CLIMATEMASTER®
A NIBE GROUP MEMBER

Tranquility® Brazed Plate Geothermal Closed Loop Water-to-Water (TBW) Series

97B0099N01

Residential EarthPure® Water-to-Water Water-Source Heat Pumps

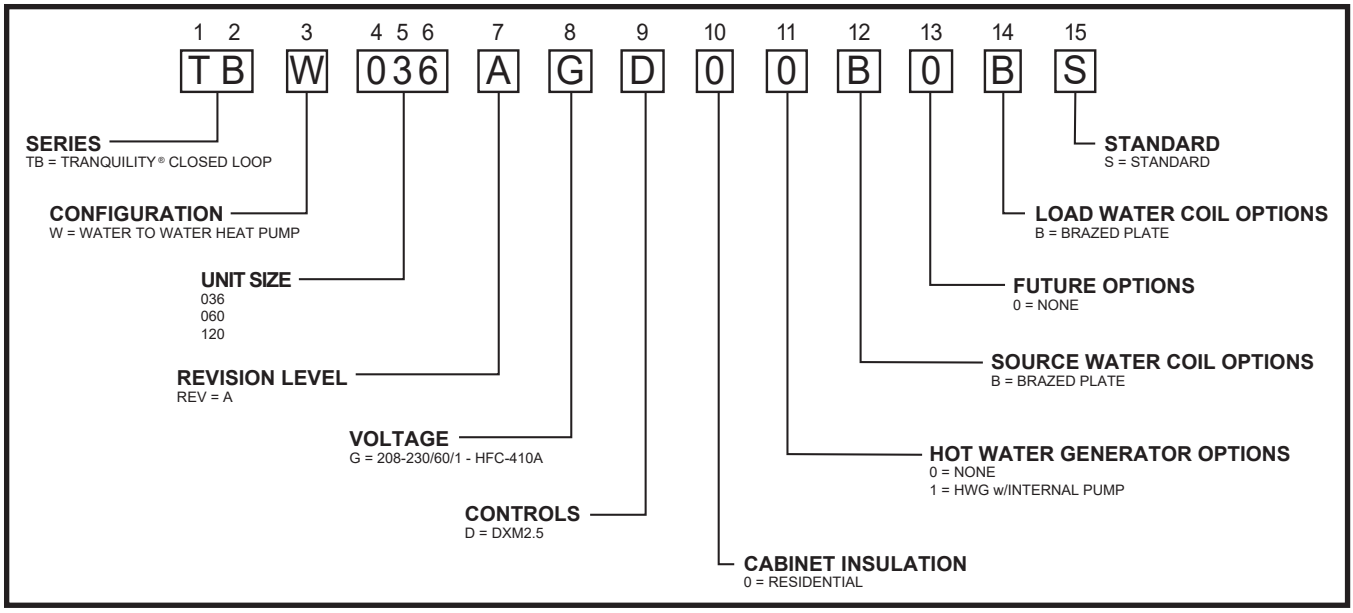
Installation, Operation & Maintenance Instructions

Rev.: December 15, 2022

Table of Contents

This page was intentionally left blank.

Model Nomenclature



⚠ WARNING! ⚠

WARNING! TBW is for GROUND LOOP INSTALLATIONS ONLY. Installing TBW on open loop system will void warranty and unit will not be eligible for federal tax credit.

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! 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.

The following warning complies with State of California law, Proposition 65.

⚠ WARNING! ⚠

WARNING! This product can expose you to chemicals including Carbon Black, which is known to the State of California to cause cancer and Methanol, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

⚠ 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.

⚠ 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.

General Information

INSPECTION
Upon receipt of the equipment, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the carton or crating of each unit, and inspect each unit for damage. Assure 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 the ClimateMaster Traffic Department 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. The stack limit for TBW036, 060 and 120 is three.

UNIT PROTECTION
Cover units on the job site with either shipping packaging, vinyl film, 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 trash found in or on these components.

PRE-INSTALLATION
Installation, Operation, and Maintenance instructions are provided with each unit. 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 shipping 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.

⚠ 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.

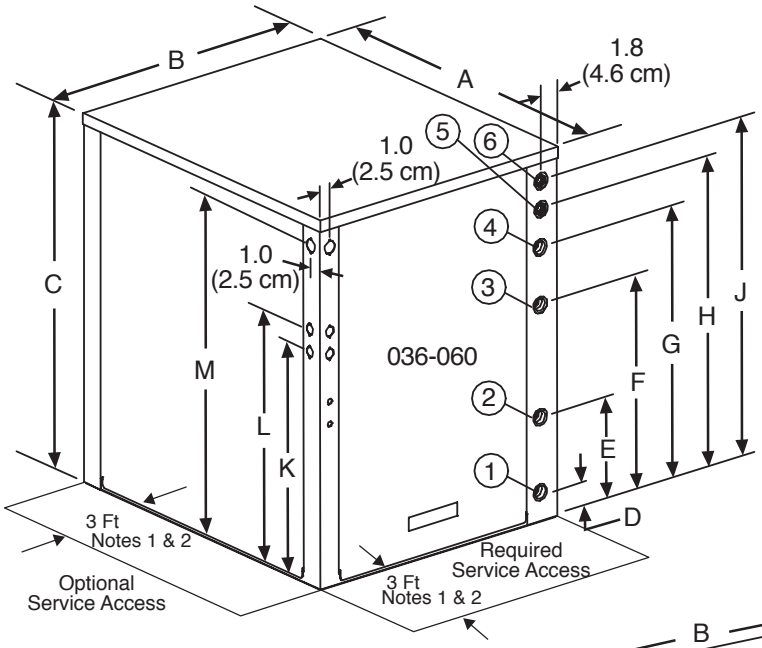
Physical Data

Model	036	060	120
Compressor (qty)	Scroll (1)		Scroll (2)
Factory Charge HFC-410A (oz) [kg] Per Circuit	50 [1.41]	68 [1.93]	68 [1.93]
Water Connection Size			
Source/Load	1" Swivel		1-1/2 FPT
HWG (in)	1" Swivel		1/2" FPT
Weight			
Weight - Operating (lbs) [kg]	295 [134]	268 [122]	541 [245]
Weight - Packaged (lbs) [kg]	320 [145]	293 [133]	585 [265]
Water Volume (Source)			
Gallons (Liters)	0.56 [2.1]	0.7 [2.7]	1.4 [5.3]

Dual isolated compressor mounting
Balanced port expansion valve (TXV)
Insulated Source and Load Water Coils standard
Insulated Refrigerant Circuit standard
Compressor on (green) and fault (red) light

