

Tranquility® 30 (TT) Series



Models TTD/H/V 026 - 072
60 Hz - HFC-410A

INSTALLATION, OPERATION, & MAINTENANCE

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Revised: October 7, 2016



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Model Nomenclature

SERIES
TT = Tranquility® Two Stage Scroll

CONFIGURATION
V = Vertical Up
H = Horizontal
D = Vertical Down

UNIT SIZE
026 = "E, F, G, H"
038 = "F, G, H"
049 = "F, G, H"
064 = "F, G, H"
072 = "F, G, H"

REVISION LEVEL
B = Current 026, 049 - 072
C = Current 038

VOLTAGE
E = 265/60/1
G = 208/230/60/1
H = 208/230/60/3
F = 460/60/3

CONTROLS
C = CXM
D = DXM
L = CXM w/LON
M = DXM w/LON
N = CXM w/MPC
P = DXM w/MPC
A = CXM
B = DXM
E = CXM w/LON
K = DXM w/LON
R = CXM w/MPC
S = DXM w/MPC
w/ Disconnect

STANDARD
S = Standard

SUPPLY AIR FLOW & MOTOR CONFIGURATION

	Supply	Configuration	Motor
K	Top	TTV	ECM
N	Down	TTD	ECM
P	Back	TTH	ECM
W	Straight	TTH	ECM

RETURN AIR FLOW CONFIGURATION
L = Left Return
R = Right Return

HEAT EXCHANGER OPTIONS

	Non Coated Air Coil		Tin Plated Air Coil	
	Copper	Cupro-Nickel	Copper	Cupro-Nickel
Standard	C	N	A	J
Motorized Valve	T	S	U	W
ClimaDry®	E	P	D	F

WATER CIRCUIT OPTIONS
0 = None
2 = HWG (Coil Only)
5 = Internal Secondary Pump
6 = HWG (Coil Only) w/Auto Flow Regulator 2.5 GPM/Ton
7 = HWG (Coil Only) w/Auto Flow Regulator 3.0 GPM/Ton
8 = Auto Flow Regulator 2.5 GPM/Ton
9 = Auto Flow Regulator 3.0 GPM/Ton

Cabinet Insulation

OPTION	RANGE	ULTRA QUIET	1" FILTER RAIL	2" FILTER RAIL	1" FILTER FRAME	2" FILTER FRAME
1	EXTENDED RANGE	YES			NO	
A		NO		NO		YES
J		NO	NO	YES		NO
K		NO	NO		YES	NO
2		YES			NO	
C	STANDARD RANGE	NO		NO		YES
L		NO	NO	YES		NO
M		NO	NO		YES	NO
3		YES			NO	
E	STANDARD RANGE	NO		NO		YES
N		NO	NO	YES		NO
P		NO	NO		YES	NO
4		YES			NO	
G		NO		NO		YES
R	STANDARD RANGE	NO	NO	YES		NO
S		NO	NO		YES	NO

Note: Above model nomenclature is a general reference. Consult individual engineering guides for detailed information.

ClimaDry® II Option Notes:

- Unit must have DXM control option. 460 volt unit units require a four wire power supply with neutral.
- ClimaDry® II may not be combined with motorized water valve, internal secondary circulating pump, or automatic flow regulator options.
- Unit minimum entering air temperature while in the dehumidification, cooling, or continuous fan modes is **65°F DB/55°F WB**. Operation below this minimum may result in nuisance faults.
- A thermostat with dehumidification mode or thermostat and separate humidistat/dehumidistat is required for activation and control of ClimaDry® II.
- Downflow and 575 volt units are not eligible for ClimaDry® II.

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

⚠ WARNING! ⚠

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

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.

General Information

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. (No action is required for compressors with rubber grommets.)
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

Tranquility® 30 (TT) Series

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Unit Physical Data

Tranquility® 30 Two-Stage (TT) Series (60Hz Only)

Model	026	038	049	064	072
Compressor (1 Each)	Two-Stage Scroll				
Factory Charge (HFC-410A) (oz) [kg]	60 [1.70]	64 [1.81]	81 [2.30]	142 [4.03]	140 [3.97]
ECM Fan Motor & Blower					
Fan Motor (hp) [W]	1/2 [373]	1/2 [373]	1 [746]	1 [746]	1 [746]
Blower Wheel Size (dia x w) - (in) [mm]	9 x 7 [229 x 178]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]
Water Connection Size					
FPT (in)	3/4	3/4	1	1	1
HWG Connection Size					
FPT (in)	1/2	1/2	1/2	1/2	1/2
Coax Volume					
Volume (US Gallons) [liters]	0.76 [2.88]	0.92 [3.48]	1.24 [4.69]	1.56 [5.91]	1.56 [5.91]
Vertical Upflow/Downflow					
Air Coil Dimensions (h x w) - (in) [mm]	28 x 20 [711 x 508]	28 x 25 [711 x 635]	32 x 25 [813 x 635]	36 x 25 [914 x 635]	36 x 25 [914 x 635]
Standard Filter - 1" [25.4mm] Throwaway, qty (in) [mm]	28 x 24 [711 x 610]	28 x 30 [711 x 762]	2 - 16 x 30 [406 x 762]	1 - 16 x 30 [813 x 762] 1 - 20 x 30 [508 x 762]	1 - 16 x 30 [813 x 762] 1 - 20 x 30 [508 x 762]
Weight - Operating, (lbs) [kg]	266 [121]	327 [148]	416 [189]	443 [201]	443 [201]
Weight - Packaged, (lbs) [kg]	276 [125]	337 [153]	426 [193]	453 [205]	453 [205]
Horizontal					
Air Coil Dimensions (h x w) - (in) [mm]	18 x 31 [457 x 787]	20 x 35 [508 x 889]	20 x 40 [508 x 1016]	20 x 45 [508 x 1143]	20 x 45 [508 x 1143]
Standard Filter - 1" [25.4mm] Throwaway, qty (in) [mm]	2 - 18 x 18 [457 x 457]	1 - 12 x 20 [305 x 508] 1 - 20 x 25 [508 x 635]	1 - 18 x 20 [457 x 508] 1 - 20 x 24 [508 x 610]	2 - 20 x 24 [508 x 610]	2 - 20 x 24 [508 x 610]
Weight - Operating, (lbs) [kg]	266 [121]	327 [148]	416 [189]	443 [201]	443 [201]
Weight - Packaged, (lbs) [kg]	276 [125]	337 [153]	426 [193]	453 [205]	453 [205]

Notes:

All units have TXV expansion device and 1/2" & 3/4" electrical knockouts.

575 volt motors are two speed.

For units with ClimaDry® option add 66lbs (30kg) to weights.

Unit Maximum Water Working Pressure	
Options	Max Pressure PSIG [kPa]
Base Unit	300 [2,068]
Internal Secondary Pump (ISP)	145 [999]
ClimaDry®	145 [999]
Internal Motorized Water Valve (MWV)	300 [2,068]
Internal Auto Flow Valve	300 [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.

Conform to the following guidelines when selecting unit location:

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

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

Mounting Horizontal Units

Horizontal units have hanger kits pre-installed from the factory as shown in Figure 1. Figure 3 shows a typical horizontal unit installation.

Horizontal heat pumps are typically suspended above a ceiling or within a soffit using field supplied, threaded rods sized to support the weight of the unit.

Use four (4) field supplied threaded rods and factory provided vibration isolators to suspend the unit. Hang the unit clear of the floor slab above and support the unit by the mounting bracket assemblies only. DO NOT attach the unit flush with the floor slab above.

Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. On small units (less than 2.5 tons/8.8kW) ensure that unit pitch does not cause condensate leaks inside the cabinet.

Figure 1: Hanger Bracket

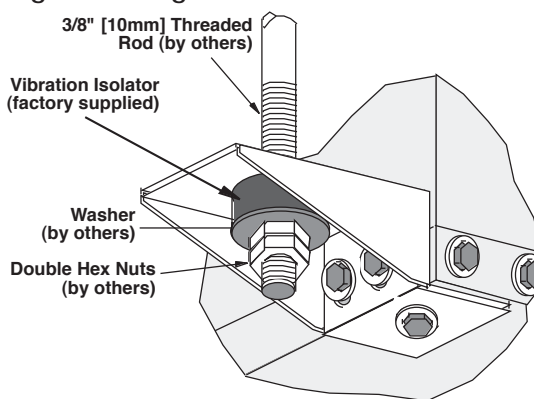
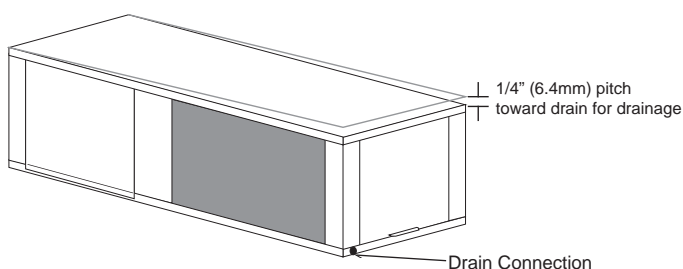


Figure 2: Horizontal Unit Pitch

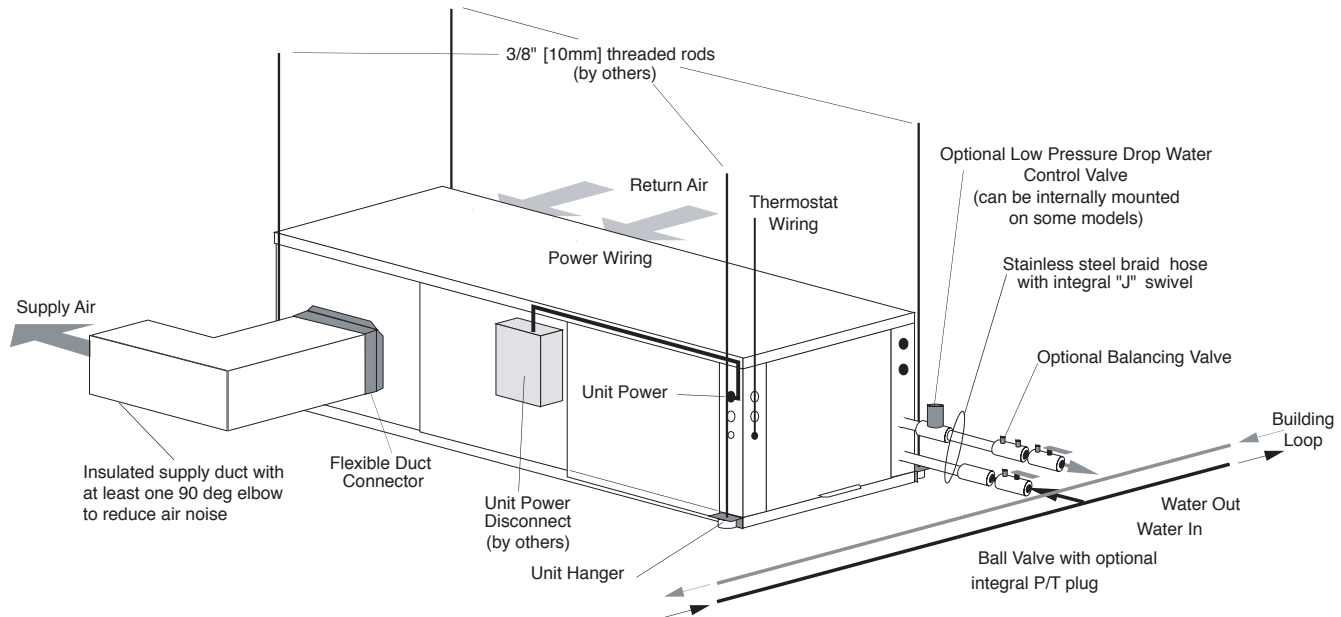


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Horizontal Installation

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.

Field Conversion of Air Discharge

Overview - Horizontal units can be field converted between side (straight) 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 - It is best to field convert the unit on the ground before hanging. If the unit is already hung it should be taken down for the field conversion.

