flow though the water loop, flow switch open.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for Line voltage across BR contacts.
				Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.

Table continued on next page.

Functional Troubleshooting

Table continued from previous page.

Fault	Htg	Clg	Possible Cause	Solution
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24 VAC on RV coil and at CXM2 board.
				If RV is stuck, run high pressure up 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	Thermostat wiring	Put thermostat in cooling mode. Check 24 VAC on O (check between C and O); check for 24 VAC on W (check between W and C). There should be voltage on O, but not on W. If voltage is present on W, thermostat may be bad or wired incorrectly.

Performance Troubleshooting

Performance Troubleshooting	Htg	Clg	Possible Cause	Solution
Insufficient capacity/ Not cooling or heating	X	X	Dirty filter	Replace or clean.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling per chart.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind stat.
	X	X	Unit undersized	Recheck loads & sizing. Check sensible clg. load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Inlet water too hot or too cold	Check load, loop sizing, loop backfill, ground moisture.

Table continued on next page.

Performance Troubleshooting

Table continued from previous page.

Performance Troubleshooting	Htg	Clg	Possible Cause	Solution
High Head Pressure	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/ setting.
				Check water flow. Adjust to proper flow rate.
				Check flow switch is operating correctly.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture. Check flow switch is operating correctly.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Re-weigh in charge.
	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.
Low Suction Pressure	X		Reduced water flow in heating.	Check pump operation or water valve operation/setting.
				Plugged strainer or filter? Clean or replace.
				Check water flow. Adjust to proper flow rate.
				Check flow switch is operating correctly.
	X		Water temperature out of range.	Bring water temperature within design parameters. Check flow switch is operating correctly.
		X	Reduced airflow in cooling.	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static? Check static vs. blower table.
		X	Air temperature out of range	Too much cold vent air? Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.

Table continued on next page.

Performance Troubleshooting

Table continued from previous page.

Performance Troubleshooting	Htg	Clg	Possible Cause	Solution
Low Discharge Air Temperature in Heating	X		Too high of airflow	Check fan motor speed selection and air flow chart.
	X		Poor performance	See 'Insufficient Capacity'.
High humidity		X	Too high of air flow	Check fan motor speed selection and airflow chart.
		X	Unit oversized	Recheck loads & sizing. Check sensible clg load and heat pump capacity.

Start-Up Log Sheet

Installer: Complete unit and system checkout and follow unit start-up procedures in the IOM. Use this form to record unit information, temperatures and pressures during start-up. Submit a copy of this completed form to your ClimateMaster representative once start-up has been completed. Keep a copy of the form your records and future use.