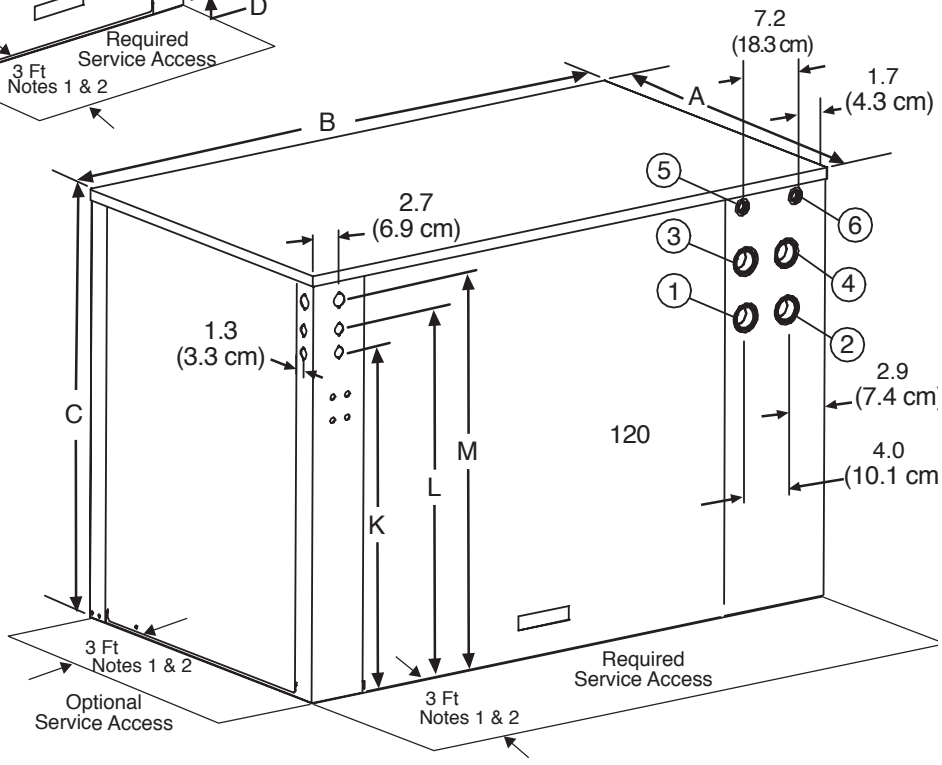
Unit Maximum Water Working Pressure PSIG (kPa)	
Unit	145 [100]
Maximum Water Flow Through Unit GAL (L)	
036	25 [94.6]
060, 120	35 [132.5]

Dimensional Data



Notes:

1. 3 feet front access is required, both sides access is optional preferred for service access. However, all components may be serviced from the front access panel if side access is not available.
2. 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 services.



Water to Water		Overall Cabinet			Water Connections						Electric Access Plugs		
					1	2	3	4	5	6			
		A Depth	B Width	C Height	D Source (Outdoor) Water In	E Source (Outdoor) Water Out	F Load (Indoor) Water In	G Load (Indoor) Water Out	H HWG Water In	J HWG Water Out	K Low Voltage	L External Pump	M Power Supply
036-060	in.	30.6	25.4	33	2.7	9.4	19.4	24.5	27.9	30.4	20.9	22.9	30.9
	cm.	77.8	64.5	83.8	6.9	23.9	49.3	62.2	70.9	77.2	53.1	58.2	78.5
120	in.	30.6	52.9	37	25.2	25.2	30.1	30.1	34.9	34.9	29.9	31.9	34.4
	cm.	77.8	134.4	94	64.0	64.0	76.5	76.5	88.6	88.6	75.9	81.0	87.4

Unit Installation

UNIT LOCATION
These 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.

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.

Locate the unit in an indoor area that allows easy removal of access panels, and has enough space for service personnel to perform maintenance or repair. Provide sufficient room to make water and electrical connections. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. These units are not approved for outdoor installation and, therefore, must be installed inside the structure being conditioned. Do not locate in areas subject to freezing or where humidity levels can cause cabinet condensation.

WATER CONNECTION INSTALLATION

Residential models using swivel piping fittings for water connections are rated for 450 psi (3101 kPa) operating pressure. The connections have a rubber gasket seal similar to a garden hose gasket, which when mated to the flush end of most 1" threaded male pipe fittings provides a leak-free seal without the need for thread sealing tape or joint compound. Insure that the rubber seal is in the swivel connector prior to attempting any connection (rubber seals are shipped attached to the swivel connector). DO NOT OVER TIGHTEN or leaks may occur.

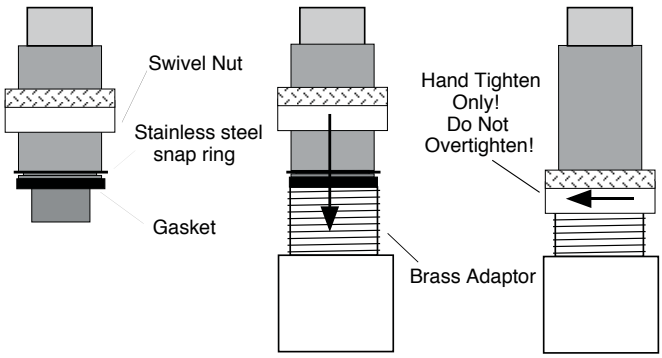
Unit is shipped with load and source strainers for field installation outside unit.

FPT CONNECTIONS (SIZE 120)
Pipe joint compound is not necessary when Teflon threaded 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 pipe threads of the fitting adapters. Prevent sealant from reaching the flared surfaces of the joint.

NOTE: When antifreeze is used in the loop, assure that it is compatible with Teflon tape or pipe joint compound employed.

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.

The female locking ring is threaded onto the pipe threads which holds the male pipe end against the rubber gasket, and seals the joint. HAND TIGHTEN ONLY! DO NOT OVERTIGHTEN!



⚠ 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.

⚠ WARNING! ⚠

WARNING! Must use strainer on both load and source sides. 20 mesh minimum. Failure to use strainers will void your warranty.

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.

PRE-INSTALLATION

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

PIPING INSTALLATION

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

Earth loop temperatures can range between 25 and 110°F [-4 to 43°C]. Flow rates between 2.25 and 3 gpm per ton [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

Once piping is completed between the unit, the flow controller and the ground loop (Figure 1), the loop is ready for final purging and charging. A flush cart with at least a 1.5 hp [1.1 kW] pump is required to achieve enough fluid velocity in the loop piping system to purge air and dirt particles. An antifreeze solution is used in most areas to prevent freezing. All air and debris must be removed from the earth loop piping before operation. Flush the loop with a high volume of water at a minimum velocity of 2 fps (0.6 m/s) in all piping. The steps below must be followed for proper flushing.

1. Fill loop with water from a garden hose through the flush cart before using the flush cart pump to insure an even fill.
2. Once full, the flushing process can begin. Do not allow the water level in the flush cart tank to drop below the pump inlet line to avoid air being pumped back out to the earth loop.
3. Try to maintain a fluid level in the tank above the return tee so that air cannot be continuously mixed back into the fluid. Surges of 50 psi (345 kPa) can be used to help purge air pockets by simply shutting off the return valve going into the flush cart reservoir. This “dead heads” the pump to 50 psi (345 kPa). To purge, dead head the pump until maximum pumping pressure is reached. Open the return valve and a pressure surge will be sent through the loop to help purge air pockets from the piping system.
4. Notice the drop in fluid level in the flush cart tank when the return valve is shut off. If air is adequately purged from the system, the level will drop only 1-2 inches (2.5 - 5 cm) in a 10” (25 cm) diameter PVC flush tank (about a half gallon [2.3 liters]), since liquids are incompressible. If the level drops more than this, flushing should continue since air is still being compressed in the loop fluid. Perform the “dead head” procedure a number of times. **NOTE: This fluid level drop is your only indication of air in the loop.**

Antifreeze may be added before, during or after the flushing procedure. However, depending upon which time is chosen, antifreeze could be wasted when emptying the flush cart tank. See antifreeze section for more details.

Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the cooling season. This fluctuation is normal and should be considered when charging the system initially. Run the unit in either heating or cooling for a number of minutes to condition the loop to a homogenous temperature. This is a good time for tool cleanup, piping insulation, etc. Then, perform final flush and pressurize the loop to a static pressure of 50-75 psi [345-517 kPa] (winter) or 35-40 psi [241-276 kPa] (summer). After pressurization, be sure to loosen the plug at the end of the Grundfos loop pump motor(s) to allow trapped air to be discharged and to insure the motor housing has been flooded. This is not required for Taco circulators. Insure that the Flow Controller provides adequate flow through the unit by checking pressure drop across the heat exchanger and compare to the pressure drop tables at the back of the manual.