Side to Back Discharge Conversion

1. Place unit in well lit area. Remove the screws as shown in Figure 4 to free top panel and discharge panel.
2. Lift out the access panel and set aside. Lift and rotate the discharge panel to the other position as shown, being careful with the blower wiring.
3. Check blower wire routing and connections for tension or contact with sheet metal edges. Re-route if necessary.
4. Check refrigerant tubing for contact with other components.
5. Reinstall top panel and screws noting that the location for some screws will have changed.
6. Manually spin the fan wheel to ensure that the wheel is not rubbing or obstructed.
7. Replace access 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

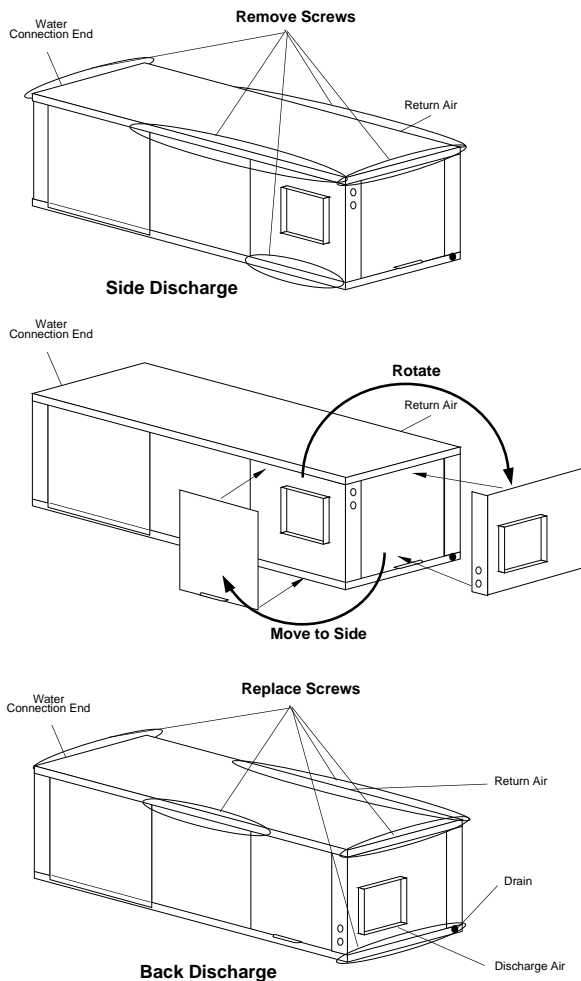
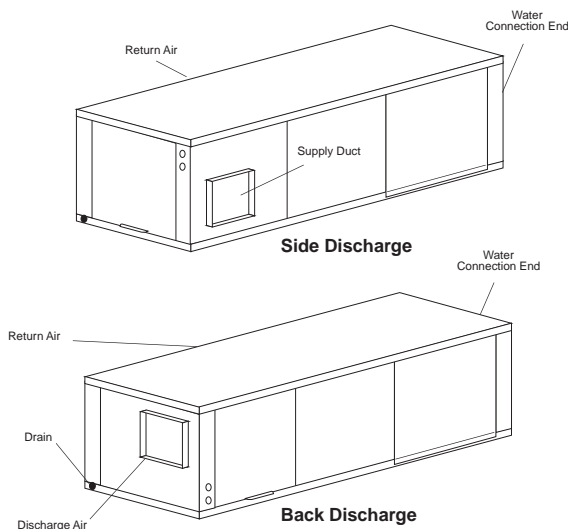


Figure 5: Right Return Side to Back



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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 2.5 tons/8.8 kW), ensure that unit pitch does not cause condensate leaks inside the cabinet.

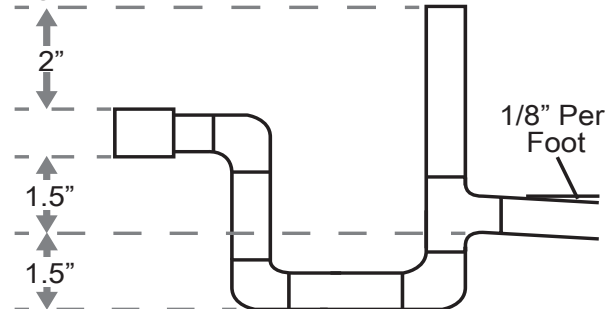
Install condensate trap at each unit with the top of the trap positioned below the unit condensate drain connection as shown in Figure 6. Design the depth of the trap (water-seal) based upon the amount of ESP capability of the blower (where 2 inches [51mm] of ESP capability requires 2 inches [51mm] of trap depth). As a general rule, 1-1/2 inch [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.**

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.

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 1/8 inch per ft [11mm per m] of run.

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 3/8" [10mm] to 1/2" [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. Provide access to water valves and fittings and screwdriver access to the unit side panels, discharge collar and all electrical connections.

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.

Figure 7: Vertical Unit Mounting

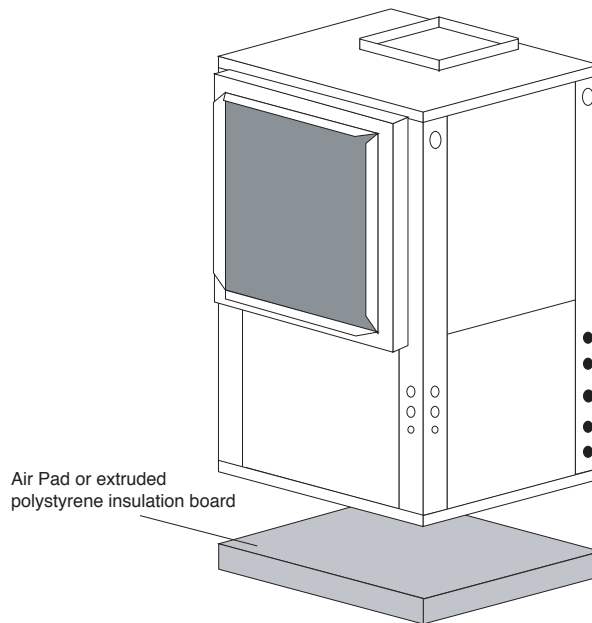
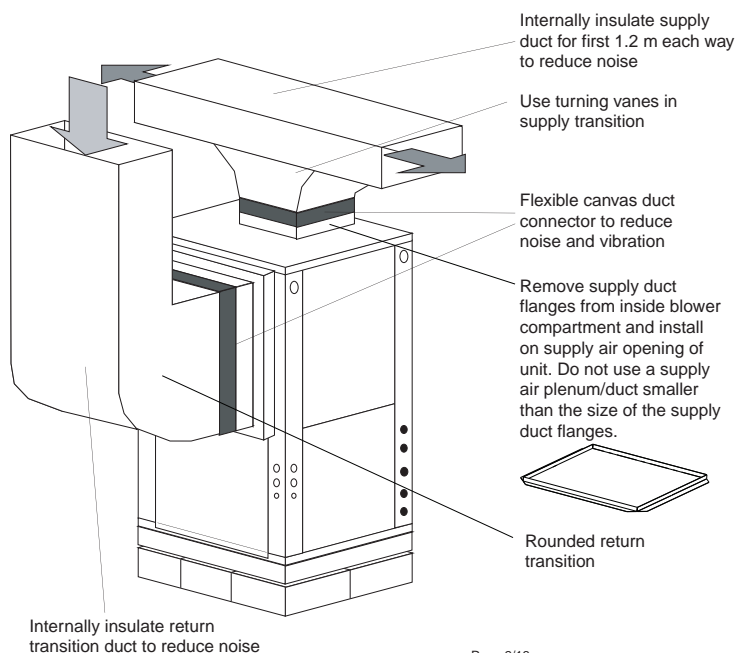


Figure 8: Typical Vertical Unit Installation Using Ducted Return Air



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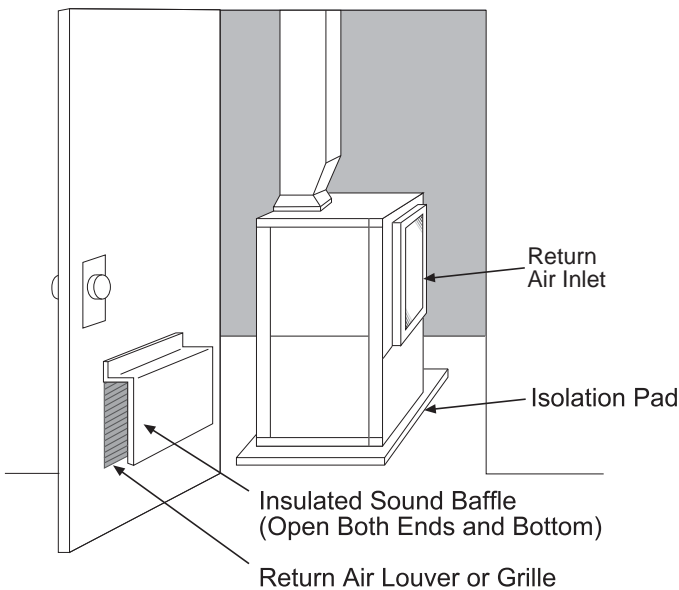
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Vertical Installation

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.

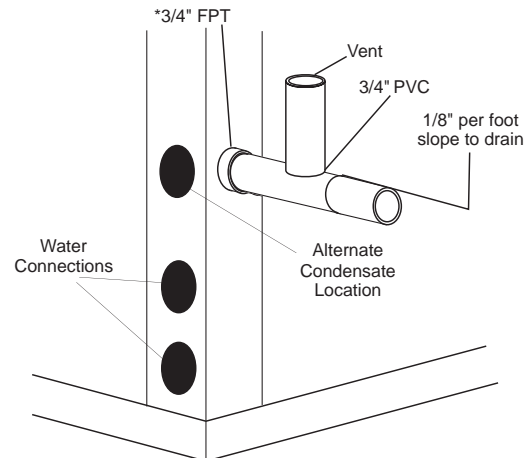
Figure 9: Vertical Sound Attenuation



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

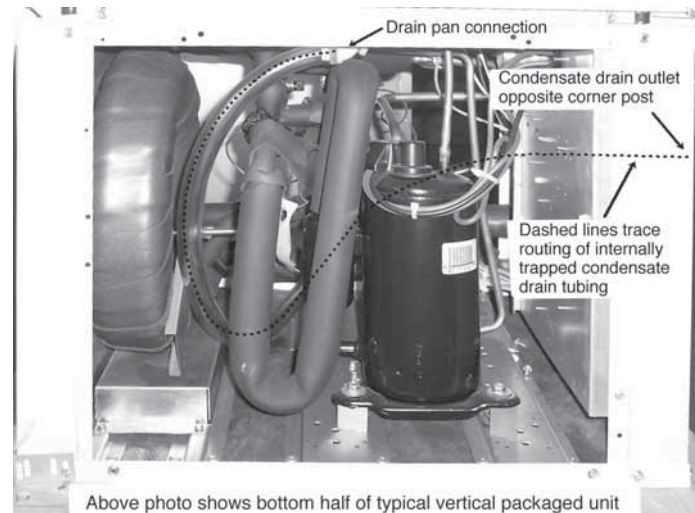
Condensate Piping for Vertical Units - A condensate line must be installed and pitched away from the unit to allow for proper drainage. This connection must meet all local plumbing/building codes. Vertical units utilize a condensate hose inside the cabinet as a trapping loop; therefore an external trap 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



Above photo shows bottom half of typical vertical packaged unit

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 30 ft-lbs [41 N-m]. If a torque wrench is not available, tighten finger-tight plus one quarter turn. Tighten steel fittings as necessary.

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

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.

Installer Caution: After making water connections on units equipped with ClimaDry®, ensure the three union nuts on the internal three-way water valve are tight.

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 the ClimaDry® to operate properly.

⚠ 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! ⚠

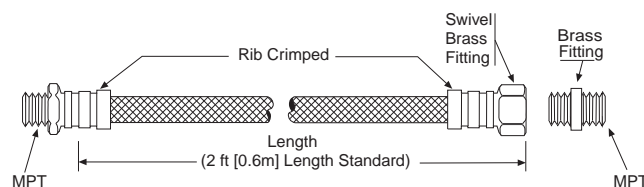
CAUTION! Piping must comply with all applicable codes.

Table 1: Metal Hose Minimum Bend Radii

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



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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 60°F (15.6°C). Metal to plastic threaded joints should never be used due to their tendency to leak over time.

