

Tranquility® 20 (TS) Series



Commercial Horizontal & Vertical Packaged Water-Source Heat Pumps

50Hz-HFC-410A

INSTALLATION, OPERATION & MAINTENANCE

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Created: 25 July, 2017

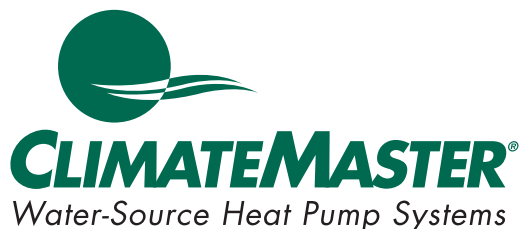


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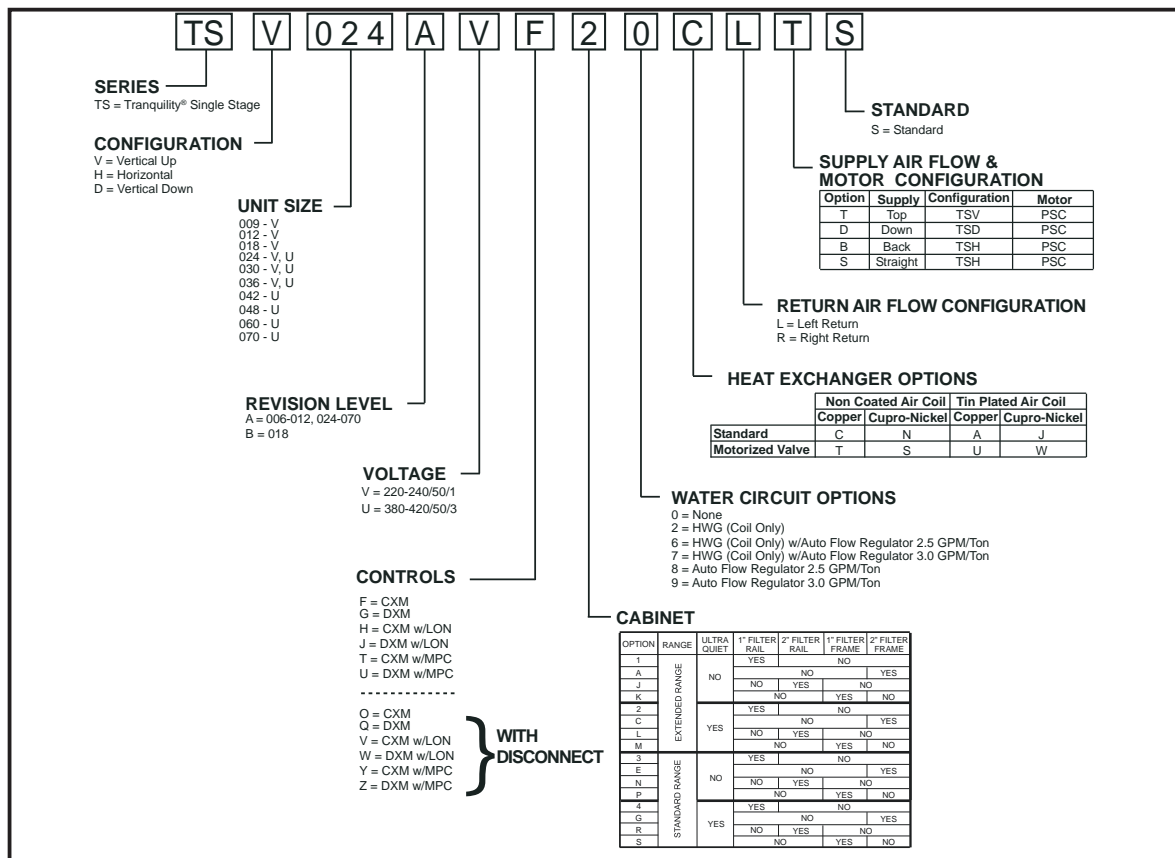
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Model Nomenclature General Overview



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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 will quickly become clogged with construction dirt and debris, which may cause system damage.

⚠ 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.

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. Loosen compressor bolts on units equipped with compressor spring vibration isolation until the compressor rides freely on the springs. Remove shipping restraints.
7. Some airflow patterns are field convertible (horizontal units only). Locate the airflow conversion section of this IOM.
8. Locate and verify any hot water generator (HWG), hanger, or other accessory kit located in the compressor section or blower section.

⚠ CAUTION! ⚠

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

⚠ 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 may 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.

NOTICE! Failure to remove shipping brackets from spring-mounted compressors will cause excessive noise, and could cause component failure due to added vibration.

CLIMATEMASTER WATER-SOURCE HEAT PUMPS

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Unit Physical Data

TRANQUILITY® 20 SINGLE-STAGE (TS) SERIES (50HZ)

Model	009	012	018	024	030	036	042	048	060	070
Compressor (1 Each)	Rotary		Scroll							
Factory Charge HFC-410A [kg]	0.88	0.96	1.13	1.59	1.64	1.98	2.27	2.27	3.86	4.08
PSC Fan Motor & Blower (3 Speeds)										
Fan Motor [W]	37	93	124	149	249	373	373	560	746	746
High Static Fan Motor [W]	N/A	N/A	149	249	373	373	560	560	746	Not Available
Blower Wheel Size (dia x w) - [mm]	6 X 5	6 X 5	9 x 7	9 x 7	9 x 7	10 x 10	10 x 10	10 x 10	11 x 10	11 x 10
Water Connection Size										
FPT (in)	1/2"	1/2"	3/4"	3/4"	3/4"	3/4"	1"	1"	1"	1"
HWG Connection Size										
FPT (in)	N/A	N/A	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
Coax Volume										
Volume [liters]	1.10	1.70	2.12	2.88	2.88	3.48	4.69	4.69	5.91	5.91
Vertical Upflow/Downflow										
Air Coil Dimensions (h x w) - [mm]	406 x 406 Upflow Only	406 x 406 Upflow Only	610 x 508	711 x 508	711 x 508	711 x 635	813 x 635	813 x 635	914 x 635	914 x 635
Standard Filter - [25.4mm] Throwaway, qty [mm]	406 x 508	406 x 508	610 x 610	711 x 610	711 x 610	711 x 762	2 - 406 x 762	2 - 406 x 762	1 - 406 x 762; 1 - 508 x 762	1 - 406 x 762; 1 - 508 x 762
Weight - Operating, [kg]	66	68	114	121	122	148	188	189	200	201
Weight - Packaged, [kg]	71	73	119	125	126	153	192	193	205	206
Horizontal										
Air Coil Dimensions (h x w) - [mm]	406 x 406	406 x 406	457 x 686	457 x 787	457 x 787	508 x 889	508 x 1016	508 x 1016	508 x 1143	508 x 1143
Standard Filter - [25.4mm] Throwaway, qty [mm]	406 x 508	406 x 508	2 - 457 x 457	2 - 457 x 457	2 - 457 x 457	1 - 305 x 508; 1 - 508 x 635	1 - 457 x 508; 1 - 508 x 610	1 - 457 x 508; 1 - 508 x 610	2 - 508 x 610	2 - 508 x 610
Weight - Operating, [kg]	71	73	117	121	122	148	188	189	200	201
Weight - Packaged, [kg]	72	77	121	125	126	153	192	193	205	206

All units have dual vibration isolation compressor mounts for quiet operation, thermal expansion valves for refrigerant metering, and 22.2 mm & 28.6 mm electrical knockouts to accommodate field wiring.

FPT - Female Pipe Thread

Condensate Drain Connection is 3/4" FPT

Unit Maximum Water Working Pressure	
Options	Max Pressure kPa
Base Unit	3447
Internal Motorized Water Valve (MWV)	2,068
Internal Auto Flow Valve	2,068

Use the lowest maximum pressure rating when multiple options are combined.

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).

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 or engineering design guide for dimensional data.

In limited side access installations, pre-removal of the control box side mounting screws will allow control box removal for future servicing.

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. Provide access to hanger brackets, water valves and fittings. Provide screwdriver clearance to access panels, discharge collars and all electrical connections.
2. 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.
3. Use a manual portable jack/lift to lift and support the weight of the unit during installation and servicing.

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

Mounting Horizontal Units

Horizontal units have 4 hanger brackets partially attached at the factory, one at each corner. Enclosed within the unit there is a hanger kit hardware bag containing vibration isolation grommets, washers, screws and a hanger installation instruction page. One additional screw from the hardware bag must be added to each hanger bracket before unit installation. Tighten each screw to 75 in-lbs (8.5 Nm). 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 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.

Figure 1: Hanger Bracket

Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. On small units (less than 8.8 kW) ensure that unit pitch does not cause condensate leaks inside the cabinet.

Figure 1: Hanger Bracket

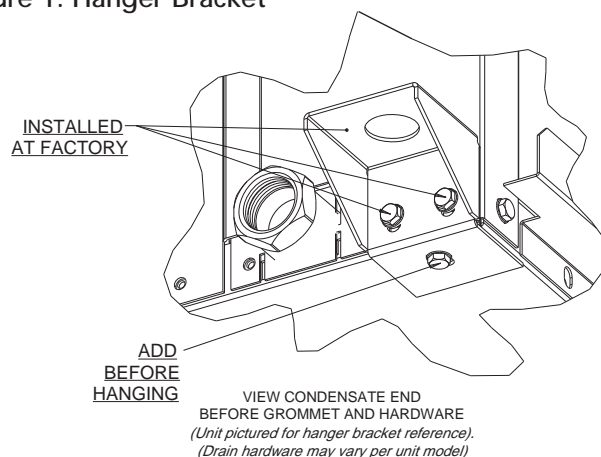
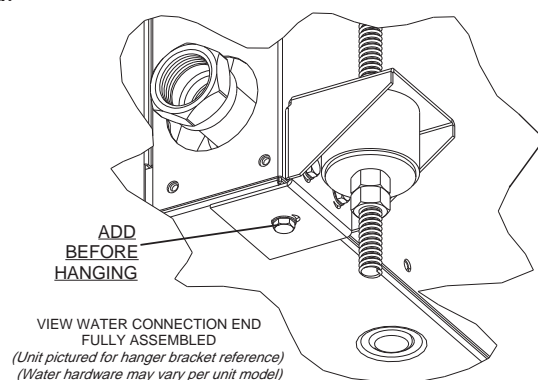


Figure 1a:



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Figure 2: Horizontal Unit Pitch

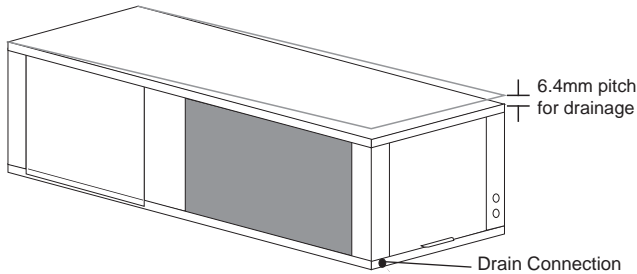
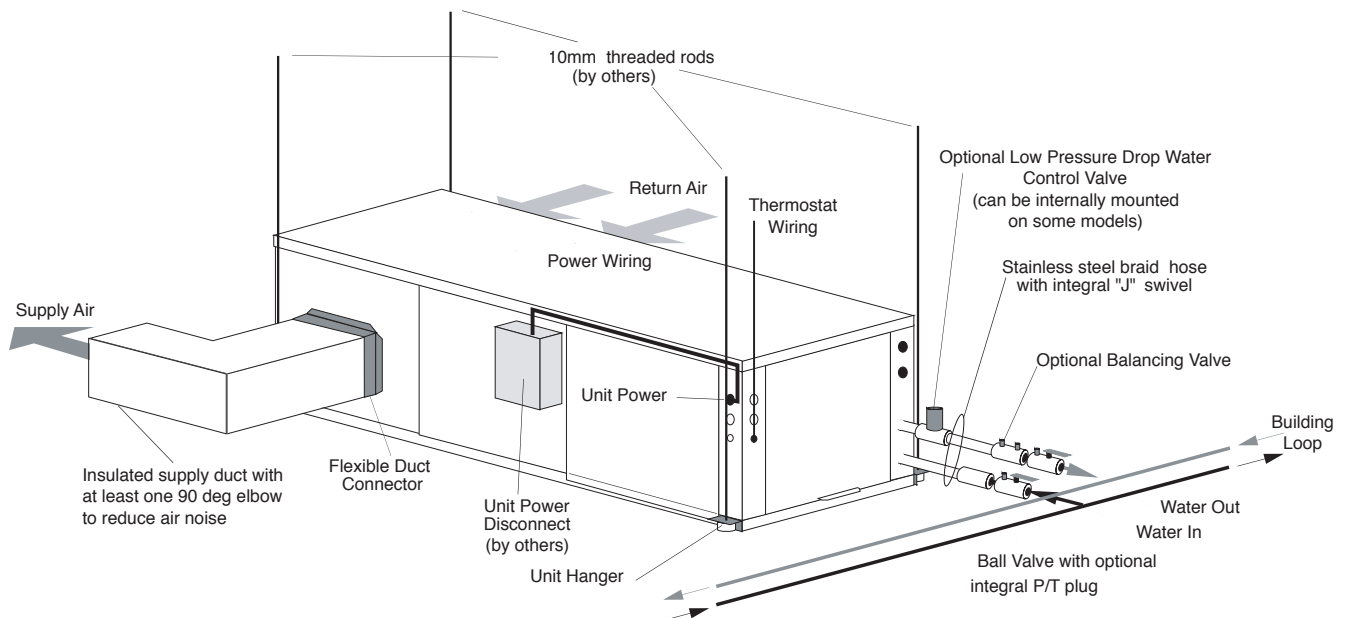


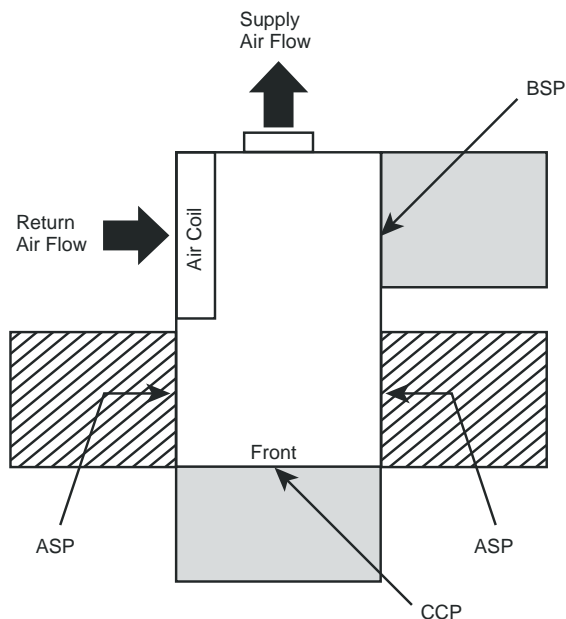
Figure 3: Typical Horizontal Unit Installation



