Tranquility® 20 (TS) Series

Models TSD/H/V 006–070 60Hz - HFC-410A

Installation, Operation & Maintenance

97B0075N06
Revised: April 17, 2023

ClimateMaster
A NIBE GROUP MEMBER

Table of Contents

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Model Nomenclature: General Overview

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
T	S	V	0	2	4	C	G	C	3	0	C	L	T	S

Model Type
TS = Tranquility® 20 Single Stage Scroll

Configuration
V = Vertical Upflow
H = Horizontal
D = Vertical Downflow

Unit Size
006 - E,G
009 - E,G
012 - E,G
018 - E,G
024 - E,F,G,H
030 - E,F,G,H
036 - E,F,G,H
042 - E,F,G,H,N
048 - E,F,G,H,N
060 - E,F,G,H,N
070 - F,G,H,N

AVAILABLE VOLTAGES

Revision Level
A = Current Revision Sizes 006-012
B = Current Revision Sizes 018
C = Current Revision Sizes 024-070

Voltage
G = 208/230-1-60
E = 265-1-60
H = 208/230-3-60
F = 460-3-60
N = 575-3-60

Controls

Control	w/o Disconnect	w/ Disconnect
CXM2	C	A
DXM2.5	D	B
CXM2 w/MPC	N	R
DXM2.5 w/MPC	P	S

Cabinet

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

Standard
S = Standard

Supply Air & Motor Option

Option	Supply	Configuration	Motor
T	Top	TSV	PSC
D	Down	TSD	PSC
B	Back	TSH	PSC
S	Straight	TSH	PSC
*V	Top	TSV	PSC Hi Static
*U	Down	TSD	PSC Hi Static
*Y	Back	TSH	PSC Hi Static
*Z	Straight	TSH	PSC Hi Static
*K	Top	TSV	ECM
*N	Down	TSD	ECM
*P	Back	TSH	ECM
*W	Straight	TSH	ECM

* N/A for Sizes 006-012

Return Air
L = Left Return
R = Right Return

Heat Exchanger Options

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

ClimaDry® II reheat coil not coated
*Microchannel On Sizes 024-048
ClimaDry® II units are equiped with DMX2.5

Water Circuit Options
0 = None
2 = HWG (Coil Only)
5 = Secondary Circulating 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

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

ClimaDry® II Option Notes:

1. Unit must have DXM2.5 control option. 460 volt unit units require a four wire power supply with neutral.
2. ClimaDry® II may not be combined with motorized water valve, internal secondary circulating pump, or automatic flow regulator options.
3. 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.
4. A thermostat with dehumidification mode or thermostat and separate humidistat/dehumidistat is required for activation and control of ClimaDry II.
5. Downflow and 575 volt units are not eligible for ClimaDry II.

General Information

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

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

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

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

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

⚠ WARNING! ⚠

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

⚠ WARNING! ⚠

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

⚠ CAUTION! ⚠

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

⚠ WARNING! ⚠

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

⚠ WARNING! ⚠

WARNING! Children Being Supervised are NOT to play with the appliance.

⚠ 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.

⚠ WARNING! ⚠

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

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, Cont'd.

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. Some airflow patterns are field convertible (horizontal units only). Locate the airflow conversion section of this IOM.
7. Locate and verify any hot water generator (HWG), hanger, or other accessory kit located in the compressor section or blower section.

⚠ 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 will cause equipment damage.

⚠ CAUTION! ⚠

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

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

Physical Data

Tranquility® 20 Single-Stage (TS) Series (60Hz)

Model	006	009	012	018	024	030	036	042	048	060	070
Compressor (1 Each)	Rotary			Scroll							
Factory Charge HFC-410A (oz) [kg]	24 [0.68]	32 [0.91]	34 [0.96]	50 [1.13]	41 [1.16]	41 [1.16]	48 [1.36]	68 [1.93]	68 [1.93]	136 [3.86]	141 [4.0]
Water Connection Size											
FPT (in)	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"	3/4"	1"	1"	1"	1"
HWG Connection Size											
FPT (in)	N/A	N/A	N/A	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
Coax Volume											
Volume (US Gallons) [liters]	0.17 [0.64]	0.29 [1.10]	0.45 [1.70]	0.56 [2.12]	0.76 [2.88]	0.76 [2.88]	0.92 [3.48]	1.24 [4.69]	1.24 [4.69]	1.56 [5.91]	1.56 [5.91]
Vertical Upflow/Downflow											
Standard Filter - 1" [25.4mm] Throwaway, qty (in) [mm]	16 x 20 [406 x 508]	16 x 20 [406 x 508]	16 x 20 [406 x 508]	24 x 24 [610 x 610]	28 x 24 [711 x 610]	28 x 24 [711 x 610]	28 x 30 [711 x 762]	2 - 16 x 30 [2 - 406 x 762]	2 - 16 x 30 [2 - 406 x 762]	1 - 16 x 30; 1 - 20 x 30 [1 - 406 x 762; 1 - 508 x 762]	1 - 16 x 30; 1 - 20 x 30 [1 - 406 x 762; 1 - 508 x 762]
Weight - Operating, (lbs) [kg]	136 [62]	156 [71]	160 [73]	257 [117]	266 [121]	268 [122]	327 [148]	414 [188]	416 [189]	441 [200]	443 [201]
Weight - Packaged, (lbs) [kg]	146 [66]	166 [75]	170 [77]	267 [121]	276 [125]	278 [126]	337 [153]	424 [192]	426 [193]	451 [205]	453 [205]
Horizontal											
Standard Filter - 1" [25.4mm] Throwaway, qty (in) [mm]	16 x 20 [406 x 508]	16 x 20 [406 x 508]	16 x 20 [406 x 508]	2 - 18 x 18 [2 - 457 x 457]	2 - 18 x 18 [2 - 457 x 457]	2 - 18 x 18 [2 - 457 x 457]	1 - 12 x 20; 1- 20 x 25 [1 - 305 x 508; 1 - 508 x 635]	1 - 18 x 20; 1 - 20 x 24 [1 - 457 x 508; 1 - 508 x 610]	1 - 18 x 20; 1 - 20 x 24 [1 - 457 x 508; 1 - 508 x 610]	2 - 20 x 24 [2 - 508 x 610]	2 - 20 x 24 [2 - 508 x 610]
Weight - Operating, (lbs) [kg]	136 [62]	156 [71]	160 [73]	257 [117]	266 [121]	268 [122]	327 [148]	414 [188]	416 [189]	441 [200]	443 [201]
Weight - Packaged, (lbs) [kg]	146 [66]	166 [75]	170 [77]	267 [121]	276 [125]	278 [126]	337 [153]	424 [192]	426 [193]	451 [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® II option add 66lbs (30kg) to weights.

Unit Maximum Water Working Pressure	
Options	Max Pressure PSIG [kPa]
Base Unit	500 [3,447]
Internal Secondary Pump (ISP)	145 [999]
ClimaDry® II	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. **NOTE: Minimum clearances for installation are the same as the minimum required service clearances. Consult the service clearances on page 8 for reference of installation clearances.**

Mounting Horizontal Units
Horizontal units have 4 hanger brackets partially attached at the factory, one at each corner. Enclosed within the unit there is a hanger kit hardware bag containing vibration isolation grommets, washers, screws and a hanger installation instruction page. One additional screw from the hardware bag must be added to each hanger bracket before unit installation. Tighten each screw to 75 in-lbs (8.5 Nm). See Figure 1. Refer to the hanger installation instruction page contained in the hardware bag for details of final hanger bracket attachment and unit suspension. See Figure 1a.

Use four (4) field supplied threaded rods and factory provided vibration isolators to suspend the unit. Safely lift the unit into position supporting the bottom of the unit. Ensure the top of the unit is not in contact with any external objects. Connect the top end of the 4 all-thread rods, slide rods through the brackets and grommet then assemble washers and double nuts at each rod. Ensure that the unit is approximately level and that the threaded rod extends past the nuts.

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

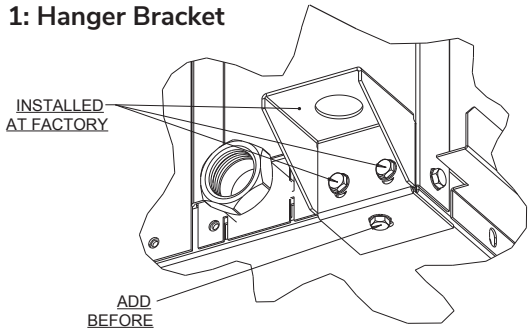
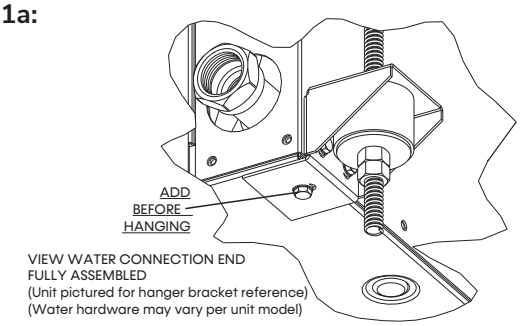
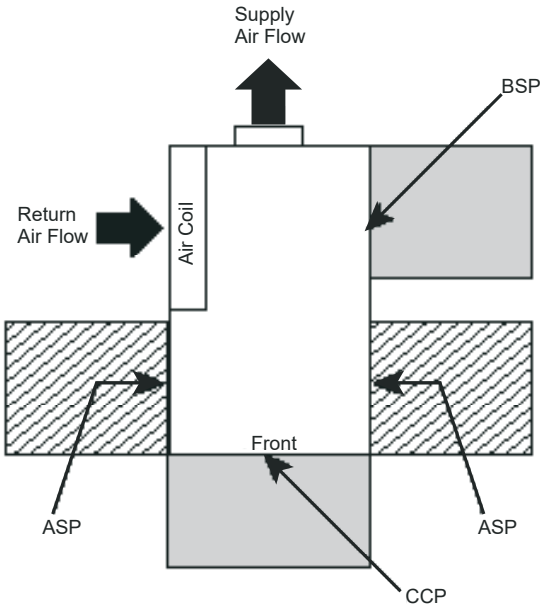


Figure 1a:

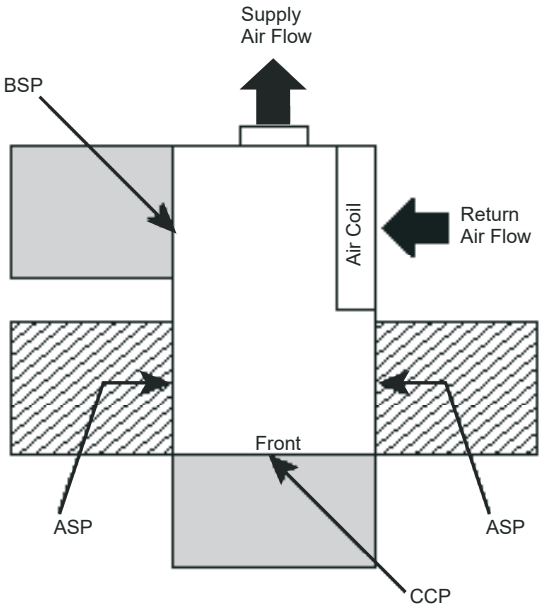


TS Horizontal – Service Access

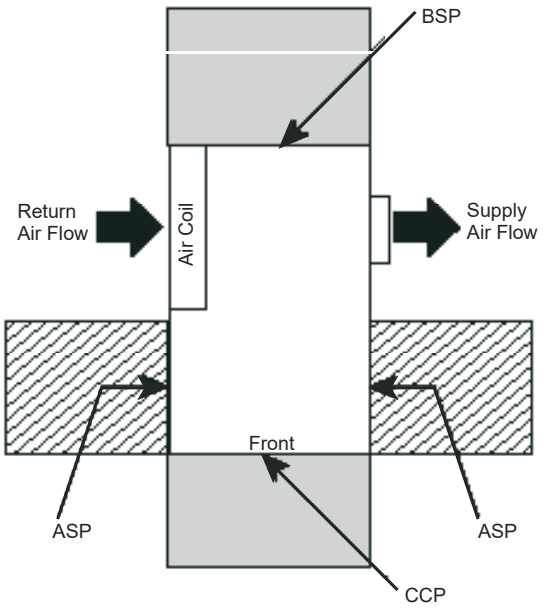
Left Return Back Discharge



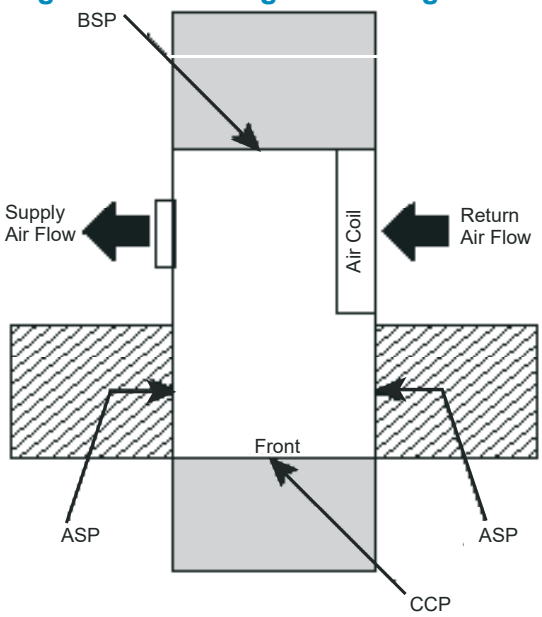
Right Return Back Discharge



Left Return Straight Discharge



Right Return Straight Discharge



Notes:

1. While clear access to all removable panels is not required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. CCP and BSP requires 2' service access.
3. Blower service access is through back panel on straight discharge units or through panel opposite air coil on back discharge units.
4. ASP are removable panels that provide additional access to the units interior. Clear access to ASP panels is not required and they are not to be used in place of the mandatory CCP and BSP panels.

= mandatory 2' (61cm) service access

= (optional) additional 2' (61cm) service access

Legend:

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

Horizontal Installation, Cont'd.

Figure 2: Horizontal Unit Pitch

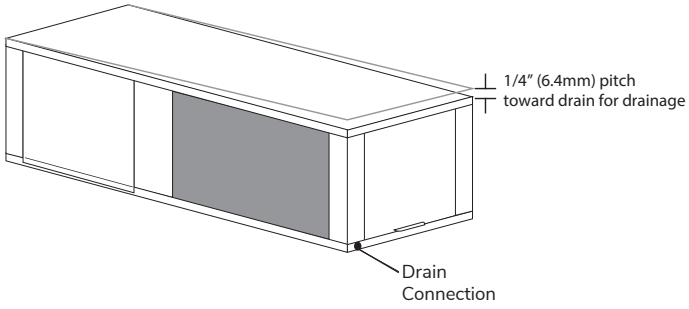
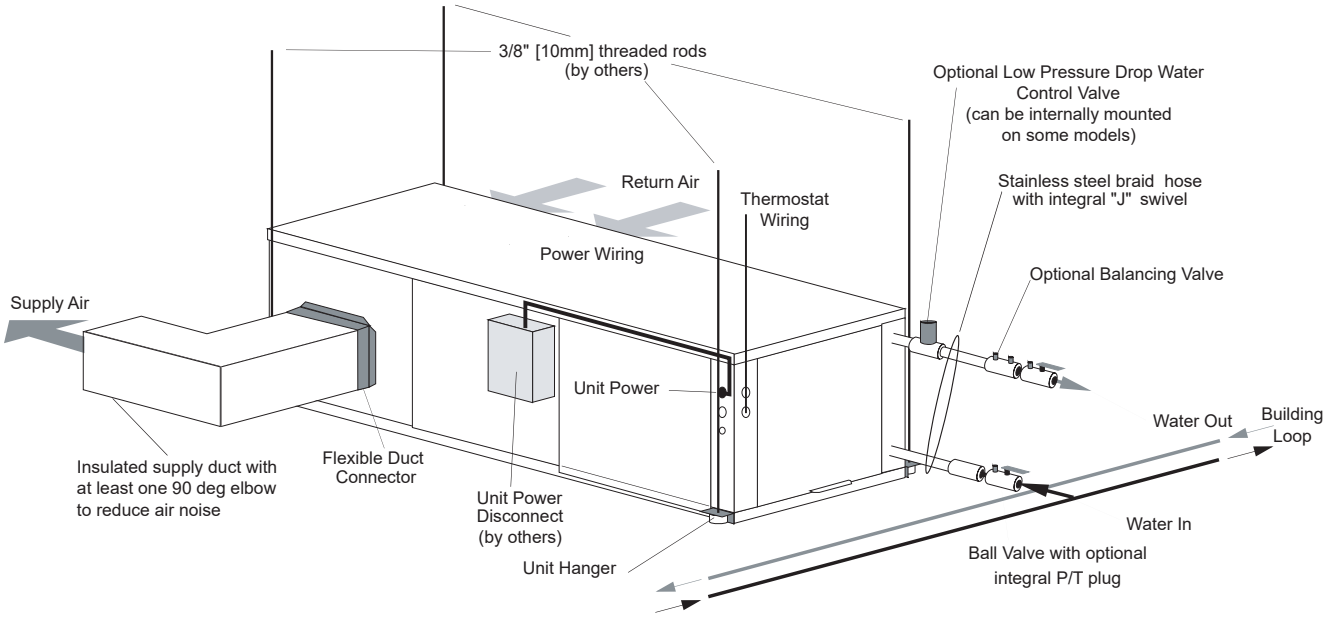


Figure 3: Typical Horizontal Unit Installation



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

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

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

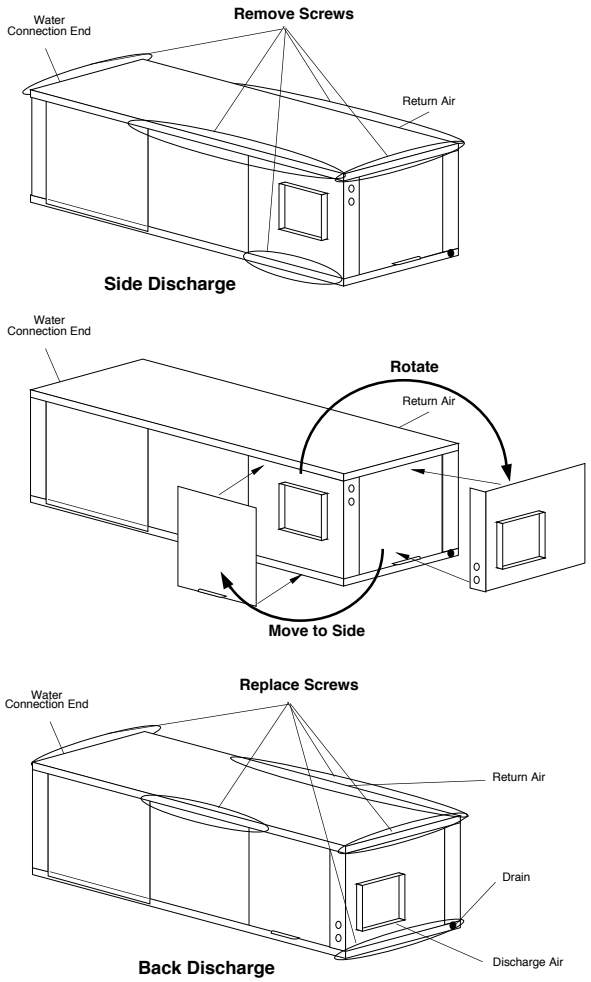
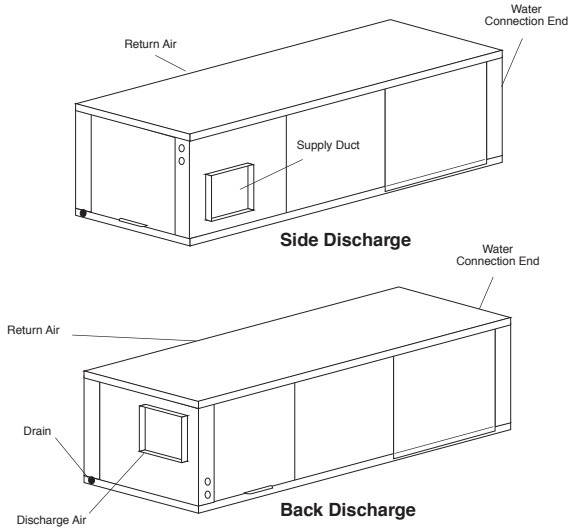


Figure 5: Right Return Side to Back



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.

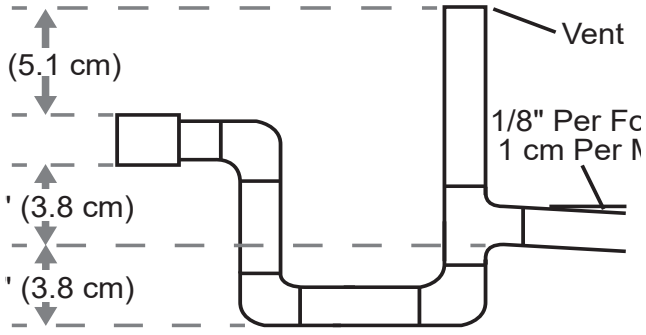
Install condensate trap at each unit with the top of the trap positioned below the unit condensate drain connection as shown in Figure 6. Design the depth of the trap (water-seal) based upon the amount of ESP capability of the blower (where 2 inches [51 mm] of ESP capability requires 2 inches [51 mm] of trap depth). As a general rule, 1-1/2 inch [38 mm] trap depth is the minimum.

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

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

Stainless Steel Drain Pans - condensate connection is female pipe thread. Field to provide condensate connection male adapter.