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 manager should be consulted for the antifreeze best suited to your area. Low temperature protection should be maintained to 15°F [9°C] below the lowest expected entering loop temperature. For example, if 30°F [-1°C] is

Ground-Loop Heat Pump Applications, Cont'd.

the minimum expected entering loop temperature, the leaving loop temperature would be 25 to 22°F [-4 to -6°C] and low temperature 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 using Table 1. 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.

Figure 1: Typical Ground-Loop Application Source Side

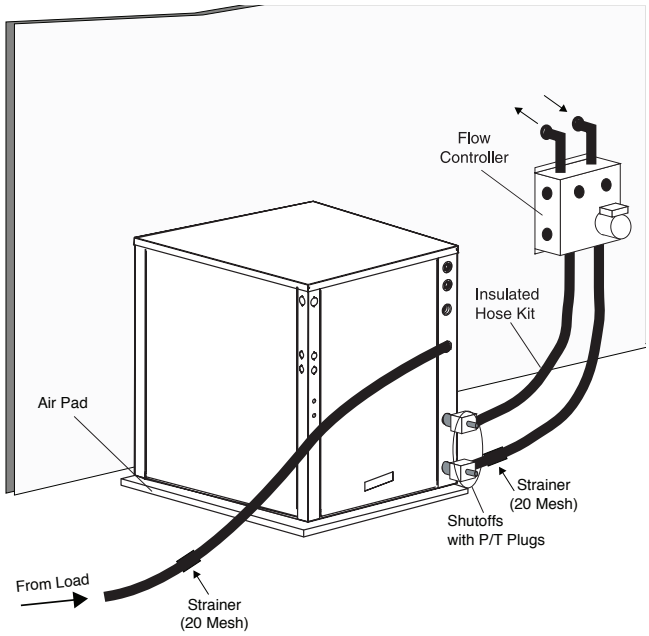


Table 2: Antifreeze Percentages by Volume

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	21%	17%	13%	8%
Propylene Glycol	29%	24%	18%	12%
Ethanol*	23%	20%	16%	11%

* Must not be denatured with any petroleum based product

LOW WATER TEMPERATURE CUTOUT SETTING - DXM2.5 CONTROL

When antifreeze is selected, the FP1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10°F [-12.2°C]) setpoint and avoid nuisance faults (see "Low Water Temperature Cutout Selection" in this manual).

Table 1: Approximate Fluid Volume (gal.) per 100' of Pipe

Fluid Volume (gal [liters] per 100' [30 meters) Pipe)		
Pipe	**Size**	**Volume (gal) [liters]**
Copper	1"	4.1 [15.3]
	1.25"	6.4 [23.8]
	2.5"	9.2 [34.3]
Rubber Hose	1"	3.9 [14.6]
Polyethylene	3/4" IPS SDR11	2.8 [10.4]
	1" iPS SDR11	4.5 [16.7]
	1.25" IPS SDR11	8.0 [29.8]
	1.5" IPS SDR11	10.9 [40.7]
	2" IPS SDR11	18.0 [67.0]
	1.25" IPS SCH40	8.3 [30.9]
	1.5" IPS SCH40	10.9 [40.7]
	2" IPS SCH40	17.0 [63.4]
Unit Heat Exchanger	Typical	1.0 [3.8]
Flush Cart Tank	10 in Dia x 3 ft tall [254 mm x 91.4 cm tall]	10 [37.9]

⚠ CAUTION! ⚠

CAUTION! Do not exceed 25 GPM [94.6 L] when flushing system. Damage to flow switch will occur.

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 requirements listed in this table.

CLIMATEMASTER 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.

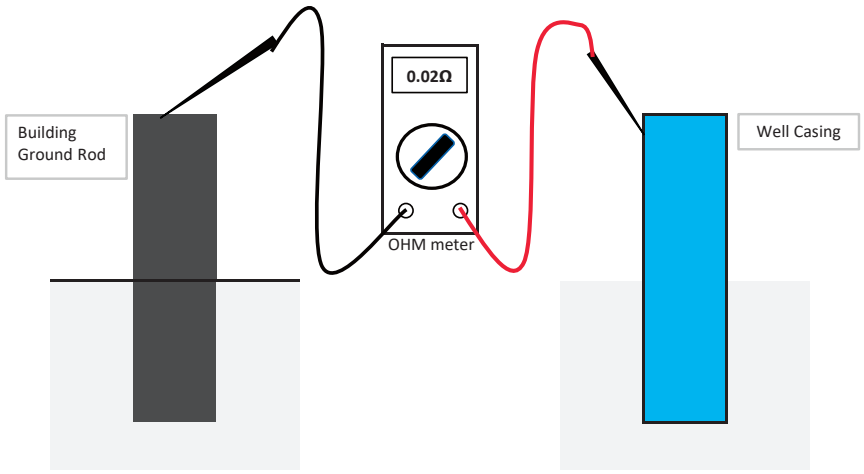
χ An electrical grounding system using a dedicated ground rod meeting NEC and Local Electrical codes must be installed. Building Ground must not be connected the WSHP piping system or other plumbing pipes.

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.

Measuring Earth Ground Resistance

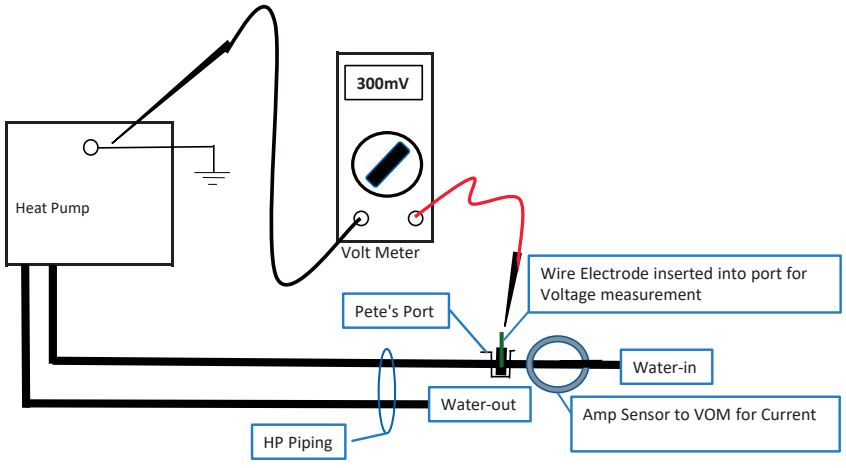


Measure the earth ground bond using an Ohm meter between the building's ground rod and the steel well casing.

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

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

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.

Load Side Plumbing Installation

TBW UNIT LOAD PLUMBING
The applications are too varied to describe in this document. However, some basic guidelines will be presented. Much of the discussions on water loop applications would be valid for the load plumbing discussion as well. Buffer tanks should be used to prevent short cycling of unit. All plumbing should conform to local codes with the following considerations:

Wide temperature variation applications such as heating/ cooling coils:

- Employ piping materials that are rated for the maximum temperature and pressure combination. This excludes PVC for most heating applications.
- Insure that load water flow in high temperature heating applications is at least 3 gpm per ton [3.9 l/m per kW] to improve performance and reduce nuisance high pressure faults.
- DO NOT employ plastic to metal threaded joints
- Utilize a pressure tank and air separator vent system to equalize pressure and remove air.

Swimming Pool/Hot Tub Applications:

- Load side should be isolated with secondary heat exchanger constructed of anti-corrosion material in all chlorine/bromine fluid applications.