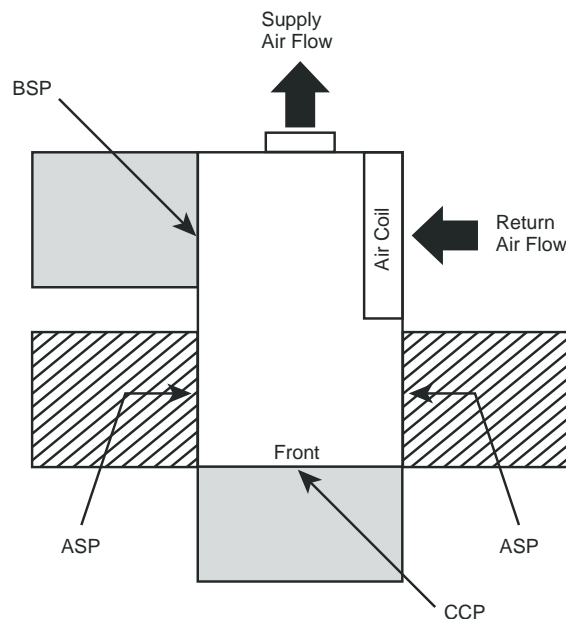
Air Coil - To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. A thorough water rinse should follow. **UV based anti-bacterial systems may damage coated air coils.**

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

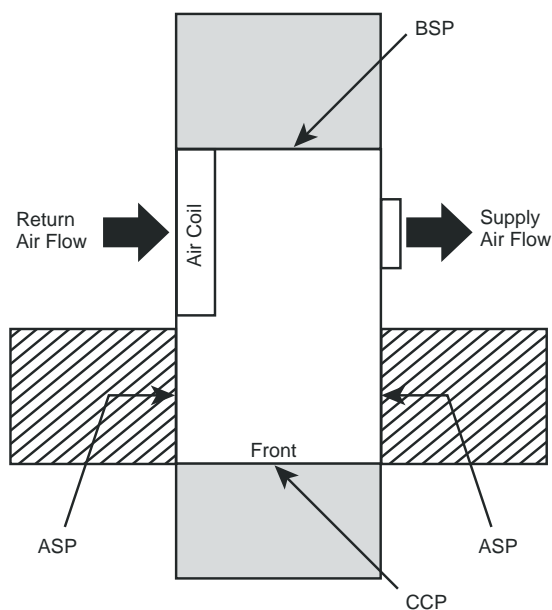
Left Return Back Discharge



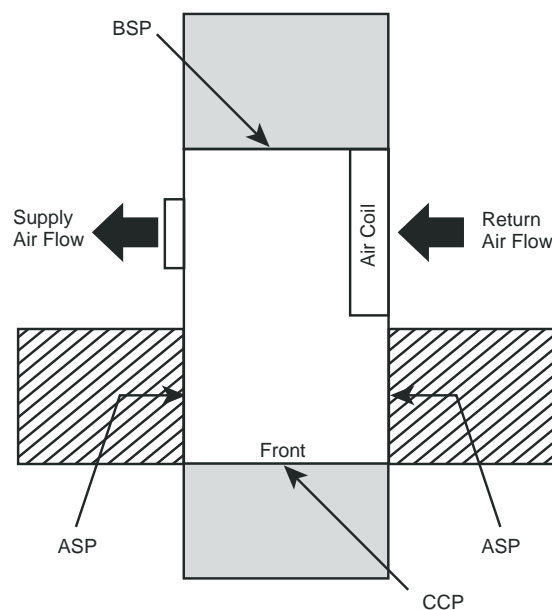
Right Return Back Discharge




Left Return Straight Discharge



Right Return Straight Discharge



 = mandatory 61 cm service access

 = (optional) additional 61 cm 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. CCP and BSP requires 61 cm service access.
3. Blower service access is through back panel on straight discharge units or through panel opposite air coil on back discharge units.
4. 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 CCP and BSP panels.

Legend:

CCP = Control/Compressor Access Panel
 BSP = Blower Service Panel
 ASP = Additional Service Panel (not required)

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Field Conversion of Air Discharge

Overview - Horizontal units can be field converted between straight (side) and back (end) discharge using the instructions below.

Note: It is not possible to field convert return air between left or right return models due to the necessity of refrigeration copper piping changes.

Preparation - Field conversion must be completed on the ground. If the unit is already hung it should be taken down for the field conversion. Place in a well-lighted area. Conversion should only be attempted by a qualified service technician.

Side to Back Discharge Conversion

1. Remove back panel and side access panel
2. Loosen 2 motor slide nuts, raise motor slide assembly and remove belt and motor sheave.
3. Remove blower sheave. Remove motor bolts and carefully remove motor.
4. Remove 2 motor clips and reattach to opposite side.
5. Unbolt (3 per side) complete housing assembly.
6. Rotate complete assembly into new position. Locate over mounting holes in base, reattach using 3 bolts per side.
7. Mount motor, motor sheave, blower sheave and belt. Make sure wires are not pinched and not over sharp edges. Adjust motor downward to tighten belt. Raise or lower motor slide assembly with adjusting bolt and retighten 2 slide nuts. Check for correct tension (See Tensioning V-Belt Drives page). Rewire motor (at contactor) for correct rotation. Spin blower wheel to ensure wheel is not obstructed.
8. Replace 2 panels.

Back to Side Discharge Conversion - If the discharge is changed from back to side, use above instruction noting that illustrations will be reversed.

Left vs. Right Return - It is not possible to field convert return air between left or right return models due to the necessity of refrigeration copper piping changes. However, the conversion process of side to back or back to side discharge for either right or left return configuration is the same. In some cases, it may be possible to rotate the entire unit 180 degrees if the return air connection needs to be on the opposite side. Note that rotating the unit will move the piping to the other end of the unit.

Figure 4: Left Return Side to Back

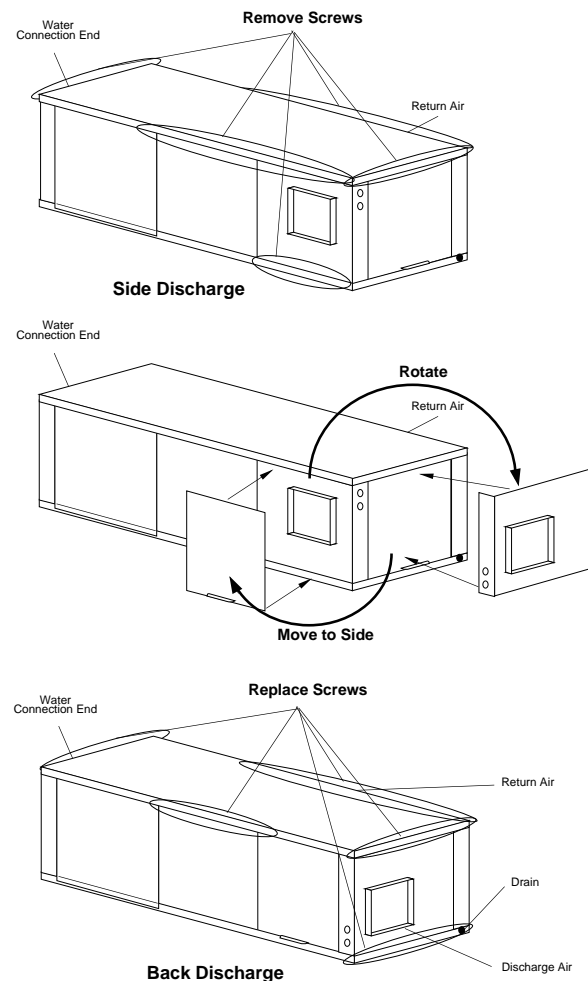
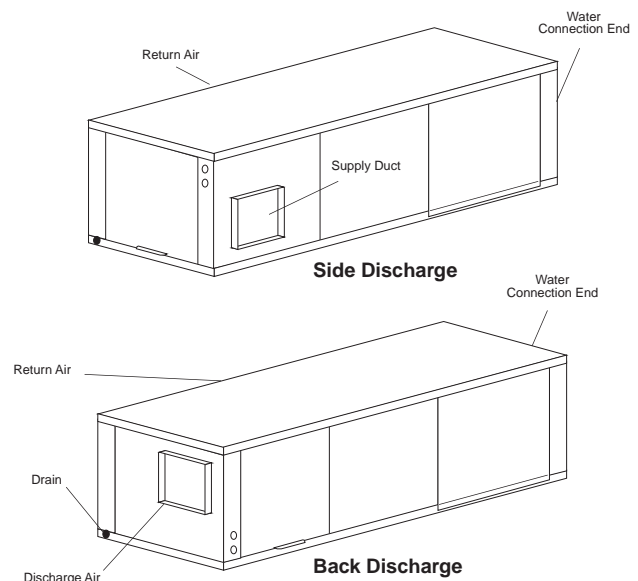


Figure 5: Right Return Side to Back



Horizontal 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.

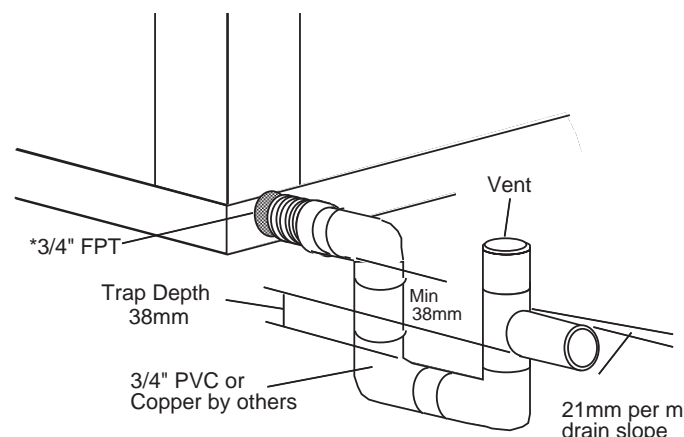
Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. On small units (less than 8.8 kW), ensure that unit pitch does not cause condensate leaks inside the cabinet.

Install condensate trap at each unit with the top of the trap positioned below the unit condensate drain connection as shown in Figure 6. Design the depth of the trap (water-seal) based upon the amount of ESP capability of the blower (where 51mm of ESP capability requires 51mm of trap depth). As a general rule, 38mm trap depth is the minimum.

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

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

Figure 6: Horizontal Condensate Connection



* Some units include a painted drain connection. Using a threaded pipe or similar device to clear any excess paint accumulated inside this fitting may ease final drain line installation.

⚠ CAUTION! ⚠

CAUTION! Ensure condensate line is pitched toward drain 21mm per m of run.

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Duct System Installation

Duct System 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 3 for horizontal duct system details or Figure 8 for vertical 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 ductboard 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.

At least one 90° elbow should be included in the supply duct to reduce air noise. 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.

Vertical Installation

Vertical 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 mechanical room/closet. Vertical units are typically installed in a mechanical room or closet. 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).

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 Figures 7 and 8 for typical installation illustrations. Refer to unit submittal data or engineering design guide for dimensional data.

1. Install the unit on a piece of rubber, neoprene or other mounting pad material for sound isolation. The pad should be at least 10mm to 13mm in thickness. Extend the pad beyond all four edges of the unit.
2. Provide adequate clearance for filter replacement and drain pan cleaning. Do not block filter access with piping, conduit or other materials. Refer to unit submittal data or engineering design guide for dimensional data.
3. Provide access for fan and fan motor maintenance and for servicing the compressor and coils without removing the unit.
4. Provide an unobstructed path to the unit within the closet or mechanical room. Space should be sufficient to allow removal of the unit, if necessary.
5. In limited side access installations, pre-removal of the control box side mounting screws will allow control box removal for future servicing (TC units only).
6. Provide access to water valves and fittings and screwdriver access to the unit side panels, discharge collar and all electrical connections.