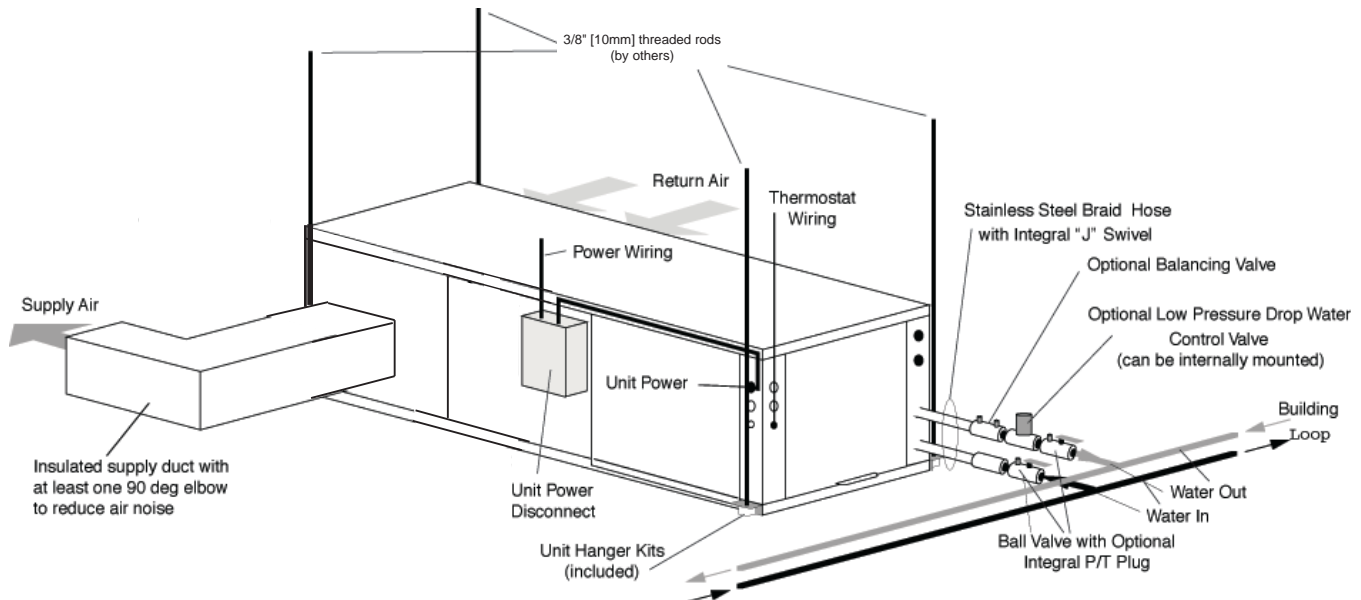
Teflon® tape thread sealant is recommended to minimize internal fouling of the heat exchanger. Do not over tighten connections and route piping so as not to interfere with service or maintenance access. Hose kits are available from ClimateMaster in different configurations as shown in Figure 12 for connection 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 2.25 and 3.5 gpm per ton [2.9 and 4.5 l/m per kW] of cooling capacity. ClimateMaster recommends 3 gpm per ton [3.9 l/m per kW] for most applications of water loop heat pumps. To ensure proper maintenance and servicing, P/T ports are imperative for temperature and flow verification, as well as performance checks.

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

Figure 12: Typical Water-Loop Application



Low Water Temperature Cutout Setting - CXM Control

When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10.0°F [-12.2°C]) setpoint and avoid nuisance faults (see "Low Water Temperature Cutout Selection" in this manual). **Note:**

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 25 and 110°F [-4 to 43°C]. Flow rates between 2.25 and 3 gpm [2.41 to 3.23 l/m per kW] of cooling capacity is recommended in these applications.

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

Flushing the Earth Loop

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

Antifreeze

In areas where minimum entering loop temperatures drop below 40°F [5°C] or where piping will be routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze; however your local sales office should be consulted to determine the antifreeze best suited to your area. Freeze protection should be maintained to 15°F [9°C] below the lowest expected entering loop temperature. For example, if 30°F [-1°C] is the minimum expected entering loop temperature, the leaving loop temperature would be 22 to 25°F [-6 to -4°C] and freeze protection should be at 15°F [-10°C]. Calculation is as follows:
 $30^{\circ}\text{F} - 15^{\circ}\text{F} = 15^{\circ}\text{F}$ [$-1^{\circ}\text{C} - 9^{\circ}\text{C} = -10^{\circ}\text{C}$].

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 Control

When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10.0°F [-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			
	10°F [-12.2°C]	15°F [-9.4°C]	20°F [-6.7°C]	25°F [-3.9°C]
Methanol	25%	21%	16%	10%
100% USP food grade Propylene Glycol	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

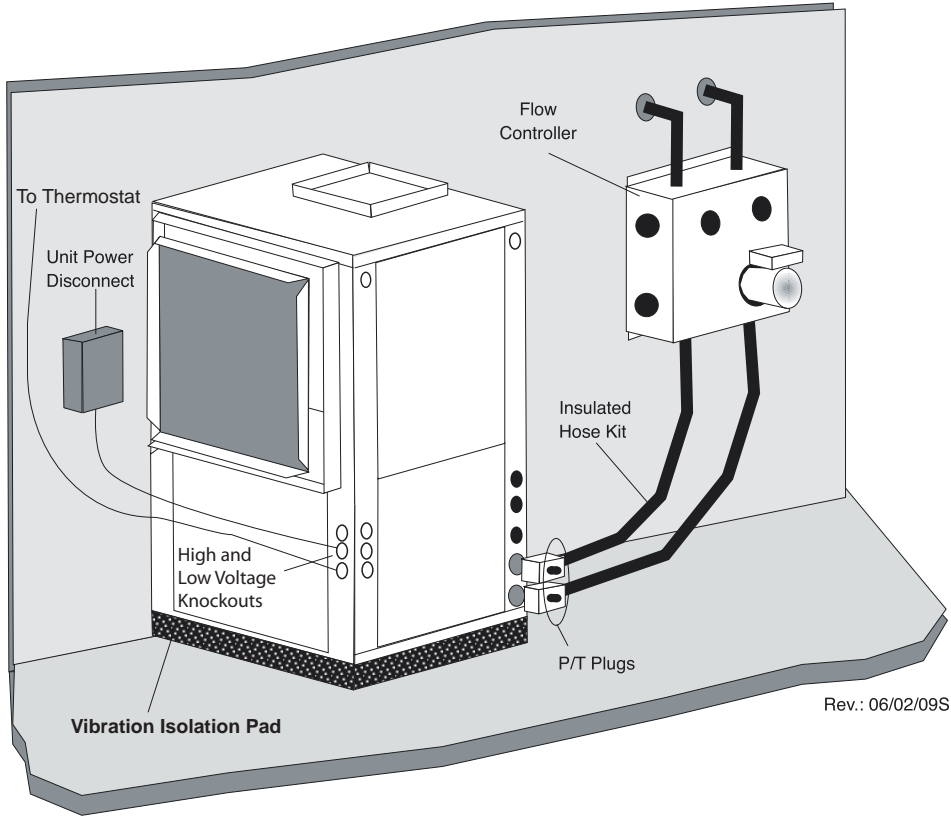
* Must not be denatured with any petroleum based product

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Ground-Loop Heat Pump Applications

Figure 13: Typical Ground-Loop Application



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. Supply and return water piping should be limited to copper, HPDE, or other acceptable high temperature material. Note that PVC or CPVC material is not recommended as they are not compatible with the polyolester oil used in HFC-410A products.

⚠ 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, 150°F [66°C] for direct use (well water/open loop) and DHW (desuperheater); 90°F [32°F] 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

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Ground-Water Heat Pump Applications

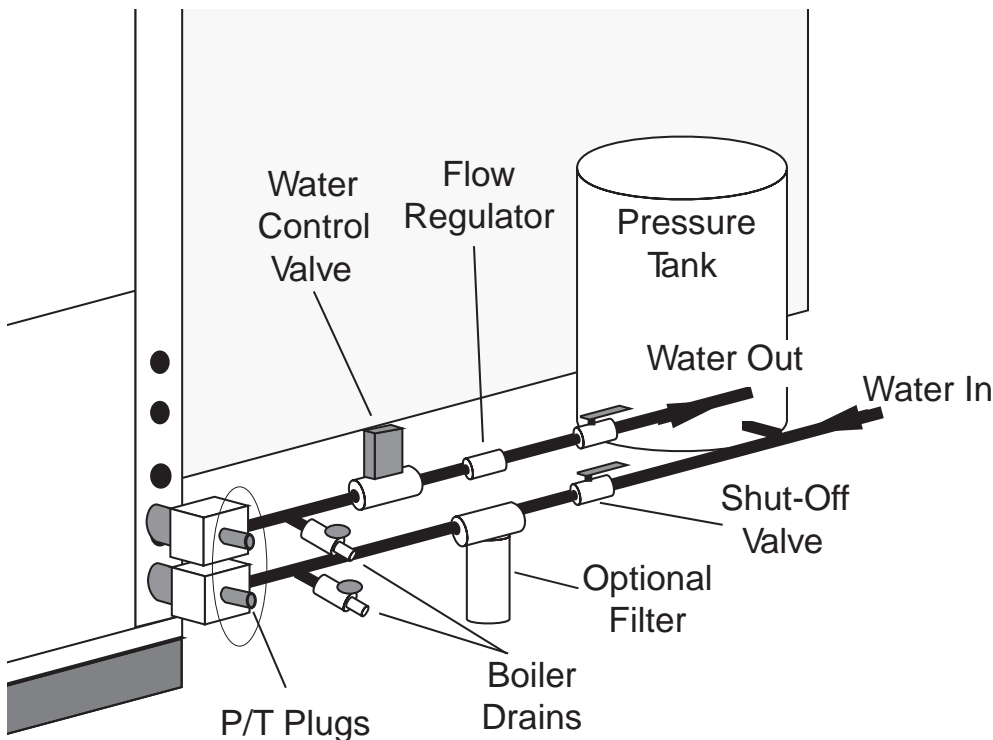
by two methods. One method of flow regulation involves simply adjusting the ball valve or water control valve on the discharge line. Measure the pressure drop through the unit heat exchanger, and determine flow rate from Tables 8a through 8e. Since the pressure is constantly varying, two pressure gauges may be needed. Adjust the valve until the desired flow of 1.5 to 2 gpm per ton [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.

(2.6 l/m per kW) is required.

Water Coil Low Temperature Limit Setting - For all open loop systems the 30°F [-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.

Note: When EWT is below 50°F [10°C], 2 gpm per ton

Figure 14: Typical Open Loop/Well Application



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	Copper Cupronickel 304 SS 316 SS Titanium	- - - - -	Maximum Allowable at maximum water temperature.		
			10°C	24°C	38°C
			<20ppm	NR	NR
			<150 ppm	NR	NR
			<400 ppm	<250 ppm	<150 ppm
<1000 ppm	<550 ppm	< 375 ppm			
>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. Rev.: 5/6/2014 S

- 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.

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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.

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

⚠ WARNING! ⚠

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

⚠ CAUTION! ⚠

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

Electrical - Line Voltage

Table 4a: Tranquility® 30 (TT) Series Electrical Data (Standard Units)

All TT Units								Standard TT Units		
Model	Voltage Code	Voltage	Min/Max Voltage	Compressor			Fan Motor FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/HACR
				QTY	RLA	LRA				
TT 026	G	208/230/60/1	197/252	1	11.7	58.3	3.9	15.6	18.5	30
	E	265/60/1	239/292	1	9.1	54.0	3.2	12.3	14.6	20
	H	208/230/60/3	197/252	1	6.5	55.4	3.9	10.4	12.0	15
	F*	460/60/3*	414/506	1	3.5	28.0	3.2	6.7	7.6	15
TT 038	G	208/230/60/1	197/252	1	15.3	83.0	3.9	19.2	23.0	35
	H	208/230/60/3	197/252	1	11.6	73.0	3.9	15.5	18.4	30
	F*	460/60/3*	414/506	1	5.7	38.0	3.2	8.9	10.3	15
TT 049	G	208/230/60/1	197/252	1	21.2	104.0	6.9	28.1	33.4	50
	H	208/230/60/3	197/252	1	14.0	83.1	6.9	20.9	24.4	35
	F*	460/60/3*	414/506	1	6.4	41.0	6.0	12.4	14.0	20
TT 064	G	208/230/60/1	197/252	1	27.1	152.9	6.9	34.0	40.8	60
	H	208/230/60/3	197/252	1	16.5	110.0	6.9	23.4	27.5	40
	F*	460/60/3*	414/506	1	7.2	52.0	6.0	13.2	15.0	20
TT 072	G	208/230/60/1	197/252	1	29.7	179.2	6.9	36.6	44.0	70
	H	208/230/60/3	197/252	1	17.6	136.0	6.9	24.5	28.9	45
	F*	460/60/3*	414/506	1	8.5	66.1	6.0	14.5	16.6	25

Wire length based on one way measurement with 2% voltage drop

Wire size based on 60°C copper conductor

All fuses Class RK-5

*** NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ECM motors require a four wire power supply with neutral. ECM motor is rated 265 vac and is wired between one hot leg and neutral.**

Table 4b: Tranquility® 30 (TT) Series Electrical Data Units with Secondary Pump or ClimaDry® Reheat

All TT Units				TT Units with ClimaDry®				TT Units with Secondary Pump			
Model	Voltage Code	Voltage	Min/Max Voltage	Reheat Pump FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/HACR	Pump FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/HACR
TT 026	G	208/230/60/1	197/252	0.8	16.4	19.3	30	0.8	16.4	19.3	30
	E	265/60/1	239/292	0.7	13.0	15.3	20	0.7	13.0	15.3	20
	H	208/230/60/3	197/252	0.8	11.2	12.8	15	0.8	11.2	12.8	15
	F*	460/60/3*	414/506	0.7	7.4	8.3	15	0.7	7.4	8.3	15
TT 038	G	208/230/60/1	197/252	0.8	20.0	23.8	35	0.8	20.0	23.8	35
	H	208/230/60/3	197/252	0.8	16.3	19.2	30	0.8	16.3	19.2	30
	F*	460/60/3*	414/506	0.7	9.6	11.0	15	0.7	9.6	11.0	15
TT 049	G	208/230/60/1	197/252	0.8	29.2	34.5	50	0.8	28.9	34.2	50
	H	208/230/60/3	197/252	0.8	22.0	25.5	35	0.8	21.7	25.2	35
	F*	460/60/3*	414/506	0.7	13.5	15.1	20	0.7	13.1	14.7	20
TT 064	G	208/230/60/1	197/252	1.1	35.1	41.8	60	1.1	35.1	41.8	60
	H	208/230/60/3	197/252	1.1	24.5	28.6	45	1.1	24.5	28.6	45
	F*	460/60/3*	414/506	1.1	14.3	16.1	20	1.1	14.3	16.1	20
TT 072	G	208/230/60/1	197/252	1.1	37.7	45.1	70	1.1	37.7	45.1	70
	H	208/230/60/3	197/252	1.1	25.6	30.0	45	1.1	25.6	30.0	45
	F*	460/60/3*	414/506	1.1	15.6	17.7	25	1.1	15.6	17.7	25

Wire length based on one way measurement with 2% voltage drop

Wire size based on 60°C copper conductor

All fuses Class RK-5

*** NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ECM motors require a four wire power supply with neutral. ECM motor is rated 265 vac and is wired between one hot leg and neutral.**

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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.