Figure 6: Horizontal Condensate Connection



⚠ CAUTION! ⚠

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

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 duct board for the first few feet. Application of the unit to uninsulated ductwork in an unconditioned space is not recommended, as the unit’s performance may be adversely affected.

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). **NOTE: Minimum clearances for installation are the same as the minimum required service clearances. Consult the service clearances on page 13 For reference of installation clearances.**

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" [10 mm] to 1/2" [13 mm] 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

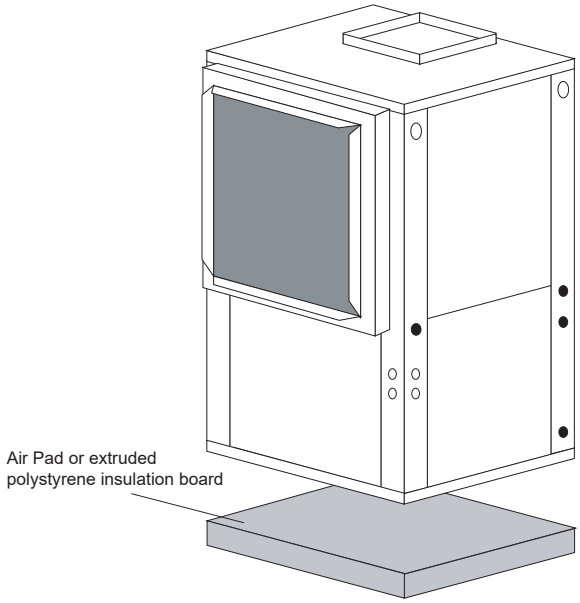
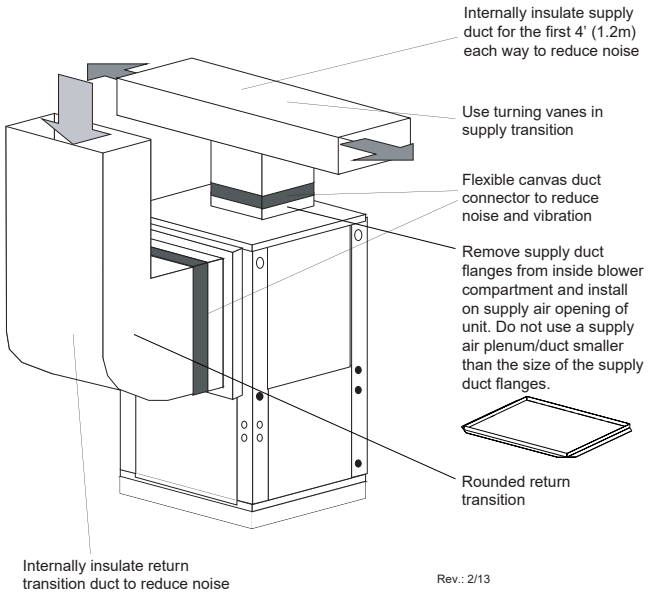


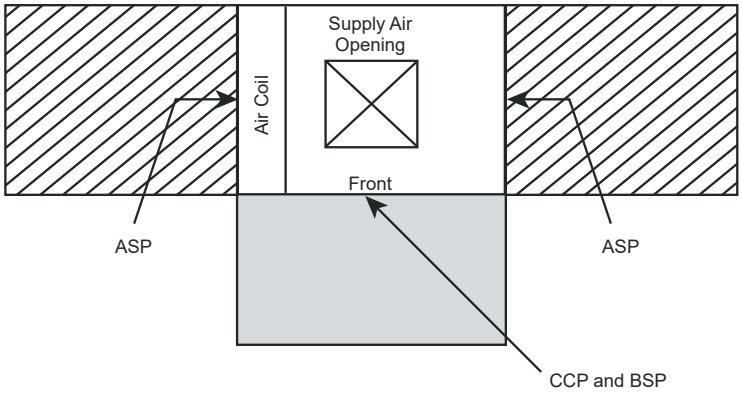
Figure 8: Typical Vertical Unit Installation Using Ducted Return Air



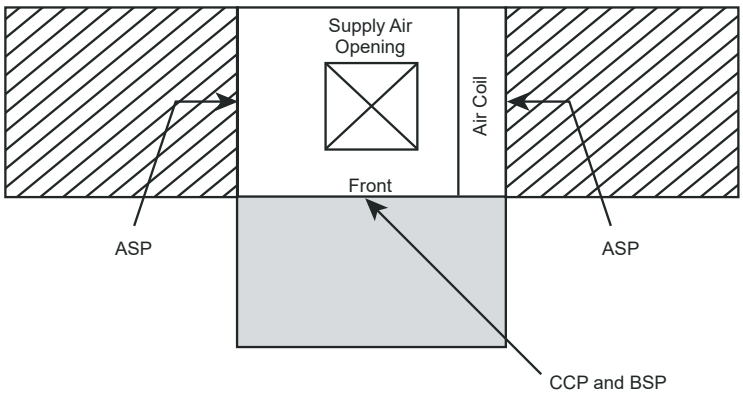
TS Vertical – Service Access

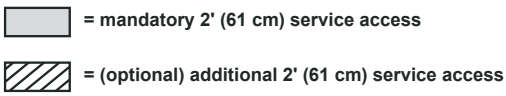
Vertical Units

Left Return



Right Return





Notes:

1. While clear access to all removable panels is not required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. Front & Side access is preferred for service access. However, all components may be serviced from the front access panel if side access is not available.
3. ASP are removable panels that provide additional access to the units interior. Clear access to ASP panels is not required and they are not to be used in place of the mandatory CCP and BSP panels.
4. Top supply air is shown, the same clearances apply to bottom supply air units.

Legend:

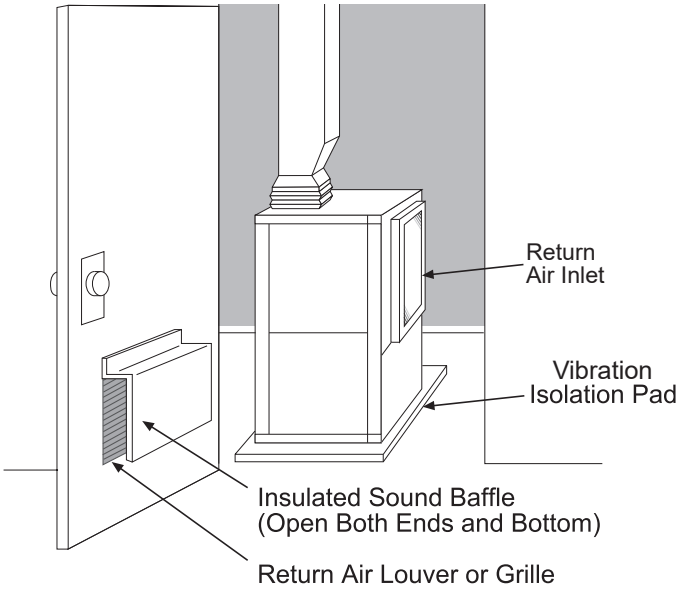
CCP = Control/Compressor Access Panel
BSP = Blower Service Panel
ASP = Additional Service Panel (not required)

Vertical Installation, Cont'd.

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.

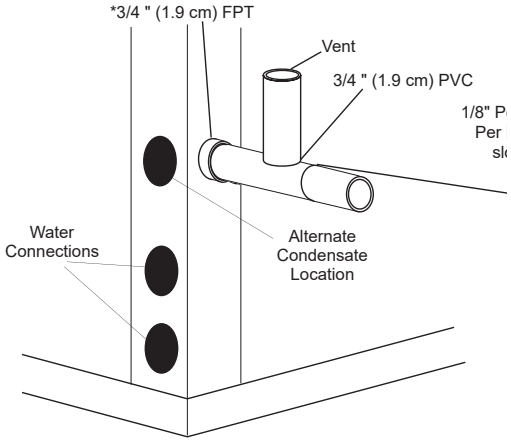
Figure 9: Vertical Sound Attenuation



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

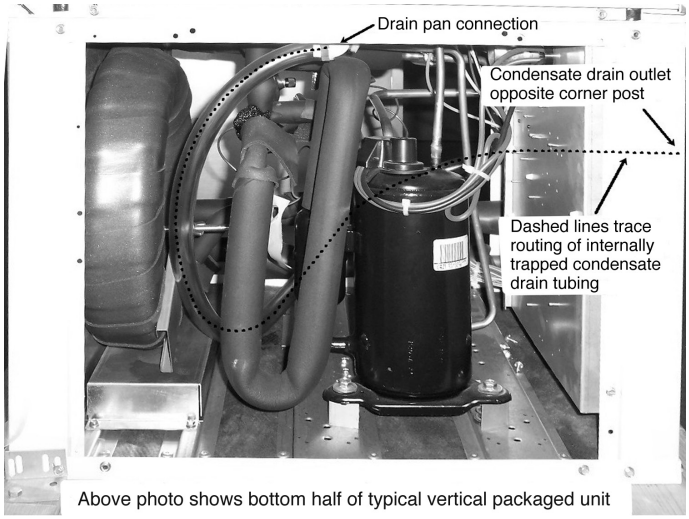
Condensate Piping for Vertical Units - A condensate line must be installed and pitched away from the unit to allow for proper drainage. This connection must meet all local plumbing/building codes. Vertical units utilize a condensate hose inside the cabinet as a trapping loop; therefore an external trap 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® II, ensure the three union nuts on the internal three-way water valve are tight.

ClimaDry II 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 II 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! ⚠

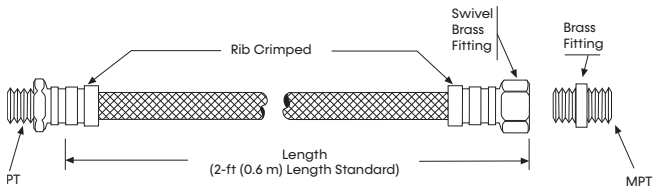
CAUTION! Piping must comply with all applicable codes.

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



Water-Loop Heat Pump Applications

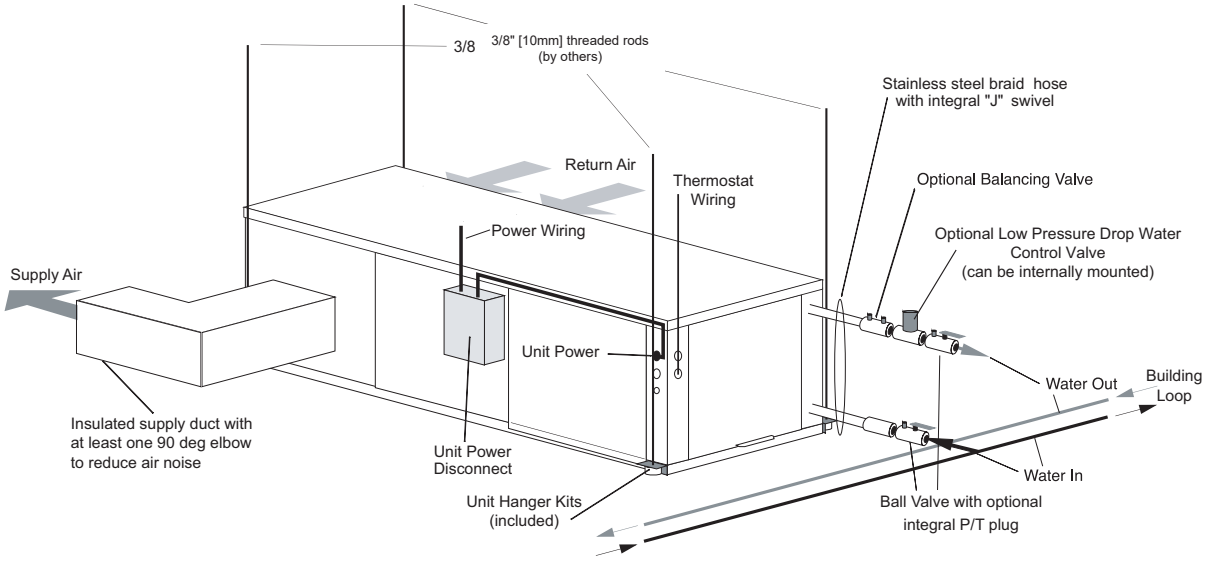
Commercial Water Loop Applications
Commercial systems typically include a number of units connected to a common piping system. Any unit plumbing maintenance work can introduce air into the piping system; therefore air elimination equipment is a major portion of the mechanical room plumbing. Consideration 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 11 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 - CXM2 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.**

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

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced under the water level to prevent fumes. Calculate the total volume of fluid in the piping system. Then use the percentage by volume shown in Table 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 - CXM2 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.**

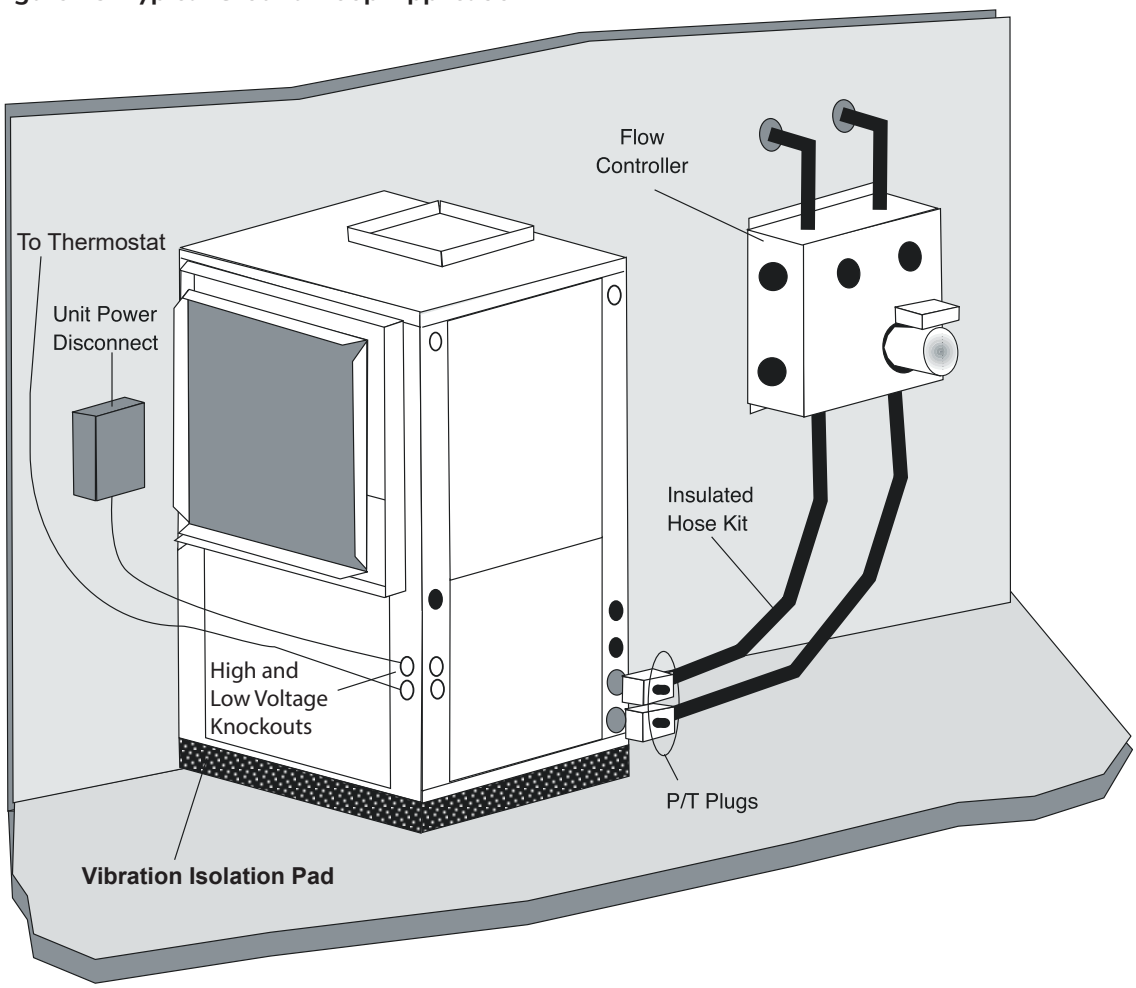
Table 2: Antifreeze Percentages by Volume

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

Ground-Loop Heat Pump Applications, Cont'd.

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 materials should be limited to copper, PE, or similar material. PVC or CPVC should never be used as they are incompatible with the POE oils used in HFC-410A products and piping system failure and property damage may result.

⚠ 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 Requirements - 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 draw down 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 19). Note the special wiring diagrams for slow closing valves (Figures 20 & 21).

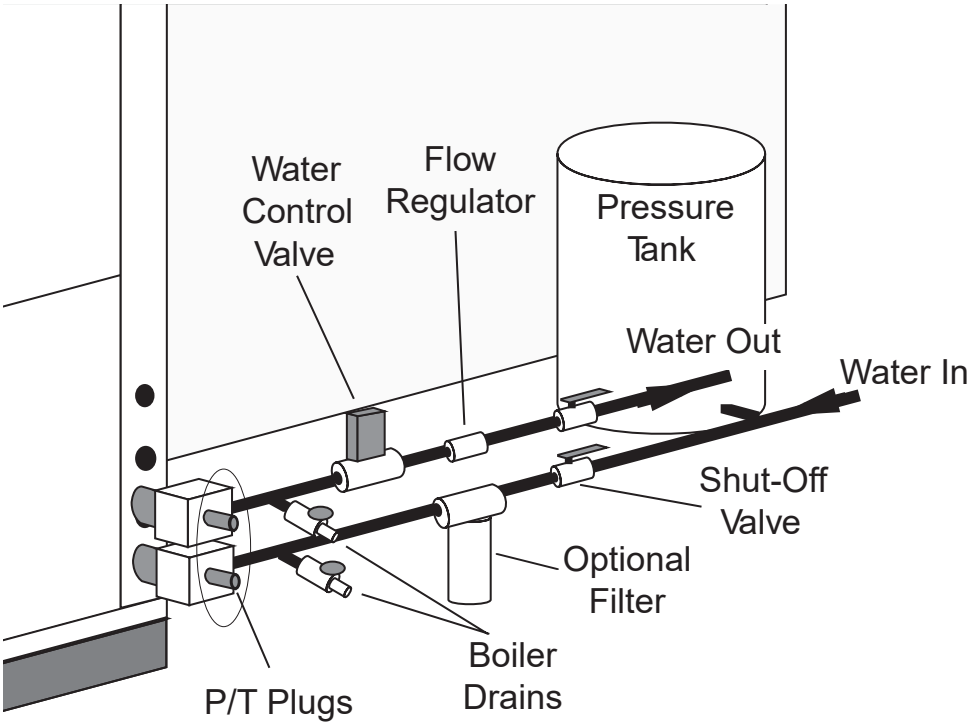
Ground-Water Heat Pump Applications, Cont'd.

Flow Regulation - Flow regulation can be accomplished by two methods. One method of flow regulation involves simply adjusting the ball valve or water control valve on the discharge line. Measure the pressure drop through the unit heat exchanger, and determine flow rate from Table 9. 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.

Note: When EWT is below 50°F [10°C], 2 gpm per ton (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] LT1 setting (factory setting-water) should be used to avoid freeze damage to the unit. See "Low Water Temperature Cutout Selection" in this manual for details on the low limit setting.

Figure 14: Typical Open Loop/Well Application



Water Quality Requirements

Table 3: Water Quality Requirements

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

WATER QUALITY REQUIREMENTS

For Closed-Loop and Open-Loop Systems

				Heat Exchanger Type			
				Closed Loop Recirculating	Open Loop, Tower, Ground Source Well		
	Description	Symbol	Units	All Heat Exchanger Types	COAXIAL HX Copper Tube in Tube	COAXIAL HX Cupronickel	Brazed Plate HX 316 SS
Scaling Potential	pH - Chilled Water <85°F			7.0 to 9.0	7.0 to 9.0	7.0 to 9.0	7.0 to 9.0
	pH - Heated Water >85°F			8.0 to 10.0	8.0 to 10.0	8.0 to 10.0	8.0 to 10.0
	Alkalinity	($HCO3^-$)	ppm - $CaCO_3$ equiv.	50 to 500	50 to 500	50 to 500	50 to 500
	Calcium	(Ca)	ppm	<100	<100	<100	<100
	Magnesium	(Mg)	ppm	<100	<100	<100	<100
	Total Hardness	(CaCO3)	ppm - CaCO3 equiv.	30 to 150	150 to 450	150 to 450	150 to 450
	Langelier Saturation Index	LSI		-0.5 to +0.5	-0.5 to +0.5	-0.5 to +0.5	-0.5 to +0.5
	Ryznar Stability Index	RSI		6.5 to 8.0	6.5 to 8.0	6.5 to 8.0	6.5 to 8.0
Corrosion Prevention	Total Dissolved Solids	(TDS)	ppm - $CaCO_3$ equiv.	<1000	<1000	<1000	<1500
	Sulfate	(SO_4^{2-})	ppm	<200	<200	<200	<200
	Nitrate	(NO_3^-)	ppm	<100	<100	<100	<100
	Chlorine (free)	(Cl)	ppm	<0.5	<0.5	<0.5	<0.5
	Chloride (water < 80°F)	(Cl^-)	ppm	<20	<20	<150	<150
	Chloride (water > 120°F)		ppm	<20	<20	<125	<125
	Hydrogen Sulfide[α]	(H_2S)	ppb	<0.5	<0.5	<0.5	<0.5
	Carbon Dioxide	(CO_2)	ppm	0	<50	10 to 50	10 to 50
	Iron Oxide	(Fe)	ppm	<1.0	<1.0	<1.0	<0.2
	Manganese	(Mn)	ppm	< 0.4	<0.4	<0.4	<0.4
	Ammonia	(NH_3)	ppm	<0.05	<0.1	<0.1	<0.1
	Chloramine	(NH_2CL)	ppm	0	0	0	0
Fouling & Biological	Iron Bacteria		cells/mL	0	0	0	0
	Slime Forming Bacteria		cells/mL	0	0	0	0
	Sulfate reducing bacteria		cells/mL	0	0	0	0
	Suspended Solids[β]	(TSS)	ppm	<10	<10	<10	<10
Electrolysis All HX types	Earth Ground Resistance[χ]		Ohms	0	Consult NEC & local electrical codes for grounding requirements		
	Electrolysis Voltage[δ]		mV	<300	Measure voltage internal water loop to HP ground		
	Leakage Current[δ]		mA	<15	Measure current in water loop pipe		
	Building Primary Electrical Ground to unit, must meet local diameter and penetration length requirements						
	Do not connect heat pump to steel pipe unless dissimilar materials are separated by using Di-electric unions. Galvanic corrosion of heat pump water pipe will occur.						