Figure 7: Typical Vertical Unit Mounting

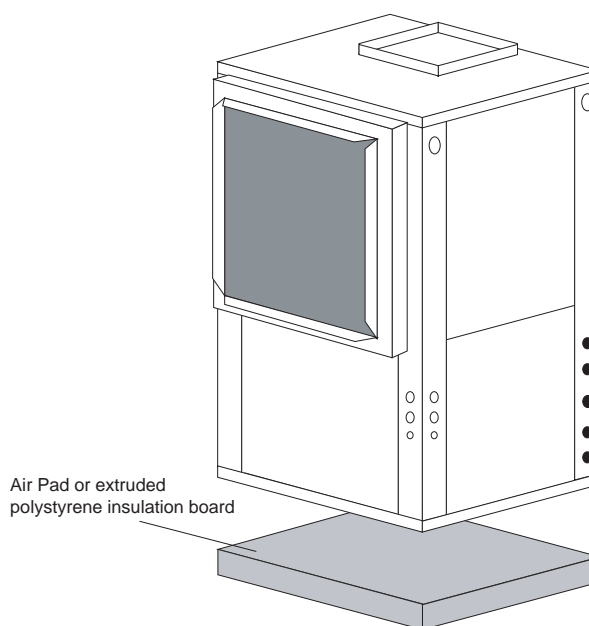
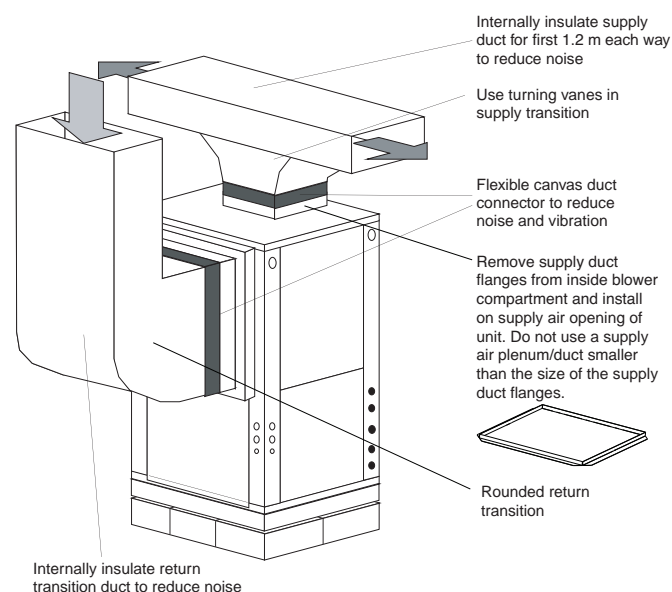


Figure 8: Typical Vertical Unit Installation Using Ducted Return Air

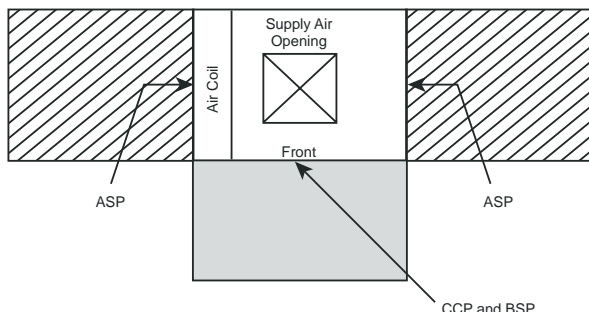


CLIMATEMASTER WATER-SOURCE HEAT PUMPS

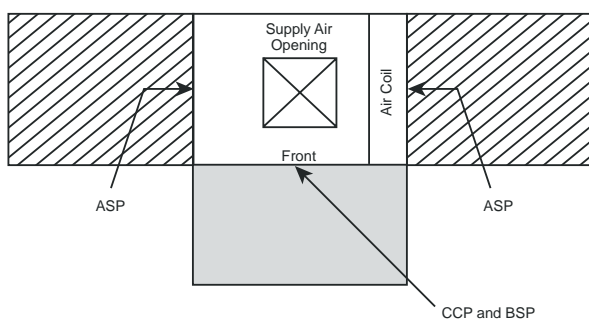
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Left Return



Right Return



 = mandatory 61 cm service access
 = (optional) additional 61 cm 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. Front & Side access is preferred for service access. However, all components may be serviced from the front access panel if side access is not available. (Except on units with front return air).
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 CCP and BSP panels.
4. Top supply air is shown, the same clearances apply to bottom supply air units.
5. Front return units (not shown) require front access for controls/compressor and left side access for blower.

Legend:

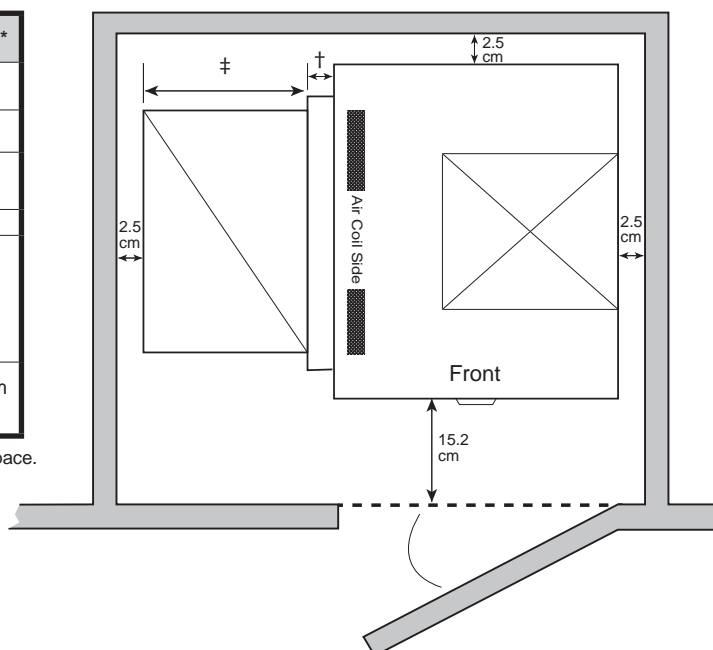
CCP = Control/Compressor Access Panel

BSP = Blower Service Panel

ASP = Additional Service Panel (not required)

Recommended Minimum Installation Clearances for Vertical Units*	
2.5 cm	Back of unit
	Side opposite return air
15.2 cm	Front if hard piped
Return Air Side	
2.5 cm	Ducted return
	- ‡ Add for duct width - † Add 5.0 cm for 2.5 cm filter frame/rail or 7.6 cm for 5.0 cm filter frame/rail
	Free (open) return - calculate required dimension for a maximum velocity of 3.0 m/s

*Field installed accessories (hoses, air cleaners, etc.) may require additional space. Top supply air is shown, the same clearances apply to bottom supply air units.

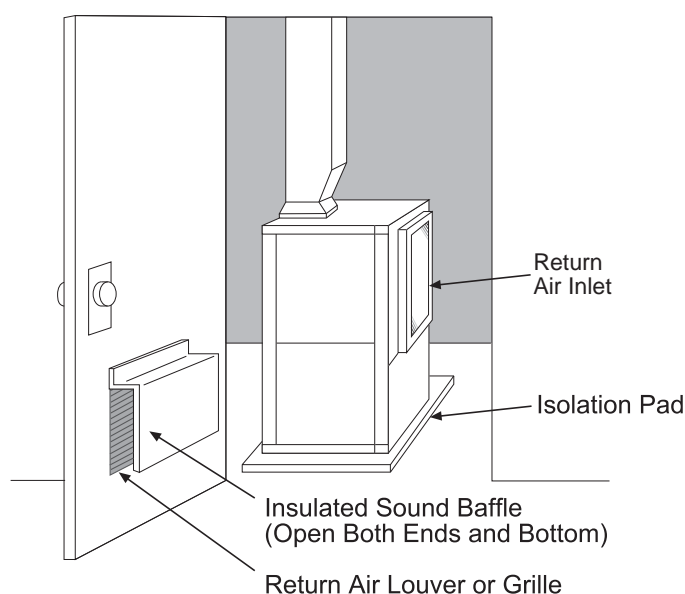


Vertical Installation

Sound Attenuation for Vertical Units - Sound attenuation is achieved by enclosing the unit within a small mechanical room or a closet. Additional measures for sound control include the following:

1. Mount the unit so that the return air inlet is 90° to the return air grille. Refer to Figure 9. Install a sound baffle as illustrated to reduce line-of sight sound transmitted through return air grilles.
2. Mount the unit on a rubber or neoprene isolation pad to minimize vibration transmission to the building structure.

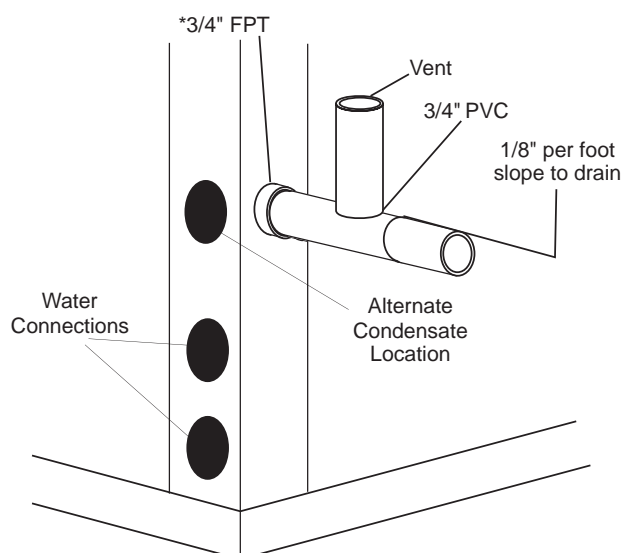
Figure 9: Vertical Sound Attenuation



Units with clear plastic drain lines should have regular maintenance (as required) to avoid buildup of debris, especially in new construction.

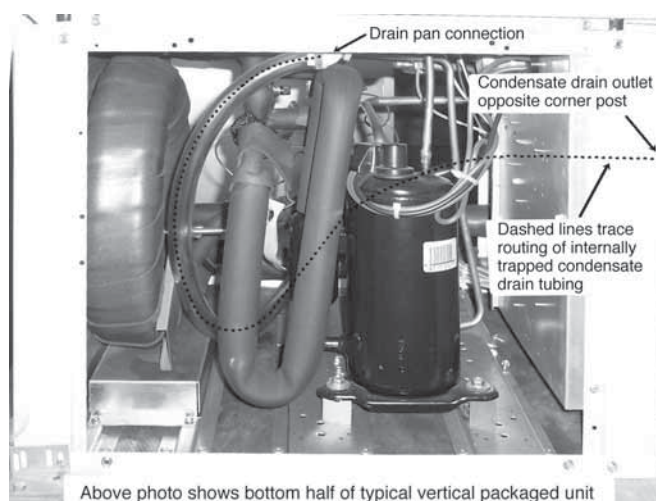
Condensate Piping for Vertical Units - A condensate line must be installed and pitched away from the unit to allow for proper drainage. This connection must meet all local plumbing/building codes. Vertical units utilize a condensate hose inside the cabinet as a trapping loop; therefore an external trap is not necessary. Figure 10a shows typical condensate connections. Figure 10b illustrates the internal trap for a typical vertical heat pump. Each unit must be installed with its own individual vent (where necessary) and a means to flush or blow out the condensate drain line. Do not install units with a common trap and/or vent.

Figure 10a: Vertical Condensate Drain



* Some units include a painted drain connection. Using a threaded pipe or similar device to clear any excess paint accumulated inside this fitting may ease final drain line installation

Figure 10b: Vertical Internal Condensate Trap



Tranquility 20 (TS) Units

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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 1. 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. Install an angle adapter to avoid sharp bends in the hose when the radius falls below the required minimum.

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 if loop water temperature drops below the dew point (insulation is required for ground loop applications in most climates).

Pipe joint compound is not necessary when Teflon® 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 Teflon tape or pipe joint compound that is applied.

Maximum allowable torque for brass fittings is 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.

Refer to Figure 11 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.

A backup wrench is required when tightening water connections to prevent water line damage for TC Series equipment. TS Series equipment has water connections secured to the corner post.

⚠ 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! ⚠

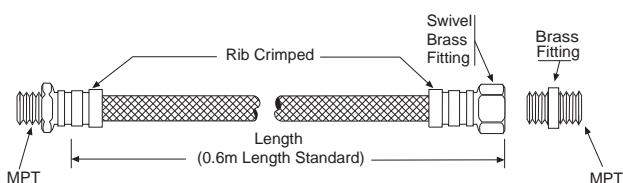
CAUTION! Piping must comply with all applicable codes.

Table 1: Metal Hose Minimum Bend Radii

Hose Diameter	Minimum Bend Radii
12.7mm	6.4cm
19.1mm	10.2cm
25.4mm	14cm
31.8mm	17.1cm

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.

Figure 11: Supply/Return Hose Kit



Water-Loop Heat Pump Applications

Commercial Water Loop Applications

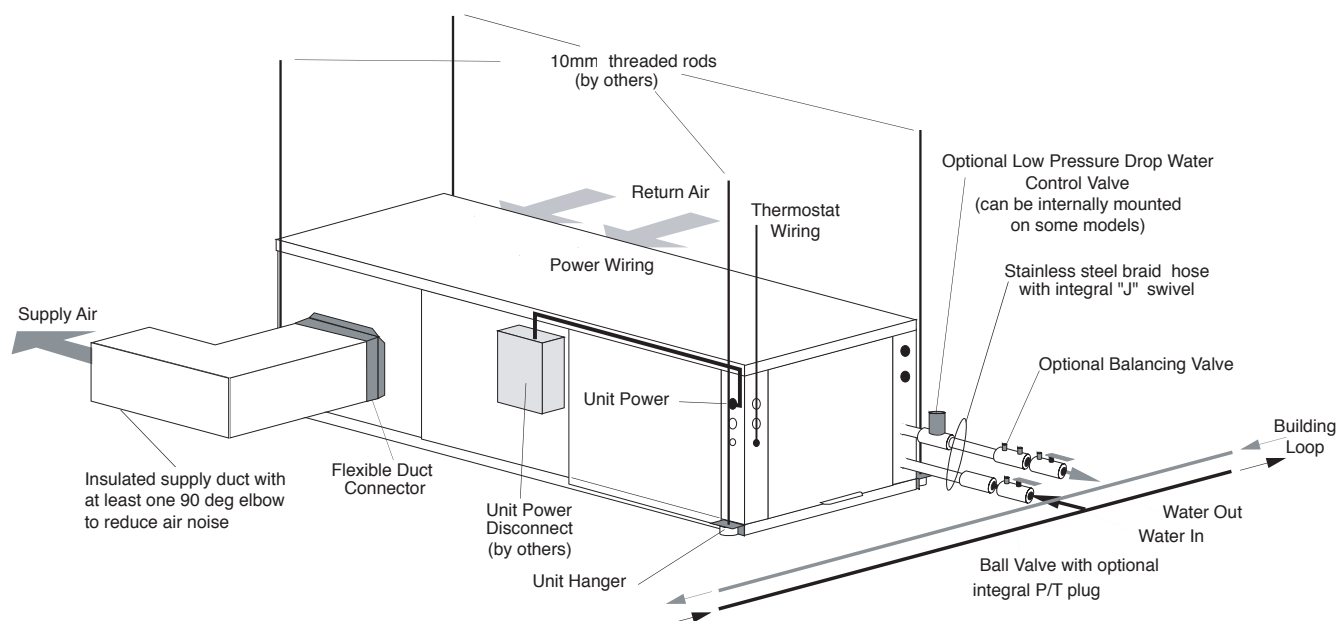
Commercial systems typically include a number of units connected to a common piping system. Any unit plumbing maintenance work can introduce air into the piping system; therefore air elimination equipment is a major portion of the mechanical room plumbing. Consideration should be given to insulating the piping surfaces to avoid condensation. ClimateMaster recommends unit insulation any time the water temperature is expected to be below 15.6°C. Metal to plastic threaded joints should never be used due to their tendency to leak over time.

Teflon® tape thread sealant is recommended to minimize internal fouling of the heat exchanger. Do not over tighten connections and route piping so as not to interfere with service or maintenance access. Hose kits are available from ClimateMaster in different configurations as shown in Figure 12 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 2.9 and 4.5 l/m per kW of cooling capacity. ClimateMaster recommends 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 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.