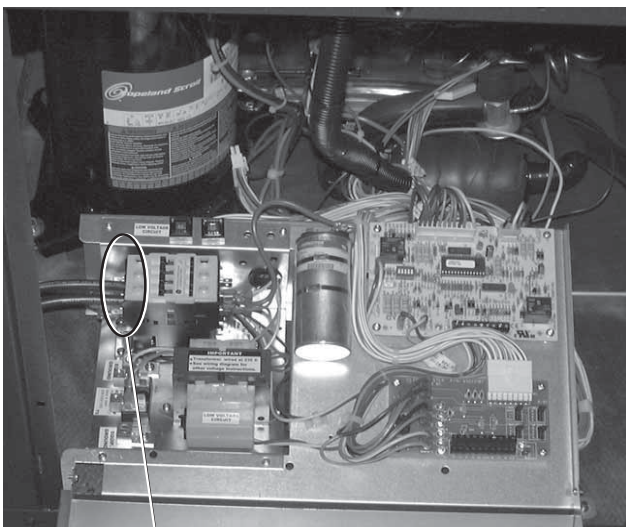
Power Connection - Line voltage connection is made by connecting the incoming line voltage wires to the "L" side of the contractor as shown in Figure 15. Consult electrical data tables for correct fuse size.

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

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.

Figure 15: 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
(see electrical table for wire and
breaker size)

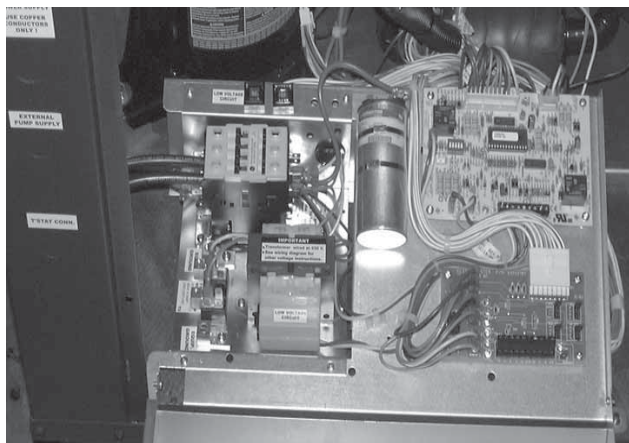
**Note: 460V units with
ECM motor require
a neutral wire.**

Electrical - Power & Low Voltage Wiring

ELECTRICAL - LOW VOLTAGE WIRING

Thermostat Connections - Depending on the unit model the thermostat will be wired to either the ECM control board or a terminal block, both are located within the unit control box. Refer to the unit wiring diagram for specific details.

Figure 16: Low Voltage Field Wiring



Low voltage field wiring for units with ECM fan

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). 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.

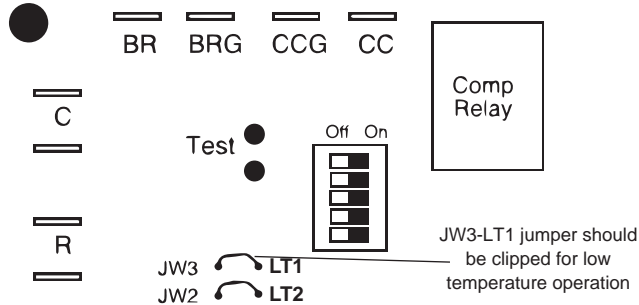
The factory setting for FP1 is for systems using water (30°F [-1.1°C] refrigerant temperature). In low water temperature (extended range) applications with antifreeze (most ground loops), jumper JW3 should be clipped as shown in Figure 17 to change the setting to 10°F [-12.2°C] refrigerant temperature, a more suitable temperature when using an antifreeze solution. All ClimateMaster units operating with entering water temperatures below 60°F [15.6°C] must include the optional water/refrigerant circuit insulation package to prevent internal condensation.

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Electrical - Low Voltage Wiring

Figure 17: LT1 Limit Setting



CXM PCB

Accessory Connections

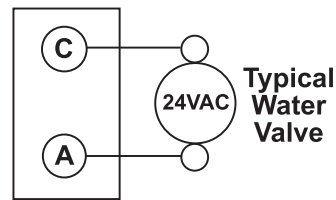
A terminal paralleling the compressor contactor coil has been provided on the CXM/DXM control. Terminal "A" is designed to control accessory devices, such as water valves. Note: This terminal should be used only with 24 Volt signals and not line voltage. Terminal "A" is energized with the compressor contactor. See Figure 18 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
Remaining VA for Accessories	19 - 29
+ DXM board (8 - 12 VA)*	24 - 34
Remaining VA for Accessories	41 - 51

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

Figure 18: Accessory Wiring Terminal Strip



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 18 shows typical wiring for a 24VAC external solenoid valve. Figures 19 and 20 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.

Two-stage Units

Tranquility® 30 (TT) two-stage units should be designed with two parallel valves for ground water applications to limit water use during first stage operation. For example, at 1.5 gpm/ton [2.0 l/m per kW], a TT049 unit requires 6 gpm [23 l/m] for full load (2nd stage) operation, but only 4 gpm [15 l/m] during 1st stage operation. Since the unit will operate on first stage 80-90% of the time, significant water savings can be realized by using two parallel solenoid valves with two flow regulators. In the example above, stage one solenoid would be installed with a 4 gpm [15 l/m] flow regulator on the outlet, while stage two would utilize a 2 gpm [8 l/m] flow regulator. When stage one is operating, the second solenoid valve will be closed. When stage two is operating, both valves will be open, allowing full load flow rate.

Figure 21 illustrates piping for two-stage solenoid valves. Review figures 19-20 for wiring of stage one valve. Stage two valve should be wired between terminal "Y2" (ECM board) and terminal "C." NOTE: When EWT is below 50°F [10°C], 2 gpm per ton (2.6 l/m per kW) is required.

Electrical - Low Voltage Wiring

Figure 19: AVM Valve Wiring

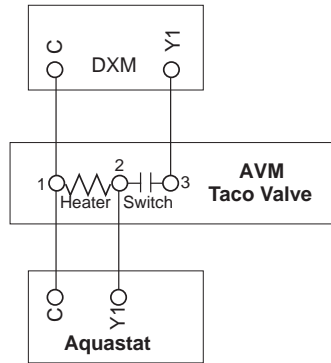


Figure 20: Taco SBV Valve Wiring

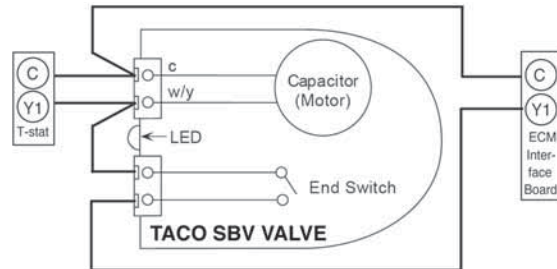
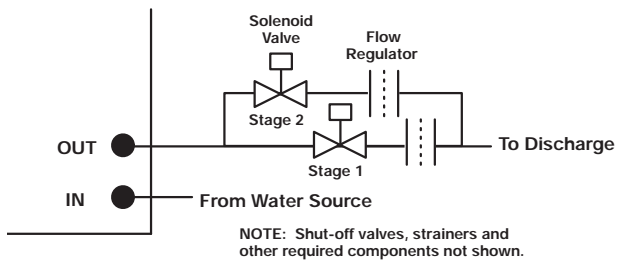


Figure 21: Two-Stage Piping



Tranquility® 30 (TT) Series

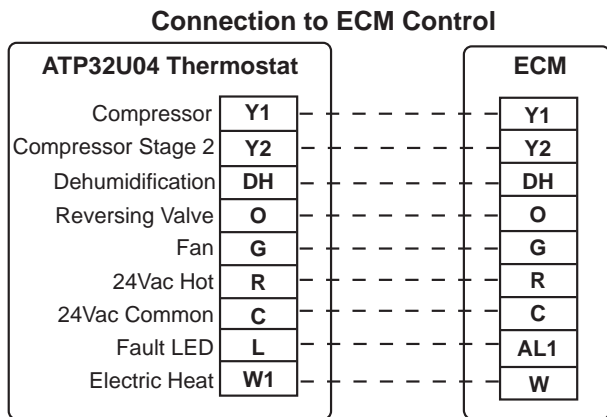
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Electrical - Thermostat Wiring

Thermostat Installation - The thermostat should be located on an interior wall in a larger room, away from supply duct drafts. DO NOT locate the thermostat in areas subject to sunlight, drafts or on external walls. The wire access hole behind the thermostat may in certain cases need to be sealed to prevent erroneous temperature measurement. Position the thermostat back plate against the wall so that it appears level and so the thermostat wires protrude through the middle

of the back plate. Mark the position of the back plate mounting holes and drill holes with a 3/16" (5mm) bit. Install supplied anchors and secure plate to the wall. Thermostat wire must be 18 AWG wire. Representative thermostat wiring is shown in Figures 22a-c however, actual wiring connections should be determined from the thermostat IOM and or unit wiring diagram. Practically any heat pump thermostat will work with ClimateMaster units, provided it has the correct number of heating and cooling stages.

Figure 22a: Auto-dehumidification Control



Units with CXM or DXM board and ECM fan motor, utilizing ECM dehumidification mode (w/o ClimaDry option)

- Notes:
- 1) ECM dehumidification mode slows down fan speed in the cooling mode when dehumidification output from thermostat is active. Normal heating and cooling fan speeds are not affected.
 - 2) ECM board DIP switch SW9 must be in dehumid. mode.

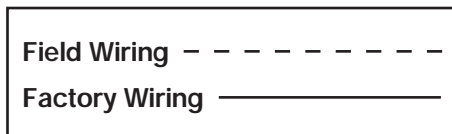


Figure 22b: No Dehumidification Control.