Potable Water Applications:

- Load side should always be isolated with secondary heat exchanger for use in potable water systems.
- Insure load water flow in high temperature heating applications is at least 3 gpm per ton to improve performance and reduce nuisance to high pressure faults.

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.

Hot Water Generator

The HWG (Hot Water Generator) or desuperheater option provides considerable operating cost savings by utilizing heat energy from the compressor discharge line to help satisfy domestic hot water requirements. The HWG is active throughout the year, providing virtually free hot water when the heat pump operates in the cooling mode or hot water at the COP of the heat pump during operation in the heating mode. Actual HWG water heating capacities are provided in the appropriate heat pump performance data.

Heat pumps equipped with the HWG option include a built-in water to refrigerant heat exchanger that eliminates the need to tie into the heat pump refrigerant circuit in the field. The control circuit and pump are also built in for residential equipment. Figure 3 shows a typical example of HWG water piping connections on a unit with built-in circulating pump. This piping layout prevents sludge/debris from the bottom of the tank being pulled into the HWG pump.

The temperature setpoint of the HWG is field selectable to 125°F or 150°F. The 150°F setpoint allows more heat storage from the HWG. For example, consider the amount of heat that can be stored by the HWG when using the 125°F setpoint, versus the amount of heat that can be generated by the HWG when using the 150°F setpoint.

In a typical 50 gallon two-element electric water heater the lower element should be turned down to 100°F, or the lowest setting, to get the most from the HWG. The tank will eventually stratify so that the lower 80% of the tank, or 40 gallons, becomes 100°F (controlled by the lower element). The upper 20% of the tank, or 10 gallons, will be maintained at 125°F (controlled by the upper element).

Using a 125°F setpoint, the HWG can heat the lower 40 gallons of water from 100°F to 125°F, providing up to 8,330 btu's of heat. Using the 150°F setpoint, the HWG can heat the same 40 gallons of water from 100°F to 150°F and the remaining 10 gallons of water from 125°F to 150°F, providing a total of up to 18,743 btu's of heat, or more than twice as much heat as when using the 125°F setpoint.

Electric water heaters are recommended. If a gas, propane, or oil water heater is used, a second preheat tank must be installed (Figure 3). If the electric water heater has only a single center element, the dual tank system is recommended to insure a usable entering water temperature for the HWG.

Typically a single tank of at least 50 gallons (189 liters) is used to limit installation costs and space. However, a dual tank, as shown in Figure 4, is the preferred system, as it provides the maximum storage and temperate source water to the HWG.

It is always advisable to use water softening equipment on domestic water systems to reduce the scaling potential and lengthen equipment life. In extreme water conditions, it may be necessary to avoid the use of the HWG option since the potential cost of frequent maintenance may offset or exceed any savings.

⚠ WARNING! ⚠

WARNING! A 150°F setpoint may lead to scalding or burns. The 150°F setpoint must only be used on systems that employ an approved anti-scald valve.

Figure 3: Typical HWG Installation

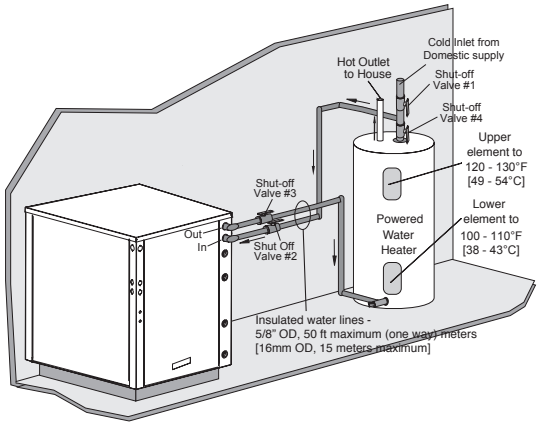
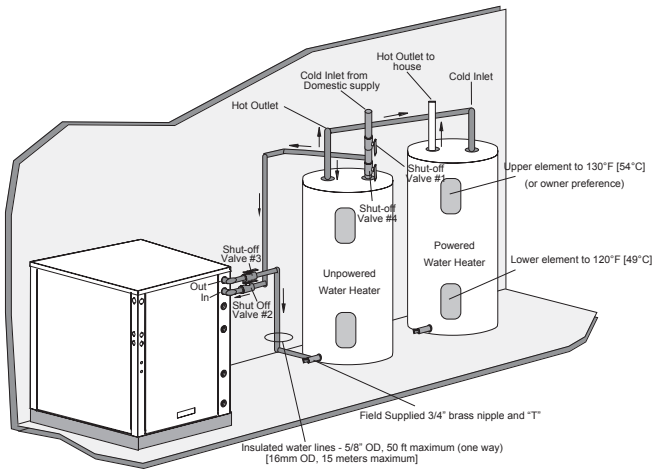


Figure 4: HWG Double Tank Installation



Hot Water Generator, Cont'd.

INSTALLATION

The HWG is controlled by two sensors and the DXM2.5 microprocessor control. One sensor is located on the compressor discharge line to sense the discharge refrigerant temperature. The other sensor is located on the HWG heat exchanger's "Water In" line to sense the potable water temperature.

⚠ WARNING! ⚠

WARNING! Under no circumstances should the sensors be disconnected or removed. Full load conditions can drive hot water tank temperatures far above safe temperature levels if sensors are disconnected or removed.

The DXM2.5 microprocessor control monitors the refrigerant and water temperatures to determine when to operate the HWG. The HWG will operate any time the refrigerant temperature is sufficiently above the water temperature. Once the HWG has satisfied the water heating demand during a heat pump run cycle, the controller will cycle the pump at regular Intervals to determine if an additional HWG cycle can be utilized.

When the control is powered and the HWG pump output is active for water temperature sampling or HWG operation, the DXM2.5 status LED will slowly flash (On 1 second, Off 1 second).

If the control has detected a HWG fault, the DXM2.5 status LED will flash a numeric fault code as follows:

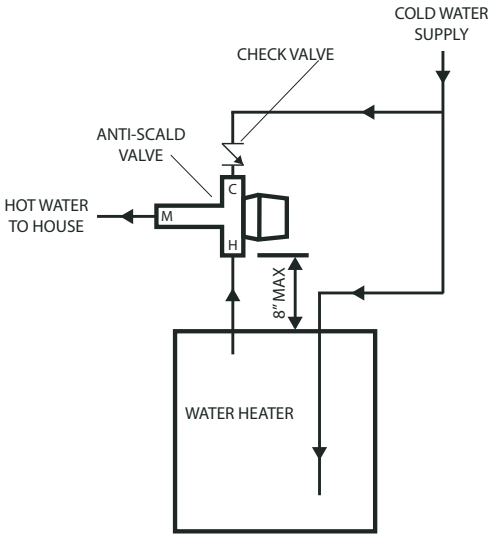
High Water Temperature (> 160°F)	5 flashes
Hot Water Sensor Fault	6 flashes
Compressor Discharge Sensor Fault	6 flashes

Fault code flashes have a duration of 0.3 seconds with a 10 second pause between fault codes. For example, a "Compressor Discharge Sensor Fault" will be six flashes 0.3 seconds long, then a 10 second pause, then six flashes again, etc.

⚠ WARNING! ⚠

WARNING! Using 150°F setpoint on the HWG will result in water temperatures sufficient to cause severe physical injury in the form of scalding or burns, even when the hot water tank temperature setting is visibly set below 150°F. The 150°F HWG setpoint must only be used on systems that employ an approved anti-scald valve (part number (AVAS4) at the hot water storage tank with such valve properly set to control water temperatures distributed to all hot water outlets at a temperature level that prevents scalding or burns.