Figure 12: Typical Water-Loop Application



Low Water Temperature Cutout Setting

CXM - When antifreeze is selected, the FP1 jumper (JW3) should be clipped to select the low temperature (antifreeze -12.2°C) setpoint and avoid nuisance faults (see "Low Water Temperature Cutout Selection" in this manual). **Note: Low water temperature operation requires extended range equipment.**

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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

The typical closed loop ground source system is shown in Figure 13. 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 -4 to 43°C. Flow rates between 2.41 to 3.23 l/m per kW of cooling capacity is recommended in these applications.

Test individual horizontal loop circuits before backfilling. Test vertical U-bends and pond loop assemblies prior to installation. Pressures of at least 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 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 9°C below the lowest expected entering loop temperature. For example, if -1°C is the minimum expected entering loop temperature, the leaving loop temperature would be -4 to -6°C and freeze protection should be at -10°C. Calculation is as follows: -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 2 for the amount of antifreeze needed. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

Low Water Temperature Cutout Setting

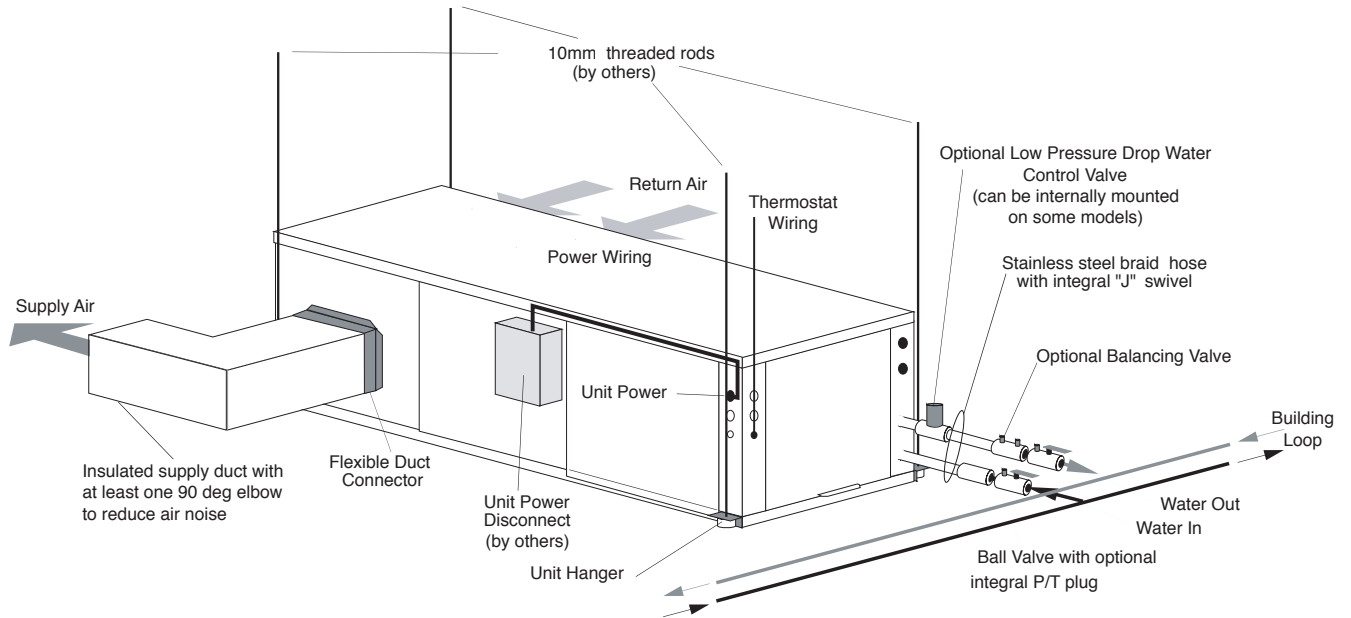
CXM - When antifreeze is selected, the FP1 jumper (JW3) should be clipped to select the low temperature (antifreeze -12.2°C) setpoint and avoid nuisance faults (see "Low Water Temperature Cutout Selection" in this manual). **Note: Low water temperature operation requires extended range equipment.**

Table 2: Antifreeze Percentages by Volume

Type	Minimum Temperature for Low Temperature Protection			
	-12.2°C	-9.4°C	-6.7°C	-3.9°C
Methanol	25%	21%	16%	10%
100% USP food grade Propylene Glycol	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

* Must not be denatured with any petroleum based product

Figure 13: Typical Ground-Loop Application



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Ground-Water Heat Pump Applications

Open Loop - Ground Water Systems

Typical open loop piping is shown in Figure 14. Shut off valves should be included for ease of servicing. Boiler drains or other valves should be "tee'd" into the lines to allow acid flushing of the heat exchanger. Shut off valves should be positioned to allow flow through the coax via the boiler drains without allowing flow into the piping system. P/T plugs should be used so that pressure drop and temperature can be measured.

⚠ 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.

Water quantity should be plentiful and of good quality. Consult table 3 for water quality guidelines. The unit can be ordered with either a copper or cupro-nickel water heat exchanger. Consult Table 3 for recommendations. Copper is recommended for closed loop systems and open loop ground water systems that are not high in mineral content or corrosiveness. In conditions anticipating heavy scale formation or in brackish water, a cupro-nickel heat exchanger is recommended. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, an open loop system is not recommended. Heat exchanger coils may over time lose heat exchange capabilities due to build up of mineral deposits. Heat exchangers must only be serviced by a qualified technician, as acid and special pumping equipment is required. Desuperheater coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional acid flushing. In some cases, the desuperheater option should not be recommended due to hard water conditions and additional maintenance required.

Water Quality Standards

Table 3 should be consulted for water quality requirements. Scaling potential should be assessed using the pH/Calcium hardness method. If the pH < 7.5 and the calcium hardness is less than 100 ppm, scaling potential is low. If this method yields numbers out of range of those listed, the Ryznar Stability and Langelier Saturation indices should be calculated. Use the appropriate scaling surface temperature for the application, 66°C for direct use (well water/open loop) and DHW (desuperheater); 32°C for indirect use.

A monitoring plan should be implemented in these probable scaling situations. Other water quality issues such as iron fouling, corrosion prevention and erosion and clogging should be referenced in Table 3.

Expansion Tank and Pump

Use a closed, bladder-type expansion tank to minimize mineral formation due to air exposure. The expansion tank should be sized to provide at least one minute continuous run time of the pump using its drawdown capacity rating to prevent pump short cycling.

Discharge water from the unit is not contaminated in any manner and can be disposed of in various ways, depending on local building codes (e.g. recharge well, storm sewer, drain field, adjacent stream or pond, etc.). Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning department to assure compliance in your area.

Water Control Valve

Note the placement of the water control valve in Figure 14. Always maintain water pressure in the heat exchanger by placing the water control valve(s) on the discharge line to prevent mineral precipitation during the off-cycle. Pilot operated slow closing valves are recommended to reduce water hammer. If water hammer persists, a mini-expansion tank can be mounted on the piping to help absorb the excess hammer shock. Ensure that the total 'VA' draw of the valve can be supplied by the unit transformer. For instance, a slow closing valve can draw up to 35VA. This can overload smaller 40 or 50 VA transformers depending on the other controls in the circuit. A typical pilot operated solenoid valve draws approximately 15VA (see Figure 21). **NOTE: the special wiring diagrams for slow closing valves (Figures 22 & 23).**

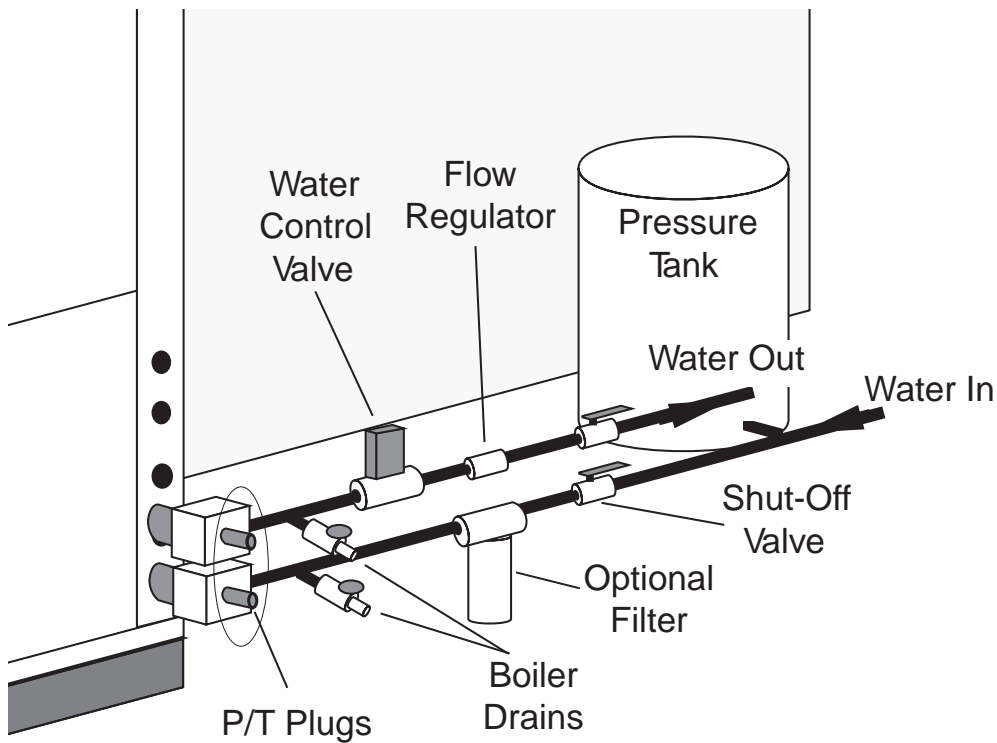
Flow Regulation

Flow regulation can be accomplished by two methods. One method of flow regulation involves simply adjusting the ball valve or water control valve on the discharge line. Measure the pressure drop through the unit heat exchanger, and determine flow rate from Tables 8a through 8e. Since the pressure is constantly varying, two pressure gauges may be needed. Adjust the valve until the desired flow of 2.0 to 2.6 l/m per kW is achieved. A second method of flow control requires a flow control device mounted on the outlet of the water control valve. The device is typically a brass fitting with an orifice of rubber or plastic material that is designed to allow a specified flow rate. On occasion, flow control devices may produce velocity noise that can be reduced by applying some back pressure from the ball valve located on the discharge line. Slightly closing the valve will spread the pressure drop over both devices, lessening the velocity noise. **NOTE: When EWT is below 10°C, 2.6 l/m per kW is required.**

Water Coil Low Temperature Limit Setting

For all open loop systems the -1.1°C FP1 setting (factory setting-water) should be used to avoid freeze damage to the unit. See "Low Water Temperature Cutout Selection" in this manual for details on the low limit setting.

Figure 14: Typical Open Loop/Well Application



CLIMATEMASTER WATER-SOURCE HEAT PUMPS

Tranquility 20 (TS) Units

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Water Quality Standards

Table 3: Water Quality Standards

Water Quality Parameter	HX Material	Closed Recirculating	Open Loop and Recirculating Well		
Scaling Potential - Primary Measurement					
Above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below					
pH/Calcium Hardness Method	All	-	pH < 7.5 and Ca Hardness <100ppm		
Index Limits for Probable Scaling Situations - (Operation outside these limits is not recommended)					
Scaling indexes should be calculated at 66°C for direct use and HWG applications, and at 32°C for indirect HX use. A monitoring plan should be implemented.					
Ryznar Stability Index	All	-	6.0 - 7.5 If >7.5 minimize steel pipe use.		
Langelier Saturation Index	All	-	-0.5 to +0.5 If <-0.5 minimize steel pipe use. Based upon 66°C HWG and Direct well, 29°C Indirect Well HX		
Iron Fouling					
Iron Fe ²⁺ (Ferrous) (Bacterial Iron potential)	All	-	<0.2 ppm (Ferrous) If Fe ²⁺ (ferrous)>0.2 ppm with pH 6 - 8, O2<5 ppm check for iron bacteria.		
Iron Fouling	All	-	<0.5 ppm of Oxygen Above this level deposition will occur .		
Corrosion Prevention					
pH	All	6 - 8.5 Monitor/treat as needed	6 - 8.5 Minimize steel pipe below 7 and no open tanks with pH <8		
Hydrogen Sulfide (H ₂ S)	All	-	<0.5 ppm At H ₂ S>0.2 ppm, avoid use of copper and copper nickel piping or HX's. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are OK to <0.5 ppm.		
Ammonia ion as hydroxide, chloride, nitrate and sulfate compounds	All	-	<0.5 ppm		
Maximum Chloride Levels			Maximum Allowable at maximum water temperature.		
			10°C	24°C	38°C
	Copper	-	<20ppm	NR	NR
	Cupronickel	-	<150 ppm	NR	NR
	304 SS	-	<400 ppm	<250 ppm	<150 ppm
	316 SS	-	<1000 ppm	<550 ppm	< 375 ppm
	Titanium	-	>1000 ppm	>550 ppm	>375 ppm
Erosion and Clogging					
Particulate Size and Erosion	All	<10 ppm of particles and a maximum velocity of 1.8 m/s Filtered for maximum 841 micron [0.84 mm, 20 mesh] size.	<10 ppm (<1 ppm "sandfree" for reinjection) of particles and a maximum velocity of 1.8 m/s. Filtered for maximum 841 micron 0.84 mm, 20 mesh] size. Any particulate that is not removed can potentially clog components.		

The ClimateMaster Water Quality Table provides water quality requirements for ClimateMaster coaxial heat exchangers. The water should be evaluated by an independent testing facility comparing to this Table and when properties are outside of these requirements, an external secondary heat exchanger must be used to isolate the heat pump heat exchanger from the unsuitable water. Failure to do so will void the warranty for the coaxial heat exchanger and any other components damaged by a leak.

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Notes:

- Closed Recirculating system is identified by a closed pressurized piping system.
- Recirculating open wells should observe the open recirculating design considerations.
- NR - Application not recommended.
- "-" No design Maximum.

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 or the National Electric Code, whichever is applicable.

⚠ 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.

Transformer

On dual voltage units the installer must confirm that the power supply and unit transformer wiring match. Installer must rewire as needed. Refer to the unit wiring diagram for proper connections.