Water Quality Requirements, Cont'd.

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

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

ppm = parts per million
ppb = parts per billion

α Hydrogen Sulfide has an odor of rotten eggs. If one detects this smell, a test for H2S must be performed. If H2S is detected above the limit indicated, remediation is necessary (Consult with your Water Testing/Treatment Professional) or a secondary heat exchanger is required using appropriate materials as recommended by the heat exchanger supplier.

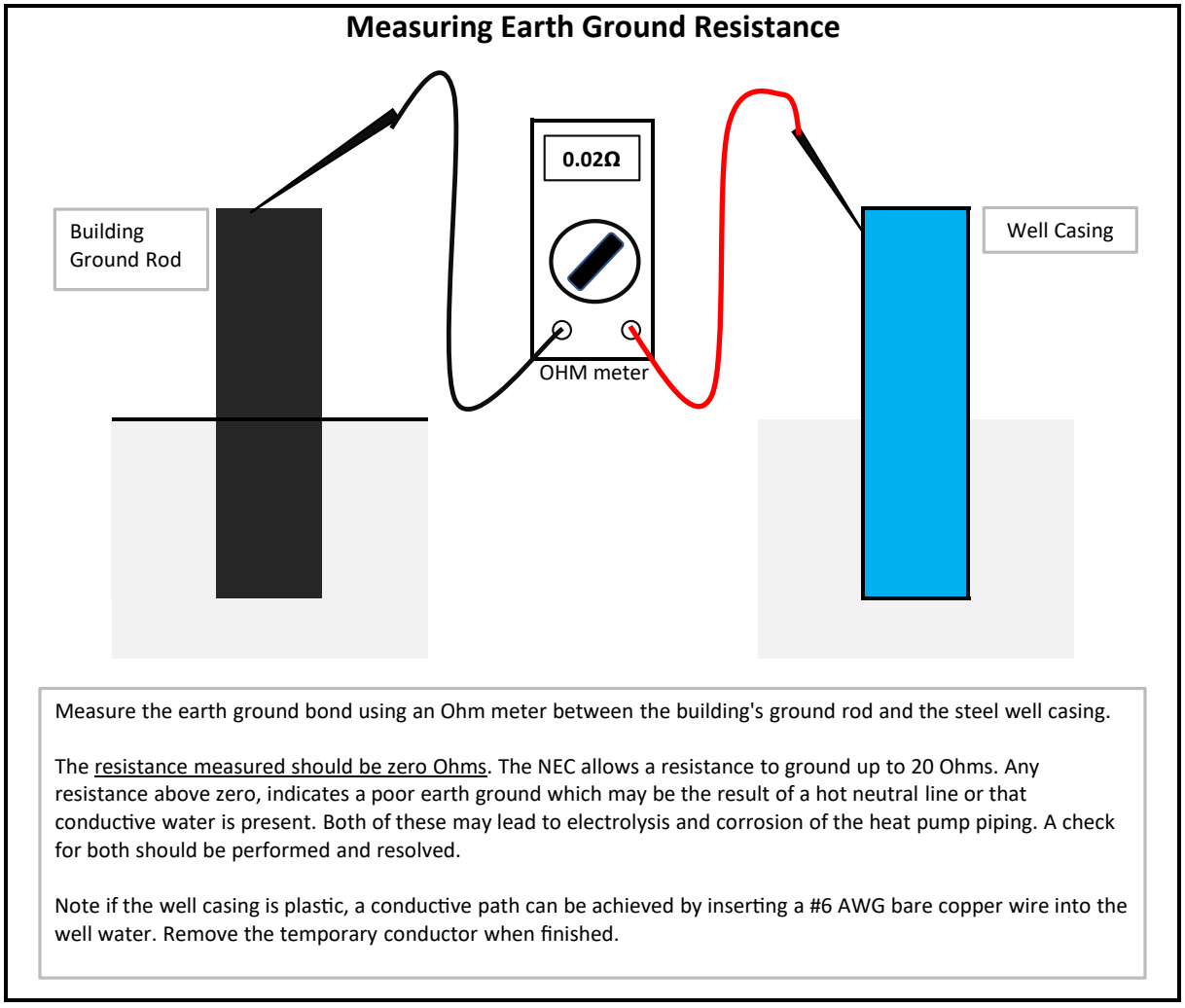
β Suspended solids and particulates must be filtered to prevent fouling and failure of heat exchangers. Strainers or particulate filters must be installed to provide a maximum particle size of 600 micron (0.60 mm, 0.023 in.) using a 20 to 30 mesh screen size. When a loop is installed in areas with fine material such as sand or clay, further filtration is required to a maximum of 100 micron. Refer to the Strainer / Filter Sizing Chart to capture the particle sizes encountered on the site.

χ An electrical grounding system using a dedicated ground rod meeting NEC and Local Electrical codes must be installed. Building Ground must not be connected the WSHP piping system or other plumbing pipes.

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

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

Water Quality Requirements, Cont'd.



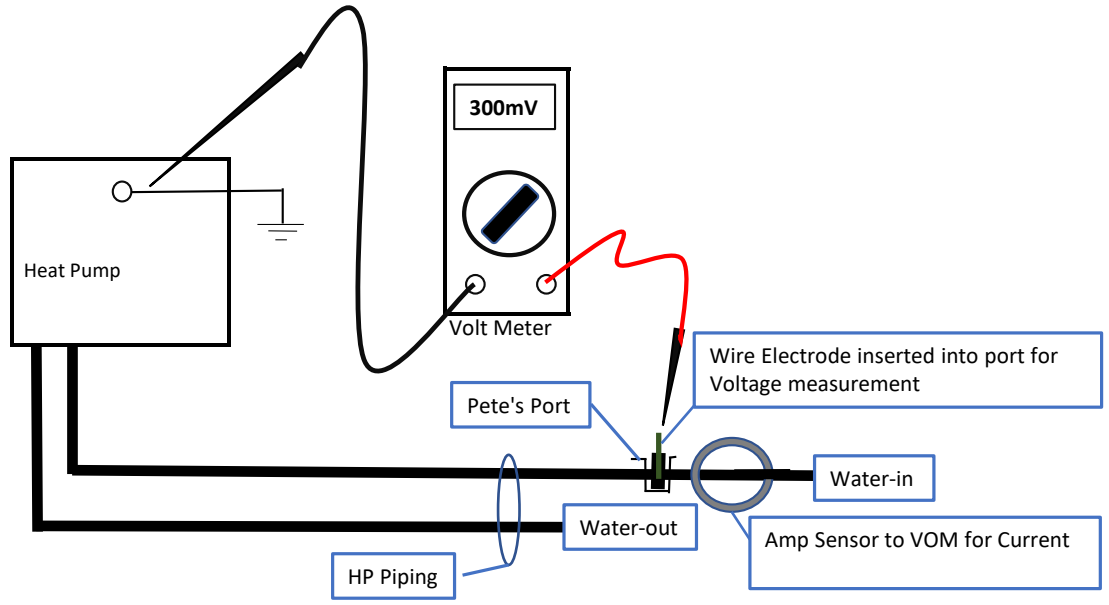
Measure the earth ground bond using an Ohm meter between the building's ground rod and the steel well casing.

The resistance measured should be zero Ohms. The NEC allows a resistance to ground up to 20 Ohms. Any resistance above zero, indicates a poor earth ground which may be the result of a hot neutral line or that conductive water is present. Both of these may lead to electrolysis and corrosion of the heat pump piping. A check for both should be performed and resolved.

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

Water Quality Requirements, Cont'd.

Measuring Electrolysis Voltage and Current



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

The HP must be operating and the water stream flowing.

The voltage measured should be less than 300mV (0.300 V). If higher than 500mV electrolysis will occure and corrosion will result.

If voltage is measured, the cause is a high resistance earth ground or current on the neutral conductor. Remedial measures should be performed.

Measure the current flowing through the piping system by using an amp clamp probe on the water-in line. The HP must be operating and the water stream flowing.

There should be zero amps measured. If current is present, there is leakage current to the plumbing system and it must be rectified to prevent pipe corrosion.

Electrical: Line Voltage

Standard Unit - PSC Blower

TS Commercial Electrical Table							STANDARD PSC				HI STATIC PSC			
MODEL	VOLT-AGE CODE	RATED VOLTAGE	VOLTAGE MIN/MAX	COMPRESSOR			FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR	FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR
				QTY	RLA	LRA								
006	G	208-230 / 60 / 1	187.2 / 253	1	2.50	17.70	0.32	2.82	3.45	15.00	NA			
	E	265 / 60 / 1	238.5 / 291.5	1	2.10	13.50	0.36	2.46	2.99	15.00				
009	G	208-230 / 60 / 1	187.2 / 253	1	3.70	22.00	0.52	4.22	5.15	15.00				
	E	265 / 60 / 1	238.5 / 291.5	1	3.50	22.00	0.40	3.90	4.78	15.00				
012	G	208-230 / 60 / 1	187.2 / 253	1	4.40	25.00	0.80	5.20	6.30	15.00				
	E	265 / 60 / 1	238.5 / 291.5	1	3.50	22.00	0.69	4.19	5.07	15.00				
018	G	208-230 / 60 / 1	187.2 / 253	1	9.00	48.02	0.91	9.91	12.16	20.00	1	10.00	12.25	20.00
	E	265 / 60 / 1	238.5 / 291.5	1	7.10	43.00	0.70	7.80	9.58	15.00	0.8	7.90	9.68	15.00
024	G	208-230 / 60 / 1	187.2 / 253	1	13.50	58.30	1.60	15.10	18.48	30.00	2.6	16.10	19.48	30.00
	E	265 / 60 / 1	238.5 / 291.5	1	9.00	54.00	1.50	10.50	12.75	20.00	2.0	11.00	13.25	20.00
	H	208-230 / 60 / 3	187.2 / 253	1	7.10	55.40	1.60	8.70	10.48	15.00	2.6	9.70	11.48	15.00
	F	460 / 60 / 3	414 / 506	1	3.50	28.00	0.85	4.35	5.23	15.00	1.2	4.70	5.58	15.00
030	G	208-230 / 60 / 1	187.2 / 253	1	12.80	64.00	2.60	15.40	18.60	30.00	2.2	15.00	18.20	30.00
	E	265 / 60 / 1	238.5 / 291.5	1	10.90	60.00	2.00	12.90	15.63	25.00	1.66	12.56	15.29	25.00
	H	208-230 / 60 / 3	187.2 / 253	1	8.30	58.00	2.60	10.90	12.98	20.00	2.2	10.50	12.58	20.00
	F	460 / 60 / 3	414 / 506	1	5.10	28.00	1.20	6.30	7.58	15.00	1.0	6.10	7.38	15.00
036	G	208-230 / 60 / 1	187.2 / 253	1	16.00	77.00	2.60	18.60	22.60	35.00	2.2	18.20	22.20	35.00
	E	265 / 60 / 1	238.5 / 291.5	1	12.20	72.00	2.00	14.20	17.25	25.00	1.66	13.86	16.91	25.00
	H	208-230 / 60 / 3	187.2 / 253	1	10.00	71.00	2.60	12.60	15.10	25.00	2.2	12.20	14.70	20.00
	F	460 / 60 / 3	414 / 506	1	4.70	38.00	1.20	5.90	7.08	15.00	1.0	5.70	6.88	15.00
042	G	208-230 / 60 / 1	187.2 / 253	1	16.70	79.00	2.20	18.90	23.08	35.00	2.7	19.40	23.58	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	13.50	72.00	1.66	15.16	18.54	30.00	2.9	16.40	19.78	30.00
	H	208-230 / 60 / 3	414 / 506	1	10.40	73.00	2.20	12.60	15.20	25.00	2.7	13.10	15.70	25.00
	F	460 / 60 / 3	238.5 / 291.5	1	5.80	38.00	1.00	6.80	8.25	15.00	1.7	7.50	8.95	15.00
	N	575 / 60 / 3	187.2 / 253	1	3.80	36.50	0.82	4.62	5.57	15.00	1.4	5.20	6.15	15.00
048	G	208-230 / 60 / 1	187.2 / 253	1	21.80	117.00	2.70	24.50	29.95	50.00	3.4	25.20	30.65	50.00
	E	265 / 60 / 1	238.5 / 291.5	1	16.30	98.00	2.90	19.20	23.28	35.00	NA			
	H	208-230 / 60 / 3	414 / 506	1	13.70	83.10	2.70	16.40	19.83	30.00	3.4	17.10	20.53	30.00
	F	460 / 60 / 3	238.5 / 291.5	1	6.20	41.00	1.70	7.90	9.45	15.00	1.8	8.00	9.55	15.00
	N	575 / 60 / 3	187.2 / 253	1	4.80	33.00	1.40	6.20	7.40	15.00	1.4	6.20	7.40	15.00
060	G	208-230 / 60 / 1	187.2 / 253	1	26.40	134.00	4.90	31.30	37.90	60.00	5.8	32.20	38.80	60.00
	E	265 / 60 / 1	238.5 / 291.5	1	19.90	130.00	NA							
	H	208-230 / 60 / 3	414 / 506	1	16.00	110.00	4.90	20.90	24.90	40.00	5.8	21.80	25.80	40.00
	F	460 / 60 / 3	238.5 / 291.5	1	7.80	52.00	2.50	10.30	12.25	20.00	2.6	10.40	12.35	20.00
	N	575 / 60 / 3	187.2 / 253	1	5.70	38.90	1.80	7.50	8.93	15.00	2	7.70	9.13	15.00
070	G	208-230 / 60 / 1	187.2 / 253	1	30.80	178.00	5.80	36.60	44.30	70.00	NA			
	H	208-230 / 60 / 3	414 / 506	1	19.60	136.00	5.80	25.40	30.30	45.00				
	F	460 / 60 / 3	238.5 / 291.5	1	8.20	66.10	2.60	10.80	12.85	20.00				
	N	575 / 60 / 3	187.2 / 253	1	6.60	55.30	2.00	8.60	10.25	15.00				

Electrical Data: PSC Blower – Internal Secondary Pump

Standard Unit with Internal Secondary Pump - PSC Blower

TS Commercial Electrical Table ISP								STANDARD PSC				HI STATIC PSC			
MODEL	VOLTAGE CODE	RATED VOLTAGE	VOLTAGE MIN/MAX	COMPRESSOR			PUMP FLA	FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR	FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR
				QTY	RLA	LRA									
006	G	208-230 / 60 / 1	187.2 / 253	1	2.50	17.70	0.43	0.32	3.25	3.88	15.00	NA			
	E	265 / 60 / 1	238.5 / 291.5	1	2.10	13.50	0.7	0.36	3.16	3.69	15.00				
009	G	208-230 / 60 / 1	187.2 / 253	1	3.70	22.00	0.43	0.52	4.65	5.58	15.00				
	E	265 / 60 / 1	238.5 / 291.5	1	3.50	22.00	0.7	0.40	4.60	5.48	15.00				
012	G	208-230 / 60 / 1	187.2 / 253	1	4.40	25.00	0.43	0.80	5.63	6.73	15.00				
	E	265 / 60 / 1	238.5 / 291.5	1	3.50	22.00	0.7	0.69	4.89	5.77	15.00				
018	G	208-230 / 60 / 1	187.2 / 253	1	9.00	48.02	0.43	0.91	10.34	12.59	20.00	1	10.43	12.68	20.00
	E	265 / 60 / 1	238.5 / 291.5	1	7.10	43.00	0.7	0.70	8.50	10.28	15.00	0.8	8.60	10.38	15.00
024	G	208-230 / 60 / 1	187.2 / 253	1	13.50	58.30	0.8	1.60	15.90	19.28	30.00	2.6	16.90	20.28	30.00
	E	265 / 60 / 1	238.5 / 291.5	1	9.00	54.00	0.7	1.50	11.20	13.45	20.00	2.0	11.70	13.95	20.00
	H	208-230 / 60 / 3	187.2 / 253	1	7.10	55.40	0.8	1.60	9.50	11.28	15.00	2.6	10.50	12.28	15.00
	F*	460 / 60 / 3	414 / 506	1	3.50	28.00	0.7	0.85	5.05	5.93	15.00	1.2	5.40	6.28	15.00
030	G	208-230 / 60 / 1	187.2 / 253	1	12.80	64.00	0.8	2.60	16.20	19.40	30.00	2.2	15.80	19.00	30.00
	E	265 / 60 / 1	238.5 / 291.5	1	10.90	60.00	0.7	2.00	13.60	16.33	25.00	1.66	13.26	15.99	25.00
	H	208-230 / 60 / 3	187.2 / 253	1	8.30	58.00	0.8	2.60	11.70	13.78	20.00	2.2	11.30	13.38	20.00
	F*	460 / 60 / 3	414 / 506	1	5.10	28.00	0.7	1.20	7.00	8.28	15.00	1.0	6.80	8.08	15.00
036	G	208-230 / 60 / 1	187.2 / 253	1	16.00	77.00	0.8	2.60	19.40	23.40	35.00	2.2	19.00	23.00	35.00
	E	265 / 60 / 1	238.5 / 291.5	1	12.20	72.00	0.7	2.00	14.90	17.95	30.00	1.66	14.56	17.61	25.00
	H	208-230 / 60 / 3	187.2 / 253	1	10.00	71.00	0.8	2.60	13.40	15.90	25.00	2.2	13.00	15.50	25.00
	F*	460 / 60 / 3	414 / 506	1	4.70	38.00	0.7	1.20	6.60	7.78	15.00	1.0	6.40	7.58	15.00
042	G	208-230 / 60 / 1	187.2 / 253	1	16.70	79.00	0.8	2.20	19.70	23.88	40.00	2.7	20.20	24.38	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	13.50	72.00	0.7	1.66	15.86	19.24	30.00	2.9	17.10	20.48	30.00
	H	208-230 / 60 / 3	414 / 506	1	10.40	73.00	0.8	2.20	13.40	16.00	25.00	2.7	13.90	16.50	25.00
	F*	460 / 60 / 3	238.5 / 291.5	1	5.80	38.00	0.7	1.00	7.50	8.95	15.00	1.7	8.20	9.65	15.00
048	G	208-230 / 60 / 1	187.2 / 253	1	21.80	117.00	0.8	2.70	25.30	30.75	50.00	3.4	26.00	31.45	50.00
	E	265 / 60 / 1	238.5 / 291.5	1	16.30	98.00	0.7	2.90	19.90	23.98	40.00	NA			
	H	208-230 / 60 / 3	414 / 506	1	13.70	83.10	0.8	2.70	17.20	20.63	30.00	3.4	17.90	21.33	35.00
	F*	460 / 60 / 3	238.5 / 291.5	1	6.20	41.00	0.7	1.70	8.60	10.15	15.00	1.8	8.70	10.25	15.00

Electrical Data: PSC Blower – Internal Secondary Pump

060	G	208-230 / 60 / 1	187.2 / 253	1	26.40	134.00	1.1	4.90	32.37	38.97	60.00	5.8	33.27	39.87	60.00
	E	265 / 60 / 1	238.5 / 291.5	1	19.90	130.00	1.3	NA							
	H	208-230 / 60 / 3	414 / 506	1	16.00	110.00	1.1	4.90	21.97	25.97	40.00	5.8	22.87	26.87	40.00
	F*	460 / 60 / 3	238.5 / 291.5	1	7.80	52.00	1.3	2.50	11.60	13.55	20.00	2.6	11.70	13.65	20.00
070	G	208-230 / 60 / 1	187.2 / 253	1	30.80	178.00	1.1	5.80	37.67	45.37	70.00	NA			
	H	208-230 / 60 / 3	414 / 506	1	19.60	136.00	1.1	5.80	26.47	31.37	50.00				
	F*	460 / 60 / 3	238.5 / 291.5	1	8.20	66.10	1.3	2.60	12.10	14.15	20.00				