Job Name: _____ **Street Address:** _____

Model Number: _____ **Serial Number:** _____

Unit Location in Building: _____

Date: _____ **Sales Order No:** _____

In order 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
CT ECM	Speed Tap	

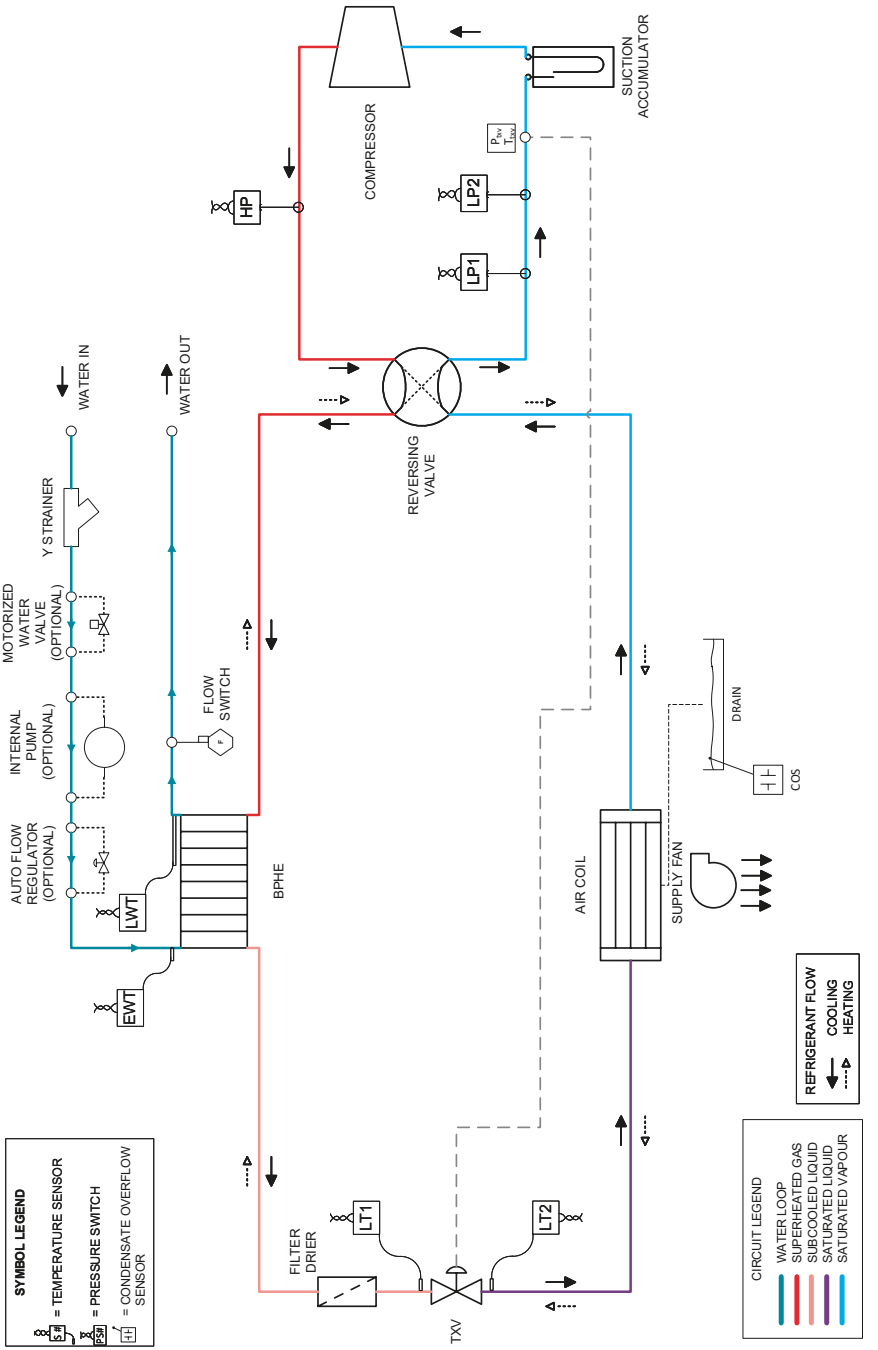
Temperatures: **F or C** **Antifreeze:** _____ **%**

Pressures: **PSIG or kPa** **Type:** _____

	Cooling Mode		Heating Mode
Entering Fluid Temperature			
Leaving Fluid Temperature			
Temperature Differential			
Return-Air Temperature	DB	WB	DB
Supply-Air Temperature	DB	WB	DB
Temperature Differential			
Brazed Plate Heat Exchanger (Water Pressure IN)			
Brazed Plate Heat Exchanger (Water Pressure OUT)			
Pressure Differential			
Water Flow GPM			
Compressor			
Amps			
Volts			
Discharge Line Temperature			
Motor			
Amps			
Volts			

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

Functional Troubleshooting Form



Functional Troubleshooting Form

Heat of Extraction (Absorption) or Heat of Rejection =

_____ flow rate (gpm)

x _____ temp. diff. (°F)

x _____ fluid factor†

= _____ (Btu/hr)

Superheat =

_____ suction temp.

– _____ suction saturation temp.

= _____ (°F)

Supercool =

_____ discharge saturation temp.

– _____ liquid line temp.

= _____ (°F)

† Use 500 for water, 485 for antifreeze.

Location	Measurement Type	Value
EWT Sensor	Temperature	
	Pressure	
LWT Sensor	Temperature	
	Pressure	
Air Coil - EAT	Temperature	
Air Coil - LAT	Temperature	
LT1 Sensor	Temperature	
LT2 Sensor	Temperature	
Flash Gas Line	Temperature	
Unit Power	Voltage	
	Amps	
Compressor	Amps	
Heating Liquid Line	Temperature	
Compressor Discharge	Temperature	
Compressor Suction	Temperature	
	Pressure	
Compressor Saturation	Temperature	
Cooling Liquid Line	Temperature	

NOTE: Never connect refrigerant gauges during startup procedures. Conduct water-side analysis using P/T ports to determine water flow and temperature difference. If water-side analysis shows poor performance, refrigerant troubleshooting may be required. Connect refrigerant gauges as a last resort.

CLIMATEMASTER
A NIBE GROUP MEMBER

CLIMATE MASTER, INC.
LIMITED EXPRESS WARRANTY/ LIMITATION OF REMEDIES AND LIABILITY

It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Climate Master, Inc., a Delaware corporation, ("CM") or its representatives, relating to CM's products, whether oral, written or contained in any sales literature, catalog or any other agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely CM's opinion or commendation of CM's products.