⚠ CAUTION! ⚠

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

⚠ WARNING! ⚠

WARNING! This appliance must be installed by a qualified electrician who is fully aware of current safety and installations regulations. Pursuant to IEC 60335-1 Section 22.2, the installer is required to connect this appliance to the electricity supply by means of an all-pole disconnect.

Table 41: Tranquility® 20 (TS) Series Electrical Data - (Standard 50Hz Units)

Model	Voltage Code	Rated Voltage	Min/Max	Compressor					Fan Motor FLA	Total Unit FLA	Min Circuit Amp	Max Fuse
				MCC	RLA	RLA	LRA	Qty				
TSH/V 009	V	220/240/50/1	209/252	16.0	10.3	3.2	17.0	1	0.3	3.5	4.3	15
TSH/V 012	V	220/240/50/1	209/252	26.0	16.7	4.0	19.0	1	0.7	4.7	5.7	15
TSH/V/D 018	V	220/240/50/1	209/252	16.0	10.3	7.1	44.0	1	0.9	8.0	9.8	15
TSH/V/D 024	V	220/240/50/1	209/252	16.0	10.3	10.9	58.0	1	0.9	11.8	14.5	25
	U	380/420/50/3	361/436	16.0	10.3	4.0	24.0	1	0.6	4.6	5.6	15
TSH/V/D 030	V	220/240/50/1	209/252	26.0	16.7	10.9	58.0	1	1.6	12.5	15.2	25
	U	380/420/50/3	361/436	26.0	16.7	4.5	26.0	1	0.9	5.4	6.5	15
TSH/V/D 036	V	220/240/50/1	209/252	16.0	10.3	12.5	61.0	1	2.0	14.5	17.6	30
	U	380/420/50/3	361/436	16.0	10.3	4.5	32.0	1	1.2	5.7	6.8	15
TSH/V/D 042	U	380/420/50/3	361/436	16.0	10.3	5.1	35.0	1	1.0	6.1	7.4	15
TSH/V/D 048	U	380/420/50/3	361/436	26.0	16.7	7.1	48.0	1	1.7	8.8	10.6	15
TSH/V/D 060	U	380/420/50/3	361/436	16.0	10.3	9.6	64.0	1	2.5	12.1	14.5	20
TSH/V/D 070	U	380/420/50/3	361/436	26.0	16.7	9.6	74.0	1	2.6	12.2	14.6	20

Tranquility 20 (TS) Units

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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 or the National Electric Code, whichever is 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 tables for correct fuse size.

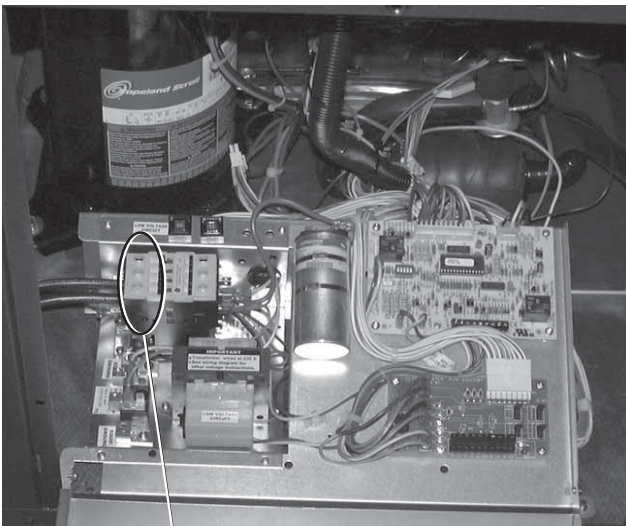
Transformer

On dual voltage units the installer must confirm that the power supply and unit transformer wiring match. Installer must rewire as needed. Refer to the unit wiring diagram for proper connections.

Blower Speed Selection – Units with PSC Motor

PSC (Permanent Split Capacitor) blower fan speed can be changed by moving the blue wire on the fan motor terminal block to the desired speed as shown in Figure 17. Most ClimateMaster units are shipped on the medium speed tap. Consult submittal data or engineering design guide for specific unit airflow tables. Typical unit design delivers rated airflow at nominal static 37Pa on medium speed and rated airflow at a higher static 100 to 125 Pa on high speed for applications where higher static is required. Low speed will deliver approximately 85% of rated airflow at 25 Pa. An optional high static blower is available on some models.

Figure 15: TS Single Phase Line Voltage Field Wiring. Three phase wiring is similar except that all three power wires are directly connected to the contactor.

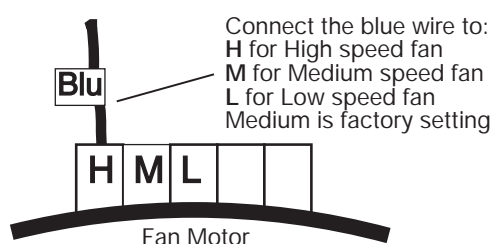


Unit Power Supply
(Field wiring will be made to the service disconnect on units that include that option.)

Electrical - Power & Low Voltage Wiring

Special Note for AHRI Testing: To achieve rated airflow for AHRI testing purposes on all PSC products, it is necessary to change the fan speed to "HI" speed. 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.

Figure 17: PSC Motor Speed Selection



ELECTRICAL - LOW VOLTAGE WIRING

Thermostat Connections

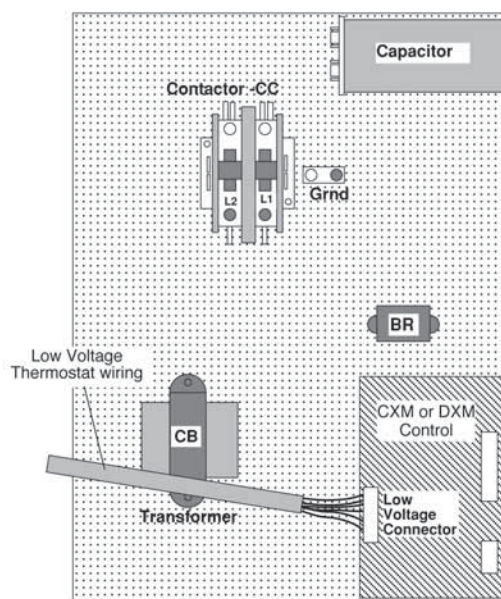
The thermostat should be wired directly to the CXM or DXM board. Figure 19 shows low voltage wiring. See "Electrical – Thermostat" for specific terminal connections. Review the appropriate AOM (Application, Operation and Maintenance) manual for units with DDC controls.

Low Water Temperature Cutout Selection

The CXM/DXM control allows the field selection of low water (or water-antifreeze solution) temperature limit by clipping jumper JW3, which changes the sensing temperature associated with thermistor FP1. Note that the FP1 thermistor is located on the refrigerant line between the coaxial heat exchanger and expansion device (TXV or cap tube). Therefore, FP1 is sensing refrigerant temperature, not water temperature, which is a better indication of how water flow rate/temperature is affecting the refrigeration circuit.

The factory setting for FP1 is for systems using water -1.1°C refrigerant temperature). In low water temperature (extended range) applications with antifreeze (most ground loops), jumper JW3 should be clipped as shown in Figure 20 to change the setting to -12.2°C refrigerant temperature, a more suitable temperature when using an antifreeze solution. All ClimateMaster units operating with entering water temperatures below 15°C must include the optional water/refrigerant circuit insulation package to prevent internal condensation.

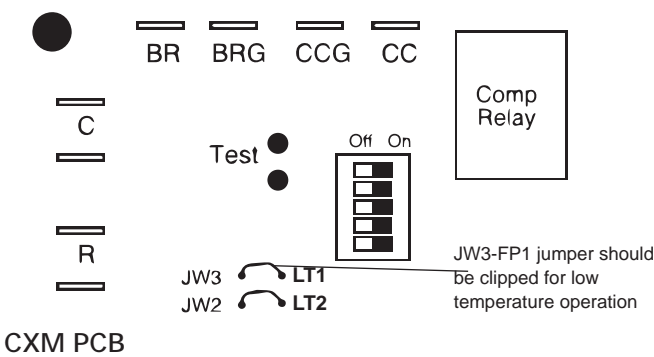
Figure 19: Low Voltage Field Wiring



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Electrical - Low Voltage Wiring

Figure 20: FP1 Limit Setting



Accessory Connections

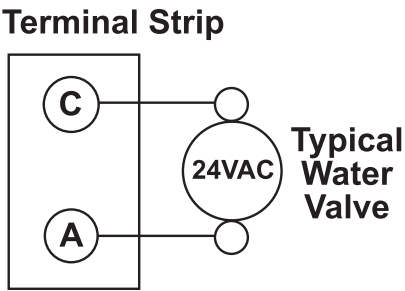
A terminal paralleling the compressor contactor coil has been provided on the CXM/DXM control. Terminal “A” is designed to control accessory devices, such as water valves. Note: This terminal should be used only with 24 Volt signals and not line voltage. Terminal “A” is energized with the compressor contactor. See Figure 19 or the specific unit wiring diagram for 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
+ CXM board (5 - 9 VA)*	21 - 31
Remaing VA for Accessories	19 - 29
+ DXM board (8 - 12 VA)*	24 - 34
Remaing VA for Accessories	41 - 51

*Standard transformer for CXM board is 50VA.
Optional DXM board and/or DDC controls include 75VA transformer.

Figure 21: Accessory Wiring



Water Solenoid Valves - An external solenoid valve(s) should be used on ground water installations to shut off flow to the unit when the compressor is not operating. A slow closing valve may be required to help reduce water hammer. Figure 19 shows typical wiring for a 24VAC external solenoid valve. Figures 20 and 21 illustrate typical slow closing water control valve wiring for Taco 500 series (ClimateMaster P/N AVM) and Taco SBV series valves. Slow closing valves take approximately 60 seconds to open (very little water will flow before 45 seconds). Once fully open, an end switch allows the compressor to be energized. Only relay or triac based electronic thermostats should be used with slow closing valves. When wired as shown, the slow closing valve will operate properly with the following notations:

1. The valve will remain open during a unit lockout.
2. The valve will draw approximately 25-35 VA through the “Y” signal of the thermostat.

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

Electrical - Thermostat Wiring

Figure 22: AMV Valve Wiring

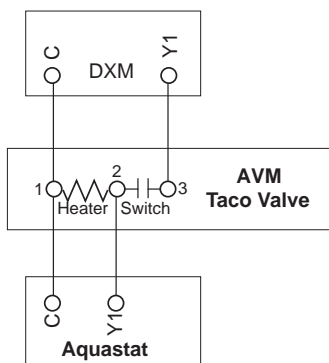
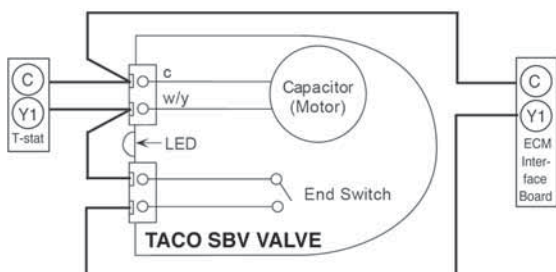


Figure 23: Taco SBV Valve Wiring

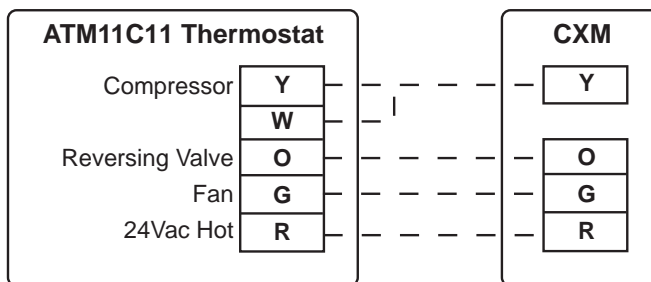


Thermostat Installation

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" (5mm) bit. Install supplied anchors and secure plate to the wall. Thermostat wire must be 18 AWG wire. Wire the appropriate thermostat as shown in Figure 25a to the low voltage terminal strip on the CXM or DXM control board. Practically any heat pump thermostat will work with ClimateMaster units, provided it has the correct number of heating and cooling stages.

Figure 25a: Units With PSC Fan And CXM

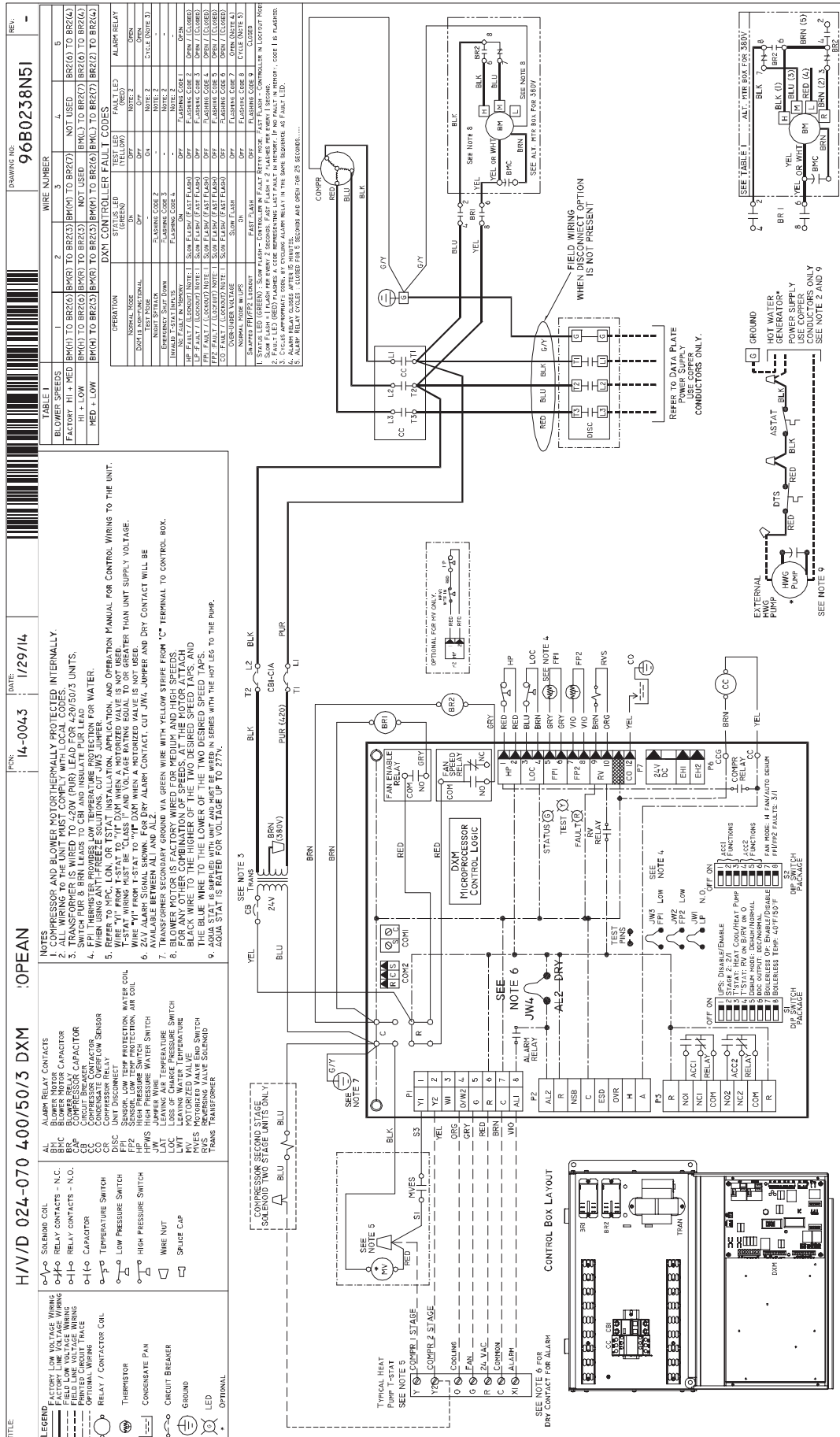
Connection to CXM Control



Field Wiring	-----
Factory Wiring	_____

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Typical Wiring Diagram - Three Phase 50 Hz TS Units with DXM Controller



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CXM Controls

CXM Control - For detailed control information, see CXM or DXM Application, Operation and Maintenance (AOM) manual (part # 97B0003N12 or part #97B0003N13).