*460 volt units with Internal Source Pump Require a Neutral

Electrical Data: PSC Blower – with ClimaDry® II

Standard Unit with ClimaDry - PSC Blower

TS Commercial Electrical Table Reheat								STANDARD PSC				HI STATIC PSC			
MODEL	VOLTAGE CODE	RATED VOLTAGE	VOLTAGE MIN/MAX	COMPRESSOR			PUMP FLA	FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR	FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR
				QTY	RLA	LRA									
018	G	208-230 / 60 / 1	187.2 / 253	1	9.00	48.02	0.43	0.91	10.34	12.59	20.00	1	10.43	12.68	20.00
	E	265 / 60 / 1	238.5 / 291.5	1	7.10	43.00	0.7	0.70	8.50	10.28	15.00	0.8	8.60	10.38	15.00
024	G	208-230 / 60 / 1	187.2 / 253	1	13.50	58.30	0.8	1.60	15.90	19.28	30.00	2.6	16.90	20.28	30.00
	E	265 / 60 / 1	238.5 / 291.5	1	9.00	54.00	0.7	1.50	11.20	13.45	20.00	2.0	11.70	13.95	20.00
	H	208-230 / 60 / 3	187.2 / 253	1	7.10	55.40	0.8	1.60	9.50	11.28	15.00	2.6	10.50	12.28	15.00
	F*	460 / 60 / 3	414 / 506	1	3.50	28.00	0.7	0.85	5.05	5.93	15.00	1.2	5.40	6.28	15.00
030	G	208-230 / 60 / 1	187.2 / 253	1	12.80	64.00	0.8	2.60	16.20	19.40	30.00	2.2	15.80	19.00	30.00
	E	265 / 60 / 1	238.5 / 291.5	1	10.90	60.00	0.7	2.00	13.60	16.33	25.00	1.66	13.26	15.99	25.00
	H	208-230 / 60 / 3	187.2 / 253	1	8.30	58.00	0.8	2.60	11.70	13.78	20.00	2.2	11.30	13.38	20.00
	F*	460 / 60 / 3	414 / 506	1	5.10	28.00	0.7	1.20	7.00	8.28	15.00	1.0	6.80	8.08	15.00
036	G	208-230 / 60 / 1	187.2 / 253	1	16.00	77.00	0.8	2.60	19.40	23.40	35.00	2.2	19.00	23.00	35.00
	E	265 / 60 / 1	238.5 / 291.5	1	12.20	72.00	0.7	2.00	14.90	17.95	30.00	1.66	14.56	17.61	25.00
	H	208-230 / 60 / 3	187.2 / 253	1	10.00	71.00	0.8	2.60	13.40	15.90	25.00	2.2	13.00	15.50	25.00
	F*	460 / 60 / 3	414 / 506	1	4.70	38.00	0.7	1.20	6.60	7.78	15.00	1.0	6.40	7.58	15.00
042	G	208-230 / 60 / 1	187.2 / 253	1	16.70	79.00	0.8	2.20	19.70	23.88	40.00	2.7	20.20	24.38	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	13.50	72.00	0.7	1.66	15.86	19.24	30.00	2.9	17.10	20.48	30.00
	H	208-230 / 60 / 3	414 / 506	1	10.40	73.00	0.8	2.20	13.40	16.00	25.00	2.7	13.90	16.50	25.00
	F*	460 / 60 / 3	238.5 / 291.5	1	5.80	38.00	0.7	1.00	7.50	8.95	15.00	1.7	8.20	9.65	15.00
048	G	208-230 / 60 / 1	187.2 / 253	1	21.80	117.00	1.1	2.70	25.57	31.02	50.00	3.4	26.27	31.72	50.00
	E	265 / 60 / 1	238.5 / 291.5	1	16.30	98.00	1.3	2.90	20.50	24.58	40.00	NA			
	H	208-230 / 60 / 3	414 / 506	1	13.70	83.10	1.1	2.70	17.47	20.90	30.00	3.4	18.17	21.60	35.00
	F*	460 / 60 / 3	238.5 / 291.5	1	6.20	41.00	1.3	1.70	9.20	10.75	15.00	1.8	9.30	10.85	15.00
060	G	208-230 / 60 / 1	187.2 / 253	1	26.40	134.00	1.1	4.90	32.37	38.97	60.00	5.8	33.27	39.87	60.00
	E	265 / 60 / 1	238.5 / 291.5	1	19.90	130.00	1.3	NA							
	H	208-230 / 60 / 3	414 / 506	1	16.00	110.00	1.1	4.90	21.97	25.97	40.00	5.8	22.87	26.87	40.00
	F*	460 / 60 / 3	238.5 / 291.5	1	7.80	52.00	1.3	2.50	11.60	13.55	20.00	2.6	11.70	13.65	21.00
070	G	208-230 / 60 / 1	187.2 / 253	1	30.80	178.00	1.1	5.80	37.67	45.37	70.00	NA			
	H	208-230 / 60 / 3	414 / 506	1	19.60	136.00	1.1	5.80	26.47	31.37	50.00				
	F*	460 / 60 / 3	238.5 / 291.5	1	8.20	66.10	1.3	2.60	12.10	14.15	20.00				

*460 volt units with Internal Source Pump Require a Neutral

Electrical Data: ECM Blower – Standard Unit

Standard Unit - ECM Blower

TS Commercial Electrical Table							ECM-CV			
MODEL	VOLTAGE CODE	RATED VOLTAGE	VOLTAGE MIN/MAX	COMPRESSOR			FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR
				QTY	RLA	LRA				
018	G	208-230 / 60 / 1	187.2 / 253	1	9.00	48.02	4.20	13.20	15.45	20.00
	E	265 / 60 / 1	238.5 / 291.5	1	7.10	43.00	3.40	10.50	12.28	15.00
024	G	208-230 / 60 / 1	187.2 / 253	1	13.50	58.30	4.20	17.70	21.08	30.00
	E	265 / 60 / 1	238.5 / 291.5	1	9.00	54.00	3.40	12.40	14.65	20.00
	H	208-230 / 60 / 3	187.2 / 253	1	7.10	55.40	4.20	11.30	13.08	20.00
	F*	460 / 60 / 3	414 / 506	1	3.50	28.00	3.40	6.90	7.78	15.00
030	G	208-230 / 60 / 1	187.2 / 253	1	12.80	64.00	5.90	18.70	21.90	30.00
	E	265 / 60 / 1	238.5 / 291.5	1	10.90	60.00	4.80	15.70	18.43	25.00
	H	208-230 / 60 / 3	187.2 / 253	1	8.30	58.00	5.90	14.20	16.28	20.00
	F*	460 / 60 / 3	414 / 506	1	5.10	28.00	4.80	9.90	11.18	15.00
036	G	208-230 / 60 / 1	187.2 / 253	1	16.00	77.00	4.20	20.20	24.20	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	12.20	72.00	3.40	15.60	18.65	30.00
	H	208-230 / 60 / 3	187.2 / 253	1	10.00	71.00	4.20	14.20	16.70	25.00
	F*	460 / 60 / 3	414 / 506	1	4.70	38.00	3.40	8.10	9.28	15.00
042	G	208-230 / 60 / 1	187.2 / 253	1	16.70	79.00	5.90	22.60	26.78	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	13.50	72.00	4.80	18.30	21.68	35.00
	H	208-230 / 60 / 3	414 / 506	1	10.40	73.00	5.90	16.30	18.90	25.00
	F*	460 / 60 / 3	238.5 / 291.5	1	5.80	38.00	4.80	10.60	12.05	15.00
048	G	208-230 / 60 / 1	187.2 / 253	1	21.80	117.00	7.50	29.30	34.75	50.00
	E	265 / 60 / 1	238.5 / 291.5	1	16.30	98.00	6.20	22.50	26.58	40.00
	H	208-230 / 60 / 3	414 / 506	1	13.70	83.10	7.50	21.20	24.63	35.00
	F*	460 / 60 / 3	238.5 / 291.5	1	6.20	41.00	6.20	12.40	13.95	20.00
060	G	208-230 / 60 / 1	187.2 / 253	1	26.40	134.00	7.50	33.90	40.50	60.00
	E	265 / 60 / 1	238.5 / 291.5	1	19.90	130.00	6.20	26.10	31.08	50.00
	H	208-230 / 60 / 3	414 / 506	1	16.00	110.00	7.50	23.50	27.50	40.00
	F*	460 / 60 / 3	238.5 / 291.5	1	7.80	52.00	6.20	14.00	15.95	20.00
070	G	208-230 / 60 / 1	187.2 / 253	1	30.80	178.00	7.50	38.30	46.00	70.00
	H	208-230 / 60 / 3	414 / 506	1	19.60	136.00	7.50	27.10	32.00	50.00
	F*	460 / 60 / 3	238.5 / 291.5	1	8.20	66.10	6.20	14.40	16.45	20.00

*460 volt units ECM-CV Require a Neutral

Electrical Data: ECM Blower – Internal Secondary Pump

Standard Unit with Internal Secondary Pump - ECM Blower

TS Commercial Electrical Table ISP								ECM-CV			
MODEL	VOLTAGE CODE	RATED VOLTAGE	VOLTAGE MIN/MAX	COMPRESSOR			PUMP FLA	FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR
				QTY	RLA	LRA					
018	G	208-230 / 60 / 1	187.2 / 253	1	9.00	48.02	0.43	4.20	13.63	15.88	20.00
	E	265 / 60 / 1	238.5 / 291.5	1	7.10	43.00	0.7	3.40	11.20	12.98	20.00
024	G	208-230 / 60 / 1	187.2 / 253	1	13.50	58.30	0.8	4.20	18.50	21.88	35.00
	E	265 / 60 / 1	238.5 / 291.5	1	9.00	54.00	0.7	3.40	13.10	15.35	20.00
	H	208-230 / 60 / 3	187.2 / 253	1	7.10	55.40	0.8	4.20	12.10	13.88	20.00
	F*	460 / 60 / 3	414 / 506	1	3.50	28.00	0.7	3.40	7.60	8.48	15.00
030	G	208-230 / 60 / 1	187.2 / 253	1	12.80	64.00	0.8	5.90	19.50	22.70	35.00
	E	265 / 60 / 1	238.5 / 291.5	1	10.90	60.00	0.7	4.80	16.40	19.13	30.00
	H	208-230 / 60 / 3	187.2 / 253	1	8.30	58.00	0.8	5.90	15.00	17.08	25.00
	F*	460 / 60 / 3	414 / 506	1	5.10	28.00	0.7	4.80	10.60	11.88	15.00
036	G	208-230 / 60 / 1	187.2 / 253	1	16.00	77.00	0.8	4.20	21.00	25.00	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	12.20	72.00	0.7	3.40	16.30	19.35	30.00
	H	208-230 / 60 / 3	187.2 / 253	1	10.00	71.00	0.8	4.20	15.00	17.50	25.00
	F*	460 / 60 / 3	414 / 506	1	4.70	38.00	0.7	3.40	8.80	9.98	15.00
042	G	208-230 / 60 / 1	187.2 / 253	1	16.70	79.00	0.8	5.90	23.40	27.58	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	13.50	72.00	0.7	4.80	19.00	22.38	35.00
	H	208-230 / 60 / 3	414 / 506	1	10.40	73.00	0.8	5.90	17.10	19.70	30.00
	F*	460 / 60 / 3	238.5 / 291.5	1	5.80	38.00	0.7	4.80	11.30	12.75	15.00
048	G	208-230 / 60 / 1	187.2 / 253	1	21.80	117.00	0.8	7.50	30.10	35.55	50.00
	E	265 / 60 / 1	238.5 / 291.5	1	16.30	98.00	0.7	6.20	23.20	27.28	40.00
	H	208-230 / 60 / 3	414 / 506	1	13.70	83.10	0.8	7.50	22.00	25.43	35.00
	F*	460 / 60 / 3	238.5 / 291.5	1	6.20	41.00	0.7	6.20	13.10	14.65	20.00
060	G	208-230 / 60 / 1	187.2 / 253	1	26.40	134.00	1.1	7.50	34.97	41.57	60.00
	E	265 / 60 / 1	238.5 / 291.5	1	19.90	130.00	1.3	6.20	27.40	32.38	50.00
	H	208-230 / 60 / 3	414 / 506	1	16.00	110.00	1.1	7.50	24.57	28.57	40.00
	F*	460 / 60 / 3	238.5 / 291.5	1	7.80	52.00	1.3	6.20	15.30	17.25	25.00
070	G	208-230 / 60 / 1	187.2 / 253	1	30.80	178.00	1.1	7.50	39.37	47.07	70.00
	H	208-230 / 60 / 3	414 / 506	1	19.60	136.00	1.1	7.50	28.17	33.07	50.00
	F*	460 / 60 / 3	238.5 / 291.5	1	8.20	66.10	1.3	6.20	15.70	17.75	25.00

*460 volt units with Internal Source Pump and/or ECM-CV Require a Neutral

Electrical Data: ECM Blower – with ClimaDry® II

Standard Unit with ClimaDry - ECM Blower

TS Commercial Electrical Table Reheat								ECM-CV**			
MODEL	VOLTAGE CODE	RATED VOLTAGE	VOLTAGE MIN/MAX	COMPRESSOR			PUMP FLA	FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/ HACR
				QTY	RLA	LRA					
018	G	208-230 / 60 / 1	187.2 / 253	1	9.00	48.02	0.43	4.20	13.63	15.88	20.00
	E	265 / 60 / 1	238.5 / 291.5	1	7.10	43.00	0.7	3.40	11.20	12.98	20.00
024	G	208-230 / 60 / 1	187.2 / 253	1	13.50	58.30	0.8	4.20	18.50	21.88	35.00
	E	265 / 60 / 1	238.5 / 291.5	1	9.00	54.00	0.7	3.40	13.10	15.35	20.00
	H	208-230 / 60 / 3	187.2 / 253	1	7.10	55.40	0.8	4.20	12.10	13.88	20.00
	F*	460 / 60 / 3	414 / 506	1	3.50	28.00	0.7	3.40	7.60	8.48	15.00
030	G	208-230 / 60 / 1	187.2 / 253	1	12.80	64.00	0.8	5.90	19.50	22.70	35.00
	E	265 / 60 / 1	238.5 / 291.5	1	10.90	60.00	0.7	4.80	16.40	19.13	30.00
	H	208-230 / 60 / 3	187.2 / 253	1	8.30	58.00	0.8	5.90	15.00	17.08	25.00
	F*	460 / 60 / 3	414 / 506	1	5.10	28.00	0.7	4.80	10.60	11.88	15.00
036	G	208-230 / 60 / 1	187.2 / 253	1	16.00	77.00	0.8	4.20	21.00	25.00	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	12.20	72.00	0.7	3.40	16.30	19.35	30.00
	H	208-230 / 60 / 3	187.2 / 253	1	10.00	71.00	0.8	4.20	15.00	17.50	25.00
	F*	460 / 60 / 3	414 / 506	1	4.70	38.00	0.7	3.40	8.80	9.98	15.00
042	G	208-230 / 60 / 1	187.2 / 253	1	16.70	79.00	0.8	5.90	23.40	27.58	40.00
	E	265 / 60 / 1	238.5 / 291.5	1	13.50	72.00	0.7	4.80	19.00	22.38	35.00
	H	208-230 / 60 / 3	414 / 506	1	10.40	73.00	0.8	5.90	17.10	19.70	30.00
	F*	460 / 60 / 3	238.5 / 291.5	1	5.80	38.00	0.7	4.80	11.30	12.75	15.00
048	G	208-230 / 60 / 1	187.2 / 253	1	21.80	117.00	1.1	7.50	30.37	35.82	50.00
	E	265 / 60 / 1	238.5 / 291.5	1	16.30	98.00	1.3	6.20	23.80	27.88	40.00
	H	208-230 / 60 / 3	414 / 506	1	13.70	83.10	1.1	7.50	22.27	25.70	35.00
	F*	460 / 60 / 3	238.5 / 291.5	1	6.20	41.00	1.3	6.20	13.70	15.25	20.00
060	G	208-230 / 60 / 1	187.2 / 253	1	26.40	134.00	1.1	7.50	34.97	41.57	60.00
	E	265 / 60 / 1	238.5 / 291.5	1	19.90	130.00	1.3	6.20	27.40	32.38	50.00
	H	208-230 / 60 / 3	414 / 506	1	16.00	110.00	1.1	7.50	24.57	28.57	40.00
	F*	460 / 60 / 3	238.5 / 291.5	1	7.80	52.00	1.3	6.20	15.30	17.25	25.00
070	G	208-230 / 60 / 1	187.2 / 253	1	30.80	178.00	1.1	7.50	39.37	47.07	70.00
	H	208-230 / 60 / 3	414 / 506	1	19.60	136.00	1.1	7.50	28.17	33.07	50.00
	F*	460 / 60 / 3	238.5 / 291.5	1	8.20	66.10	1.3	6.20	15.70	17.75	25.00

*460 volt units with Internal Source Pump Require a Neutral

Electrical: Power Wiring

⚠ SAFETY! ⚠

SAFETY! Unit must have an all-pole disconnect installed between the supply mains and the unit. Disconnect is to be provided and installed either by the manufacturer, equipment installer or electrical contractor as local codes and laws allow.

⚠ WARNING! ⚠

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

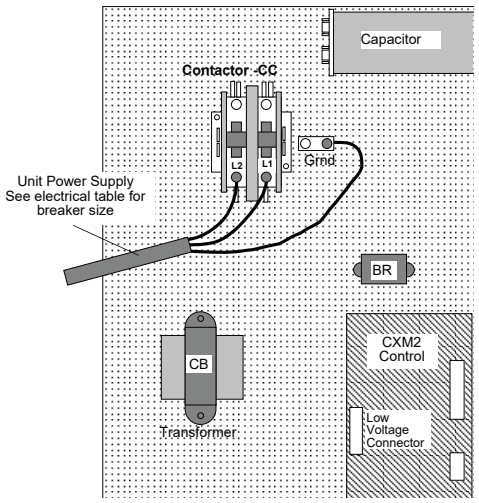
⚠ CAUTION! ⚠

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

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

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

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.



Note: 460V units with ECM, ClimaDry® II, or Internal Secondary Pump require a neutral wire.

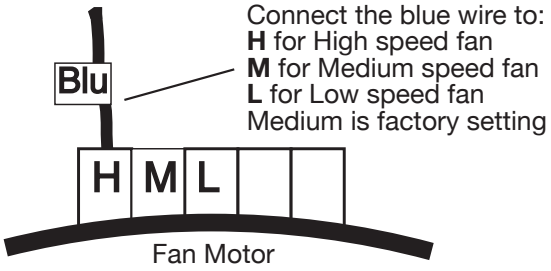
Power Connection - Line voltage connection is made by connecting the incoming line voltage wires to the "L" side of the contactor as shown in Figure 15. Consult electrical data tables for correct fuse size.

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

Blower Speed Selection – Units with PSC Motor - PSC (Permanent Split Capacitor) blower fan speed can be changed by moving the blue wire on the fan motor terminal block to the desired speed as shown in Figure 16. Most units are shipped on the medium speed tap. Consult submittal data or engineering design guide for specific unit airflow tables. Typical unit design delivers rated airflow at nominal static (0.15 in. w.g. [37Pa]) on medium speed and rated airflow at a higher static (0.4 to 0.5 in. w.g. [100 to 125 Pa]) on high speed for applications where higher static is required. Low speed will deliver approximately 85% of rated airflow at 0.10 in. w.g. [25 Pa]. An optional high static blower is available on some models.

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

Figure 16: PSC Motor Speed Selection



Electrical: Power & Low Voltage Wiring

ELECTRICAL - LOW VOLTAGE WIRING

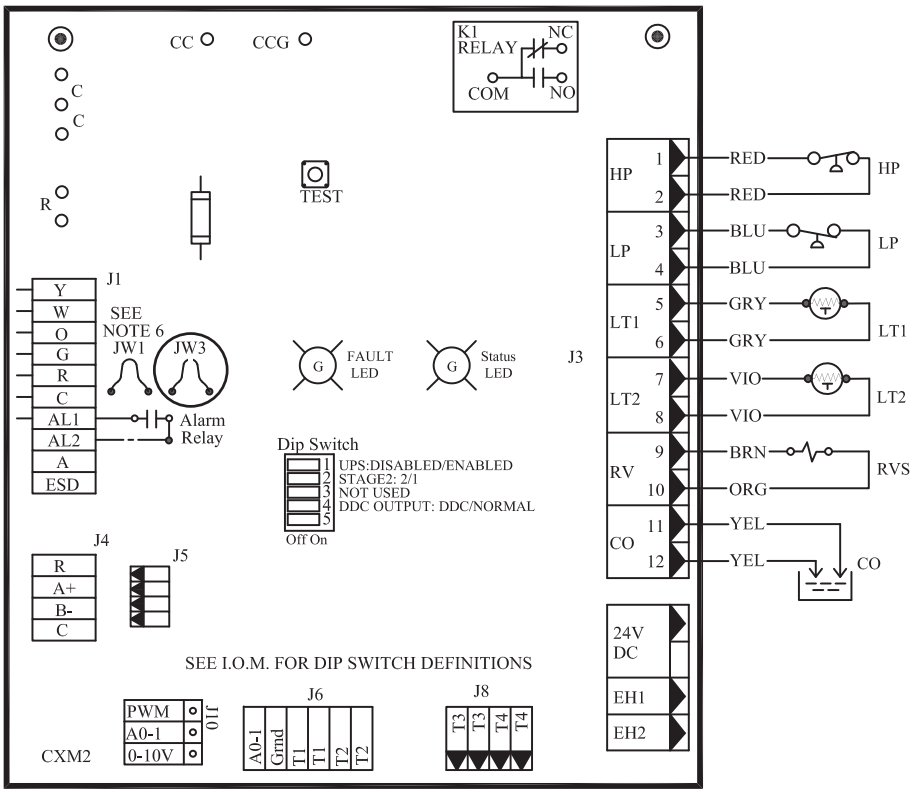
Thermostat Connections - The thermostat should be wired directly to the CXM2 or DXM2.5 board. See "Electrical – Thermostat" for specific terminal connections. Review the appropriate AOM (Application, Operation and Maintenance) manual for units with DDC controls.

Low Water Temperature Cutout Selection - The CXM2/DXM2.5 control allows the field selection of low water (or water-antifreeze solution) temperature limit by clipping jumper JW3 (see Figure 17), which changes the sensing temperature associated with thermistor LT1. Note that the LT1 thermistor is located on the refrigerant line between the coaxial heat exchanger and expansion device (TXV). Therefore, LT1 is sensing refrigerant temperature, not water temperature, which is a better indication of how water flow rate/temperature is affecting the refrigeration circuit.