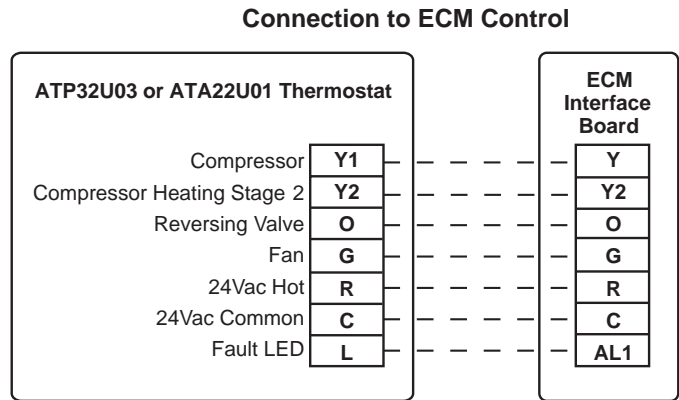
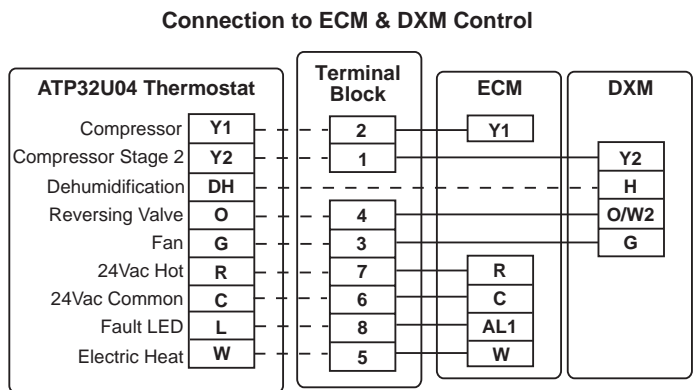


Figure 22c: Units with ClimaDry® Reheat



Blower Performance Data

TT Standard Unit - No Reheat

Airflow in CFM with wet coil and clean air filter

Model	Max ESP (in. wg)	Fan Motor (hp)	Tap Setting	Cooling Mode			Dehumid Mode			Heating Mode		
				Stg 1	Stg 2	Fan	Stg 1	Stg 2	Fan	Stg 1	Stg 2	Fan
026	0.50	1/2	4	810	950	475	630	740	475	920	1060	475
	0.50	1/2	3	725	850	425	560	660	425	825	950	425
	0.50	1/2	2	620	730	370	490	570	370	710	820	370
	0.50	1/2	1	520	610	300				600	690	300
038	0.50	1/2	4	1120	1400	700	870	1090	700	1120	1400	700
	0.50	1/2	3	1000	1250	630	780	980	630	1000	1250	630
	0.50	1/2	2	860	1080	540	670	840	540	860	1080	540
	0.50	1/2	1	730	900	450				730	900	450
049	0.75	1	4	1460	1730	870	1140	1350	870	1560	1850	870
	0.75	1	3	1300	1550	780	1020	1210	780	1400	1650	780
	0.75	1	2	1120	1330	670	870	1040	670	1200	1430	670
	0.75	1	1	940	1120	560				1010	1200	560
064	0.75	1	4	1670	2050	1020	1300	1600	1020	1860	2280	1020
	0.75	1	3	1500	1825	920	1160	1430	920	1650	2050	920
	0.75	1	2	1280	1580	790	1000	1230	790	1430	1750	790
	0.75	1	1	1080	1320	660				1200	1470	660
072	0.75	1	4	1620	2190	1050	1270	1650	1050	1690	2230	1050
	0.75	1	3	1500	1950	980	1170	1520	980	1600	2100	980
	0.75	1	2	1400	1830	910	1100	1420	910	1400	1850	910
	0.75	1	1	1320	1700	850				1240	1620	850

Factory shipped on Tap Setting 2

During Auxiliary operation (residential units only) the CFM will run at the higher if the heating (delay jumper) or AUX settings

Airflow is controlled within +/- 5% up to Max ESP shown with wet coil and standard 1" fiberglass filter

Do not select Dehumidification mode if HP CFM is on setting 1

All units AHRI/ISO/ASHRAE 13256-1 rated HP (Cooling) Delay (Heating) CFM Setting 3

ClimaDry units are factory wired to operate in Stage 2 airflow.

Tranquility® 30 (TT) Series with ClimaDry® Reheat Option - All Tranquility® 30 (TT) units have an ECM fan motor as a standard feature. The small additional pressure drop of the reheat coil causes the ECM motor to slightly increase RPM to overcome the added pressure drop, and maintain selected CFM up to the maximum ESP.

Unit minimum entering air temperature while in the dehumidification, cooling, or continuous fan modes is **70°F DB/61°F WB**. Operation below this minimum may result in nuisance faults.

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ECM Blower Control

The ECM fan is controlled by an interface board that converts thermostat inputs and field selectable CFM settings to signals used by the ECM motor controller. Fan speeds are selected with DIP switch settings. To take full advantage of the ECM motor features, a multi-stage thermostat should be used (2-stage heat/2-stage cool or 3-stage heat/2-stage cool).

Note: Power must be off to the unit for at least three seconds before the ECM motor will recognize a speed change. The motor will recognize a change in the CFM Adjust or dehumidification mode settings while the unit is powered.

There are four different airflow settings from lowest airflow rate (speed tap 1) to the highest airflow rate (speed tap 4).

Cooling Settings: The cooling setting determines the cooling (normal) CFM for all units with ECM motor. Cooling (normal) setting is used when the unit is not in dehumidification mode. Tap 1 is the lowest CFM setting, while tap 4 is the highest CFM setting. To avoid air coil freeze-up, tap 1 may not be used if the dehumidification mode is selected. Consult submittal data or specifications catalog for the specific unit series and model to correlate speed tap setting to airflow in CFM.

Heating Settings: The heating setting determines the heating CFM. Tap 1 is the lowest CFM setting, while tap 4 is the highest CFM setting. Consult submittal data or specifications catalog for the specific unit series and model to correlate speed tap setting to airflow in CFM.

CFM Adjust Settings: The CFM adjust setting allows four selections. The NORM setting is the factory default position. The + or – settings adjust the airflow by +/- 5%. The +/- settings are used to “fine tune” airflow adjustments. The TEST setting runs the ECM motor at 400 cfm/ton, which causes the motor to operate like a standard PSC motor, and disables the CFM counter.

Dehumidification Mode Settings: The dehumidification mode setting provides field selection of humidity control. When operating in the normal mode, the cooling airflow settings are determined by the cooling tap setting above. When dehumidification is enabled there is a reduction in airflow in cooling to increase the moisture removal of the heat pump. Consult submittal data or specifications catalog for the specific unit series and model to correlate speed tap to airflow in CFM. The dehumidification mode can be enabled in two ways.

1. **Constant Dehumidification Mode:** When the dehumidification mode is selected (via DIP switch or jumper setting), the ECM motor will operate with a multiplier applied to the cooling CFM settings (approx. 20-25% lower airflow). Any time the unit is running in the cooling mode, it will operate at the lower airflow to improve latent capacity. The “DEHUM” LED will be illuminated at all times. Heating airflow is not affected **Note: Do not select dehumidification mode if cooling setting is tap 1.**
2. **Automatic (Humidistat-controlled) Dehumidification Mode:** When the dehumidification mode is selected (via DIP switch or jumper setting AND a humidistat is connected to terminal DH(version II) or HUM (version I), the cooling airflow will only be reduced when the humidistat senses that additional dehumidification is required. The DH (or HUM) terminal is reverse logic. Therefore, a humidistat (not dehumidistat) is required. The “DEHUM” LED will be illuminated only when the humidistat is calling for dehumidification mode. Heating airflow is not affected. **Note: Do not select dehumidification mode if cooling setting is tap 1.**

The ECM motor includes “soft start” and “ramp down” features. The soft start feature is a gentle increase of motor rpm at blower start up. This creates a much quieter blower start cycle.

The ramp down feature allows the blower to slowly decrease rpm to a full stop at the end of each blower cycle. This creates a much quieter end to each blower cycle and adds overall unit efficiency.

ECM Blower Control

The ramp down feature may be eliminated during an ESD (Emergency Shut Down) situation when using a DXM unit controller. A relay is required to break the line voltage to the ECM motor during ESD. This relay can be wired as shown below to eliminate the ramp down (and operation) of the ECM blower motor.

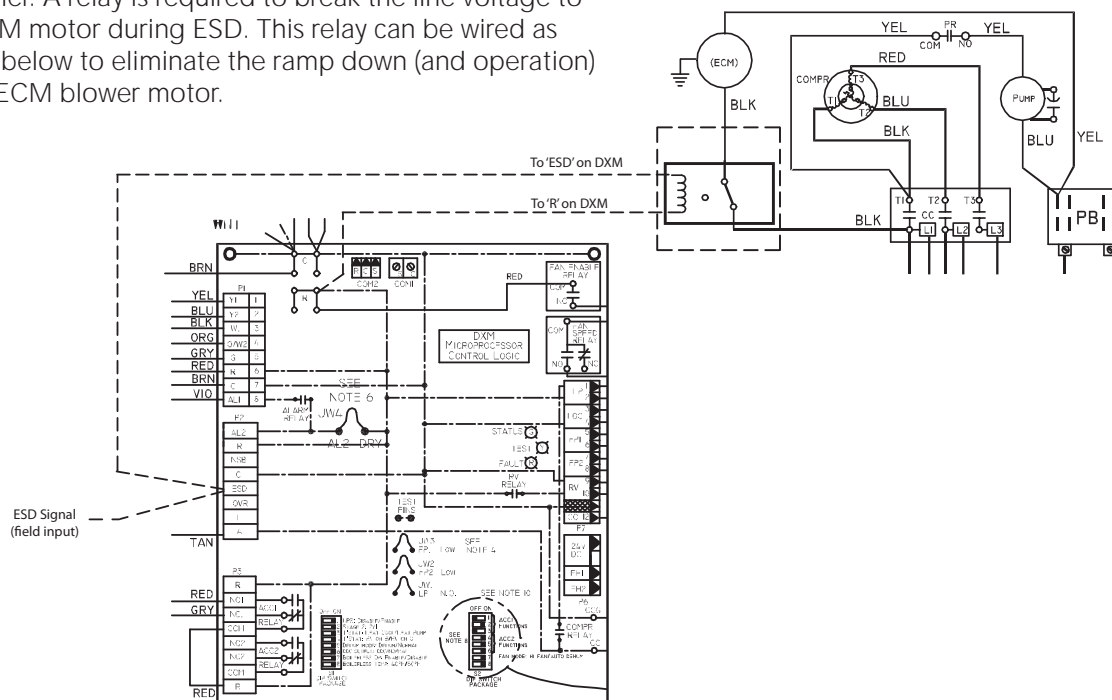


Table 5: ECM Board Tap Settings

Cooling settings

Tap Setting	DIP Switch	
	SW1	SW2
1	ON	ON
2	ON	OFF
3	OFF	ON
4	OFF	OFF

Heating settings

Tap Setting	DIP Switch	
	SW3	SW4
1	ON	ON
2	ON	OFF
3	OFF	ON
4	OFF	OFF

CFM Adjust settings

Tap Setting	DIP Switch	
	SW7	SW8
TEST	ON	ON
-	ON	OFF
+	OFF	ON
NORM	OFF	OFF

Dehum Mode settings

Tap Setting	DIP Switch
	SW9
NORM	ON
Dehumid	OFF

Only DIP switch numbers 1 to 4 and 7 to 9 are used.

CXM Controls

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

Field Selectable Inputs - Test mode: Test mode allows the service technician to check the operation of the control in a timely manner. At board, momentarily shorting the test terminals or externally, momentarily push test button (See Fig 10), 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 or holding button 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-LT1 Low Temp) provides field selection of temperature limit setting for LT1 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature).

Not Clipped = 30°F [-1°C]. Clipped = 10°F [-12°C].

Air coil low temperature limit setting: Jumper 2 (JW2-LT2 Low Temp) provides field selection of temperature limit setting for LT2 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature). Note: This jumper should only be clipped under extenuating circumstances, as recommended by the factory.

Not Clipped = 30°F [-1°C]. Clipped = 10°F [-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: LED And Alarm Relay Operations

Description of Operation	LED	Alarm
Normal Mode	ON	Open
Normal Mode w/UPS Warning	ON	Cycle (Closed 5 seconds, Open 25 seconds)
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 - LT1 Fault in Memory	Flashing Code 4	Cycling Code 4
Test Mode - LT2 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.

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DXM Controls

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

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-LT1 Low Temp) provides field selection of temperature limit setting for LT1 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature).

Not Clipped = 30°F [-1°C]. Clipped = 10°F [-12°C]. Air coil low temperature limit setting; Jumper 2 (JW2-LT2 Low Temp) provides field selection of temperature limit setting for LT2 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature). **Note: This jumper should only be clipped under extenuating circumstances, as recommended by ClimateMaster technical services.**

Not Clipped = 30°F [-1°C]. Clipped = 10°F [-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.

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

DXM Controls

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.

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 LT1 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 LT1 thermistor is sensing refrigerant temperature between the coaxial heat exchanger and the expansion device (TXV). Therefore, the 50°F [10°C] setting is not 50°F [10°C] water, but approximately 60°F [16°C] EWT.

On = 50°F [10°C]. Off = 40°F [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 5c for description of functionality.

2.2 - Accessory1 relay personality: DIP 2.2 provides selection of ACC 1 relay personality (relay operation/ characteristics). See table 5c for description of functionality.

2.3 - Accessory1 relay personality: DIP 2.3 provides

selection of ACC 1 relay options. See table 5c for description of functionality.

2.4 - Accessory2 relay personality: DIP 2.4 provides selection of ACC 2 relay personality (relay operation/ characteristics). See table 5c for description of functionality.