Field Selectable Inputs - Test mode: Test mode allows the service technician to check the operation of the control in a timely manner. By momentarily shorting the test terminals, the CXM control enters a 20 minute test mode period in which all time delays are sped up 15 times. Upon entering test mode, the status LED will flash a code representing the last fault. For diagnostic ease at the thermostat, the alarm relay will also cycle during test mode. The alarm relay will cycle on and off similar to the status LED to indicate a code representing the last fault, at the thermostat. Test mode can be exited by shorting the test terminals for 3 seconds.

Retry Mode: If the control is attempting a retry of a fault, the status LED will slow flash (slow flash = one flash every 2 seconds) to indicate the control is in the process of retrying.

Field Configuration Options - Note: In the following field configuration options, jumper wires should be clipped **ONLY** when power is removed from the CXM control.

Water coil low temperature limit setting: Jumper 3 (JW3-FP1 Low Temp) provides field selection of temperature limit setting for FP1 of -1°C or -12°C] (refrigerant temperature).

Not Clipped = -1°C. *Clipped* = -12°C.

Air coil low temperature limit setting: Jumper 2 (JW2-FP2 Low Temp) provides field selection of temperature limit setting for FP2 of -1°C or -12°C (refrigerant temperature). **Note: This jumper should only be clipped under extenuating circumstances, as recommended by the factory.**

Not Clipped = -1°C. *Clipped* = -12°C.

Alarm relay setting: Jumper 1 (JW1-AL2 Dry) provides field selection of the alarm relay terminal AL2 to be jumpered to 24VAC or to be a dry contact (no connection).

Not Clipped = AL2 connected to R. *Clipped* = AL2 dry contact (no connection).

DIP Switches - Note: In the following field configuration options, DIP switches should only be changed when power is removed from the CXM control.

DIP switch 1: Unit Performance Sentinel Disable - provides field selection to disable the UPS feature.

On = Enabled. *Off* = Disabled.

DIP switch 2: Stage 2 Selection - provides selection of

whether compressor has an "on" delay. If set to stage 2, the compressor will have a 3 second delay before energizing. Also, if set for stage 2, the alarm relay will NOT cycle during test mode.

On = Stage 1. *Off* = Stage 2

DIP switch 3: Not Used.

DIP switch 4: DDC Output at EH2 - provides selection for DDC operation. If set to "DDC Output at EH2," the EH2 terminal will continuously output the last fault code of the controller. If set to "EH2 normal," EH2 will operate as standard electric heat output.

On = EH2 Normal. *Off* = DDC Output at EH2.

Note: Some CXM controls only have a 2 position DIP switch package. If this is the case, this option can be selected by clipping the jumper which is in position 4 of SW1.

Jumper not clipped = EH2 Normal. *Jumper clipped* = DDC Output at EH2.

DIP switch 5: Factory Setting - Normal position is "On." Do not change selection unless instructed to do so by the factory.

Table 6a: CXM/DXM LED And Alarm Relay Operations

Description of Operation	LED	Alarm Relay
Normal Mode	On	Open
Normal Mode with UPS Warning	On	Cycle (closed 5 sec., Open 25 sec.)
CXM is non-functional	Off	Open
Fault Retry	Slow Flash	Open
Lockout	Fast Flash	Closed
Over/Under Voltage Shutdown	Slow Flash	Open (Closed after 15 minutes)
Test Mode - No fault in memory	Flashing Code 1	Cycling Code 1
Test Mode - HP Fault in memory	Flashing Code 2	Cycling Code 2
Test Mode - LP Fault in memory	Flashing Code 3	Cycling Code 3
Test Mode - FP1 Fault in memory	Flashing Code 4	Cycling Code 4
Test Mode - FP2 Fault in memory	Flashing Code 5	Cycling Code 5
Test Mode - CO Fault in memory	Flashing Code 6	Cycling Code 6
Test Mode - Over/Under shutdown in memory	Flashing Code 7	Cycling Code 7
Test Mode - UPS in memory	Flashing Code 8	Cycling Code 8
Test Mode - Swapped Thermistor	Flashing Code 9	Cycling Code 9

-Slow Flash = 1 flash every 2 seconds

-Fast Flash = 2 flashes every 1 second

-Flash code 2 = 2 quick flashes, 10 second pause, 2 quick flashes, 10 second pause, etc.

-On pulse 1/3 second; off pulse 1/3 second

⚠ CAUTION! ⚠

CAUTION! Do not restart units without inspection and remedy of faulting condition. Equipment damage may occur.

DXM Controls

DXM Control - For detailed control information, see CXM AOM (part # 97B0003N12), DXM AOM (part #97B0003N13), Lon controller AOM (part #97B0013N01) or MPC AOM (part # 97B0031N01).

Air coil low temperature limit setting: Jumper 2 (JW2-FP2 Low Temp) provides field selection of temperature limit setting for FP2 of -1°C or -12°C] (refrigerant temperature). **Note: This jumper should only be**

clipped under extenuating circumstances, as recommended by ClimateMaster technical services.

Not Clipped = -1°C. Clipped = -12°C.

Alarm relay setting: Jumper 4 (JW4-AL2 Dry) provides field selection of the alarm relay terminal AL2 to be jumpered to 24VAC or to be a dry contact (no connection).

Not Clipped = AL2 connected to R.

Clipped = AL2 dry contact (no connection).

Low pressure normally open: Jumper 1 (JW1-LP norm open) provides field selection for low pressure input to be normally closed or normally open.

Not Clipped = LP normally closed. Clipped = LP normally open.

Table 6b: DXM LED And Alarm Relay Operations

Description of Operation	Status LED (green)	Test LED (yellow)	Fault LED (red)	Alarm Relay
Normal mode	On	-	Off	Open
Normal mode with UPS	On	-	Flashing Code 8	Cycle (closed 5 sec, open 25 sec)
DXM is non-functional	Off	Off	Off	Open
Fault Retry	Slow Flash	-	Flashing fault code	Open
Lockout	Fast Flash	-	Flashing fault code	Closed
Test Mode	-	On	-	-
Night Setback	Flashing Code 2	-	-	-
ESD	Flashing Code 3	-	-	-
Invalid T-stat Inputs	Flashing Code 4	-	-	-
HP Fault	Slow Flash	-	Flashing Code 2	Open
LP Fault	Slow Flash	-	Flashing Code 3	Open
LT1 Fault	Slow Flash	-	Flashing Code 4	Open
LT2 Fault	Slow Flash	-	Flashing Code 5	Open
CO Fault	Slow Flash	-	Flashing Code 6	Open
Over/Under Voltages	Slow Flash	-	Flashing Code 7	Open (closed after 15 minutes)

-Slow Flash = 1 flash every 2 seconds

-Fast Flash = 2 flashes every 1 second

-Flash code 2 = 2 quick flashes, 10 second pause, 2 quick flashes, 10 second pause, etc.

-On pulse 1/3 second; off pulse 1/3 second

Field Selectable Inputs - Test mode: Test mode allows the service technician to check the operation of the control in a timely manner. By momentarily shorting the test terminals, the DXM control enters a 20 minute test mode period in which all time delays are sped up 15 times. Upon entering test mode, the status LED will flash a code representing the last fault. For diagnostic ease at the thermostat, the alarm relay will also cycle during test mode. The alarm relay will cycle on and off similar to the status LED to indicate a code representing the last fault, at the thermostat. Test mode can be exited by shorting the test terminals for 3 seconds.

Retry mode: If the control is attempting a retry of a fault, the status LED will slow flash (slow flash = one flash every 2 seconds) to indicate the control is in the process of retrying.

Field Configuration Options - **Note: In the following field configuration options, jumper wires should be clipped ONLY when power is removed from the DXM control.**

Water coil low temperature limit setting: Jumper 3 (JW3-FP1 Low Temp) provides field selection of temperature limit setting for FP1 of -1°C or -12°C (refrigerant temperature).

Not Clipped = -1°C. Clipped = -12°C.

DIP Switches - **Note: In the following field configuration options, DIP switches should only be changed when power is removed from the DXM control.**

DIP Package #1 (S1) - DIP Package #1 has 8 switches and provides the following setup selections:

1.1 - Unit Performance Sentinel (UPS) disable: DIP Switch 1.1 provides field selection to disable the UPS feature. On = Enabled. Off = Disabled.

1.2 - Compressor relay staging operation: DIP 1.2 provides selection of compressor relay staging operation. The compressor relay can be selected to turn on with a stage 1 or stage 2 call from the thermostat. This is used with dual stage units (2 compressors where 2 DXM controls are being used) or with master/slave applications. In master/slave applications, each compressor and fan will stage according to its appropriate DIP 1.2 setting. If set to stage 2, the compressor will have a 3 second on-delay before energizing during a Stage 2 demand. Also, if set for stage 2, the alarm relay will NOT cycle during test mode. On = Stage 1. Off = Stage 2.

1.3 - Thermostat type (heat pump or heat/cool): DIP 1.3 provides selection of thermostat type. Heat pump or heat/cool thermostats can be selected. When in heat/cool mode, Y1 is the input call for cooling stage 1; Y2 is the input call for cooling stage 2; W1 is the input call for heating stage 1; and O/W2 is the input call for heating stage 2. In heat pump mode, Y1 is the input call for compressor stage 1; Y2 is the input call for compressor stage 2; W1 is the input call for heating stage 3 or emergency heat; and O/W2 is the input call for reversing valve (heating or cooling, depending upon DIP 1.4). On = Heat Pump. Off = Heat/Cool.

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1.4 - Thermostat type (O/B): DIP 1.4 provides selection of thermostat type for reversing valve activation. Heat pump thermostats with "O" output (reversing valve energized for cooling) or "B" output (reversing valve energized for heating) can be selected with DIP 1.4. On = HP stat with "O" output for cooling. Off = HP stat with "B" output for heating.

1.5 - Dehumidification mode: DIP 1.5 provides selection of normal or dehumidification fan mode. In dehumidification mode, the fan speed relay will remain off during cooling stage 2. In normal mode, the fan speed relay will turn on during cooling stage 2. On = Normal fan mode. Off = Dehumidification mode.

1.6 - DDC output at EH2: DIP 1.6 provides selection for DDC operation. If set to "DDC Output at EH2," the EH2 terminal will continuously output the last fault code of the controller. If set to "EH2 normal," EH2 will operate as standard electric heat output. On = EH2 Normal. Off = DDC Output at EH2.

1.7 - Boilerless operation: DIP 1.7 provides selection of boilerless operation. In boilerless mode, the compressor is only used for heating when FP1 is above the temperature specified by the setting of DIP 1.8. Below DIP 1.8 setting, the compressor is not used and the control goes into emergency heat mode, staging on EH1 and EH2 to provide heating. On = normal. Off = Boilerless operation.

1.8 - Boilerless changeover temperature: DIP 1.8 provides selection of boilerless changeover temperature setpoint. Note that the FP1 thermistor is sensing refrigerant temperature between the coaxial heat exchanger and the expansion device (TXV). Therefore, the 10°C setting is not 10°C water, but approximately 16°C EWT. On = 10°C. Off = 16°C.

DIP Package #2 (S2) - DIP Package #2 has 8 switches and provides the following setup selections:

2.1 - Accessory1 relay personality: DIP 2.1 provides selection of ACC1 relay personality (relay operation/ characteristics). See table 6c for description of functionality.

2.2 - Accessory1 relay personality: DIP 2.2 provides selection of ACC 1 relay personality (relay operation/ characteristics). See table 6c for description of functionality.

2.3 - Accessory1 relay personality: DIP 2.3 provides selection of ACC 1 relay options. See table 6c for description of functionality.

2.4 - Accessory2 relay personality: DIP 2.4 provides selection of ACC 2 relay personality (relay operation/ characteristics). See table 6c for description of functionality.

2.5 - Accessory2 relay personality: DIP 2.5 provides selection of ACC 2 relay personality (relay operation/ characteristics). See table 6c for description of functionality.

2.6 - Accessory2 relay personality: DIP 2.6 provides selection of ACC 2 relay options. See table 6c for description of functionality.

2.7 - Auto dehumidification fan mode or high fan mode: DIP 2.7 provides selection of auto dehumidification fan mode or high fan mode. In auto dehumidification mode, the fan speed relay will remain off during cooling stage 2 IF the H input is active. In high fan mode, the fan enable and fan speed relays will turn on when the H input is active.

On = Auto dehumidification mode. Off = High fan mode.