The factory setting for LT1 is for systems using water (30°F [-1.1°C] refrigerant temperature). In low water temperature (extended range) applications with antifreeze (most ground loops), jumper JW3 should be clipped as shown in 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.

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

Figure 17: LT1 Limit Setting



Electrical: Low Voltage Wiring

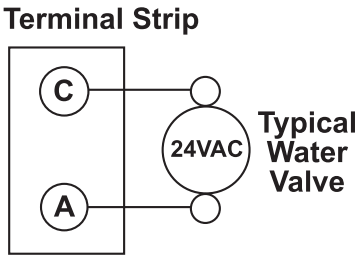
Accessory Connections
A terminal paralleling the compressor contactor coil has been provided on the CXM2/DXM2.5 control. Terminal "A" is designed to control accessory devices, such as water valves. Note: This terminal should be used only with 24 Volt signals and not line voltage. Terminal "A" is energized 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
+ CXM2 board (5 - 9 VA)*	21 - 31
Remaining VA for Accessories	19 - 29
+ DXM2.5 board (8 - 12 VA)*	24 - 34
Remaining VA for Accessories	41 - 51

*Standard transformer for CXM2 board is 50VA.
Optional DXM2.5 board and/or DDC controls
Include 75VA transformer.

Figure 18: Accessory Wiring



Water Solenoid Valves - An external solenoid valve(s) should be used on ground water installations to shut off flow to the unit when the compressor is not operating. A slow closing valve may be required to help reduce water hammer. Figure 18 shows typical wiring for a 24VAC external solenoid valve. Figures 19 and 20 illustrates a slow closing water control valve wiring for two styles of typical accessory water valves. Slow closing valves take approximately 60 seconds to open (very little water will flow before 45 seconds). Once fully open, an end switch allows the compressor to be energized. Only 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.

Figure 19: Accessory Motorized Water Valve - Typical Wiring Example #1

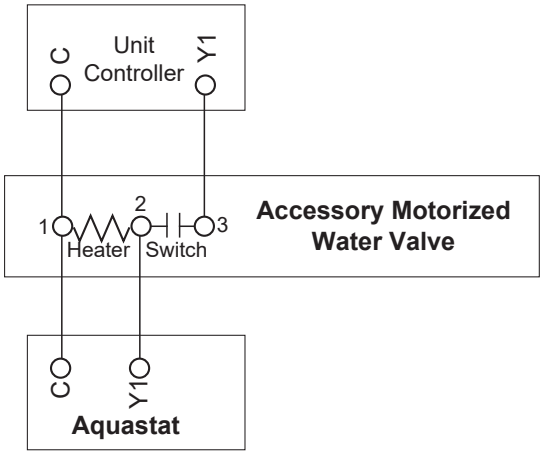
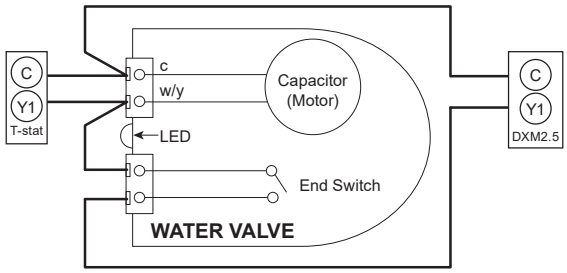


Figure 20: Accessory Motorized Water Valve - Typical Wiring Example #2



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 21 and 21a however, actual wiring connections should be determined from the thermostat IOM and or unit wiring diagram. Practically any heat pump thermostat will work with heat pump units, provided it has the correct number of heating and cooling stages. Heat/Cool thermostats are required for the hydronic heating option.

Figure 21: Units with PSC Fan

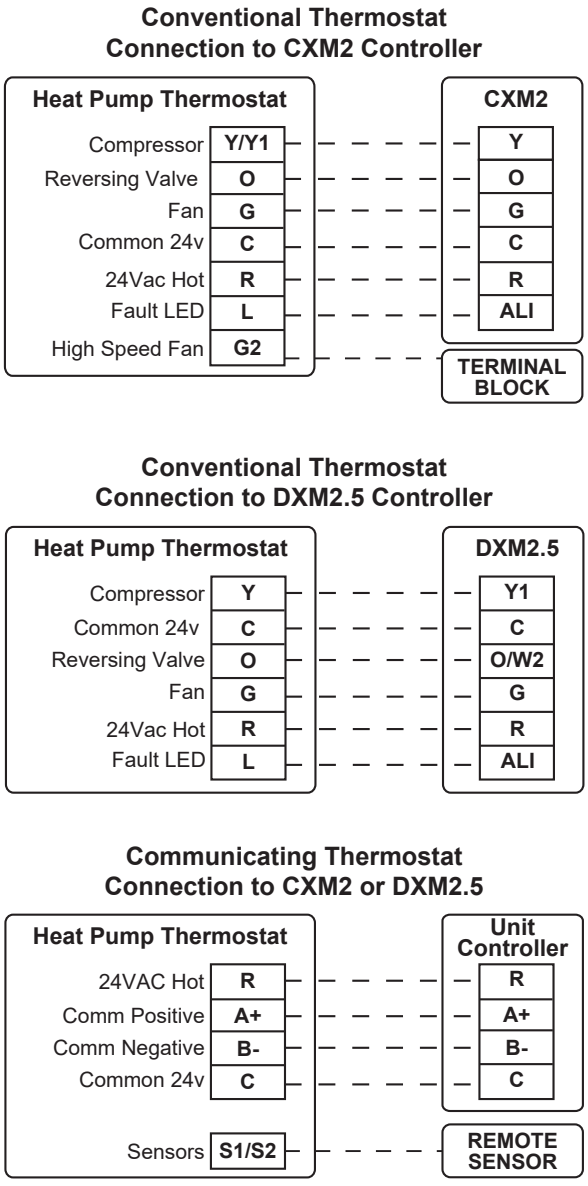
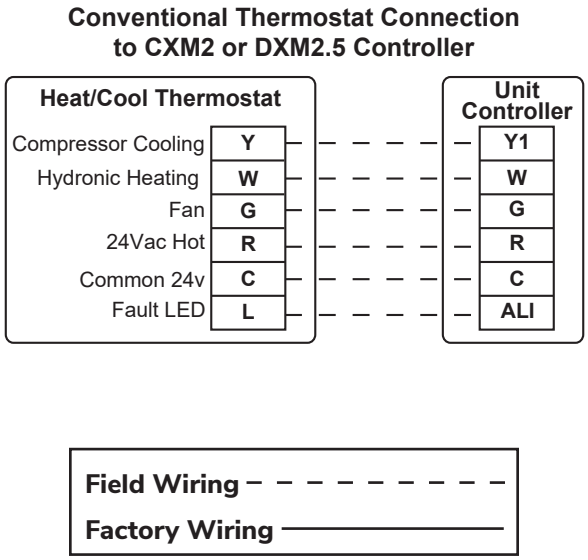


Figure 21a: Units with Hydronic Heating and CT ECM Fan



Blower Performance Data - TS006-024

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
6	240	150	PSC	HI	CFM	305	285	271	250	230	203	168			
				MED	CFM	245	230	214	190	167					
				LO	CFM	201	189	156							
9	300	225	PSC	HI	CFM	378	364	346	325	253					
				MED	CFM	353	341	326	310	230					
12	350	300	PSC	HI	CFM	500	479	453	403	347	312				
				MED	CFM	447	428	411	368	317					
				LO	CFM	368	358	345	315						

Airflow in CFM with wet coil and clean air filter

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
18	600	450	PSC	HI	CFM	711	693	690	675	640	598	515			
				MED	CFM	599	581	585	573	547	492				
				LO	CFM	527	517	506	495	462					
			HI Stitic PSC	HI	CFM	877	841	812	760	728	659				
				MED	CFM	755	738	711	668	640	602				
				LO	CFM	661	636	596	571	549					
	750		ECM CV	MIN	RPM	571	666	754	852	942	1012	1073	1134	1196	1254
					Power (W)	44	56	69	84	99	111	122	135	149	161
					CFM	450	450	450	450	450	450	450	450	450	450
				DEFAULT	RPM	717	787	855	920	982	1045	1113	1182	1248	1307
					Power (W)	95	110	125	142	157	175	195	216	237	258
					CFM	750	750	750	750	750	750	750	750	750	750
				MAX	RPM	739	807	873	937	997	1054	1113	1184	1248	1306
					Power (W)	105	119	136	153	170	186	205	228	250	271
					CFM	800	800	800	800	800	800	800	800	800	800

Airflow in CFM with wet coil and clean air filter

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
24	950	600	PSC	HI	CFM	1105	1066	1006	934	854	765	662			
				MED	CFM	879	854	818	770	708					
				LO	CFM	745	730	704	662						
			HI Stitic PSC	HI	CFM	1351	1296	1228	1159	1090	1016	919	775		
				MED	CFM	1151	1128	1091	1047	997	934	844	705		
				LO	CFM	1015	999	945	911	863	785	656			
			ECM CV	MIN	RPM	674	759	835	902	969	1035	1101	1161	1219	1273
					Power (W)	71	85	100	114	127	143	159	174	190	205
					CFM	600	600	600	600	600	600	600	600	600	600
				DEFAULT	RPM	906	945	990	1047	1102	1153	1202	1248	1292	1337
					Power (W)	180	195	209	230	251	272	291	311	331	351
					CFM	950	950	950	950	950	950	950	950	950	950
				MAX	RPM	988	1027	1069	1109	1160	1212	1260	1304	1347	1390
					Power (W)	236	253	270	288	311	336	359	382	404	428
					CFM	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050

Airflow in CFM with wet coil and clean air filter

Blower Performance Data - TS030-042

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
30	1000	750	PSC	HI	CFM			1228	1159	1090	1016	919	775		
				MED	CFM	1151	1128	1091	1047	997	934	844			
				LO	CFM	1015	999	945	911	863	785				
			HI Stitic PSC	HI	CFM		1249	1166	1083	1006	927	830			
				MED	CFM	1250	1183	1110	1039	969	894	796			
				LO	CFM	1172	1112	1046	982	919	850	758			
			ECM CV	MIN	RPM	721	797	865	930	991	1049	1105	1157	1209	1259
					Power (W)	93	108	124	140	156	173	189	205	221	237
					CFM	750	750	750	750	750	750	750	750	750	750
				DEFAULT	RPM	884	946	1007	1061	1115	1165	1214	1260	1304	1349
					Power (W)	187	209	232	252	274	295	316	338	358	380
					CFM	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
				MAX	RPM	1091	1148	1202	1255	1305					
					Power (W)	373	405	438	471	503					
					CFM	1250	1250	1250	1250	1250					

Airflow in CFM with wet coil and clean air filter

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
36	1200	900	PSC	HI	CFM	1387	1377	1350	1307	1251	1182	1099	1003	890	
				MED	CFM	1013	1013	1002	986	967	941	900			
				LO	CFM	900	897								
			HI Stitic PSC	HI	CFM	1717	1664	1592	1503	1399	1285	1163	1039	919	
				MED	CFM	1520	1485	1432	1361	1271	1165	1049	926		
				LO	CFM	1294	1263	1226	1182	1130	1064	980			
			ECM CV	MIN	RPM	646	730	805	873	936	996	1083	1127	1171	1215
					Power (W)	104	128	152	176	199	223	260	281	302	324
					CFM	900	900	900	900	900	900	900	900	900	900
				DEFAULT	RPM	777	849	913	973	1028	1080	1129	1178	1223	1270
					Power (W)	199	232	263	294	323	353	383	413	444	477
					CFM	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
				MAX	RPM	906	968	1025	1077	1129					
					Power (W)	346	387	426	465	505					
					CFM	1500	1500	1500	1500	1500					

Airflow in CFM with wet coil and clean air filter

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
42	1400	1000	PSC	HI	CFM	1759	1723	1680	1617	1524	1399	1247	1075		
				MED	CFM	1518	1494	1459	1408	1338	1247	1134	1001		
				LO	CFM	1309	1284	1246	1192	1122	1036				
			HI Stitic PSC	HI	CFM	1791	1760	1720	1674	1620	1552	1457	1318	1116	
				MED	CFM	1297	1299	1299	1293	1276	1240	1176	1072		
				LO	CFM	998	1013	1019	1004	963					
			ECM CV	MIN	RPM	533	617	679	725	781	838	805	942	988	1030
					Power (W)	95	124	147	167	192	220	252	277	303	330
					CFM	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
				DEFAULT	RPM	650	722	788	844	893	937	966	996	1038	1078
					Power (W)	203	244	286	324	357	390	413	437	471	506
					CFM	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
				MAX	RPM	749	809	862	918	968	1015	1060	1099	1135	
					Power (W)	352	402	449	500	547	596	645	688	733	
					CFM	1750	1750	1750	1750	1750	1750	1750	1750	1750	

Airflow in CFM with wet coil and clean air filter

Blower Performance Data - TS048-070

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
48	1600	1100	PSC	HI	CFM	1791	1760	1720	1674	1620	1552	1457	1318	1116	
				MED	CFM	1297	1299	1299	1293	1276	1240	1176			
				LO	CFM	Operation not recommended									
			HI Stitic PSC	HI	CFM	1889	1873	1833	1777	1706	1617	1504	1353	1150	
				MED	CFM	1680	1686	1678	1650	1599	1520	1409	1262		
				LO	CFM	1508	1521	1516	1492	1446	1376	1249			
			ECM CV	MIN	RPM	560	628	692	754	810	863	911	955	1007	1059
					Power (W)	125	152	179	208	234	262	289	315	347	380
					CFM	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
				DEFAULT	RPM	707	763	815	863	910	954	997	1038	1082	1122
					Power (W)	291	329	367	404	441	478	516	554	596	637
					CFM	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
				MAX	RPM	827	880	926	970	1011	1050	1086	1122	1158	1193
					Power (W)	508	561	610	658	706	754	798	845	892	939
					CFM	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000

Airflow in CFM with wet coil and clean air filter

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
60	1950	1500	PSC	HI	CFM	2300	2279	2257	2209	2140	2088	1990	1901	1856	1752
				MED	CFM	2039	2016	1983	1949	1920	1874	1807	1750	1670	1582
				LO	CFM	1858	1858	1838	1806	1792	1749	1699	1636	1570	
			HI Stitic PSC	HI	CFM	2486	2455	2424	2377	2318	2247	2161	2078	1986	1855
				MED	CFM	2162	2162	2153	2117	2085	2024	1971	1891	1823	1691
				LO	CFM	2006	2006	2006	1977	1947	1892	1851	1782	1705	1600
			ECM CV	MIN	RPM	770	812	848	886	926	965	1006	1047		
					Power (W)	305	330	351	375	400	427	455	483		
					CFM	1500	1500	1500	1500	1500	1500	1500	1500		
				DEFAULT	RPM	937	972	581	1036	1068	1100	1130	1164	1196	1228
					Power (W)	570	600	628	659	690	720	750	783	819	857
					CFM	1950	1950	1950	1950	1950	1950	1950	1950	1950	1950
				MAX	RPM	1005	1036	1068	1096	1125					
					Power (W)	724	758	792	822	854					
					CFM	2150	2150	2150	2150	2150					

Airflow in CFM with wet coil and clean air filter

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
70	2100	1750	PSC	HI	CFM	2486	2455	2424	2377	2318	2247	2161	2078	1986	1855
				MED	CFM	2162	2162	2153	2117	2085	2024	1971	1891	1823	
				LO	CFM	2006	2006	2006	1977	1947	1892	1851			
	1950		ECM CV	MIN	RPM	846	892	934	974	1013	1049	1085	1120	1158	1196
					Power (W)	417	458	499	537	577	615	654	694	737	782
					CFM	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
				DEFAULT	RPM	959	997	1035	1070	1103	1137	1170	1189		
					Power (W)	620	664	710	754	796	842	886	888		
					CFM	2050	2050	2050	2050	2050	2050	2050	2050		
				MAX	RPM	1019	1055	1089	1118						
					Power (W)	759	805	851	885						
					CFM	2250	2250	2250	2250						

Airflow in CFM with wet coil and clean air filter

Blower Performance Data: PSC – TS018-030 - w/ClimaDry® II

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
18	600	450	PSC	HI	CFM	700	704	694							
				MED	CFM										
				LO	CFM										
			HI Stitic PSC	HI	CFM	874	844	808	766						
				MED	CFM	757	734	706							
				LO	CFM										
	750		ECM CV	MIN	RPM										
					Power (W)										
					CFM										
				DEFAULT	RPM										
					Power (W)										
					CFM	750	750	750	750	750	750	750	750	750	
				MAX	RPM										
					Power (W)										
					CFM	800	800	800	800	800	800	800	800	800	

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
24	950	600	PSC	HI	CFM	1106	1060	1003	935						
				MED	CFM	877	853								
				LO	CFM										
			HI Stitic PSC	HI	CFM	1343	1295	1237	1168	1090	1000				
				MED	CFM	1141	1128	1099	1055	994	918				
				LO	CFM	1007	993	962	914	849					
			ECM CV	MIN	RPM										
					Power (W)										
					CFM										
				DEFAULT	RPM										
					Power (W)										
					CFM	950	950	950	950	950	950	950	950	950	
				MAX	RPM										
					Power (W)										
					CFM	1050	1050	1050	1050	1050	1050	1050	1050	1050	

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
30	1000	750	PSC	HI	CFM			1218	1166	1096	1008				
				MED	CFM	1148	1126	1093	1049	993	926				
				LO	CFM	1015	990	955	909	854					
			HI Stitic PSC	HI	CFM		1246	1168	1087	1005	920				
				MED	CFM	1247	1183	1114	1042	965	885				
				LO	CFM	1169	1112	1050	985	915					
			ECM CV	MIN	RPM										
					Power (W)										
					CFM										
				DEFAULT	RPM										
					Power (W)										
					CFM	1000	1000	1000	1000	1000	1000	1000	1000	1000	
				MAX	RPM										
					Power (W)										
					CFM	1250	1250	1250	1250						

Blower Performance Data: PSC – TS036-048 - w/ClimaDry® II

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
36	1200	900	PSC	HI	CFM	1384	1378	1351	1308	1250	1181	1097			
				MED	CFM	1012	1011	1003	987						
				LO	CFM										
			HI Stitic PSC	HI	CFM	1726	1659	1582	1494	1397	1289	1172			
				MED	CFM	1521	1482	1426	1356	1270	1168				
				LO	CFM	1290	1264	1228	1182	1125	1059				
			ECM CV	MIN	RPM										
					Power (W)										
					CFM										
				DEFAULT	RPM										
					Power (W)										
					CFM	1200	1200	1200	1200	1200	1200	1200	1200	1200	
				MAX	RPM										
					Power (W)										
					CFM	1500	1500	1500	1500						

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
42	1400	1000	PSC	HI	CFM	1748	1728	1682	1611	1515	1393				
				MED	CFM	1512	1495	1460	1406	1333	1242				
				LO	CFM	1307	1283	1244	1190						
			HI Stitic PSC	HI	CFM	1767	1763	1737	1691	1624	1535	1426	1296		
				MED	CFM	1283	1305	1310	1298	1270	1225				
				LO	CFM										
			ECM CV	MIN	RPM										
					Power (W)										
					CFM										
				DEFAULT	RPM										
					Power (W)										
					CFM	1400	1400	1400	1400	1400	1400	1400	1400	1400	
				MAX	RPM										
					Power (W)										
					CFM	1750	1750	1750	1750	1750	1750	1750	1750		

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
48	1600	1100	PSC	HI	CFM	1767	1763	1737	1691	1624	1535	1426	1296		
				MED	CFM	1289	1303	1304	1292	1268	1231				
				LO	CFM										
			HI Stitic PSC	HI	CFM	1877	1870	1840	1786	1709	1608	1484	1336		
				MED	CFM	1669	1688	1682	1650	1592	1509	1400			
				LO	CFM	1499	1522	1520	1492	1438	1360				
			ECM CV	MIN	RPM										
					Power (W)										
					CFM										
				DEFAULT	RPM										
					Power (W)										
					CFM	1600	1600	1600	1600	1600	1600	1600	1600	1600	
				MAX	RPM										
					Power (W)										
					CFM	2000	2000	2000	2000	2000	2000	2000	2000	2000	

Blower Performance Data: PSC – TS060-070 - w/ClimaDry® II

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
60	1950	1500	PSC	HI	CFM	2310	2280	2242	2195	2140	2077	2006	1927	1839	
				MED	CFM	2032	2015	1990	1957	1915	1866	1808	1742	1668	
				LO	CFM	1857	1852	1839	1816	1785	1745	1695	1637		
			HI Stitic PSC	HI	CFM	2484	2459	2422	2375	2316	2246	2166	2075	1973	
				MED	CFM	2161	2160	2146	2120	2082	2031	1967	1891	1803	
				LO	CFM	2004	2007	1998	1978	1945	1901	1845	1777	1697	
			ECM CV	MIN	RPM										
					Power (W)										
					CFM	1500	1500	1500	1500	1500	1500	1500			
				DEFAULT	RPM										
					Power (W)										
					CFM	1950	1950	1950	1950	1950	1950	1950	1950	1950	
				MAX	RPM										
					Power (W)										
					CFM	2150	2150	2150	2150						

Size	Rated Airflow	Min CFM	Motor	Fan Speed	Value	Airflow (cfm) at External Static Pressure (in. wg)									
						0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
70	2100	1750	PSC	HI	CFM	2484	2459	2422	2375	2316	2246	2166	2075	1973	
				MED	CFM	2165	2160	2144	2117	2079	2029	1969	1897		
				LO	CFM	2005	2007	1998	1976	1944	1900				
	1950		ECM CV	MIN	RPM										
					Power (W)										
					CFM	1750	1750	1750	1750	1750	1750	1750	1750	1750	
				DEFAULT	RPM										
					Power (W)										
					CFM	2050	2050	2050	2050	2050	2050	2050			
				MAX	RPM										
					Power (W)										
					CFM	2250	2250	2250							

Constant Volume (CV) ECM

The Intelligent Constant Volume (CV) ECM blower motor provides unmatched functionality that saves installing and service technicians time while also providing increased comfort levels to occupants.