2.5 - Accessory2 relay personality: DIP 2.5 provides selection of ACC 2 relay personality (relay operation/ characteristics). See table 5c for description of functionality.

2.6 - Accessory2 relay personality: DIP 2.6 provides selection of ACC 2 relay options. See table 5c 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

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Safety Features - 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:** LT1/LT2 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 (LT1): The LT1 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 LT1 fault. The LT1 input is bypassed for the initial 120 seconds of a compressor run cycle. LT1 is set at the factory for one try. Therefore, the control will go into lockout mode once the LT1 fault has occurred.

LT1 lockout code = 4

Air coil low temperature (LT2): The LT2 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 LT2 fault. The LT2 input is bypassed for the initial 60 seconds of a compressor run cycle. LT2 is set at the factory for one try. Therefore, the control will go into lockout mode once the LT2 fault has occurred.

LT2 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, LT2 is greater than 125°F [52°C] for 30 continuous seconds, or:
- In cooling mode with compressor energized, LT1 is greater than 125°F [52°C] for 30 continuous seconds, or:
- In cooling mode with compressor energized, LT2 is less than 40°F [4.5°C] for 30 continuous seconds.

Safety Features - CXM and DXM Controls

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

Swapped LT1/LT2 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 LT1 sensor is colder than the LT2 sensor, or:
- b. The compressor is on in the heating mode and the LT2 sensor is colder than the LT1 sensor.

Swapped LT1/LT2 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.

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ClimaDry® Modulating Reheat Option

ClimaDry® Sequence Of Operation

A heat pump equipped with ClimaDry® can operate in three modes, cooling, cooling with reheat, and heating. The cooling/heating modes are like any other ClimateMaster WSHP. The reversing valve ("O" signal) is energized in cooling, along with the compressor contactor(s) and blower relay. In the heating mode the reversing valve is de-energized. Almost any thermostat will activate the heat pump in heating or cooling modes. The DXM microprocessor board, which is standard with the ClimaDry® option, will accept either heat pump (Y,O) thermostats or non-heat pump (Y,W) thermostats.

The reheat mode requires either a separate humidistat/dehumidistat or a thermostat that has an integrated dehumidification function for activation. The DXM board is configured to work with either a humidistat or dehumidistat input to terminal "H" (DIP switch settings for the DXM board are shown below in table 7). Upon receiving an "H" input, the DXM board will activate the cooling mode and engage reheat. Table 8 shows the relationship between thermostat input signals and unit operation.

There are four operational inputs for single stage units and six operational inputs for dual stage units:

- Fan Only
- 1st Stage Cooling
- 2nd Stage Cooling
- 1st Stage Heating
- 2nd Stage Heating
- Reheat Mode

- **Fan Only:** A (G) call from the thermostat to the (G) terminal of the DXM control board will bring the unit on in fan only mode.
- **1st Stage Cooling:** A simultaneous call from (G), (Y1), and (O) to the (G), (Y1), (O/W2) terminals of the DXM control board will bring the unit on in 1st Stage Cooling.
- **2nd Stage Cooling:** A simultaneous call from (G), (Y1), (Y2), and (O) to the (G), (Y1), (Y2), and (O/W2) terminals of the DXM control board will bring the unit on in 2nd Stage Cooling. When the call is satisfied at the thermostat the unit will continue to run in 1st Stage Cooling until the 1st Stage Cooling call is removed or satisfied, shutting down the unit. Note: Not all units have two-stage cooling functionality (e.g. GC series units).
- **1st Stage Heating:** A simultaneous call from (G) and (Y1) to the (G) and (Y1) terminals of the DXM control board will bring the unit on in 1st Stage Heating.

- **2nd Stage Heating:** A simultaneous call from (G), (Y1), and (Y2) to the (G), (Y1), and (Y2) terminals of the DXM control board will bring the unit on in 2nd Stage Heating. When the call is satisfied at the thermostat the unit will continue to run in 1st Stage Heating until the call is removed or satisfied, shutting down the unit. NOTE: Not all units have two-stage heating functionality (e.g. GC series units).
- **Reheat Mode:** A call from the Humidistat/Dehumidistat to the (H) terminal of the DXM control board will bring the unit on in Reheat Mode if there is no call for cooling at the thermostat. When the Humidistat/Dehumidification call is removed or satisfied the unit will shut down. Note: Cooling always overrides Reheat Mode. In the Cooling mode, the unit cools and dehumidifies. If the cooling thermostat is satisfied but there is still a call for dehumidification, the unit will continue to operate in Reheat Mode.

ClimaDry® Component Functions

The ClimaDry® option consists of the following components:

- Proportional Controller
- Supply Air Sensor
- Motorized Valve
- Loop Pump
- Hydronic Coil

The Proportional Controller operates on 24 VAC power supply and automatically adjusts the water valve based upon the Supply Air Sensor. The Supply Air Sensor senses supply air temperature at the blower inlet providing the input signal necessary for the proportional control to drive the motorized valve during the reheat mode of operation. The Motorized Valve is a proportional actuator/three-way valve combination used to divert the condenser water from the coax to the hydronic reheat coil during the reheat mode of operation. The proportional controller sends a signal to the motorized valve based on the supply air temperature of the supply air sensor.

ClimaDry® Modulating Reheat Option

The Loop Pump circulates condenser water through the hydronic reheat coil during the reheat mode of operation. In this application, the loop pump is only energized during the reheat mode of operation. The Hydronic Coil is utilized during the reheat mode of operation to reheat the air to the setpoint of the proportional controller. Condenser water is diverted by the motorized valve and pumped through the hydronic coil by the loop pump in proportion to the control setpoint. The amount of reheating is dependent on the setpoint and how far from setpoint the supply air temperature is. The factory setpoint is 70–75°F [21–24°C], generally considered “neutral” air.

ClimaDry® Application Considerations

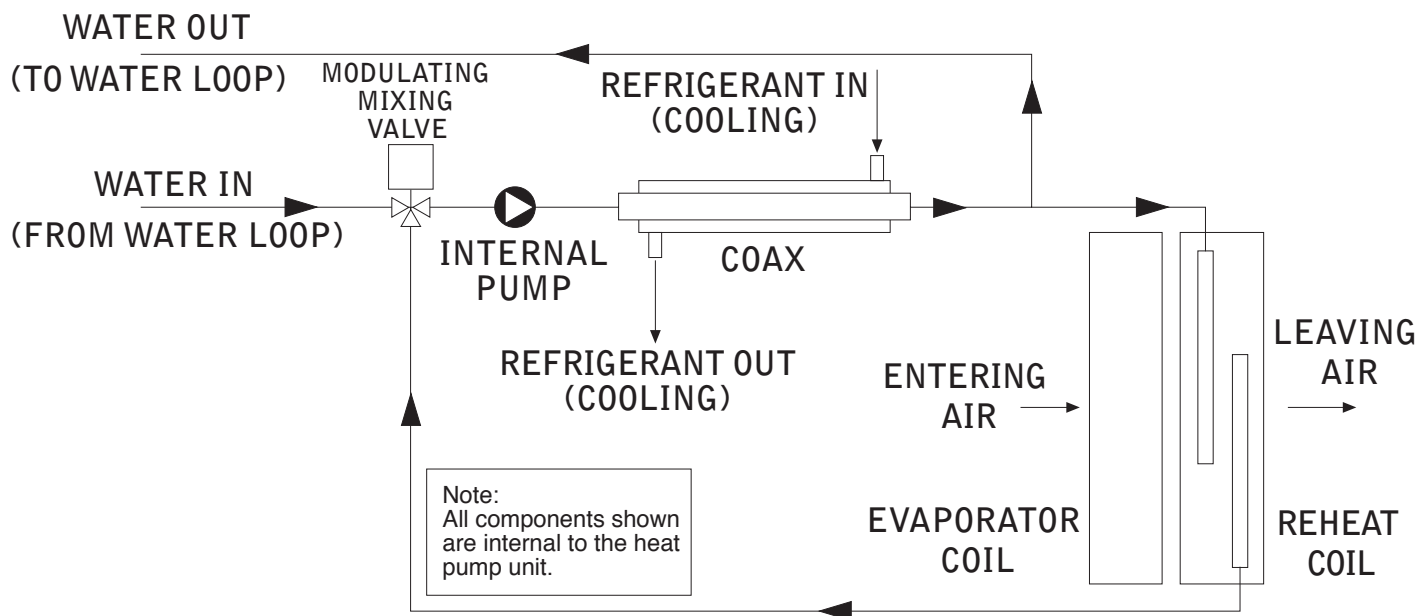
Unlike most hot gas reheat options, the ClimaDry® option will operate over a wide range of EWTs. Special flow regulation (water regulating valve) is not required for low EWT conditions. However, below 55°F [13°C], supply air temperatures may not be maintained at 72°F [22°C] because the cooling capacity exceeds the reheat coil capacity at low water temperatures. Below 55°F [13°C], essentially all water is diverted to the

reheat coil (no heat of rejection to the building loop). Although the ClimaDry® option will work fine with low EWTs, overcooling of the space may result with well water systems or on rare occasions with ground loop (geothermal) systems (**Note: Extended range units are required for well water and ground loop systems**). Since dehumidification is generally only required in cooling, most ground loop systems will not experience overcooling of the supply air temperature. If overcooling of the space is a concern (e.g. computer room well water application), auxiliary heating may be required to maintain space temperature when the unit is operating in the dehumidification mode.

Unit minimum entering air temperature while in the dehumidification, cooling, or continuous fan modes is **65°F DB/55°F WB**. Operation below this minimum may result in nuisance faults.

Water-Source Heat Pumps with ClimaDry® should not be used as make-up air units. These applications should use equipment specifically designed for makeup air.

Figure 24: ClimaDry® Schematic



CLIMATEMASTER WATER-SOURCE HEAT PUMPS

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ClimaDry® Modulating Reheat Option

Table 7: Humidistat/Dehumidistat Logic & DXM (2.1, 2.2., 2.3) DIP Settings

Sensor	2.1	2.2	2.3	Logic	Reheat (ON) - H	Reheat (OFF) - H
Humidistat	OFF	OFF	OFF	Reverse	0 VAC	24 VAC
Dehumidistat	OFF	ON	OFF	Standard	24 VAC	0 VAC

Table 8: ClimaDry® Operating Modes

Mode	Input					Output				
	O	G	Y1	Y2 ³	H	O	G	Y1	Y2 ³	Reheat
No Demand	ON/OFF	OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF	OFF	OFF
Fan Only	ON/OFF	ON	OFF	OFF	OFF	ON/OFF	ON	OFF	OFF	OFF
Cooling 1st Stage	ON	ON	ON	OFF	OFF	ON	ON	ON	OFF	OFF
Cooling 2nd Stage	ON	ON	ON	ON	OFF	ON	ON	ON	ON	OFF
Cooling & Dehumidistat ¹	ON	ON	ON	ON/OFF	ON	ON	ON	ON	ON/OFF	OFF
Dehumidistat Only	ON/OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON
Heating 1st Stage	OFF	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF
Heating 2nd Stage	OFF	ON	ON	ON	OFF	OFF	ON	ON	ON	OFF
Heating & Dehumidistat ²	OFF	ON	ON	ON/OFF	ON	OFF	ON	ON	ON/OFF	OFF

¹Cooling input takes priority over dehumidify input.

²DXM is programmed to ignore the H demand when the unit is in heating mode.

³N/A for single stage units; Full load operation for dual capacity units.

⁴ON/OFF = Either ON or OFF.

UNIT STARTING AND OPERATING CONDITIONS

Operating Limits

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

Power Supply – A voltage variation of +/- 10% of nameplate utilization voltage is acceptable.

Determination of operating limits is dependent primarily upon three factors: 1) return air temperature. 2) water temperature, and 3) ambient temperature. When any one of these factors is at minimum or maximum levels, the other two factors should be at normal levels to ensure proper unit operation. Extreme variations in temperature and humidity and/or corrosive water or air will adversely affect unit performance, reliability, and service life. Consult Table 9a for operating limits.

Table 9a: Operating Limits

Operating Limits	TT	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45°F [7°C]	39°F [4°C]
Rated ambient air, DB	80.6°F [27°C]	68°F [20°C]
Max. ambient air, DB	130°F [54.4°C]	85°F [29°C]
Min. entering air, DB/WB	*60/45°F [16/7°C]	40°F [4.4°C]
Rated entering air, DB/WB	80.6/66.2°F [27/19°C]	68°F [20°C]
Max. entering air, DB/WB	100/75°F [38/24°C]	80°F [27°C]
Water Limits		
Min. entering water	30°F [-1°C]	20°F [-6.7°C]
Normal entering water	50-110°F [10-43°C]	30-70°F [-1 to 21°C]
Max. entering water	120°F [49°C]	90°F [32°C]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

*If with ClimaDry® 65/55°

Unit Starting and Operating Conditions

Commissioning Conditions

Consult Table 9b for the particular model. Starting conditions vary depending upon model and are based upon the following notes:

Notes:

1. 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.
2. Voltage utilization range complies with AHRI Standard 110.