Figure 5: Anti-Scald Valve Piping Connections



Hot Water Generator settings are determined by DIP switches 3-2, 3-3, and 3-4.

DIP 3-2 controls the HWG Test Mode. It provides for forced operation of the HWG output, activating the HWG pump for up to five minutes.

ON = HWG test mode, OFF = normal HWG operation.

The control will revert to standard operation after five minutes regardless of switch position.

DIP 3-3 determines HWG setpoint temperature. It provides for selection of the HWG operating setpoint.

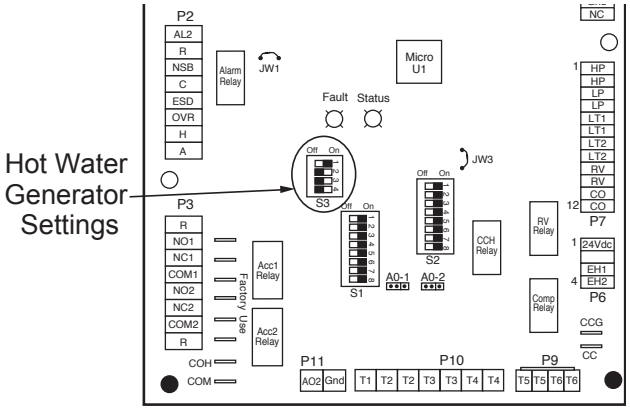
ON = 150°F (66°C), OFF = 125°F (52°C).

DIP 3-4 is for the HWG status. It provides HWG operation control.

ON = HWG mode enabled, OFF = HWG mode disabled.

Units are shipped from the factory with this switch in the OFF position.

Figure 6: Hot Water Generator Settings



Hot Water Generator, Cont'd.

⚠ WARNING! ⚠

WARNING! The HWG pump is fully wired from the factory. Use extreme caution when working around the microprocessor control as it contains line voltage connections that presents a shock hazard that can cause severe injury or death!

The heat pump, water piping, pump, and hot water tank should be located where the ambient temperature does not fall below 50°F [10°C]. Keep water piping lengths at a minimum. DO NOT use a one way length greater than 50 ft. (one way) [15 m]. See Table 4 for recommended piping sizes and maximum lengths.

All installations must be in accordance with local codes. The installer is responsible for knowing the local requirements, and for performing the installation accordingly. DO NOT activate the HWG (turn DIP 3-4 to the ON position) until "Initial Start-Up" section, below is completed. Powering the pump before all installation steps are completed will damage the pump.

WATER TANK PREPARATION

1. Turn off power or fuel supply to the hot water tank.
2. Connect a hose to the drain valve on the water tank.
3. Shut off the cold water supply to the water tank.
4. Open the drain valve and open the pressure relief valve or a hot water faucet to drain tank.
5. When using an existing tank, it should be flushed with cold water after it is drained until the water leaving the drain hose is clear and free of sediment.
6. Close all valves and remove the drain hose.
7. Install HWG water piping.

HWG WATER PIPING

1. Using at least 1/2" [12.7 mm] I.D. copper, route and install the water piping and valves as shown in Figures 21 or 22. Install an approved anti-scald valve if the 150°F HWG setpoint is or will be selected. An appropriate method must be employed to purge air from the HWG piping. This may be accomplished by flushing water through the HWG (as in Figures 21 and 22) or by installing an air vent at the high point of the HWG piping system.
2. Insulate all HWG water piping with no less than 3/8 inches [10 mm] wall closed cell insulation.
3. Open both shut off valves and make sure the tank drain valve is closed.

WATER TANK REFILL

1. Close valve #4. Ensure that the HWG valves (valves #2 and #3) are open. Open the cold water supply (valve #1) to fill the tank through the HWG piping. This will force water flow through the HWG and purge air from the HWG piping.
2. Open a hot water faucet to vent air from the system until water flows from faucet; turn off faucet. Open valve #4.
3. Depress the hot water tank pressure relief valve handle to ensure that there is no air remaining in the tank.
4. Inspect all work for leaks.
5. Before restoring power or fuel supply to the water heater, adjust the temperature setting on the tank thermostat(s) to insure maximum utilization of the heat available from the refrigeration system and conserve the most energy. On tanks with both upper and lower elements and thermostats, the lower element should be turned down to 100°F [38°C] or the lowest setting; the upper element should be adjusted to 120-130°F [49-54°C]. Depending upon the specific needs of the customer, you may want to adjust the upper element differently. On tanks with a single thermostat, a preheat tank should be used (Figure 4).
6. Replace access cover(s) and restore power or fuel supply.

INITIAL START-UP

1. Make sure all valves in the HWG water circuit are fully open.
2. Turn on the heat pump and allow it to run for 10-15 minutes.
3. Set S3-4 to the "ON" position (enabled) to engage the HWG. See Figure 6.
4. The HWG pump should not run if the compressor is not running.
5. The temperature difference between the water entering and leaving the HWG coil should be approximately 5-10°F [3-6°C].
6. Allow the unit to operate for 20 to 30 minutes to insure that it is functioning properly.

Table 4: HWG Water Piping Sizes and Length

Unit Nominal Tonnage	Nominal HWG Flow (gpm)	1/2" Copper (max length*)	3/4" Copper (max length*)
2.0	0.8	50	-
2.5	1.0	50	-
3.0	1.2	50	-
3.5	1.4	50	-
4.0	1.6	45	50
5.0	2.0	25	50
6.0	2.4	10	50

*Maximum length is equivalent length (in feet) one way of type L copper.

⚠ CAUTION! ⚠

CAUTION! Use only copper piping for HWG piping due to the potential of high water temperatures for water that has been in the HWG heat exchanger during periods of no-flow conditions (HWG pump not energized). Piping other than copper may rupture due to high water temperature and potable water pressure. CPVC, PEX, or other plastic pipe should not be used HWG piping

Electrical – Line Voltage

⚠ CAUTION! ⚠

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

⚠ WARNING! ⚠

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

⚠ WARNING! ⚠

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

GENERAL LINE VOLTAGE WIRING

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

POWER CONNECTION

Line voltage connection is made by connecting the incoming line voltage wires to the power distribution block, or compressor contactor, refer to unit wiring diagram. Consult the electrical data table (Table 5) for correct fuse size.

TRANSFORMER

The units are factory wired for 230 Volt. If supply voltage is 208V, transformer must be rewired by installer as illustrated on the wiring diagram by switching the Red (208V) and the Orange (230V) at the contactor terminal L1.

LOAD AND SOURCE PUMPS

Wire pumps to unit per unit wire diagram.

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 wiring diagrams and electrical data table (Table 5) for fuse sizes and a schematic of the field connections which must be made by the installing (or electrical) contractor.