CV ECM's are programed to maintain a constant CFM across a wide range of external static pressures (ESP). This functionality differs from traditional PSC or even Constant Torque (CT) ECM's. With traditional PSC and CT ECM fan motors, as ESP is increased CFM is reduced. To increase or decrease the speed of the fan motor requires a fan motor switch or a technician to wire into a different motor tap. CT ECM's provide increased efficiency over PSC motors but with no additional functionality. With a CV ECM, as changes in ESP occur the fan motor will adjust its speed to deliver the desired CFM (within its operating range). This ensures the system is delivering the airflow and capacity it was designed for.

A major benefit of the CV ECM over other fan motor types its ability to adjust airflow remotely through the iGate® 2 web portal/mobile app or directly at the unit with a communicating diagnostic service tool or thermostat. Airflow levels can be adjusted in increments of 25 CFM from the units minimum and maximum CFM range (see CV ECM configuration table for details). This functionality allows technicians to dial in airflow during start-up and commissioning via an easy to use service tool. During operation occupants may have a desire for airflow adjustments. Reducing CFM can reduce airflow sound levels and increase cooling dehumidification (latent capacity). Technicians can easily make these adjustments without making wiring changes reducing service time with minimal disruption to the occupants.

The fan motor operating modes include:

- First Stage Cooling (Y1 & O)
- Second Stage Cooling (Y1, Y2, & O)
- First Stage Heating (Y1)
- Second Stage Heating (Y1 & Y2)
- Fan (G with no Y1, Y2, or W)

The CV ECM motor includes **"soft start"** and **"ramp down"** features. The soft start feature gently increases the motors rpm at blower start up resulting quieter blower start cycles. Likewise, the ramp down feature allows the blower to slowly decrease rpm to a full stop resulting in a quieter end to each blower cycle. The ramp down feature (also known as the heating or cooling "Off Delay") also has the functionality to be field selected by the technician in the allowable range of 0 to 255 seconds.

Airflow Configuration Screen on Mobile App

Wiring Diagram Matrix

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

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

Unit Controller	Fan Motor	Hydronic Options	208/60/1 - 265/60/1		208/60/3	460/60/3	575/60/3
			006-012	018-070	024-060	024-060	042-070
CXM2	PSC	None	96B0514N11		96B0514N21	96B0514N31	
	CT ECM	None	96B0514N12		96B0514N22	96B0514N32	
DXM2.5	PSC	None	96B0521N11		96B0521N21	96B0521N31	
		Reheat		96B0524N11	96B0524N21	96B0524N31	
	CT ECM	None	96B0527N11		96B0527N21	96B0527N31	
		Reheat		96B0525N11	96B0525N21	96B0525N31	
	CV ECM	None	96B0523N01	96B0523N11	96B0523N21	96B0523N31	
		Reheat		96B0528N11	96B0528N21	96B0528N31	
Auxiliary WD for MPC Controls			96B0147N14				

Controls: CXM2 and DXM2.5

CXM2 Controls

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

DXM2.5 Controls

For detailed controller information, see the DXM2.5 Application, Operation, and Maintenance (AOM) manual (part # 97B0142N01). To confirm the controller type of your particular unit, refer to digit 9 on the unit model number and the unit nomenclature diagram found on page 3 of this manual.

ClimaDry® II Modulating Reheat Option

ClimaDry® II Sequence Of Operation

A heat pump equipped with ClimaDry® II 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. The DXM2.5 microprocessor board, which is standard with the ClimaDry II option, will accept either heat pump (Y, O) thermostats or non-heat pump (Y, W) thermostats.

Almost any thermostat will activate the heat pump in heating or cooling modes. The reheat mode requires either a separate humidistat/dehumidistat or a thermostat that has an integrated dehumidification function for activation. The DXM2.5 board is configured to work with either a humidistat or dehumidistat input to terminal "H" (DIP switch settings for the DXM2.5 board are shown in Table 4). Upon receiving an "H" input, the DXM2.5 board will activate the cooling mode and engage reheat. Table 5 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 DXM2.5 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 DXM2.5 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 DXM2.5 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 DXM2.5 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 DXM2.5 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 DXM2.5 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® II Component Functions

The ClimaDry® II 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® II Modulating Reheat Option, Cont'd.

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® II Application Considerations

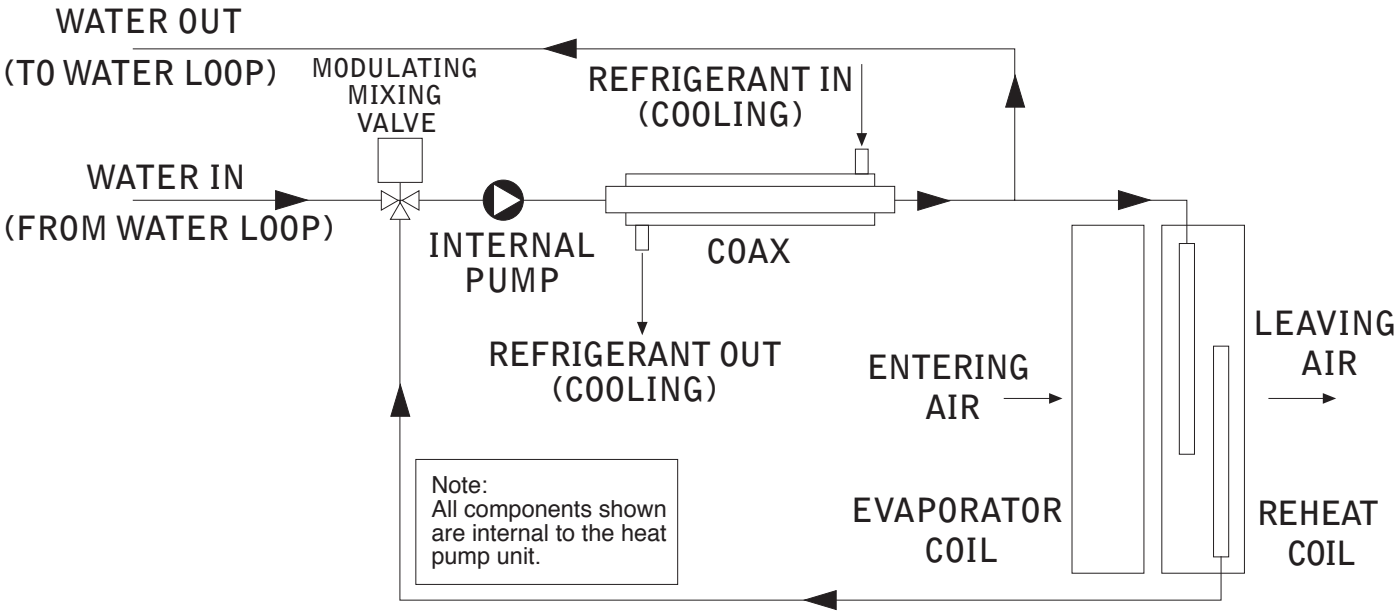
Unlike most hot gas reheat options, the ClimaDry® II option will operate over a wide range of EWTs. Special flow regulation (water regulating valve) is not required for low EWT conditions. However, below 55°F [13°C], supply air temperatures may not be maintained at 72°F [22°C] because the cooling capacity 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 II 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 II should not be used as make-up air units. These applications should use equipment specifically designed for makeup air.

Figure 23: ClimaDry® II Schematic



ClimaDry® II Modulating Reheat Option, Cont'd.

Table 4: Humidistat/Dehumidistat Logic & DXM2.5 (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 5: ClimaDry® II Operating Modes

Mode	Input					Output				
	O	G	Y1	Y2[3]	H	RV	Fan	1st stg H/C	2nd stg H/C[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

[1]Cooling input takes priority over dehumidify input.
[2]DXM2.5 is programmed to ignore the H demand when the unit is in heating mode.
[3]N/A for single stage units; Full load operation for dual capacity units.
[4]ON/OFF = Either ON or OFF.

Operating Limits and Commissioning 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 8a for operating limits.

Commissioning Conditions

Consult table 8b for the particular model. Starting conditions vary depending upon model and are based upon the following notes:

NOTES:

1. Conditions in table 8b 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 8a: Operating Limits

Operating Limits	TS	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45ºF [7ºC]	39ºF [4ºC]
Rated ambient, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	130ºF [54.4ºC]	85ºF [29ºC]
Min. entering air, DB/WB	*60/50ºF [16/10ºC]	45ºF [7ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	95/75ºF [35/24ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43.3ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	
Maximum Altitude PSC	10000 ft	
Maximum Altitude ECM	6500 ft	

* If with ClimaDry® II 65/55°F (18/13°C)

Table 8b: Commissioning Conditions

Commissioning Conditions	TS	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45ºF [7ºC]	39ºF [4ºC]
Rated ambient, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	130ºF [54.4ºC]	85ºF [29ºC]
Min. entering air, DB/WB	50/45ºF [10/7ºC]	40ºF [4.5ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	110/83ºF [43/28ºC]	90ºF [32ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43.3ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	
Maximum Altitude PSC	10000 ft	
Maximum Altitude ECM	6500 ft	

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 85°F [29°C]. Open a drain at the lowest point in the system. Adjust the make-up water replacement rate to equal the rate of bleed.
7. Refill the system and add trisodium phosphate in a proportion of approximately one pound per 150 gallons (.8 kg per 1000 l) of water (or other equivalent approved cleaning agent). Reset the boiler to raise the loop temperature to 100°F [38°C]. Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
8. When the cleaning process is complete, remove the short-circuited hoses. Reconnect the hoses to the proper supply, and return the connections to each of the units. Refill the system and bleed off all air.
9. 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.

⚠ CAUTION! ⚠

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

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.

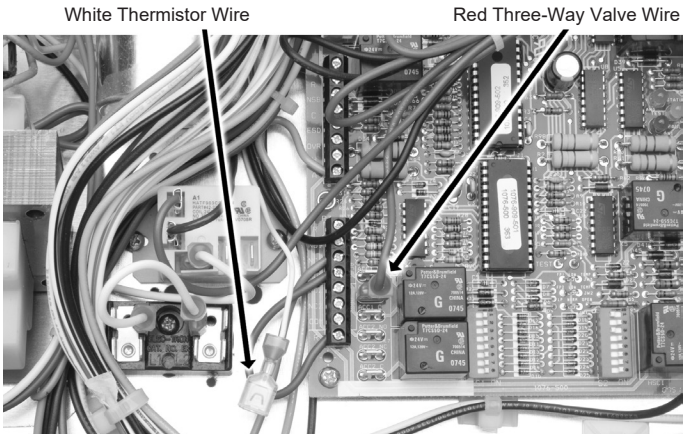
Flushing/Purging Units with ClimaDry® II

When flushing/purging units equipped with ClimaDry® II the unit should be fully flushed/purged before attempting to flush/purge the ClimaDry II coil. Once the unit is flushed, energize the modulating three-way dehumidification valve to allow flow through the ClimaDry II 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 II 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 DXM2.5 board. Connect this wire to the ACC1 'NC' terminal of the DXM2.5 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.

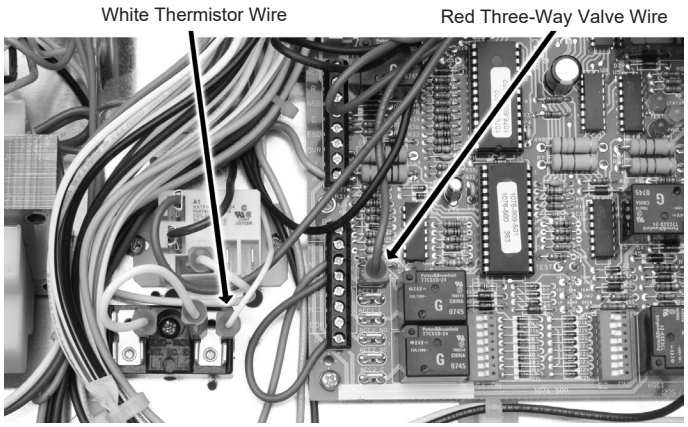
Flushing/Purging Wiring



De-energize the valve by removing the red wire from the ACC1 'NC' terminal on the DXM2.5 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 DXM2.5 for normal operation. Reconnect the white sensor wire to the LVTB, as shown below. If air is allowed to collect in the ClimaDry II piping, nuisance trips may occur. Additional flush/purge cycles may be used when required.

Normal Unit Wiring



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 8a-b.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out on the CXM2/DXM2.5 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 CXM2 or DXM2.5 field selection options are properly set.

SYSTEM CHECKOUT

- ❑ System water temperature: Check water temperature for proper range and also verify heating and cooling setpoints for proper operation.
- ❑ System pH: Check and adjust water pH if necessary to maintain a level between 6 and 8.5. Proper pH promotes longevity of hoses and fittings (see table 3).
- ❑ System flushing: Verify that all hoses are connected end to end when flushing to ensure that debris bypasses the unit heat exchanger, water valves and other components. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Verify that all air is purged from the system. Air in the system can cause poor operation or system corrosion.
- ❑ Cooling tower/boiler: Check equipment for proper setpoints and operation.
- ❑ Standby pumps: Verify that the standby pump is properly installed and in operating condition.
- ❑ System controls: Verify that system controls function and operate in the proper sequence.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out controls are provided for the outdoor portion of the loop. Otherwise, operating problems may occur.
- ❑ System control center: Verify that the control center and alarm panel have appropriate setpoints and are operating as designed.
- ❑ Miscellaneous: Note any questionable aspects of the installation.

⚠ CAUTION! ⚠

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

⚠ CAUTION! ⚠

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

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

Unit Start-Up Procedure

Unit Start-up Procedure

1. Turn the thermostat fan position to “ON”. Blower should start.
2. Balance air flow at registers.
3. Adjust all valves to their full open positions. Turn on the line power to all heat pumps.
4. Room temperature should be within the minimum-maximum ranges of Tables 8a-b. 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.

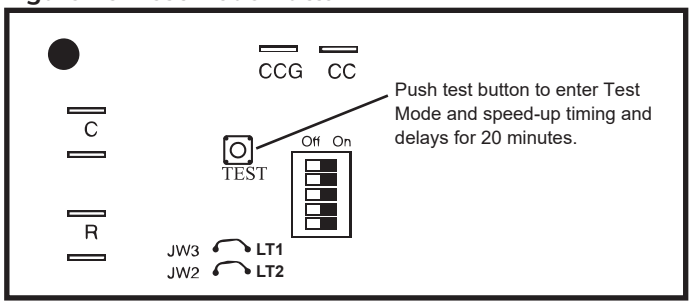
      Note: Units have a five minute time delay in the control circuit that can be eliminated on the CXM2/DXM2.5 control board as shown in Figure 25. See controls description for details.
   c. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using the P/T plugs and comparing to Table 9.
   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 9. Heat of rejection (HR) can be calculated and compared to submittal data capacity pages. The formula for HR for systems with water is as follows:
      HR (Btuh) = TD x GPM x 500,where TD is the temperature difference between the entering and leaving water, and GPM is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to table 9. In S-I units, the formula is as follows: HR (kW) = TD x l/s x 4.18.
   f. Check air temperature drop across the air coil when compressor is operating. Air temperature drop should be between 15°F and 25°F [8°C and 14°C].
   g. Turn thermostat to “OFF” position. A hissing noise indicates proper functioning of the reversing valve.
6. Allow five (5) minutes between tests for pressure to equalize before beginning heating test.
   a. Adjust the thermostat to the lowest setting. Place the thermostat mode switch in the “HEAT” position.
   b. Slowly raise the thermostat to 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 11. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. If temperature is outside of the operating range, check refrigerant pressures and compare to table 10. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in table 9. Heat of extraction (HE) can be calculated and compared to submittal data capacity pages. The formula for HE for systems with water is as follows:

      HE (kW) = TD x GPM x 500, where TD is the temperature difference between the entering and leaving water, and l/s is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to table 9. In S-I units, the formula is as follows: HE (kW) = TD x l/s x 4.18.
   e. Check air temperature rise across the air coil when compressor is operating. Air temperature rise should be between 20°F and 30°F [11°C and 17°C].
   f. Check for vibration, noise, and water leaks.
7. If unit fails to operate, perform troubleshooting analysis (see troubleshooting section). If the check described fails to reveal the problem and the unit still does not operate, contact a trained service technician to ensure proper diagnosis and repair of the equipment.
8. When testing is complete, set system to maintain desired comfort level.

NOTE: If performance during any mode appears abnormal, refer to the CXM2/DXM2.5 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.

Unit Start-Up Procedure, Cont'd.

Figure 25: Test Mode Button



⚠ 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 Limits

Table 9: TS Coax Water Pressure Drop

Model	U.S. GPM	l/s	l/m	Pressure Drop, psi [kPa]*			
				30ºF [-1ºC]	50ºF [10ºC]	70ºF [21ºC]	90ºF [32ºC]
006	1.0	0.063	4	0.3 [2.1]	0.3 [2.1]	0.2 [1.4]	0.2 [1.4]
	1.5	0.095	6	1.6 [11.0]	1.4 [11.0]	1.2 [11.0]	1.0 [11.0]
	2.0	0.126	8	3.0 [20.7]	2.6 [17.9]	2.2 [15.2]	1.8 [12.4]
009	1.4	0.088	5	0.8 [5.5]	0.7 [4.8]	0.6 [4.1]	0.6 [4.1]
	2.1	0.132	8	1.5 [10.3]	1.4 [9.7]	1.2 [8.3]	1.1 [7.6]
	2.8	0.177	11	2.7 [18.6]	2.4 [16.5]	2.2 [15.2]	1.9 [13.1]
012	1.8	0.114	7	0.6 [4.1]	0.5 [3.4]	0.4 [2.8]	0.3 [2.1]
	2.6	0.164	10	2.1 [14.5]	1.9 [13.1]	1.6 [11.0]	1.4 [9.7]
	3.5	0.221	13	3.8 [26.2]	3.4 [23.4]	3.0 [20.7]	2.6 [17.9]
018	2.8	0.176	11	0.7 [4.8]	0.5 [3.4]	0.3 [2.1]	0.2[1.4]
	4.1	0.258	15	2.1 [14.5]	1.7 [11.7]	1.4 [9.7]	1.1 [7.6]
	5.5	0.347	21	3.5 [24.1]	2.8 [19.3]	2.4 [16.6]	2.0 [13.8]
024	3.0	0.189	11	1.2 [8.0]	0.3 [2.4]	0.2 [1.1	0.1 [.69]
	4.5	0.284	17	1.9 [13.2]	1.0 [7.2]	0.7 [4.7]	0.5 [3.4]
	6.0	0.379	23	2.0 [13.8]	1.4 [9.7]	1.2 [7.8]	1.0 [6.8]
030	3.8	0.240	14	0.9 [5.9]	0.8 [5.6]	0.8 [5.2]	0.7 [5.0]
	5.6	0.353	21	1.6 [11.0]	1.4 [9.7]	1.3 [9.2]	1.3 [8.8]
	7.5	0.473	28	2.5 [17.5]	2.2 [15.2]	2.1 [14.3]	2.0 [13.7]
036	4.5	0.284	17	1.2 [8.0]	0.8 [5.6]	0.9 [6.1]	0.8 [5.6]
	6.8	0.430	26	2.4 [16.5]	1.9 [13.4]	1.8 [12.4]	1.7 [11.6]
	9.0	0.568	34	4.0 [27.6]	3.2 [22.2]	3.0 [20.6]	2.8 [19.4]
042	5.5	0.347	21	1.0 [7.0]	0.9 [6.1]	0.8 [5.8]	0.8 [5.6]
	8.3	0.524	31	2.2 [15.2]	1.9 [12.8]	1.8 [12.3]	1.8 [12.4]
	11.0	0.694	42	3.8 [25.8]	3.4 [23.1]	3.2 [22.1]	3.1 [21.4
048	6.0	0.379	23	1.1 [7.6]	0.9 [5.9]	0.7 [5.2]	0.8 [5.4]
	9.0	0.568	34	2.3 [15.9]	1.8 [12.5]	1.8 [12.7]	1.8 [12.3]
	12.0	0.757	45	3.9 [26.9]	3.2 [22.0]	3.2 [21.9]	3.0 [21.0]
060	7.5	0.473	28	1.3 [9.1]	0.6 [4.3]	0.5 [3.2]	0.5 [3.4]
	11.3	0.713	43	3.5 [24.5]	2.5 [16.9]	2.1 [14.2]	2.0 [13.6]
	15.0	0.947	57	6.1 [42.0]	4.7 [32.4]	4.1 [28.2]	3.9 [27.0]
070	9.0	0.568	34	2.7 [18.7]	1.7 [12.0]	1.5 [10.4]	1.6 [10.7]
	13.5	0.852	51	5.2 [35.8]	3.8 [26.3]	3.3 [22.8]	3.2 [22.2]
	18.0	1.140	68	8.1 [56.0]	6.4 [44.1]	5.7 [39.0]	5.5 [37.6]

Motorized Water Valve Option Corrections

Model	Cv	MOPD	WPD Adders		
			GPM	PSI	FT
006	4.9	150	1.0	0.04	0.10
	4.9	150	1.5	0.09	0.22
	4.9	150	2.0	0.17	0.38
009	4.9	150	1.4	0.08	0.19
	4.9	150	2.1	0.18	0.42
	4.9	150	2.8	0.33	0.75
012	4.9	150	1.8	0.13	0.31
	4.9	150	2.6	0.28	0.65
	4.9	150	3.5	0.51	1.18
018	10.3	125	2.8	0.07	0.16
	10.3	125	4.1	0.16	0.37
	10.3	125	5.5	0.29	0.66
024	10.3	125	4.0	0.15	0.35
	10.3	125	6.0	0.34	0.78
	10.3	125	8.0	0.60	1.39
030	10.3	125	4.0	0.15	0.35
	10.3	125	6.0	0.34	0.78
	10.3	125	8.0	0.60	1.39
036	10.3	125	4.5	0.19	0.44
	10.3	125	6.8	0.43	0.99
	10.3	125	9.0	0.76	1.76
042	10.3	125	5.5	0.29	0.66
	10.3	125	8.3	0.64	1.48
	10.3	125	11.0	1.14	2.63
048	10.3	125	6.0	0.34	0.78
	10.3	125	9.0	0.76	1.76
	10.3	125	12.0	1.36	3.14
060	8.9	125	7.5	0.71	1.64
	8.9	125	11.3	1.60	3.69
	8.9	125	15.0	2.84	6.56
070	8.9	125	8.3	0.86	1.98
	8.9	125	12.4	1.93	4.47
	8.9	125	16.5	3.44	7.94

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

Model	WPD Adders		
	GPM	PSI	FT
018	2.8	0.77	1.77
	4.1	1.65	3.80
024	4.0	1.57	3.62
	6.0	3.53	8.14
030	4.0	0.69	1.59
	6.0	1.55	3.58
036	4.5	0.87	2.02
	6.8	1.99	4.60
042	5.5	1.30	3.01
	8.3	6.75	15.58
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
070	8.3	1.83	4.22
	12.4	4.08	9.42

Unit Maximum Water Working Pressure	
Options	Max Pressure PSIG [kPa]
Base Unit	500 [3,447]
Internal Secondary Pump (ISP)	145 [999]
ClimaDry® II	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.