Table 9b: Building Commissioning Limits

Commissioning Limits	Cooling	Heating
Air Limits		
Min. ambient air, DB	45°F [7°C]	39°F [4°C]
Rated ambient air, DB	80.6°F [27°C]	68°F [20°C]
Max. ambient air, DB	130°F [54.4°C]	85°F [29°C]
Min. entering air, DB/WB	*50/45°F [10/7°C]	40°F [4.5°C]
Rated entering air, DB/WB	80.6/66.2°F [27/19°C]	68°F [20°C]
Max. entering air, DB/WB	110/83°F [43/28°C]	80°F [27°C]
Water Limits		
Min. entering water	30°F [-1°C]	20°F [-6.7°C]
Normal entering water	50-110°F [10-43°C]	30-70°F [-1 to 21°C]
Max. entering water	120°F [49°C]	90°F [32°C]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

*If with ClimaDry® 65/55°

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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 86°F [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 one pound per 150 gallons (.8 kg per 1000 l) of water (or other equivalent approved cleaning agent). Reset the boiler to raise the loop temperature to 100°F [38°C]. Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
8. When the cleaning process is complete, remove the short-circuited hoses. Reconnect the hoses to the proper supply, and return the connections to each of the units. Refill the system and bleed off all air.

9. 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.

Flushing/Purging Units with ClimaDry®

When flushing/purging units equipped with ClimaDry® the unit should be fully flushed/purged before attempting to flush/purge the ClimaDry® coil. Once the unit is flushed, energize the modulating three-way dehumidification valve to allow flow through the ClimaDry® hydronic circuit.

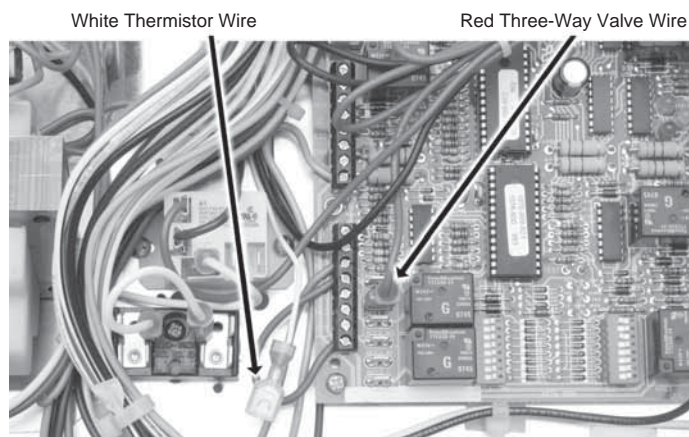
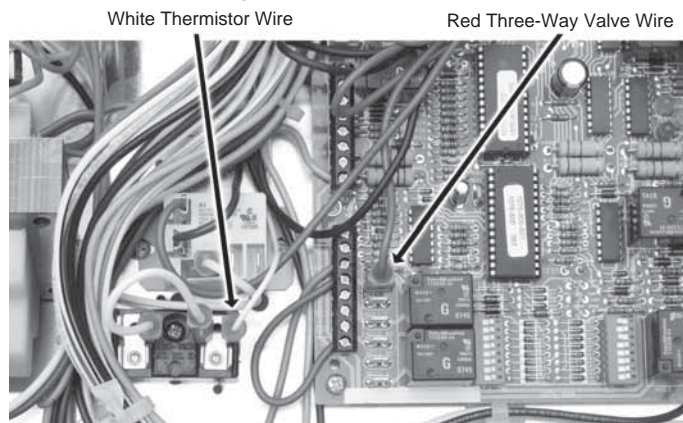
The unit must be powered (but not operating) during flushing/purging. Unit power is required to operate the three-way modulating valve during flushing.

Disable the ClimaDry® sensor located in the supply air stream by removing the white wire from the low voltage terminal block (LVTB) as shown in the figure that follows. Energize the modulating three-way dehumidification valve by removing the red wire from the ACC1 'N.O.' terminal on the DXM board. Connect this wire to the ACC1 'NC' terminal of the DXM controller, as shown in figure 1, to energize the modulating three-way dehumidification valve. Once energized, the valve will take 45 – 75 seconds to fully shift. Continue flushing during this time. After the valve has completed its shift, use the air bleed from the top of the reheat coil to purge air from the coil.

De-energize the valve by removing the red wire from the ACC1 'NC' terminal on the DXM board. The valve will spring return to its normal position in just a few seconds. After the valve has fully returned, repeat the process of running the valve through its cycle and purging air from the reheat coil.

Under extreme circumstances this procedure may be required multiple times to purge all air from the circuit. After completing the flushing/purging procedure, reconnect the red wire to the ACC1 'N.O.' terminal on the DXM for normal operation. Reconnect the white sensor wire to the LVTB, as shown below. If air is allowed to collect in the ClimaDry® piping, nuisance trips may occur. Additional flush/purge cycles may be used when required.

Normal Unit Wiring



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Unit and System Checkout

⚠ WARNING! ⚠

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water source heat pump products containing HFC-410A as system failures and property damage may result.

Unit and System Checkout

BEFORE POWERING SYSTEM, please check the following:

UNIT 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 9a-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 set points for proper operation.
- System pH: Check and adjust water pH if necessary to maintain a level between 6 and 8.5. Proper pH promotes longevity of hoses and fittings (see 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.

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 9b. During start-up checks, loop water temperature entering the heat pump should be between 60°F [16°C] and 95°F [35°C].
5. Two factors determine the operating limits of ClimateMaster heat pumps, (a) return air temperature, and (b) water temperature. When any one of these factors is at a minimum or maximum level, the other factor must be at normal level to ensure proper unit operation.
 - a. Adjust the unit thermostat to the warmest setting. Place the thermostat mode switch in the "COOL" position. Slowly reduce thermostat setting until the compressor activates.
 - b. Check for cool air delivery at the unit grille within a few minutes after the unit has begun to operate.
Note: Units have a five minute time delay in the control circuit that can be eliminated on the CXM/DXM control board as shown below in Figure 25. 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 12. 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 rejection (HR) can be calculated and compared to submittal data capacity pages. The formula for HR for systems with water is as follows:

$$HR \text{ (Btuh)} = TD \times GPM \times 500$$
 where TD is the temperature difference between the entering and leaving water, and GPM is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to table 10. In S-I units, the formula is as follows: $HR \text{ (kW)} = TD \times I/s \times 4.18$.
 - f. Check air temperature drop across the air coil when compressor is operating. Air temperature drop should be between 15°F and 25°F [8°C and 14°C].
 - g. Turn thermostat to "OFF" position. A hissing noise indicates proper functioning of the reversing valve.
6. Allow five (5) minutes between tests for pressure to equalize before beginning heating test.
 - a. Adjust the thermostat to the lowest setting. Place the thermostat mode switch in the "HEAT" position.
 - b. Slowly raise the thermostat to 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 12. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. If temperature is outside of the operating range, check refrigerant pressures and compare to table 11. 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:

$$HE \text{ (kW)} = TD \times GPM \times 500$$
 where TD is the temperature difference between the entering and leaving water, and I/s is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to table 10. In S-I units, the formula is as follows: $HE \text{ (kW)} = TD \times I/s \times 4.18$.
 - e. Check air temperature rise across the air coil when compressor is operating. Air temperature rise should be between 20°F and 30°F [11°C and 17°C].
 - f. Check for vibration, noise, and water leaks.
7. If unit fails to operate, perform troubleshooting analysis (see troubleshooting section). If the check described fails to reveal the problem and the unit still does not operate, contact a trained service technician to ensure proper diagnosis and repair of the equipment.
8. When testing is complete, set system to maintain desired comfort level.

Note: If performance during any mode appears abnormal, refer to the 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.

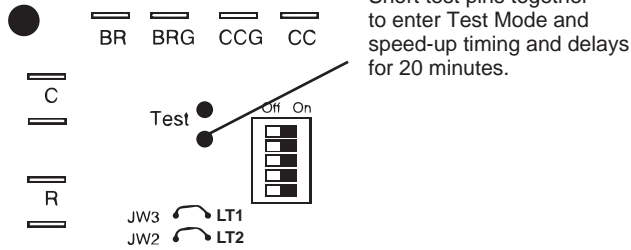
CLIMATEMASTER WATER-SOURCE HEAT PUMPS

Tranquility® 30 (TT) Series

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Unit Start-Up Procedure

Figure 25: 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

Motorized Water Valve Option Corrections

Model	Cv	MOPD	WPD Adders (Part Load)			WPD Adders (Full Load)		
			GPM	PSI	FT	GPM	PSI	FT
026	10.3	150	3.5	0.12	0.27	4.0	0.15	0.35
	10.3	150	5.8	0.31	0.72	6.0	0.34	0.78
	10.3	150	7.0	0.46	1.07	8.0	0.60	1.39
038	10.3	150	4.0	0.15	0.35	4.5	0.19	0.44
	10.3	150	6.0	0.34	0.78	6.8	0.43	0.99
	10.3	150	8.0	0.60	1.39	9.0	0.76	1.76
049	10.3	150	5.5	0.29	0.66	6.0	0.34	0.78
	10.3	150	8.3	0.64	1.48	9.0	0.76	1.76
	10.3	150	11.0	1.14	2.63	12.0	1.36	3.14
064	8.9	150	7.0	0.62	1.43	7.5	0.71	1.64
	8.9	150	10.5	1.39	3.22	11.3	1.60	3.69
	8.9	150	14.0	2.47	5.72	15.0	2.84	6.56
072	8.9	150	7.5	0.71	1.64	8.5	0.91	2.11
	8.9	150	11.3	1.61	3.72	12.8	2.07	4.78
	8.9	150	15.0	2.84	6.56	17.0	3.65	8.43

ClimaDry® II Option Corrections
(When Operating in Non-ClimaDry® Mode)

Model	Additional WPD		
	GPM	PSI	FT
015	1.8	0.32	0.73
	2.8	0.77	1.77
018	2.3	0.52	1.20
	3.4	1.13	2.62
024	3.0	0.88	2.04
	4.5	1.98	4.58
030	3.8	0.62	1.44
	5.6	1.35	3.12
036	4.5	0.87	2.02
	6.8	1.99	4.60
042	5.3	1.21	2.80
	7.9	2.69	6.21
048	6.0	1.55	3.58
	9.0	3.49	8.06
060	7.5	1.49	3.45
	11.3	3.39	7.82

Table 10: TT Coax Water Pressure Drop

Model	U.S. GPM	l/s	l/m	Pressure Drop, psi [kPa]*			
				30°F [-1°C]	50°F [10°C]	70°F [21°C]	90°F [32°C]
026	2.3	0.145	9	0.7 [4.8]	0.4 [2.8]	0.4 [2.8]	0.5 [3.4]
	3.0	0.189	11	1.1 [7.6]	0.7 [4.8]	0.6 [4.1]	0.7 [4.8]
	3.4	0.215	13	1.3 [9.0]	0.9 [6.2]	0.8 [5.5]	0.8 [5.5]
	4.5	0.284	17	2.0 [13.8]	1.4 [9.6]	1.2 [8.3]	1.2 [8.3]
	6.0	0.379	23	3.1 [21.4]	2.3 [15.9]	1.9 [13.1]	1.8 [12.4]
038	3.0	0.189	11	1.5 [10.3]	0.9 [6.2]	0.8 [5.5]	0.9 [6.2]
	4.5	0.284	17	2.6 [17.9]	1.7 [11.7]	1.5 [10.3]	1.5 [10.3]
	6.0	0.379	23	3.8 [26.2]	2.7 [18.6]	2.3 [15.9]	2.2 [15.2]
	6.8	0.429	26	4.5 [31.0]	3.2 [22.0]	2.7 [18.6]	2.6 [17.9]
	9.0	0.568	34	6.9 [47.5]	5.2 [35.8]	4.4 [30.3]	4.1 [28.2]
049	4.5	0.284	17	0.8 [5.5]	0.6 [4.1]	0.5 [3.4]	0.3 [2.1]
	6.0	0.379	23	1.3 [9.0]	1.1 [7.6]	1.0 [6.9]	0.9 [6.2]
	6.8	0.429	26	1.6 [11.0]	1.4 [9.6]	1.3 [9.0]	1.2 [8.3]
	9.0	0.568	34	2.7 [18.6]	2.5 [17.2]	2.3 [15.9]	2.2 [15.2]
	12.0	0.757	45	4.6 [31.7]	4.2 [28.9]	3.8 [26.2]	3.5 [24.1]
064	6.0	0.379	23	0.9 [6.2]	0.2 [1.4]	0.2 [1.4]	0.3 [2.1]
	7.5	0.473	28	1.7 [11.7]	0.9 [6.2]	0.7 [4.8]	0.8 [5.5]
	9.0	0.568	34	2.5 [17.2]	1.5 [10.3]	1.3 [9.0]	1.4 [9.6]
	11.3	0.713	43	3.7 [25.5]	2.6 [17.9]	2.3 [15.9]	2.3 [15.9]
	12.0	0.757	45	4.1 [28.2]	3.0 [20.7]	2.6 [17.9]	2.6 [17.9]
072	15.0	0.947	57	6.1 [42.0]	4.7 [32.4]	4.1 [28.2]	4.0 [27.6]
	7.0	0.442	27	1.4 [9.6]	0.7 [4.8]	0.5 [3.4]	0.7 [4.8]
	8.5	0.536	32	2.2 [15.2]	1.3 [9.0]	1.1 [7.6]	1.2 [8.3]
	10.5	0.663	40	3.3 [22.7]	2.2 [15.2]	1.9 [13.1]	2.0 [13.8]
	12.8	0.808	49	4.6 [31.7]	3.4 [23.4]	3.0 [20.7]	2.9 [20.0]
072	14.0	0.883	53	5.4 [37.2]	4.1 [28.2]	3.6 [24.8]	3.5 [24.1]
	17.0	1.073	64	7.6 [52.4]	6.0 [41.3]	5.4 [37.2]	5.2 [35.9]