EXCEPT AS SPECIFICALLY SET FORTH HEREIN, THERE IS NO EXPRESS WARRANTY AS TO ANY OF CM'S PRODUCTS. CM MAKES NO WARRANTY AGAINST LATENT DEFECTS. CM MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.

GRANT OF LIMITED EXPRESS WARRANTY
CM warrants CM products purchased and retained in the United States of America and Canada to be free from defects in material and workmanship under normal use and maintenance as follows: (1) All complete air conditioning, heating and/or heat pump units built or sold by CM for twelve (12) months from date of unit start up or eighteen (18) months from date of shipment (from factory), whichever comes first; (2) Repair and replacement parts, which are not supplied under warranty, for ninety (90) days from date of shipment (from factory). All parts must be returned to CM's factory in Oklahoma City, Oklahoma, freight prepaid, no later than sixty (60) days after the date of the failure of the part; if CM determines the part to be defective and within CM's Limited Express Warranty, CM shall, when such part has been either replaced or repaired, return such to a factory recognized dealer, contractor or service organization, F.O.B. CM's factory, Oklahoma City, Oklahoma, freight prepaid. The warranty on any parts repaired or replaced under warranty expires at the end of the original warranty period.

This warranty does not cover and does not apply to: (1) Air filters, fuses, refrigerant, fluids, oil; (2) Products relocated after initial installation; (3) Any portion or component of any system that is not supplied by CM, regardless of the cause of the failure of such portion or component; (4) Products on which the unit identification tags or labels have been removed or defaced; (5) Products on which payment to CM is or has been in default; (6) Products which have defects or damage which result from improper installation, wiring, electrical imbalance characteristics or maintenance; or are caused by accident, misuse or abuse, fire, flood, alteration or misapplication of the product; (7) Products which have defects or damage which result from a contaminated or corrosive air or liquid supply, operation at abnormal temperatures, or unauthorized opening of refrigerant circuit; (8) Mold, fungus or bacteria damages; (9) Products subjected to corrosion or abrasion; (10) Products manufactured or supplied by others; (11) Products which have been subjected to misuse, negligence or accidents; (12) Products which have been operated in a manner contrary to CM's printed instructions; or (13) Products which have defects, damage or insufficient performance as a result of insufficient or incorrect system design or the improper application of CM's products.

CM is not responsible for: (1) The costs of any fluids, refrigerant or other system components, or associated labor to repair or replace the same, which is incurred as a result of a defective part covered by CM's Limited Express Warranty; (2) The costs of labor, refrigerant, materials or service incurred in removal of the defective part, or in obtaining and replacing the new or repaired part; or, (3) Transportation costs of the defective part from the installation site to CM or of the return of any part not covered by CM's Limited Express Warranty.

Limitation: This Limited Express Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such warranties, including without limitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Warranty.

LIMITATION OF REMEDIES
In the event of a breach of the Limited Express Warranty, CM will only be obligated at CM's option to repair the failed part or unit or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to CM's factory in Oklahoma City, Oklahoma of each defect, malfunction or other failure and a reasonable number of attempts by CM to correct the defect, malfunction or other failure and the remedy fails of its essential purpose, CM shall refund the purchase price paid to CM in exchange for the return of the sold good(s). Said refund shall be the maximum liability of CM. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR THEIR PURCHASER AGAINST CM FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR CM'S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY
CM shall have no liability for any damages if CM's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes or work stoppages, fire, flood, accident, shortages of transportation, fuel, material, or labor, acts of God or any other reason beyond the sole control of CM. **CM EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR CM's NEGLIGENCE OR AS STRICT LIABILITY.**

OBTAINING WARRANTY PERFORMANCE
Normally, the contractor or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any CM recognized dealer, contractor or service organization. If assistance is required in obtaining warranty performance, write or call:

Climate Master, Inc. • Customer Service • 7300 S.W. 44th Street • Oklahoma City, Oklahoma 73179 (405) 745-6000

NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province.

Please refer to the CM Installation, Operation and Maintenance Manual for operating and maintenance instructions.

Rev.: 11/09

LC083

Notes:

Notes:

Revision History

Date:	Description:	Page #:
01/12/24	Added Part reference for field accessory kit	36
02/28/23	Update Controls Information	All
07/12/22	Added 265v “E” voltage option	All
03/04/22	Updated Max Fuse Amp size for sizes 12 & 15	Page 29
11/11/21	Created	All

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