Unit Operating Limits, Cont'd.

Table 10: TS Series Typical Unit Operating Pressures and Temperatures (60Hz - I-P Units)

006		Full Load Cooling						Full Load Heating					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Sub cooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	114-124	142-162	24-29	3-8	15.2-17.2	17-23	75-85	272-292	13-18	4-9	5.9-7.9	16-22
	2.25	111-121	132-152	26-31	3-8	11.4-13.4	17-23	78-88	274-294	13-18	4-9	4.3-6.3	16-22
	3	109-119	122-142	28-33	3-8	7.5-9.5	17-23	81-91	276-296	13-18	4-9	2.7-4.7	17-23
50	1.5	130-140	190-210	14-19	2-7	16.5-18.5	18-24	104-114	299-319	12-17	6-11	8.8-10.8	21-27
	2.25	129-139	180-200	16-21	2-7	12.3-14.3	18-24	112-122	304-324	12-17	4-9	6.7-8.7	22-28
	3	128-138	170-190	19-24	2-7	8-10	18-24	120-130	308-328	12-17	3-8	4.5-6.5	23-29
70	1.5	143-153	265-285	9-14	2-7	15.5-17.5	18-24	129-139	321-341	11-16	7-12	11.2-13.2	25-31
	2.25	141-151	252-272	10-15	2-7	11.5-13.5	18-24	144-154	330-350	13-18	4-9	8.8-10.8	27-33
	3	140-150	240-260	11-16	2-7	7.5-9.5	18-24	159-169	340-360	15-20	3-8	6.3-8.3	28-34
90	1.5	149-159	340-370	8-13	2-7	14.2-16.2	17-23	163-173	349-369	13-18	7-12	14.3-16.3	30-36
	2.25	149-159	335-355	8-13	2-7	10.6-12.6	17-23	180-190	360-380	11-16	4-9	11.2-13.2	32-38
	3	148-158	320-340	8-13	2-7	7-9	17-23	198-208	372-392	10-15	3-8	8.1-10.1	34-40
110	1.5	154-164	451-471	8-13	2-7	12.7-14.7	15-21						
	2.25	154-164	428-448	8-13	2-7	9.5-11.5	15-21						
	3	153-163	405-425	8-13	2-7	6.5-8.5	15-21						

*Based on 15% Methanol antifreeze solution

009		Full Load Cooling						Full Load Heating					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Sub cooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	126-136	161-181	17-22	8-13	19.8-21.8	21-27	74-84	278-298	6-11	4-9	6.1-8.1	18-24
	2.25	126-136	146-166	17-22	7-12	14.9-16.9	21-27	77-87	280-300	6-11	4-9	4.5-6.5	18-24
	3	126-136	131-151	17-22	6-11	9.9-11.9	21-27	79-89	283-303	6-11	3-8	2.8-4.8	19-25
50	1.5	132-142	215-235	10-15	8-13	18.8-20.8	20-26	104-114	309-329	8-12	7-12	9.6-11.6	24-30
	2.25	132-142	200-220	10-15	7-12	14.1-16.1	20-26	106-116	312-332	8-12	7-12	7-9	24-30
	3	132-142	185-205	10-15	6-11	9.4-11.4	20-26	108-118	315-335	8-12	7-12	4.5-6.5	25-31
70	1.5	138-148	278-298	8-13	9-14	17.7-19.7	19-25	127-137	332-352	10-15	10-15	12-14	29-35
	2.25	138-148	263-283	8-13	8-13	13.1-15.1	19-25	132-142	340-360	11-16	10-15	9-10	29-35
	3	137-147	248-268	8-13	7-12	8.5-10.5	19-25	138-148	347-367	13-18	10-15	6.1-8.1	30-36
90	1.5	142-152	365-385	8-13	9-14	16-18	18-24	164-174	372-392	17-22	13-18	14.5-16.5	35-41
	2.25	142-152	351-371	8-13	8-13	12-14	18-24	165-175	375-395	18-23	13-18	11.2-13.2	35-41
	3	142-152	337-357	8-13	7-12	8-10	18-24	167-177	379-399	19-24	13-18	7.9-9.9	36-42
110	1.5	150-160	439-459	7-12	9-14	14.2-16.2	17-23						
	2.25	150-160	439-459	7-12	8-13	10.6-12.6	17-23						
	3	150-160	439-459	7-12	7-12	6.9-8.9	17-23						

*Based on 15% Methanol antifreeze solution

012		Full Load Cooling						Full Load Heating					
Entering Water Temp °F	Water Flow GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Sub cooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.5	98-108	140-160	36-41	14-19	17.1-19.1	19-25	72-82	301-321	9-14	12-17	6.5-8.5	21-27
	2.25	98-108	135-155	36-41	12-17	12.5-14.5	19-25	85-95	304-324	9-14	12-17	4.7-6.7	21-27
	3	99-109	127-148	36-41	10-15	7.9-9.9	19-25	78-88	308-328	9-14	12-17	2.9-4.9	22-28
50	1.5	118-128	215-235	22-27	14-19	18.1-20.1	20-26	100-110	337-357	10-15	15-20	9.5-11.5	26-32
	2.25	118-128	200-220	22-27	12-17	13.1-15.1	20-26	98-108	334-354	10-15	15-20	6.6-8.6	26-32
	3	118-128	185-205	22-27	10-15	8.1-10.1	19-25	95-105	332-352	11-16	15-20	3.8-5.8	26-32
70	1.5	132-142	300-320	11-16	12-17	17-19	19-25	115-125	361-381	19-24	18-23	11.1-13.1	29-35
	2.25	132-142	263-282	11-16	10-15	12.6-14.6	19-25	112-122	360-380	20-25	18-23	8-10	29-35
	3	132-142	245-265	12-17	7-12	8.2-10.2	19-25	110-120	356-376	21-26	18-23	4.8-6.8	29-35
90	1.5	138-148	366-386	9-14	11-16	15.8-17.8	18-24	122-132	376-396	34-39	22-27	12.1-14.1	32-38
	2.25	138-148	353-373	9-14	9-14	14.9-16.9	18-24	123-133	378-398	36-41	22-27	9-11	32-38
	3	138-148	340-360	9-14	6-11	14-16	18-24	124-134	380-400	38-43	23-28	5.8-7.8	32-38
110	1.5	145-155	453-473	9-14	9-14	14.7-16.7	16-22						
	2.25	145-155	442-462	9-14	7-12	10.8-12.8	16-22						
	3	145-155	431-451	9-14	5-10	6.8-8.8	17-23						

*Based on 15% Methanol antifreeze solution

Unit Operating Limits, Cont'd.

Table 10, cont'd.: TS Series Typical Unit Operating Pressures and Temperatures

018		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	155-175	27-32	11-16	16.9-19.9	16-22	73-83	268-288	8-13	4-9	6.1-8.1	15-21
	2.25	120-130	142-162	27-32	9-14	12.5-14.5	17-23	75-85	270-290	8-13	4-9	4.4-6.4	16-22
	3	120-130	128-148	27-32	9-14	8.1-10.1	17-23	78-88	272-292	8-13	4-9	2.9-4.9	16-22
50	1.5	137-147	220-240	16-21	10-15	17-19	16-22	102-112	295-315	8-13	8-13	9.1-11.1	20-26
	2.25	137-147	206-226	16-21	8-13	12.6-14.6	17-23	106-116	297-317	8-13	8-13	6.9-8.9	21-27
	3	137-147	192-212	16-21	8-13	8.4-10.4	17-23	110-120	299-319	8-13	8-13	4.7-6.7	21-27
70	1.5	142-152	287-307	7-12	10-15	15.9-17.9	16-22	131-141	324-344	9-14	10-15	12.1-14.1	25-33
	2.25	142-152	273-239	7-12	8-13	11.8-13.8	17-23	137-147	326-346	9-14	10-15	9.3-11.3	26-34
	3	142-152	259-279	7-12	8-13	7.8-9.8	17-23	144-154	328-348	9-14	10-15	6.6-8.6	26-34
90	1.5	146-156	375-395	6-11	10-15	14.9-16.9	16-22	174-184	360-380	10-15	12-17	15.8-17.8	32-40
	2.25	146-156	361-381	6-11	8-13	11-13	17-23	180-190	367-387	11-16	12-17	11.9-13.9	33-41
	3	146-156	347-367	6-11	8-13	7.2-9.2	17-23	187-197	374-394	12-17	12-17	8-10	33-41
110	1.5	154-164	478-498	6-11	10-15	14-16	16-22						
	2.25	154-164	461-481	6-11	8-13	10.2-12.2	16-22						
	3	154-164	445-465	6-11	8-13	6.5-8.5	16-22						

*Based on 15% Methanol antifreeze solution

024		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	115-125	154-174	40-45	8-13	16.5-18.5	19-25	73-83	283-303	8-12	6-11	5.9-7.9	16-22
	2.25	115-125	141-161	40-45	6-11	12.1-14.1	20-26	75-85	285-305	8-12	6-11	4.2-6.2	17-23
	3	115-125	127-147	40-45	6-11	77.7-9.7	20-26	78-88	287-307	8-12	6-11	2.7-4.7	18-24
50	1.5	115-120	209-229	24-29	10-15	15.7-17.7	18-24	102-112	313-333	8-12	8-13	8.9-10.9	22-28
	2.25	115-120	195-215	24-29	8-13	11.6-13.6	18-24	106-116	314-334	8-12	8-13	6.7-8.7	23-29
	3	115-120	181-201	24-29	8-13	7.6-9.6	18-24	110-120	316-336	8-12	8-13	4.5-6.5	23-29
70	1.5	136-146	275-295	6-11	6-11	15.7-17.7	18-24	128-138	340-360	9-14	9-14	11.3-13.3	27-34
	2.25	136-146	261-281	6-11	5-10	11.6-13.6	18-24	134-144	342-362	9-14	9-14	8.5-10.5	28-35
	3	136-146	247-267	6-11	4-9	7.6-9.6	18-24	141-151	344-364	9-14	9-14	5.8-7.8	28-35
90	1.5	140-150	361-381	6-11	6-11	14.9-16.9	18-24	162-172	370-390	14-19	9-14	14.4-16.4	32-40
	2.25	140-150	347-367	6-11	5-10	11-13	18-24	166-176	376-396	15-20	9-14	10.8-12.8	34-42
	3	140-150	333-353	6-11	4-9	7.2-9.2	18-24	171-181	383-403	16-21	9-14	7.1-9.1	34-42
110	1.5	144-154	460-480	6-11	6-11	13.9-15.9	17-23						
	2.25	144-154	445-465	6-11	4-9	10.2-12.2	17-23						
	3	144-154	428-448	6-11	4-9	6.5-8.5	17-23						

*Based on 15% Methanol antifreeze solution

030		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	116-126	146-166	27-32	7-13	19.6-21.6	16-22	69-79	275-295	7-12	6-11	7.2-9.2	16-22
	2.25	115-125	138-158	27-32	6-11	14.3-16.3	17-23	73-83	277-297	7-12	6-11	5.4-7.4	17-23
	3	115-125	128-148	27-32	6-11	8-10	17-23	76-86	279-299	7-12	6-11	3.5-5.5	17-23
50	1.5	129-139	217-237	12-17	6-11	20.8-22.8	17-23	96-106	300-320	10-15	9-14	10.5-12.5	21-27
	2.25	128-138	203-223	12-17	5-10	15-17	18-24	100-110	304-324	10-15	9-14	7.6-9.6	22-28
	3	128-138	189-209	12-17	5-10	9.2-11.2	18-24	105-115	309-329	10-15	9-14	4.8-6.8	22-28
70	1.5	132-142	293-313	9-14	6-11	20.1-22.1	17-23	123-133	327-347	11-16	11-16	13.2-15.2	25-32
	2.25	131-141	274-294	9-14	5-10	14.4-16.4	18-24	129-139	333-353	11-16	11-16	9.8-11.8	26-33
	3	131-141	256-276	9-14	5-10	8.6-10.6	18-24	135-145	339-359	11-16	11-16	6.4-8.4	27-34
90	1.5	137-147	383-403	7-12	5-10	19.4-21.4	16-22	155-165	355-375	13-18	11-16	16.8-18.8	30-38
	2.25	137-147	362-382	7-12	5-10	13.8-15.8	16-22	162-172	362-382	14-19	11-16	12.7-14.7	31-39
	3	137-147	342-362	7-12	5-10	8.2-10.2	16-22	169-179	369-389	16-21	11-16	8.6-10.6	32-40
110	1.5	143-153	475-495	6-11	9-14	18.2-20.2	16-22						
	2.25	143-153	457-477	6-11	6-11	13-14	16-22						
	3	143-153	439-459	6-11	6-11	7.7-9.7	16-22						

*Based on 15% Methanol antifreeze solution

Unit Operating Limits, Cont'd.

Table 10, cont'd.: TS Series Typical Unit Operating Pressures and Temperatures

036		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	142-162	33-38	8-14	19.1-21.1	15-22	69-79	276-296	10-15	10-15	7.2-9.2	17-23
	2.25	116-126	134-154	33-38	7-12	13.8-15.8	15-22	73-83	278-298	10-15	10-15	5.3-7.3	18-24
	3	116-126	124-144	33-38	7-12	7.4-9.4	15-22	76-86	280-300	10-15	10-15	3.5-5.5	18-24
50	1.5	136-146	211-231	11-16	6-11	20.6-22.6	17-23	99-109	302-322	10-15	13-18	10.6-12.6	22-28
	2.25	136-146	197-217	11-16	5-10	14.8-16.8	17-23	103-113	306-326	10-15	13-18	7.7-9.7	23-29
	3	136-146	183-203	11-16	5-10	9-11	17-23	108-118	311-331	10-15	13-18	5-7	23-29
70	1.5	137-147	275-295	9-14	10-15	19-21	18-24	127-137	332-352	10-15	15-20	13.5-15.5	27-34
	2.25	137-147	260-280	9-14	9-14	13.8-15.8	19-25	133-143	338-358	10-15	15-20	10.1-12.1	28-35
	3	137-147	245-265	9-14	9-14	8-10	19-25	139-149	344-364	10-15	15-20	6.7-8.7	29-36
90	1.5	142-152	373-393	7-12	10-15	19.5-21.5	17-23	164-174	365-385	11-16	15-20	17.4-19.4	34-42
	2.25	142-152	352-372	8-13	6-11	13.9-15.9	17-23	172-182	372-392	11-16	15-20	13.2-15.2	35-43
	3	142-152	332-352	8-13	6-11	8.3-10.3	17-23	181-191	379-399	12-17	15-20	9-11	36-44
110	1.5	147-157	467-487	6-11	10-15	16.2-18.2	16-22						
	2.25	147-157	448-468	6-11	8-13	11.9-13.9	16-22						
	3	147-157	430-450	6-11	7-12	7.6-9.6	16-22						

*Based on 15% Methanol antifreeze solution

042		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	114-124	170-190	27-32	10-15	17.2-19.2	17-23	69-79	286-306	5-10	5-10	4.5-6.5	16-22
	2.25	113-123	150-170	27-32	9-14	12.7-14.7	17-23	72-82	289-309	5-10	6-11	3.9-5.9	17-23
	3	113-123	131-151	27-32	7-12	8.2-10.2	17-23	75-85	292-312	6-11	6-11	3.2-5.2	18-24
50	1.5	130-140	226-246	10-15	6-11	17.8-19.8	20-26	100-110	315-335	7-12	6-11	9-11	22-28
	2.25	129-139	208-228	10-15	5-10	13.3-15.3	20-26	105-115	322-342	8-13	6-11	7-9	23-29
	3	129-139	190-210	10-15	4-9	8.8-10.8	20-26	110-120	330-350	10-15	7-12	5-7	24-30
70	1.5	132-142	290-310	6-11	6-11	17.3-19.3	19-25	131-141	347-367	11-16	6-11	13.4-15.4	29-35
	2.25	131-141	273-293	6-11	5-10	12.8-14.8	19-25	138-148	358-378	13-18	8-13	10-12	30-36
	3	131-141	255-275	6-11	4-9	8.3-10.3	19-25	145-155	369-389	16-21	9-14	6.9-8.9	31-37
90	1.5	136-146	370-390	6-11	6-11	16-18	17-23	175-185	393-413	19-24	7-12	17.6-19.6	36-42
	2.25	135-145	350-370	6-11	5-10	11.8-13.8	17-23	177-187	401-421	20-25	9-14	13.2-15.2	37-43
	3	135-145	330-350	6-11	4-9	7.6-9.6	17-23	180-190	409-429	22-27	12-17	8.7-10.7	38-44
110	1.5	143-153	469-489	6-11	6-11	14-16	16-22						
	2.25	142-152	448-468	6-11	5-10	11-13	16-22						
	3	141-151	427-447	6-11	4-9	7-9	16-22						

*Based on 15% Methanol antifreeze solution

048		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	108-118	180-200	27-32	12-17	19.8-21.8	19-25	65-75	293-313	7-12	9-14	8.2-10.2	17-23
	2.25	107-117	161-181	28-33	10-15	14.8-16.8	19-25	68-78	297-217	8-13	9-14	6.2-8.2	18-24
	3	107-117	142-162	29-34	9-14	9.8-11.8	19-25	72-82	301-321	9-14	9-14	4.2-6.2	19-25
50	1.5	123-133	236-256	16-21	8-13	20.2-22.2	21-27	92-102	321-341	10-15	11-16	11.6-13.6	23-29
	2.25	122-132	218-238	17-22	7-12	15.2-18.2	21-27	100-110	330-350	11-16	11-16	8.9-10.9	24-30
	3	122-132	200-220	17-22	6-11	10.2-12.2	21-27	108-118	340-360	12-17	11-16	6-8	26-32
70	1.5	130-140	305-325	10-15	8-13	20-22	20-26	122-132	353-373	12-17	11-16	15-17	29-35
	2.25	129-139	285-305	11-16	6-11	15-17	20-26	133-143	365-385	14-19	11-16	11.5-13.5	31-37
	3	129-139	265-285	11-16	5-10	10-12	20-26	144-154	378-398	16-21	11-16	8-10	33-39
90	1.5	133-143	390-410	8-13	8-13	19-21	19-25	166-176	397-417	16-21	9-14	19.5-21.5	37-43
	2.25	132-142	368-388	9-14	6-11	14-16	19-25	173-183	407-727	18-23	9-14	14.7-16.7	38-44
	3	132-142	345-365	9-14	5-10	9-11	19-25	181-191	417-437	19-24	10-15	9.9-11.9	40-46
110	1.5	141-151	497-517	6-11	8-13	18-20	18-24						
	2.25	140-150	472-492	7-12	6-11	13.5-15.5	18-24						
	3	140-150	447-467	8-13	5-10	8.7-10.7	18-24						

*Based on 15% Methanol antifreeze solution

Unit Operating Limits, Cont'd.