2.8 - Special factory selection: DIP 2.8 provides special factory selection. Normal position is "On". Do not change selection unless instructed to do so by the factory.

Table 6c: Accessory DIP Switch Settings

DIP 2.1	DIP 2.2	DIP 2.3	ACC1 Relay Option
On	On	On	Cycle with fan
Off	On	On	Digital NSB
On	Off	On	Water Valve - slow opening
On	On	Off	OAD
Off	Off	Off	Reheat Option - Humidistat
Off	On	Off	Reheat Option - Dehumidistat
DIP 2.4	DIP 2.5	DIP 2.6	ACC2 Relay Option
On	On	On	Cycle with compressor
Off	On	On	Digital NSB
On	Off	On	Water Valve - slow opening
On	On	Off	OAD

All other DIP combinations are invalid

CXM and DXM Controls

Safety Features – CXM/DXM Control

The safety features below are provided to protect the compressor, heat exchangers, wiring and other components from damage caused by operation outside of design conditions.

Anti-short cycle protection: The control features a 5 minute anti-short cycle protection for the compressor.

Note: The 5 minute anti-short cycle also occurs at power up.

Random start: The control features a random start upon power up of 5-80 seconds.

Fault Retry: In Fault Retry mode, the Status LED begins slowly flashing to signal that the control is trying to recover from a fault input. The control will stage off the outputs and then "try again" to satisfy the thermostat input call. Once the thermostat input call is satisfied, the control will continue on as if no fault occurred.

If 3 consecutive faults occur without satisfying the thermostat input call, the control will go into "lockout" mode. The last fault causing the lockout will be stored in memory and can be viewed at the "fault" LED (DXM board) or by going into test mode (CXM board). **Note: FP1/FP2 faults are factory set at only one try.**

Lockout: In lockout mode, the status LED will begin fast flashing. The compressor relay is turned off immediately. Lockout mode can be "soft" reset by turning off the thermostat (or satisfying the call). A "soft" reset keeps the fault in memory but resets the control. A "hard" reset (disconnecting power to the control) resets the control and erases fault memory.

Lockout with emergency heat: While in lockout mode, if W becomes active (CXM), emergency heat mode will occur. If DXM is configured for heat pump thermostat type (DIP 1.3), emergency heat will become active if O/W2 is energized.

High pressure switch: When the high pressure switch opens due to high refrigerant pressures, the compressor relay is de-energized immediately since the high pressure switch is in series with the compressor contactor coil. The high pressure fault recognition is immediate (does not delay for 30 continuous seconds before de-energizing the compressor).

High pressure lockout code = 2

Example: 2 quick flashes, 10 sec pause, 2 quick flashes, 10 sec. pause, etc.

Low pressure switch: The low pressure switch must be open and remain open for 30 continuous seconds during "on" cycle to be recognized as a low pressure fault. If the low pressure switch is open for 30 seconds prior to compressor power up it will be considered a low pressure (loss of charge) fault. The low pressure switch input is bypassed for the initial 120 seconds of a compressor run cycle.

Low pressure lockout code = 3

Water coil low temperature (FP1): The FP1 thermistor temperature must be below the selected low temperature limit setting for 30 continuous seconds during a compressor run cycle to be recognized as a FP1 fault. The FP1 input is bypassed for the initial 120 seconds of a compressor run cycle. FP1 is set at the factory for one try. Therefore, the control will go into lockout mode once the FP1 fault has occurred.

FP1 lockout code = 4

Air coil low temperature (FP2): The FP2 thermistor temperature must be below the selected low temperature limit setting for 30 continuous seconds during a compressor run cycle to be recognized as a FP2 fault. The FP2 input is bypassed for the initial 60 seconds of a compressor run cycle. FP2 is set at the factory for one try. Therefore, the control will go into lockout mode once the FP2 fault has occurred.

FP2 lockout code = 5

Condensate overflow: The condensate overflow sensor must sense overflow level for 30 continuous seconds to be recognized as a CO fault. Condensate overflow will be monitored at all times.

CO lockout code = 6

Over/under voltage shutdown: An over/under voltage condition exists when the control voltage is outside the range of 19VAC to 30VAC. Over/under voltage shutdown is a self-resetting safety. If the voltage comes back within range for at least 0.5 seconds, normal operation is restored. This is not considered a fault or lockout. If the CXM/DXM is in over/under voltage shutdown for 15 minutes, the alarm relay will close.

Over/under voltage shut down code = 7

Unit Performance Sentinel-UPS (patent pending): The UPS feature indicates when the heat pump is operating inefficiently. A UPS condition exists when:

- In heating mode with compressor energized, FP2 is greater than 52°C for 30 continuous seconds, or:
- In cooling mode with compressor energized, FP1 is greater than 52°C for 30 continuous seconds, or:
- In cooling mode with compressor energized, FP2 is less than 4.5°C for 30 continuous seconds.

If a UPS condition occurs, the control will immediately go to UPS warning. The status LED will remain on as if the control is in normal mode. Outputs of the control, excluding LED and alarm relay, will NOT be affected by UPS. The UPS condition cannot occur during a compressor off cycle. During UPS warning, the alarm relay will cycle on and off. The cycle rate will be "on" for 5 seconds, "off" for 25 seconds, "on" for 5 seconds, "off" for 25 seconds, etc.

UPS warning code = 8

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Swapped FP1/FP2 thermistors: During test mode, the control monitors to see if the FP1 and FP2 thermistors are in the appropriate places. If the control is in test mode, the control will lockout with code 9 after 30 seconds if:

- a) The compressor is on in the cooling mode and the FP1 sensor is colder than the FP2 sensor, or;
- b) The compressor is on in the heating mode and the FP2 sensor is colder than the FP1 sensor.

Swapped FP1/FP2 thermistor code = 9.

ESD (DXM only): The ESD (Emergency Shut Down) mode can be enabled from an external common signal to terminal ESD to shut down the unit. The green status light will flash code 3 when the unit is in ESD mode.

ESD mode = code 3 (green "status" LED)

Diagnostic Features - The LED on the CXM board advises the technician of the current status of the CXM control. The LED can display either the current CXM mode or the last fault in memory if in test mode. If there is no fault in memory, the LED will flash Code 1 (when in test mode).

The green status LED and red fault LED on the DXM board advise the technician of the current status of the DXM control. The status LED will indicate the current mode that the DXM control is in. The fault LED will ALWAYS flash a code representing the LAST fault in memory. If there is no fault in memory, the fault LED will flash Code 1. The yellow test LED will turn on when in test mode. **CAUTION: Do not restart units without inspection and remedy of faulting condition. Damage may occur.**

CXM/DXM Control Start-up Operation - The control will not operate until all inputs and safety controls are checked for normal conditions. The compressor will have a 5 minute anti-short cycle delay at power-up. The first time after power-up that there is a call for compressor, the compressor will follow a 5 to 80 second random start delay. After the random start delay and anti-short cycle delay, the compressor relay will be energized. On all subsequent compressor calls, the random start delay is omitted.

Operating Limits

Table 9a: Operating Limits

Operating Limits	TS	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	7°C	4°C
Rated ambient air, DB	27°C	20°C
Max. ambient air, DB	43°C	29°C
Min. entering air, DB/WB	16/10°C	7°C
Rated entering air, DB/WB	27/19°C	20°C
Max. entering air, DB/WB	35/24°C	27°C
Water Limits		
Min. entering water	-1°C	-6.7°C
Normal entering water	10-43°C	-1 to 21°C
Max. entering water	49°C	32°C
Normal Water Flow	1.6 to 3.2 l/m per kW	

Operating Conditions

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 9a for operating limits.

Comissioning Conditions

Starting conditions are based upon the following notes:

Notes:

- Conditions in Table 9b 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.
- Voltage utilization range complies with AHRI Standard 110.

Table 9b: Comissioning Limits

Comissioning Limits	TS	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	7°C	4°C
Rated ambient air, DB	27°C	20°C
Max. ambient air, DB	43°C	29°C
Min. entering air, DB/WB	10/7°C	4.5°C
Rated entering air, DB/WB	27/19°C	20°C
Max. entering air, DB/WB	43/28°C	27°C
Water Limits		
Min. entering water	-1°C	-6.7°C
Normal entering water	10-43°C	-1 to 21°C
Max. entering water	49°C	32°C
Normal Water Flow	1.6 to 3.2 l/m per kW	

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Piping System Cleaning and Flushing

Piping System Cleaning and Flushing - Cleaning and flushing the WLHP piping system is the single most important step to ensure proper 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. ClimaDry®-equipped units have a manual air bleed valve at the top of the reheat coil. This valve must be used to bleed the air from the reheat coil after filling the system, for ClimaDry® to operate properly.
4. Verify that all strainers are in place (ClimateMaster recommends a strainer with a #20 stainless steel wire mesh). 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 30°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 1/2 kg per 750 l of water (or other equivalent approved cleaning agent). Reset the boiler to raise the loop temperature to 38°C. Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
8. When the cleaning process is complete, remove the short-circuited hoses. Reconnect the hoses to the proper supply, and return the connections to each of the units. Refill the system and bleed off all air.
9. Test the system pH with litmus paper. The system water should be in the range of pH 6.0 - 8.5 (see table 3). Add chemicals, as appropriate to maintain neutral pH levels.
10. When the system is successfully cleaned, flushed, refilled and bled, check the main system panels, safety cutouts and alarms. Set the controls to properly maintain loop temperatures.

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.

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 Starting and Operating Conditions

⚠ 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 CHECKOUT

- ❑ 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 Table 8a-b.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out on the CXM/DXM control is properly set.
- ❑ Unit fan: Manually rotate fan to verify free rotation and ensure that blower wheel is secured to the motor shaft. Be sure to remove any shipping supports if needed. DO NOT oil motors upon 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 CXM or DXM field selection options are properly set.

SYSTEM CHECKOUT

- ❑ System water temperature: Check water temperature for proper range and also verify heating and cooling setpoints 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 table 3).
- ❑ System flushing: Verify that all hoses are connected end to end when flushing to ensure that debris bypasses the unit heat exchanger, water valves and other components. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Verify that all air is purged from the system. Air in the system can cause poor operation or system corrosion.
- ❑ Cooling tower/boiler: Check equipment for proper setpoints and operation.
- ❑ Standby pumps: Verify that the standby pump is properly installed and in operating condition.
- ❑ System controls: Verify that system controls function and operate in the proper sequence.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out controls are provided for the outdoor portion of the loop. Otherwise, operating problems may occur.
- ❑ System control center: Verify that the control center and alarm panel have appropriate setpoints and are operating as designed.
- ❑ Miscellaneous: Note any questionable aspects of the installation.

⚠ CAUTION! ⚠

CAUTION! Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the coax 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.

NOTICE! Failure to remove shipping brackets from spring-mounted compressors will cause excessive noise, and could cause component failure due to added vibration.

Tranquility 20 (TS) Units

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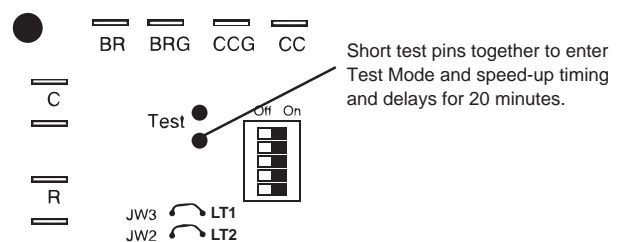
Unit Start-Up Procedure

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 table 9. During start-up checks, loop water temperature entering the heat pump should be between 16°C and 35°C.
5. Two factors determine the operating limits of ClimateMaster heat pumps, (a) return air temperature, and (b) water temperature. When any one of these factors is at a minimum or maximum level, the other factor must be at normal level to insure 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 CXM/DXM control board as shown below in Figure 28. 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 and comparing to table 10.
 - 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 17. 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 tables 10b and c. 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: $HR (kW) = TD \times l/s \times 4.18$, where TD is the temperature difference between the entering and leaving water, and l/s is the flow rate, determined by comparing the pressure drop across the heat exchanger to table 10.
 - f. Check air temperature drop across the air coil when compressor is operating. Air temperature drop should be between 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 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 table 17. 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 10. 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: $HE (kW) = TD \times l/s \times 4.18$, 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 10.
 - e. Check air temperature rise across the air coil when compressor is operating. Air temperature rise should be between 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 insure proper diagnosis and repair of the equipment.
8. When testing is complete, set system to maintain desired comfort level.
9. BE CERTAIN TO FILL OUT AND FORWARD ALL WARRANTY REGISTRATION PAPERS TO CLIMATEMASTER.

Note: If performance during any mode appears abnormal, refer to the CXM/DXM 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 28: Test Mode Pins

**⚠ 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 coax or water lines can permanently damage the heat pump.

Unit Operating Conditions

Table 10: TS Coax Water Pressure Drop

Model	l/s	Pressure Drop, kPa*			
		-1°C	10°C	21°C	32°C
009	0.088	5.5	4.8	4.1	4.1
	0.132	10.3	9.7	8.3	7.6
	0.777	18.6	16.5	15.2	13.1
012	0.114	4.1	3.4	2.8	2.1
	0.164	14.5	13.1	11.0	9.7
	0.221	26.2	23.4	20.7	17.9
018	0.176	4.8	3.4	2.1	1.4
	0.258	14.5	11.7	9.7	7.6
	0.347	24.1	19.3	16.6	13.8
024	0.252	10.3	9.0	7.6	6.9
	0.378	21.4	17.9	15.9	14.5
	0.504	35.2	29.7	26.2	23.4
030	0.252	10.3	9.0	7.6	6.9
	0.378	21.4	17.9	15.9	14.5
	0.504	35.2	29.7	26.2	23.4
036	0.284	11.7	9.0	7.6	6.2
	0.428	22.8	21.4	20.0	17.9
	0.567	39.3	35.9	33.1	30.3
042	0.347	7.6	6.2	5.5	4.8
	0.523	15.2	14.5	13.8	12.4
	0.693	26.9	24.8	22.1	21.4
048	0.378	9.0	7.6	6.9	6.2
	0.567	17.9	17.2	15.9	15.2
	0.756	31.0	29.0	26.2	24.1
060	0.473	4.1	2.8	2.1	1.4
	0.712	15.9	14.5	13.8	12.4
	0.945	33.1	29.7	26.9	24.1
070	0.523	16.6	13.8	11.7	11.0
	0.781	35.9	31.0	27.6	26.2
	1.040	55.2	48.3	43.4	41.4

*Note: To convert kPa to millibars, multiply by 10.