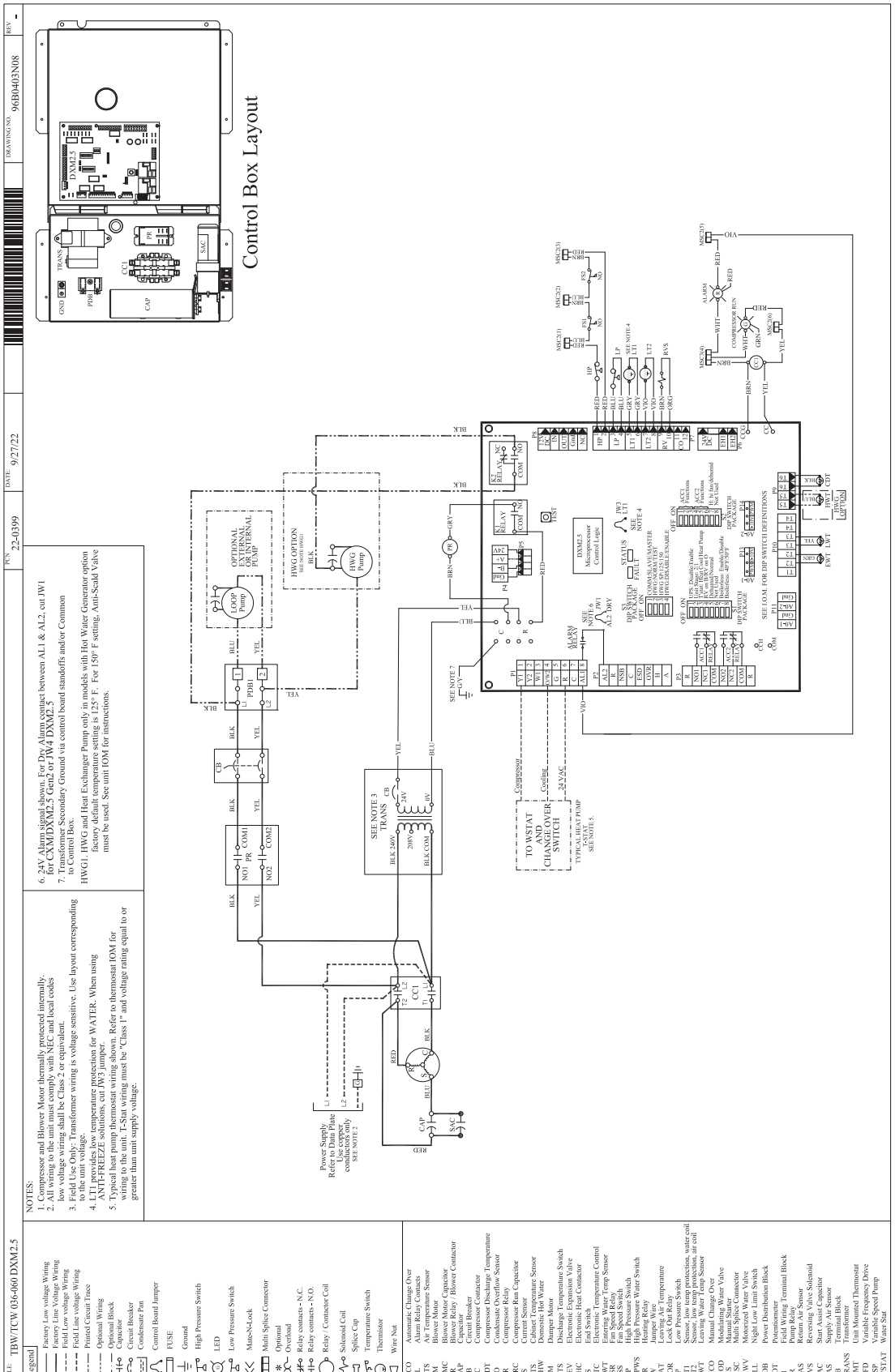
Consult the unit wiring diagram located on the inside of the compressor access panel to ensure proper electrical hookup. All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

Table 5: TBW Electrical Data

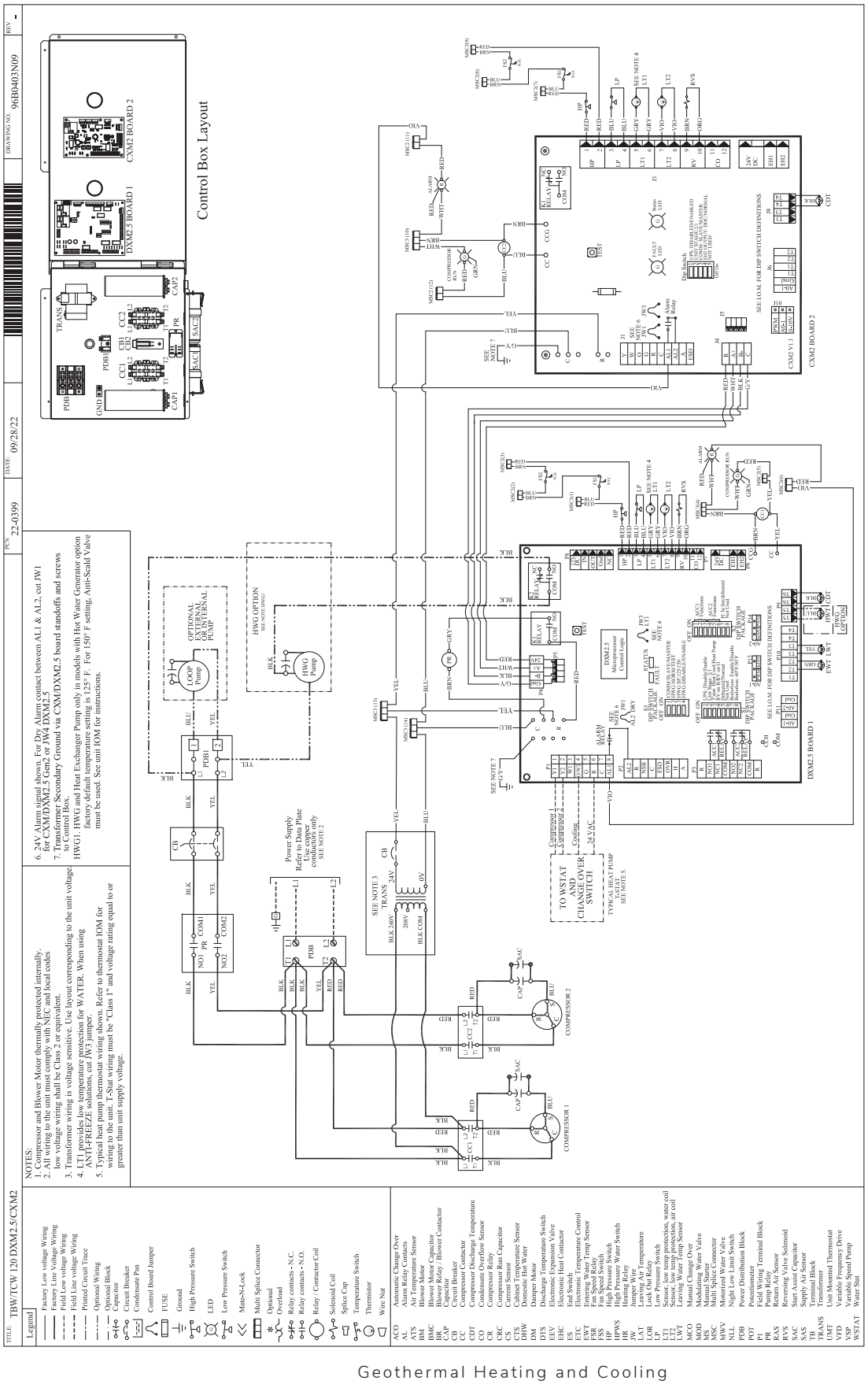
Model	Voltage Code	Voltage	Min/Max Voltage	Compressor			HWG Pump FLA	EXT Loop Pump FLA	Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR
				RLA	LRA	QTY					
036	3	208/230/60/1	197/252	16.7	79.0	1	0.5	4.0	21.2	25.3	40
060	3	208/230/60/1	197/252	26.3	134.0	1	0.5	4.0	30.8	37.3	60
120	3	208/230/60/1	197/252	26.3	134.0	2	0.5	4.0	57.1	63.6	80

HACR circuit breaker in USA only
Residential units come standard with 75VA transformer, and optional HWG pump.

TBW036 & TBW060 Electrical Wiring Diagram – 96B0403N08



TBW120 Electrical Wiring Diagram – 96B0403N09



Controls – DXM2.5

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.