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

Unit Operating Conditions

Operating Pressure/Temperature tables include the following notes:

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

Table 11: TT Series Typical Unit Operating Pressures and Temperatures (60Hz - I-P Units)

TT026		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	118-128	159-179	25-30	9-14	16.7-18.7	19-25	72-83	273-293	6-11	3-8	5.9-7.9	16-22
	2.25	118-128	146-166	25-30	7-12	12.3-14.3	20-26	75-85	275-295	6-11	3-8	4.2-6.2	17-23
	3	118-128	132-152	25-30	7-12	7.9-9.9	20-26	78-88	277-297	6-11	3-8	2.7-4.7	18-24
50	1.5	128-138	186-206	18-23	8-13	16.3-18.3	19-25	102-112	302-322	8-12	6-11	8.9-10.9	22-28
	2.25	128-138	172-192	18-23	6-11	12.1-14.1	20-26	106-116	303-323	8-12	6-11	6.7-8.7	23-29
	3	128-138	158-178	18-23	6-11	7.8-9.8	20-26	110-120	305-325	8-12	6-11	4.5-6.5	23-29
70	1.5	136-146	281-301	7-12	7-12	15.7-17.7	19-25	128-138	330-350	10-15	8-13	11.3-13.3	27-34
	2.25	136-146	267-287	7-12	5-10	11.6-13.6	19-25	134-144	332-352	10-15	8-13	8.5-10.5	28-35
	3	136-146	253-273	7-12	4-9	7.6-9.6	19-25	141-151	334-354	10-15	8-13	5.8-7.8	28-35
90	1.5	139-149	368-388	6-11	7-12	14.9-16.9	18-24	162-172	367-387	14-19	10-15	14.4-16.4	33-41
	2.25	139-149	354-374	6-11	5-10	11-13	18-24	166-176	372-392	15-20	10-15	10.8-12.8	34-42
	3	139-149	340-360	6-11	5-10	7.2-9.2	18-24	171-181	377-397	17-22	10-15	7.1-9.1	34-42
110	1.5	143-153	465-485	6-11	7-12	13.9-15.9	17-23						
	2.25	143-153	450-470	6-11	5-10	10.2-12.2	17-23						
	3	143-153	433-453	6-11	5-10	6.5-8.5	17-23						

*Based on 15% Methanol antifreeze solution

TT038		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	120-130	156-176	25-30	9-14	22.1-24.1	18-24	69-79	293-313	7-12	14-19	8.9-10.9	17-23
	2.25	119-129	148-168	25-30	8-13	16.8-18.8	19-25	73-83	297-317	7-12	14-19	6.7-8.7	18-24
	3	119-129	138-158	25-30	8-13	10.5-12.5	19-25	76-86	300-320	7-12	14-19	4.5-6.5	19-25
50	1.5	129-139	225-245	15-20	10-15	21.9-23.9	18-24	96-106	322-342	10-15	17-22	12.2-14.2	23-29
	2.25	128-138	211-231	15-20	9-14	16.1-18.1	19-25	100-110	326-346	10-15	17-22	9.3-11.3	24-30
	3	128-138	197-217	15-20	9-14	10.3-12.3	19-25	105-115	331-351	10-15	17-22	6.4-8.4	24-30
70	1.5	136-146	302-322	9-14	13-18	21.5-23.5	18-24	123-133	352-372	11-16	19-24	15-17	28-35
	2.25	135-145	283-303	9-14	12-17	15.8-17.8	19-25	129-139	358-378	11-16	19-24	11.6-13.6	29-36
	3	135-145	265-285	9-14	12-17	10-12	19-25	135-145	364-384	11-16	19-24	8.2-10.2	30-37
90	1.5	140-150	390-410	7-12	13-18	20.5-22.5	17-23	157-167	390-410	13-18	18-23	21-23	36-44
	2.25	140-150	369-389	8-13	8-13	14.9-16.9	17-23	169-179	399-419	13-18	16.5-21.5	15.5-17.5	37-45
	3	140-150	349-369	8-13	8-13	9.3-11.3	17-23	181-191	408-428	14-19	15-20	10.5-12.5	39-47
110	1.5	145-155	488-508	7-12	13-18	19-21	17-23						
	2.25	145-155	467-487	8-13	8-13	14-16	17-23						
	3	145-155	447-467	8-13	8-13	9-11	17-23						

*Based on 15% Methanol antifreeze solution

CLIMATEMASTER WATER-SOURCE HEAT PUMPS

Tranquility® 30 (TT) Series

Rev.: October 7, 2016

Unit Operating Conditions

TT049		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	112-122	187-207	22-27	14-19	20.7-22.7	18-24	66-76	286-306	7-12	8-13	8-10	18-24
	2.25	111-121	167-187	22-27	12-17	15.5-17.5	18-24	69-79	289-309	7-12	9-14	6-8	19-25
	3	111-121	147-167	23-28	11-16	10.2-12.2	18-24	72-82	292-312	7-12	9-14	4-6	19-25
50	1.5	125-135	242-262	13-18	10-15	20.9-22.9	19-25	93-103	314-334	8-13	10-15	11.5-13.5	23-29
	2.25	123-133	224-244	13-18	9-14	15.6-17.6	19-25	98-108	320-340	8-13	10-15	8.7-10.7	24-30
	3	122-132	205-225	14-19	7-12	10.2-12.2	19-25	103-113	326-346	8-13	10-15	5.9-7.9	25-31
70	1.5	133-143	310-330	8-13	8-13	20.5-22.5	19-25	123-133	344-364	9-14	9-14	15-17	28-35
	2.25	132-142	290-310	8-13	7-12	15.2-17.2	19-25	130-140	354-374	9-14	9-14	11.5-13.5	29-36
	3	131-141	270-290	9-14	5-10	9.9-11.9	19-25	137-147	361-381	9-14	9-14	7.9-9.9	30-37
90	1.5	138-148	396-416	7-12	7-12	19.2-21.2	18-24	165-175	390-410	13-18	8-13	19.6-21.6	37-45
	2.25	137-147	374-394	7-12	6-11	14.3-16.3	18-24	175-185	401-421	15-20	8-13	15-17	38-46
	3	136-146	352-372	7-12	4-9	9.3-11.3	18-24	185-195	413-433	17-22	8-13	10.3-12.3	39-47
110	1.5	144-154	497-517	7-12	5-10	18-20	17-23						
	2.25	143-153	472-492	7-12	4-9	13.3-15.3	17-23						
	3	142-152	447-467	7-12	3-8	8.5-10.5	17-23						

*Based on 15% Methanol antifreeze solution

TT064		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	117-127	170-190	27-32	15-20	18.2-20.2	17-23	66-76	282-302	10-16	9-14	8-10	19-25
	2.25	116-126	143-163	28-33	13-18	12.6-14.6	17-23	69-79	285-305	10-16	9-14	6-8	19-25
	3	115-125	135-155	29-34	12-17	7-9	17-23	72-82	289-309	10-16	10-15	4-6	20-26
50	1.5	128-138	238-258	16-21	14-19	20.5-22.5	21-27	90-100	310-330	11-17	12-17	11.3-13.3	24-30
	2.25	126-136	222-242	21-26	13-18	14.9-16.9	21-27	95-105	313-333	11-17	12-17	8.5-10.5	25-31
	3	125-135	205-225	26-31	12-17	9.2-11.2	21-27	99-109	316-336	11-17	12-17	5.7-7.7	26-32
70	1.5	135-145	315-335	10-15	14-19	21-23	22-28	115-125	337-357	12-18	14-19	14-16	28-35
	2.25	134-144	296-316	12-17	13-18	15.5-17.5	22-28	120-130	341-361	12-18	14-19	10.6-12.6	29-36
	3	133-143	276-296	15-20	11-16	10-12	22-28	126-136	345-365	12-18	15-20	7.3-9.3	30-37
90	1.5	139-149	408-428	10-15	15-20	20.1-22.1	21-27	157-167	390-410	15-20	14-19	18.2-20.2	37-45
	2.25	138-148	386-406	10-15	13-18	14.8-16.8	21-27	161-171	394-414	15-20	14-19	13.9-15.9	38-46
	3	138-148	364-384	10-15	11-16	9.5-11.5	21-27	166-176	398-418	15-20	15-20	9.6-11.6	39-47
110	1.5	144-154	515-535	8-13	14-19	19-21	20-26						
	2.25	143-153	493-513	8-13	13-18	14-16	20-26						
	3	142-152	469-489	8-13	12-17	9-11	20-26						

*Based on 15% Methanol antifreeze solution

TT072		Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	119-129	155-175	25-30	17-22	18-20	21-27	61-71	292-312	11-16	13-18	7.2-9.2	19-25
	2.25	117-127	150-170	25-30	17-22	13.2-15.2	21-27	65-75	296-316	11-16	14-19	5.4-7.4	20-26
	3	115-125	144-164	28-32	17-22	8.4-9.4	22-28	68-78	300-320	10-15	15-20	3.5-5.5	21-27
50	1.5	131-141	210-230	10-15	12-17	18.5-20.5	22-28	89-99	327-347	10-15	19-24	10.9-12.9	26-32
	2.25	130-140	205-225	11-16	12-17	14-16	23-29	98-108	337-357	10-15	14-19	8.3-10.3	28-34
	3	129-139	200-220	13-18	12-17	9.5-11.5	24-30	106-116	348-368	10-15	9-14	5.7-7.7	30-36
70	1.5	135-145	300-320	10-15	15-20	17.6-19.6	23-29	119-129	365-385	10-15	21-26	14.7-16.7	33-39
	2.25	131-141	295-315	11-16	14-19	13.8-15.8	23-29	132-142	380-400	10-15	16-21	11.3-13.3	36-42
	3	128-138	290-310	13-18	14-19	10-12	23-29	144-154	395-415	10-15	11-16	7.9-9.9	38-44
90	1.5	139-149	390-410	10-15	16-21	16.7-18.7	22-28	162-172	418-438	10-15	19-24	19.4-21.4	43-49
	2.25	137-147	370-390	10-15	14-19	12.6-14.6	22-28	172-182	430-450	10-15	19-24	14.7-16.7	45-51
	3	135-145	350-370	10-15	13-18	8.5-10.5	22-28	182-192	444-464	11-16	19-24	10.1-12.1	47-53
110	1.5	145-155	490-510	10-15	16-21	15.9-17.9	20-27						
	2.25	145-155	470-490	10-15	14-19	11.7-13.7	20-27						
	3	144-154	452-472	9-14	13-18	7.4-9	20-27						

*Based on 15% Methanol antifreeze solution

Table 12: Water Temperature Change Through Heat Exchanger

Water Flow, gpm [l/m]	Rise, Cooling °F, [°C]	Drop, Heating °F, [°C]
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton [3.2 l/m per kW]	9 - 12 [5 - 6.7]	4 - 8 [2.2 - 4.4]
For Open Loop: Ground Water Systems at 1.5 gpm per ton [1.6 l/m per kW]	20 - 26 [11.1 - 14.4]	10 - 17 [5.6 - 9.4]