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Table 17: Water Temperature Change Through Heat Exchanger

Water Flow, l/m	Rise, Cooling °C	Drop, Heating °C
For Closed Loop: Ground Source or Closed Loop Systems at 3.2 l/m per kW	5 - 6.7	2.2 - 4.4
For Open Loop: Ground Water Systems at 1.6 l/m per kW	11.1 - 14.4	5.6 - 9.4

Preventive Maintenance

Water Coil Maintenance

(Direct ground water applications only)

If the system is installed in an area with a known high mineral content (125 P.P.M. or greater) in the water, it is best to establish a periodic maintenance schedule with the owner so the coil can be checked regularly. Consult the well water applications section of this manual for a more detailed water coil material selection. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. Therefore, 1.6 l/m per kW is recommended as a minimum flow. Minimum flow rate for entering water temperatures below 10°C is 2.2 l/m per kW.

Water Coil Maintenance

(All other water loop applications)

Generally water coil 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 water coil 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. 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 3.9 l/m per kW can produce water (or debris) velocities that can erode the heat exchanger wall and ultimately produce leaks.

Hot Water Generator Coils

See water coil maintenance for ground water units. If the potable water is hard or not chemically softened, the high temperatures of the desuperheater will tend to scale even quicker than the water coil and may need more frequent inspections. In areas with extremely hard water, a HWG is not recommended.

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 insure 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 insure 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 insure amp draw is no more than 10% greater than indicated on serial plate data.

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. Generally, vertical cabinets are set up from the floor 7 - 8 cm to prevent water from entering the cabinet. 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.

CLIMATEMASTER WATER-SOURCE HEAT PUMPS

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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 24VAC between R and C on CXM/DXM
				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.
		X	Water Temperature out of range in cooling	Bring water temp within design parameters. Check for dirty air filter and clean or replace.
	X		Reduced or no air flow in heating	Check fan motor operation and airflow restrictions. Dirty Air Coil- construction dust etc. Too high of external static. Check static vs blower table.
				Bring return air temp within design parameters.
				Check superheat/subcooling vs typical operating condition table.
	X	X	Bad HP Switch	Check switch continuity and operation. Replace.
	X	X	Insufficient charge	Check for refrigerant leaks
LP/LOC Fault Code 3 Low Pressure / Loss of Charge	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.
				Inadequate antifreeze level
				Check antifreeze density with hydrometer.
	X		Improper temperature limit setting (30°F vs 10°F [-1°C vs -2°C])	Clip JW3 jumper for antifreeze (10°F [-12°C]) use.
	X		Water Temperature out of range	Bring water temp within design parameters.
LT2 Fault Code 5 Air coil low temperature limit	X	X	Bad thermistor	Check temp and impedance correlation per chart
		X	Reduced or no air flow 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		Too much cold vent air? Bring entering air temp within design parameters.
		X		Normal airside applications will require 30°F [-1°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		Check for moisture shorting to air coil.
		X		Replace air filter.
	X	X	Restricted Return Air Flow	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 24VAC voltage before and during operation. Check power supply wire size. Check compressor starting. Need hard start kit? Check 24VAC and unit transformer tap for correct power supply voltage.
				Check power supply voltage and 24VAC before and during operation.
				Check 24VAC and unit transformer tap for correct power supply voltage.
	X	X	Over Voltage	Check power supply voltage and 24VAC before and during operation.
Unit Performance Sentinel Code 8	X		Heating mode FP2>125°F [52°C]	Check for poor air flow or overcharged unit.
		X	Cooling Mode FP1>125°F [52°C] OR FP2< 40°F [4°C]	Check for poor water flow, or air flow.
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.
	X	X	Dirty air filter	Check and clean air filter.
Unit Short Cycles	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
	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
Only Fan Runs	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.
	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation
Only Compressor Runs	X	X	Fan motor relay	Jumper G and R for fan operation. Check for Line voltage across BR contacts.
	X	X	Fan motor	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
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24VAC on RV coil and at CXM/DXM 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

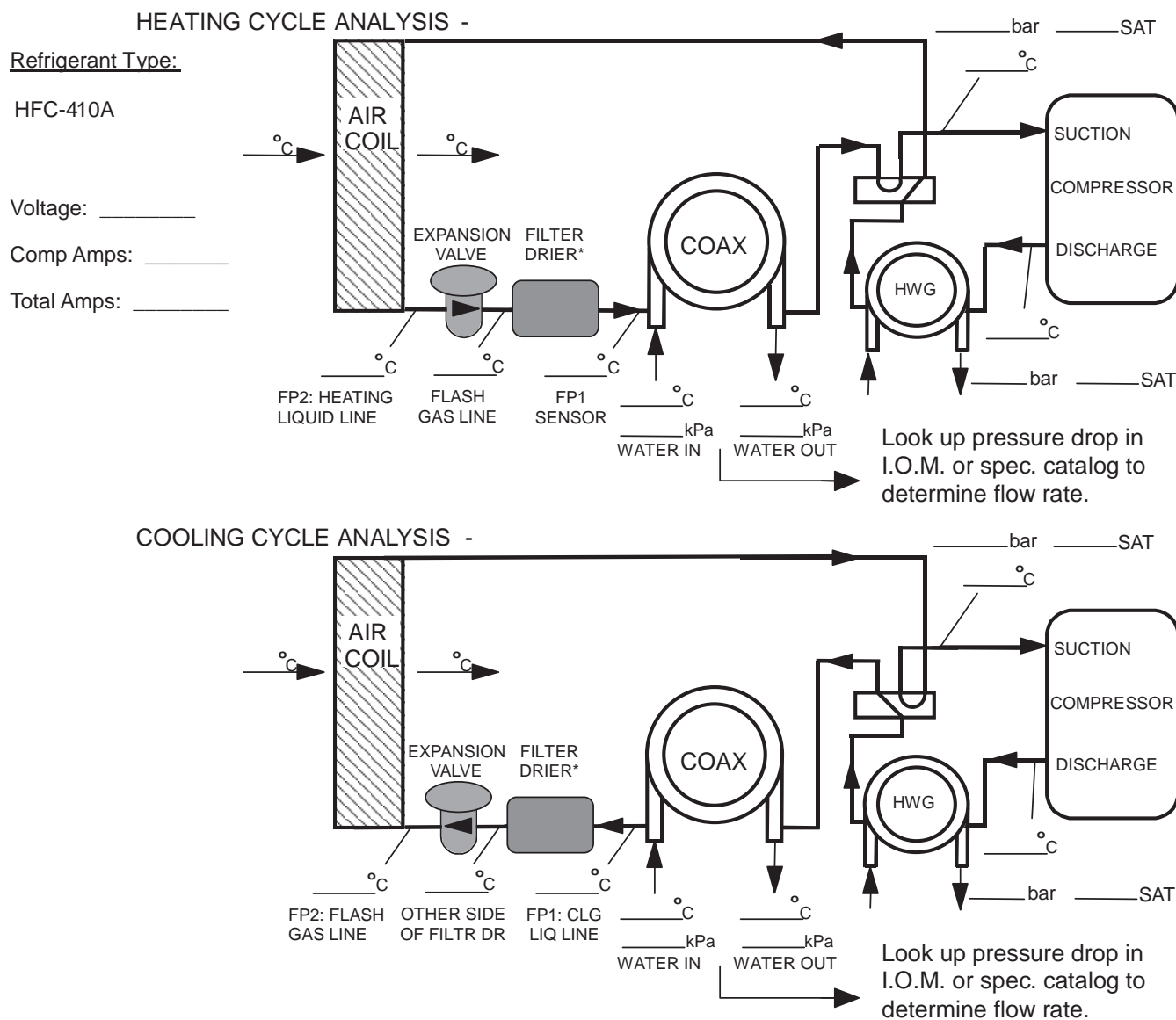
Performance Troubleshooting	Htg	Clg	Possible Cause	Solution
Insufficient capacity/ Not cooling or heating	X	X	Dirty filter	Replace or clean.
	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static. Check static vs. blower table.
		X	Reduced or no air flow 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.
High Head Pressure	X		Reduced or no air flow in heating	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	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow. Adjust to proper flow rate.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	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.
Low Suction Pressure	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.
	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.
Low Discharge Air Temperature in Heating	X		Water temperature out of range.	Bring water temperature within design parameters.
				Check for dirty air filter and clean or replace.
High humidity		X	Reduced air flow in cooling.	Check fan motor operation and air flow restrictions.
				Too high of external static. Check static vs. blower table.
				Too much cold vent air? Bring entering air temperature within design parameters.
Low Discharge Air Temperature in Heating	X		Air temperature out of range	Too much cold vent air? Bring entering air temperature within design parameters.
				Check for refrigerant leaks.
High humidity		X	Insufficient charge	Check for refrigerant leaks.
				Check fan motor speed selection and air flow chart.
High humidity		X	Too high of air flow	Check fan motor speed selection and airflow chart.
				Recheck loads & sizing. Check sensible clg load and heat pump capacity.

CLIMATEMASTER WATER-SOURCE HEAT PUMPS

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Functional Troubleshooting - S-I Units



Heat of Extraction (Absorption) or Heat of Rejection =

$$\text{_____ flow rate (l/s) x _____ temp. diff. (deg. C) x _____ fluid factor}^{\dagger} = \text{_____ (kW)}$$

Superheat = Suction temperature - suction saturation temp. = _____ (deg C)

Subcooling = Discharge saturation temp. - liquid line temp. = _____ (deg C)

[†] Use 4.18 for water, 4.05 for antifreeze

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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.



CLIMATE MASTER, INC. LIMITED EXPRESS WARRANTY /LIMITATION OF REMEDIES AND LIABILITY (FOR INTERNATIONAL CLASS PRODUCTS)

Disclaimer: It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Climate Master, Inc., a Delaware corporation, U.S.A. ("CM") or its representatives, relating to CM's products, whether oral, written or otherwise, are not intended to constitute a warranty, and shall not be relied upon as such. This disclaimer applies to all products manufactured by CM, including but not limited to, geothermal heat pumps, heat exchangers, and other related equipment. **SPECIFICALLY SET FORTH HEREIN AND TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, CM MAKES NO WARRANTY AS TO ANY OF CM'S PRODUCTS, AND CM MAKES NO WARRANTY AGAINST LATENT DEFECTS OR ANY 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 installed outside the United States ("U.S.A.") and Canada to be free from material defects in materials and workmanship under normal use and maintenance as follows: (1) All complete air conditioning, heating 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 CM's factory), whichever comes first; and, (2) Repair and replacement parts, which are not supplied under warranty, for ninety (90) days from date of shipment (from factory).

Warranty parts shall be furnished by CM if ordered through an authorized sales representative of CM ("Representative") within sixty (60) days after the failure of the part. If CM determines that a parts order qualifies for replacement under CM's warranty, such parts shall be shipped freight prepaid to the Representative on the ultimate user, as requested by Representative. All duties, taxes and other fees shall be paid by the ultimate user through the Representative.

If requested by CM, all defective parts shall be returned to CM's factory in Oklahoma City, Oklahoma, U.S.A. freight and duty prepaid, not later than sixty (60) days after the date of the request. If the defective part is not timely returned or if CM determines the part to not be defective or otherwise not to qualify under CM's Limited Express Warranty, CM shall invoice Customer the costs for the parts furnished, including freight. The warranty on any part 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 tag or labels have been removed or defaced; (5) Products, on which payment by Customer to CM or its distributors or Representatives, or the Customer's seller is in default; (6) Products which have defects or damage which result from improper installation, wiring, electrical imbalance characteristics or maintenance; or from parts or components manufactured by others, or are caused by accident, misuse, negligence, abuse, fire, flood, lightning, alteration or disassembly of the product; (7) Products which have defects or damage which result from a contaminated or unconditioned air flow, or from a supply of air that is not clean, dry, or unobstructed opening of the refrigerant unit; (8) Mold, fungi or bacteria damages; (9) Products subjected to corrosion or abrasion; (10) Products, parts or components 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; (13) Products which have defects, damage or insufficient performance as a result of insufficient or incorrect system design or the improper application, installation, or use of CM's products; or (14) Electricity or fuel costs, or any increases or unrealized savings in same, for any reason.

CM is not responsible for: (1) The cost of any fluids, refrigerant or other system components, or the 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 cost of labor, refrigerant, materials or service incurred in diagnosis and removal of the defective part, or in obtaining and replacing the new or repaired part; (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; or (4) The costs of normal maintenance.

Limitation: This Limited Express Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined by a court or other qualified judicial body that other warranties exist, any such warranty, including without limitation any express warranty or any implied warranty of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Warranty. This Limited Express Warranty does not exclude any warranty that is mandatory and that may not be excluded under applicable imperative law.

LIMITATION OF REMEDIES

In the event of a breach of this Limited Express Warranty or any warranty that is mandatory under applicable imperative law, CM will only be obligated at CM's option to either 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, U.S.A. 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 goods(s). Said refund shall be the maximum liability of CM. **TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE CUSTOMER 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 war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, allocation, shortages of transportation, fuel, materials, or labor, acts of God or any other reason beyond the sole control of CM. **TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW AND SUBJECT TO THE NEXT SENTENCE, CM EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR LOSS OF PROFITS, LOSS OF BUSINESS OR GOODWILL, CONSEQUENTIAL, INCIDENTAL, SPECIAL, LIQUIDATED, OR PUNITIVE DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR CM'S NEGLIGENCE OR AS STRICT LIABILITY.** Nothing in this Agreement is intended to exclude CM's liability for death, personal injury or fraud.

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 Representative. If assistance is required in obtaining warranty performance, write or call:

Climate Master, Inc. • Customer Service • 7300 S.W. 44th Street • Oklahoma City, Oklahoma, U.S.A. 73179 • (405) 745-6000 • FAX (405) 745-6068

NOTE: Some countries 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 country to country.

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

Rev: 10/09



LC079

Tranquility 20 (TS) Units
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Notes

Tranquility 20 (TS) Units

Rev.: 25 July, 2017

Revision History

Date	Item	Description
25 July, 2017	Page 7	Hanger and mounting details
30 November, 2016	Electrical Table	Updated Min/Max Voltage
18 August, 2015	All	First Published



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