Unit Commissioning & Operating Conditions

ENVIRONMENT
This unit is designed for indoor installation only. Do not install in an area subject to freezing or where humidity levels can cause cabinet condensation.

POWER SUPPLY
A voltage variation of +/- 10% of nameplate utilization voltage is acceptable.

Operation and performance is primarily dependent upon water temperatures, water flow rates and ambient air temperature. This water-to-water heat pump is capable of operating over a wide temperature range and with flow rates of between 1.5 GPM (.1 l/s) and 3 GPM (.19 l/s) per ton, however usually no more than one of these factors may be at a minimum or maximum level at a time.

THE COMMISSIONING TABLE indicates water temperatures which are suitable for initial unit commissioning in an environment where the flow rate and water temperature is not yet stable and to avoid nuisance shut down of the units freeze and refrigerant pressure safeties.

THE OPERATING TABLE indicates the maximum and minimum ranges of the unit.

For more specific unit performance, reference the product catalog, the submittal data sheets or contact your supplier for assistance.

Table 6

BUILDING COMMISSIONING				
	Cooling		Heating	
Unit Size	036	060/120	036	060/120
Source Min/Max	50/110°F 10/43°C	50/120°F 10/49°C	30/80°F -1/27°C	30/80°F -1/27°C
Load Min/Max	60/80°F 16/27°C	60/90°F 16/32°C	60/120°F 16/49°C	60/120°F 16/49°C
Ambient Min/Max	45/110°F 7/43°C		39/85°F 4/29°C	

BUILDING OPERATING				
	COOLING		HEATING	
Unit Size	036	060/120	036	060/120
Source Min/Max	50/120°F 10/49°C	50/120°F 10/49°C	20/80°F -7/27°C	20/80°F -7/27°C
Load Min/Max	50/90°F 10/32°C	50/90°F 10/32°C	60/130°F 16/54°C	60/130°F 16/54°C
Ambient Min/Max	45/110°F 7/43°C		39/85°F 4/29°C	

Unit & System Checkout

⚠ WARNING! ⚠

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

BEFORE POWERING SYSTEM, please check the following:

UNIT CHECKOUT

- ❑ Balancing/Shutoff Valves: Ensure all isolation valves are open, water control valves wired and open, and flow switch (load and source) are operational* or brazed plates may burst.
- ❑ Line Voltage and Wiring: Ensure Voltage is within an acceptable range for the unit and wiring and fuses/breakers are properly sized. Low voltage wiring is complete.
- ❑ Unit Control Transformer: Ensure transformer has properly selected control voltage tap. 208-230V units are factory wired for 230 operation unless specified otherwise.
- ❑ Entering Water: Ensure entering water temperatures are within operating limits of Table 6.
- ❑ Low Water Temperature Cutout: Verify low water temperature cut-out on DXM2.5 is properly set.
- ❑ Water Flow Balancing: Verify inlet and outlet water temperatures on both load and source are recorded for each heat pump upon startup. This check can eliminate nuisance trip outs and high velocity water flows that can erode heat exchangers.
- ❑ Unit Controls: Verify DXM2.5 settings are proper and complete.

* Water flow switches are normal open (no flow) contacts.
TBW036 switch contacts close at 2.2 GPM flow.
TBW060 and TBW120 switch contacts close at 3.3 GPM flow.

SYSTEM CHECKOUT

- ❑ System Water Temperature: Check load and source water temperature for proper range and also verify heating and cooling setpoints for proper operation.
- ❑ System pH: System water pH is 6 - 8.5. Proper pH promotes longevity of hoses and fittings.
- ❑ System Flushing: Verify all hoses are connected end to end when flushing to ensure debris bypasses unit heat exchanger and water valves etc. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Verify 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 the standby pump is properly installed and in operating condition.
- ❑ System Controls: Verify system controls function and operate in the proper sequence.
- ❑ Low Water Temperature Cutout: Verify low water temperature cut-out controls are provided for the outdoor portion of the loop or operating problems will occur.
- ❑ System Control Center: Verify control center and alarm panel for proper setpoints and operation.
- ❑ Strainers: Verify 20 mesh (841 micron) [0.84 mm] strainers are installed in load and source water piping. Confirm maintenance schedule for strainers.
- ❑ Units with HWG: Confirm hot water tank(s) and piping have been filled and air has been purged. HWG is de-engerized (DIP Switch 12 is "On") unit start up.
- ❑ Miscellaneous: Note any questionable aspects of the installation.

⚠ WARNING! ⚠

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

Unit Start Up Procedure

⚠ 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.

1. Adjust all valves to their full open position. Turn on the line power to all heat pump units.
2. Source and Load water temperatures should be within the minimum-maximum ranges of Table 6.
3. It is recommended that water-to-water units be first started in the heating mode, when possible. This will allow liquid refrigerant to flow through the filter-drier before entering the TXV, allowing the filter-drier to catch any debris that might be in the system before it reaches the TXV.
4. Four factors determine the operating limits of water source heat pumps, (a) source entering water temperature, (b) source entering water flow rate, (c) load entering water temperature, and (d) load entering water flow rate. When any one of these factors is at a minimum or maximum level, the other factors must be at normal levels to ensure proper unit operation.
   a. Place the mode switch (if applicable) in the "HEAT" position. Adjust the unit aquastat to the lowest setting.
   b. Slowly raise the aquastat setting to a higher temperature until the compressor activates.
   c. Check for warm load water delivery within a few minutes after the unit has begun to operate.
   d. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in Table 8. Refer to Table 7. Check the temperature of both entering and leaving source water. If the temperature drop is within range, proceed with the test. If the temperature drop is outside of the operating range, check refrigerant pressures and compare to Tables 9 and 10. Heat of extraction (HE) can be calculated for the source and compared to submittal data capacity pages. The formula for HE for systems with water is as follows:

      HE = TD x GPM x 500,

      where TD is the temperature difference between the entering and leaving source water, and GPM is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to Table 8.

Table 7: Water Temperature Change Through Source 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 [3.9 l/m per kW]	9 - 12 [5 - 6.7]	4 - 8 [2.2 - 4.4]

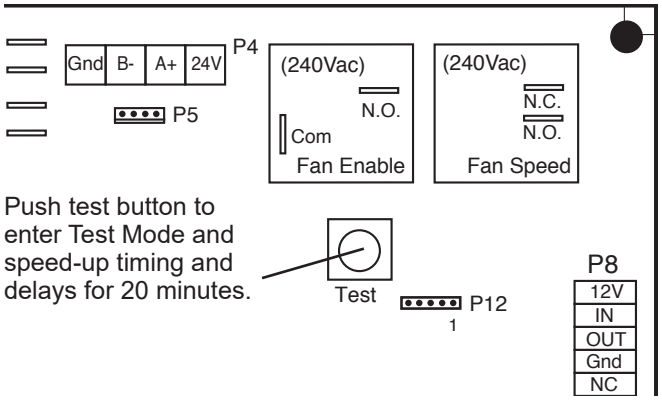
Table 8: Water Pressure Drop TBW036-120

Model	GPM	Pressure Drop PSI			
		30°F	50°F	70°F	90°F
SOURCE/OUTDOOR BRAZED PLATE					
036	4.5	1.7	1.3	1.0	0.8
	6.8	4.1	3.4	2.8	2.4
	9.0	7.1	6.0	5.1	4.5
060	7.5	1.5	1.3	1.1	0.9
	11.3	4.0	3.4	3.0	2.7
	15.0	6.9	6.2	5.5	5.0
120	15.0	1.7	1.4	1.2	0.9
	22.5	4.4	3.8	3.3	2.7
	30.0	7.6	6.8	6.1	5.0
LOAD/INDOOR BRAZED PLATE					
036	4.5		0.6	0.5	0.3
	6.8		1.4	1.3	1.1
	9.0		2.6	2.4	2.2
060	7.5		1.4	1.3	1.2
	11.3		3.5	3.2	3.0
	15.0		6.2	5.8	5.5
120	15.0		1.6	1.4	1.3
	22.5		3.8	3.5	3.3
	30.0		6.8	6.4	6.0

Must use antifreeze if operation falls in grey area
Operation not recommended
Multiply PSI x 2.31 to determine ft of hd

NOTE: Units have a five minute time delay in the control circuit that can be eliminated on the DXM2.5 PCB as shown in Figure 8. See controls description for detailed features of the control.