Table 10, cont'd.: TS Series Typical Unit Operating Pressures and Temperatures

060		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	98-108	160-180	40-45	12-17	20-22	19-25	62-72	276-296	6-11	6-11	8-10	17-23
	2.25	97-107	149-169	41-46	12-17	14.3-16.3	19-25	66-76	280-300	6-11	6-11	6-8	18-24
	3	96-106	137-157	42-48	11-16	8.5-10.5	20-26	70-80	284-304	7-12	6-11	4-6	19-25
50	1.5	118-128	225-245	36-41	11-16	21.2-23.2	19-25	88-98	306-326	10-15	8-13	11-13	23-29
	2.25	117-127	210-230	37-42	10-15	15.7-17.7	20-26	94-104	311-331	10-15	8-13	8.3-10.3	24-30
	3	115-125	195-215	38-43	9-14	10.2-12.2	21-27	100-110	317-337	11-16	9-14	5.5-7.5	25-31
70	1.5	135-145	300-320	12-17	9-14	20.3-22.3	21-27	112-122	333-353	12-17	10-15	14-16	28-34
	2.25	133-143	285-305	14-19	8-13	15-17	21-27	122-132	342-362	14-19	10-15	10.5-12.5	30-36
	3	132-142	270-290	16-21	7-12	10-12	22-28	130-140	351-371	15-20	11-16	7.3-9.3	32-38
90	1.5	139-149	390-410	8-13	7-12	19.3-21.3	20-26	147-157	369-389	15-20	10-15	17.7-19.7	36-42
	2.25	138-148	370-390	8-13	6-11	14.3-16.3	21-27	154-164	377-397	18-23	10-15	13.4-15.4	37-43
	3	138-148	350-370	8-13	6-11	9.3-11.3	21-27	160-170	385-405	19-24	11-16	9-11	38-44
110	1.5	144-154	488-508	8-13	8-13	18.4-20.4	21-27						
	2.25	143-153	468-488	7-12	6-11	13.6-15.6	21-27						
	3	142-152	448-468	7-12	5-10	8.8-10.8	21-27						

*Based on 15% Methanol antifreeze solution

070		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	110-120	177-197	36-41	15-20	20.2-22.2	21-27	61-71	290-310	12-18	9-14	8-10	19-25
	2.25	109-119	162-182	37-42	13-18	15-17	21-27	65-75	292-312	12-18	10-15	6-8	20-26
	3	107-117	147-167	38-43	11-16	9.7-11.7	22-28	68-78	296-316	12-18	10-15	4-6	21-27
50	1.5	128-138	246-266	18-23	11-16	21-23	22-28	88-98	320-340	11-17	13-18	11.7-13.7	26-32
	2.25	128-138	228-248	19-24	9-14	15.6-17.6	23-29	96-106	330-350	11-17	11-16	9-11	27-33
	3	127-137	210-230	20-25	6-11	10.2-12.2	24-30	105-115	338-358	11-17	9-14	6-8	29-35
70	1.5	134-144	305-325	9-14	11-16	20.8-22.8	23-29	118-128	355-375	10-16	14-19	15.2-17.2	33-39
	2.25	133-143	289-309	9-14	9-14	15.4-17.4	23-29	130-140	368-388	12-18	13-18	11.7-13.7	35-41
	3	131-141	273-293	9-14	6-11	10-12	23-29	141-151	380-400	15-21	11-16	8-10	37-43
90	1.5	140-150	390-410	10-15	11-16	19.6-21.6	22-28	158-168	401-421	9-15	13-18	19.5-21.5	41-47
	2.25	139-149	373-393	10-15	9-14	14.5-16.5	22-28	168-178	412-432	10-16	12-17	14.8-16.8	43-49
	3	138-148	355-375	10-15	6-11	9.3-11.3	22-28	178-188	423-443	12-18	12-17	10-12	45-51
110	1.5	144-154	488-508	10-15	9-14	18.4-20.4	20-27						
	2.25	143-153	468-488	10-15	6-11	13.6-15.6	20-27						
	3	142-152	448-468	9-14	5-10	8.8-10.8	20-27						

*Based on 15% Methanol antifreeze solution

Table 11: Water Temperature Change Through Heat Exchanger

Water Flow, gpm [l/m]	Rise, Cooling °F, [°C]	Drop, Heating °F, [°C]
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton [3.2 l/m per kW]	9 - 12 [5 - 6.7]	4 - 9 [2.2 - 5]
For Open Loop: Ground Water Systems at 1.5 gpm per ton [1.6 l/m per kW]	18 - 26 [9.9 - 14.4]	7 - 19 [3.9 - 10.5]

Preventive Maintenance

Water Coil Maintenance - (Direct ground water applications only) If the system is installed in an area with a known high mineral content (125 P.P.M. or greater) in the water, it is best to establish a periodic maintenance schedule with the owner so the coil can be checked regularly. Consult the well water applications section of this manual for a more detailed water coil material selection. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. Therefore, 1.5 gpm per ton [1.6 l/m per kW] is recommended as a minimum flow. Minimum flow rate for entering water temperatures below 50°F [10°C] is 2.0 gpm per ton [2.2 l/m per kW].

Water Coil Maintenance - (All other water loop applications) Generally water coil maintenance is not needed for closed loop systems. However, if the piping is known to have high dirt or debris content, it is best to establish a periodic maintenance schedule with the owner so the water coil can be checked regularly. Dirty installations are typically the result of deterioration of iron or galvanized piping or components in the system. Open cooling towers requiring heavy chemical treatment and mineral buildup through water use can also contribute to higher maintenance. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with both the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. However, flow rates over 3 gpm per ton (3.9 l/m per kW) can produce water (or debris) velocities that can erode the heat exchanger wall and ultimately produce leaks.

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

Filters - Filters must be clean to obtain maximum performance. Filters should be inspected every month under normal operating conditions and be replaced when necessary. Units should never be operated without a filter.

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

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

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

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

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

Cabinet - Do not allow water to stay in contact with the cabinet for long periods of time to prevent corrosion of the cabinet sheet metal. Generally, vertical cabinets are set up from the floor a few inches [7 - 8 cm] to prevent water from entering the cabinet. The cabinet can be cleaned using a mild detergent.

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

Functional Troubleshooting

Fault	Htg	Clg	Possible Cause	Solution
Main power problems	X	X	Green Status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24VAC between R and C on CXM2/DXM2.5.
				Check primary/secondary voltage on transformer.
HP Fault Code 2 **High Pressure**		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow adjust to proper flow rate.
		X	Water Temperature out of range in cooling	Bring water temp within design parameters.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Dirty Air Coil - construction dust etc.
				Too high of external static? Check static vs blower table.
	X		Air temperature out of range in heating	Bring return air temp within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table.
	X	X	Bad HP Switch	Check switch continuity and operation. Replace.
LP/LOC Fault Code 3 **Low Pressure / Loss of Charge**	X	X	Insufficient charge	Check for refrigerant leaks.
	X		Compressor pump down at start-up	Check charge and start-up water flow.
LT1 Fault Code 4 **Water coil low temperature limit**	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter? Clean or replace.
				Check water flow. Adjust to proper flow rate.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper temperature limit setting (30°F vs 10°F [-1°C vs -2°C])	Clip JW3 jumper for antifreeze (10°F [-12°C]) use.
	X		Water Temperature out of range	Bring water temp within design parameters.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
LT2 Fault Code 5 **Air coil low temperature limit**		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs blower table.
		X	Air Temperature out of range	Too much cold vent air? Bring entering air temp within design parameters.
		X	Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C])	Normal airside applications will require 30°F [-1°C] only.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
Condensate Fault Code 6	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit.
				Check slope of unit toward outlet.
				Poor venting? Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
	X	X	Plugged air filter	Replace air filter.
	X	X	Restricted Return Airflow	Find and eliminate restriction. Increase return duct and/or grille size.

Table continued on next page.

Functional Troubleshooting, Cont'd.

Table continued from previous page.

Fault	Htg	Clg	Possible Cause	Solution
Over/Under Voltage Code 7 (Auto resetting)	X	X	Under Voltage	Check power supply and 24VAC voltage before and during operation.
				Check power supply wire size.
				Check compressor starting. Need hard start kit?
				Check 24VAC and unit transformer. Tap for correct power supply voltage.
	X	X	Over Voltage	Check power supply voltage and 24VAC before and during operation.
				Check 24VAC and unit transformer. Tap for correct power supply voltage.
Unit Performance Sentinel Code 8	X		Heating mode LT2>125°F [52°C]	Check for poor airflow or overcharged unit.
		X	Cooling Mode LT1>125°F [52°C] OR LT2< 40ºF [4ºC])	Check for poor water flow or airflow.
Swapped Thermistor Code 9	X	X	LT1 and LT2 swapped	Reverse position of thermistors
No Fault Code Shown	X	X	No compressor operation	See "Only Fan Operates".
	X	X	Compressor overload	Check and replace, if necessary.
	X	X	Control board	Reset power and check operation.
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in "test mode"	Reset power or wait 20 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace, if necessary.
Only Fan Runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor Overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X		Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for line voltage across BR contacts.
	X	X		Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24VAC on RV coil and at CXM2/DXM2.5 board.
		X		If RV is stuck, run high pressure up by reducing water flow and while operating engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil 'click'.
		X		Put thermostat in cooling mode. Check 24 VAC on O (check between C and O); check for 24 VAC on W (check between W and C). There should be voltage on O, but not on W. If voltage is present on W, thermostat may be bad or wired incorrectly.

Performance Troubleshooting

Symptom	Htg	Clg	Possible Cause	Solution
Insufficient capacity/ Not cooling or heating	X	X	Dirty filter	Replace or clean.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs blower table.
		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs blower table.
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling per chart.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind stat.
	X	X	Unit undersized	Recheck loads & sizing. Check sensible clg. load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Inlet water too hot or too cold	Check load, loop sizing, loop backfill, ground moisture.
High Head Pressure	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static? Check static vs blower table.
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow. Adjust to proper flow rate.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Re-weigh in charge.
	X	X	Non-condensables in system	Vacuum system and re-weigh in charge.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
Low Suction Pressure	X		Reduced water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter? Clean or replace.
				Check water flow. Adjust to proper flow rate.
	X		Water temperature out of range	Bring water temperature within design parameters.
		X	Reduced airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static? Check static vs blower table.
		X	Air temperature out of range	Too much cold vent air? Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.
Low Discharge Air Temperature in Heating	X		Too high of airflow	Check fan motor speed selection and airflow chart.
	X		Poor performance	See ‘Insufficient Capacity’.
High humidity		X	Too high of airflow	Check fan motor speed selection and airflow chart.
		X	Unit oversized	Recheck loads & sizing. Check sensible cooling load and heat pump capacity.

Start-Up Log Sheet

Installer: Complete unit and system checkout and follow unit start-up procedures in the IOM. Use this form to record unit information, temperatures and pressures during start-up. Keep this form for future reference.

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

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

Unit Location in Building: _____

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

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

Fan Motor	Description	Value
PSC	Speed Tap	
CT ECM	Speed Tap	
CV ECM	CFM Setting	

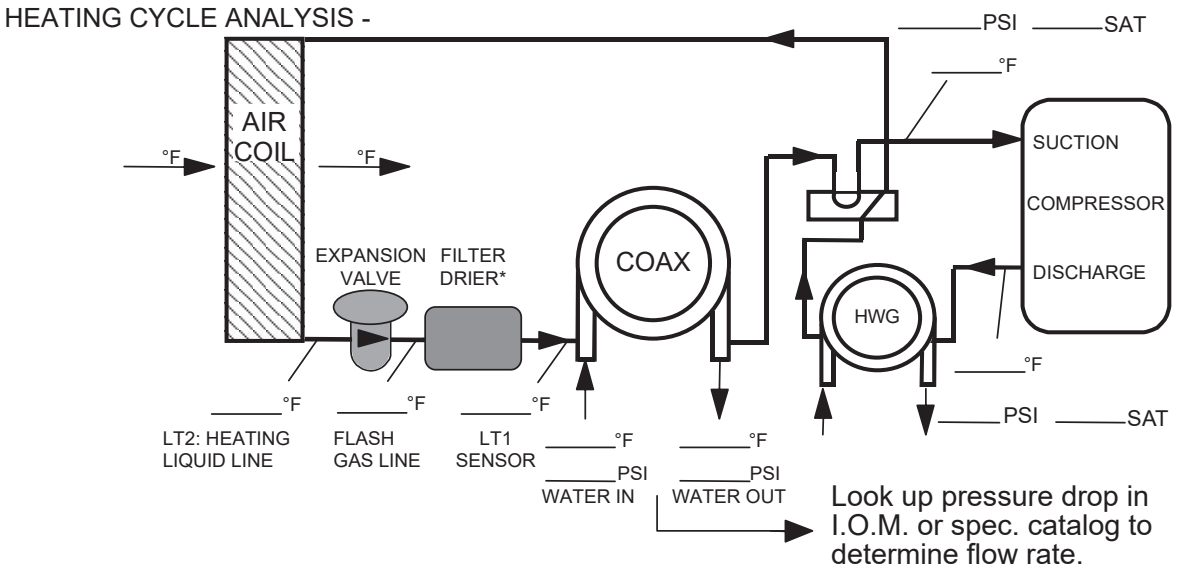
Temperatures: F or C **Antifreeze: _____%**

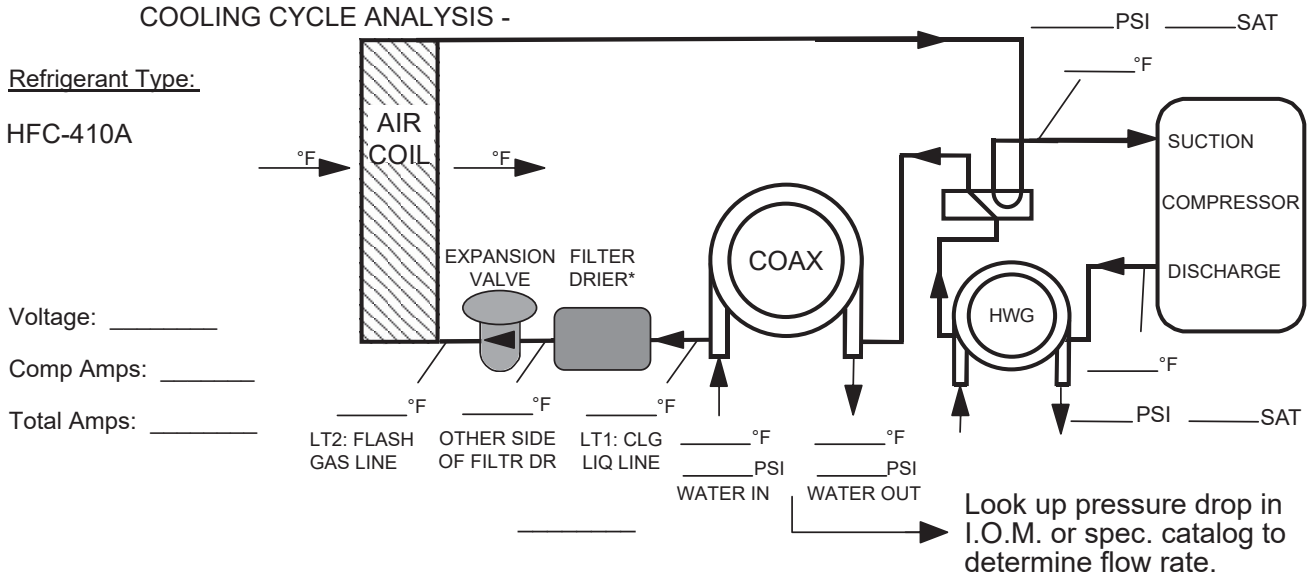
Pressures: PSIG or kPa **Type _____**

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

Allow unit to run 15 minutes in each mode before taking data.
Do not connect gauge lines

Functional Troubleshooting Form





Heat of Extraction (Absorption) or Heat of Rejection =

_____ flow rate (GPM) x _____ temp. diff. (deg. F) x _____ fluid factor† = _____ (Btu/hr)

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

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

† Use 500 water for water, 485 for antifreeze.

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

CLIMATEMASTER
A NIBE GROUP MEMBER

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

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

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

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

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

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

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

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

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

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

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

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

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

Rev.: 11/09

LC083

Warranty (International)

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

A NIBE GROUP MEMBER

Disclaimer: It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Climate Master, Inc., a Delaware corporation, U. S. A. ("CM") or its representatives, relating to CM's products, whether oral, written or contained in any sales literature, catalog, this or any other agreement or other materials, are not express warranties and do not form a part of the basis of the bargain, but are merely CM's opinion or commendation of CM's products. **EXCEPT AS SPECIFICALLY SET FORTH HEREIN AND TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, CM MAKES NO WARRANTY AS TO ANY OF CM'S PRODUCTS, AND CM MAKES NO WARRANTY AGAINST LATENT DEFECTS OR ANY WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.**

GRANT OF LIMITED EXPRESS WARRANTY

CM warrants CM products purchased and installed outside the United States of America ("U.S.A.") and Canada to be free from material defects in materials and workmanship under normal use and maintenance as follows: (1) All complete air conditioning, heating or heat pump units built or sold by CM for twelve (12) months from date of unit start-up or eighteen (18) months from date of shipment (from CM's factory), whichever comes first; and, (2) Repair and replacement parts, which are not supplied under warranty, for ninety (90) days from date of shipment (from factory).

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

If requested by CM, all defective parts shall be returned to CM's factory in Oklahoma City, Oklahoma, U.S.A, freight and duty prepaid, not later than sixty (60) days after the date of the request. If the defective part is not timely returned or if CM determines the part to not be defective or otherwise not to qualify under CM's Limited Express Warranty, CM shall invoice Customer the costs for the parts furnished, including freight. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

This warranty does not cover and does not apply to: (1) Air filters, fuses, refrigerant, fluids, oil; (2) Products relocated after initial installation; (3) Any portion or component of any system that is not supplied by CM, regardless of the cause of the failure of such portion or component; (4) Products on which the unit identification tags or labels have been removed or defaced; (5) Products on which payment by Customer to CM or its distributors or Representatives, or the Customer's seller is in default; (6) Products which have defects or damage which result from improper installation, wiring, electrical imbalance characteristics or maintenance; or from parts or components manufactured by others; or are caused by accident, misuse, negligence, abuse, fire, flood, lightning, alteration or misapplication of the product; (7) Products which have defects or damage which result from a contaminated or corrosive air or liquid supply, operation at abnormal temperatures or flow rates, or unauthorized opening of the refrigerant circuit; (8) Mold, fungus or bacteria damages; (9) Products subjected to corrosion or abrasion; (10) Products, parts or components manufactured or supplied by others; (11) Products which have been subjected to misuse, negligence or accidents; (12) Products which have been operated in a manner contrary to CM's printed instructions; (13) Products which have defects, damage or insufficient performance as a result of insufficient or incorrect system design or the improper application, installation, or use of CM's products; or (14) Electricity or fuel costs, or any increases or unrealized savings in same, for any reason.

CM is not responsible for: (1) The cost of any fluids, refrigerant or other system components, or the associated labor to repair or replace the same, which is incurred as a result of a defective part covered by CM's Limited Express Warranty; (2) The cost of labor, refrigerant, materials or service incurred in diagnosis and removal of the defective part, or in obtaining and replacing the new or repaired part; (3) Transportation costs of the defective part from the installation site to CM or of the return of any part not covered by CM's Limited Express Warranty; or (4) The costs of normal maintenance.

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

LIMITATION OF REMEDIES

In the event of a breach of this Limited Express Warranty or any warranty that is mandatory under applicable imperative law, CM will only be obligated at CM's option to either repair the failed part or unit or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to CM's factory in Oklahoma City, Oklahoma, U.S.A. of each defect, malfunction or other failure and a reasonable number of attempts by CM to correct the defect, malfunction or other failure and the remedy fails of its essential purpose, CM shall refund the purchase price paid to CM in exchange for the return of the sold good(s). Said refund shall be the maximum liability of CM. **TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE CUSTOMER AGAINST CM FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR CM'S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY

CM shall have no liability for any damages if CM's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, allocation, shortages of transportation, fuel, materials, or labor, acts of God or any other reason beyond the sole control of CM. TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW AND SUBJECT TO THE NEXT SENTENCE, CM EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR LOSS OF PROFITS, LOSS OF BUSINESS OR GOODWILL, CONSEQUENTIAL, INCIDENTAL, SPECIAL, LIQUIDATED, OR PUNITIVE DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR CM's NEGLIGENCE OR AS STRICT LIABILITY. Nothing in this Agreement is intended to exclude CM's liability for death, personal injury or fraud.

OBTAINING WARRANTY PERFORMANCE

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

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

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

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

LC079

Created: 10/09

Notes:

Revision History

Date:	Item:	Action:
04/17/23	All	Transitioned from CXM to CXM2 and DXM to DXM2 unit controls. Upgraded ECM fan motor controls capability.
07/22/22	Page 38	Added Wiring Diagram Matrix
10/05/21	Pages 19-22	Updated Water Quality Standards table
09/23/21	Page 3	Removed LON option, discontinued
06/05/20	Page 63	Updated Start-Up Log Sheet
04/07/20	ALL	Updated Format
09/10/19	All Pages	Update Text
07/25/17	Page 7	Updated hanger and mounting instructions
06/14/17	Page 34	Update drawing
10/12/16	Page 30	Added ClimaDry note
10/7/16	Page 7	Text Update
04/15/15	Text	Updated
03/03/16	Pages 32 to 34	Update EAT and ECM information
06/17/15	Decoder - Page 3; Text - Pages 20-25	Updated
03/25/15	Page 6	Updated Maximum Working Water Pressure
01/23/15	Page 23	Updated Table
08/15/14	TS060 E Voltage	Added to Tables 4c and 4f
06/25/14	Rev. C 036 E Voltage	Added
06/11/14	Page 8, 11 & 19	Change Text - Filter “rack” to “frame” Updated Water Quality Table
02/05/14	All	Updated sizes 024-070 to Rev. C
10/07/13	Figure 10a: Vertical Condensate Drain	Updated
07/17/13	Wiring Diagrams and EAT Limit ClimaDry®	Updated
11/09/12	POE Oil Warning	Added
09/27/12	Water Quality Table Condensate Drain Connection EAT Limits	Updated Updated Updates to Text - ClimaDry® Option
04/16/12	All	Updated ClimaDry® II Information
08/09/11	Unit Maximum Working Water Pressure	Updated to Reflect New Safeties
08/01/11	First Published	

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ClimateMaster works continually to improve its products. As a result, the design and specifications of each product at the time for order may be changed without notice and may not be as described herein. Please contact ClimateMaster’s Customer Service Department at 1-405-745-6000 for specific information on the current design and specifications. Statements and other information contained herein are not express warranties and do not form the basis of any bargain between the parties, but are merely ClimateMaster’s opinion or commendation of its products.