Figure 8: Test Mode Button



   e. Heating capacity, also known as 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 = TD X GPM X 500,

      where TD is the temperature difference between the entering and leaving load water, and GPM is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to Table 8.
   f. Check for vibration, noise, and water leaks.

Unit Start Up Procedure, Cont'd.

⚠ WARNING! ⚠

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

5. Allow five (5) minutes between tests for pressure to equalize before beginning cooling test.
   a. Place the mode switch (if applicable) in the "COOL" position. Adjust the unit aquastat to the highest setting.
   b. Slowly lower the aquastat setting to a lower temperature until the compressor activates.
   c. Check for cool load water delivery within a few minutes after the unit has begun to operate.
   d. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in Table 8. Refer to Table 7. Check the temperature of both entering and leaving source water. If the temperature rise is within range, proceed with the test. If the temperature rise is outside of the operating range, check refrigerant pressures and compare Tables 9 and 10. Heat of rejection (HR) can be calculated for the source and compared to submittal data capacity pages. The formula for HR for systems with water is as follows:

      HR = TD X GPM X 500,

      where TD is the temperature difference between the entering and leaving source water, and GPM is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to Table 8.
   e. Cooling capacity, also known as 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 = TD X GPM X 500,

      where TD is the temperature difference between the entering and leaving load water, and GPM is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to Table 8.
   f. Check for vibration, noise, and water leaks.
6. 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.
7. When testing is complete, set system to maintain desired comfort level.
8. BE CERTAIN TO FILL OUT AND RETURN ALL WARRANTY REGISTRATION PAPERWORK.

Operating Pressures

Table 9

TBW036-120 (TBW120 Per Circuit) (60 Hz I-P Units)								
Source Entering Water Temp °F	Source Water Flow GPM/ton	Cooling						
		Load EWT °F @ 1.5-3.0 GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat °F	Subcooling °F	Water Temp Rise °F Source	Water Temp Drop °F Load
50	1.5	50	99-106	230-234	11-18	18-25	20-28	7-15
		60	111-122	241-243	11-18	18-25		8-17
		70	122-137	251-253	17-25	18-25		8-19
		80	126-145	254-258	26-35	18-25		9-20
	2.3	50	98-105	212-214	18-23	14-20	13-18	7-15
		60	106-117	218-220	18-23	14-20		8-17
		70	114-129	225-227	24-32	14-20		9-19
		80	117-135	228-230	32-41	14-20		9-20
	3.0	50	87-101	199-203	12-18	12-18	9-12	8-16
		60	91-113	203-207	12-18	12-18		8-17
		70	95-124	204-216	16-34	12-18		9-19
		80	107-128	212-217	33-35	12-18		9-20
80	1.5	50	104-111	343-348	9-14	18-25	19-28	7-14
		60	121-132	355-360	9-14	18-25		7-16
		70	138-152	367-373	9-14	18-25		8-18
		80	148-161	377-381	12-23	18-25		9-20
	2.3	50	103-111	320-325	8-14	14-21	13-18	7-14
		60	118.-129	328-334	8-14	14-21		8-16
		70	132-147	336-344	12-20	14-21		8-18
		80	140-172	343-353	19-29	14-21		9-20
	3.0	50	94-110	305-314	9-13	12-18	8-12	7-15
		60	112-121	313-319	9-13	12-18		8-16
		70	121-146	317-329	12-20	12-18		9-18
		80	131-151	324-333	18-27	12-18		9-20
110	1.5	50	109-116	483-497	9-13	17-23	18-26	5-11
		60	128-135	494-511	9-13	17-23		6-13
		70	147-154	505-525	9-13	17-23		7-15
	2.3	50	109-116	459-473	9-13	15-20	14-17	5-11
		60	127-135	466-484	9-13	15-20		6-13
		70	153-159	473-495	9-13	15-20		7-15
	3.0	50	100-112	444-431	9-14	12-17	8-13	5-12
		60	120-130	449-467	9-14	12-17		6-14
		70	131-152	454-474	9-14	12-17		7-15
		80	153-164	463-479	13-21	12-17		8-17

Operating Pressures, Cont'd.

Table 10

TBW036-120 (TBW120 Per Circuit) (60 Hz I-P Units)								
Source Entering Water Temp °F	Source Water Flow GPM/ton	Heating						
		Load EWT °F @ 1.5-3.0 GPM/ton	Suction Pressure PSIG	Discharge Pressure PSIG	Supeheat °F	Subcooling °F	Water Temp Drop °F Source	Water Temp Rise °F Load
20	3.0	60	56-63	199-228	4-14	6-14	2-6	5-14
		80	58-65	286-297	4-14	6-14		5-14
		90	59-66	310-344	4-14	6-14		4-14
		100	61-65	360-385	4-14	6-14		4-14
		120	64-69	459-510	4-14	6-14		4-13
50	1.5	60	85-95	212-224	6-11	7-11	9-16	6-17
		80	91-99	290-310	6-11	7-11		6-17
		90	92-101	326-338	6-11	7-11		6-17
		100	96-103	381-399	6-11	7-11		5-17
		120	100-108	474-488	6-11	7-11		4-16
	2.3	60	95-102	215-228	6-13	7-11	6-12	7-18
		80	98-106	299-313	6-13	7-11		6-18
		90	99-108	329-341	6-13	7-11		6-18
		100	102-110	384-401	6-13	7-11		6-17
		120	106-114	475-491	6-13	7-11		5-17
	3.0	60	95-107	215-256	6-14	7-15	5-9	7-19
		80	101-110	310-326	6-14	7-15		7-19
		90	103-112	329-376	6-14	7-15		6-19
		100	105-114	399-414	6-14	7-15		6-18
		120	108-118	476-524	6-14	7-15		5-17
80	1.5	60	109-129	225-237	14-26	5-14	15-21	8-18
		80	123-138	314-327	14-26	5-14		8-19
		90	130-142	343-357	10-15	5-14		7-19
		100	137-147	402-415	10-15	5-14		7-19
		120	150-157	493-504	10-15	5-14		6-20
	2.3	60	111-132	227-239	14-38	6-15	10-15	8-20
		80	135-147	315-330	14-38	6-15		8-20
		90	143-152	344-360	10-16	6-15		8-20
		100	145-154	405-418	10-16	6-15		7-20
		120	156-163	494-507	10-16	6-15		6-20
	3.0	60	110-149	227-279	19-44	6-18	7-12	9-21
		80	135-150	286-332	19-44	6-18		8-21
		90	145-166	345-408	13-23	6-18		8-21
		100	148-158	405-420	13-23	6-18		8-21

Preventative Maintenance

WATER COIL MAINTENANCE
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.

STRAINERS
For proper water flow strainers must be cleaned regularly.

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.

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

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 cabinets are set up from the floor a few inches for prevention. 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 chart for pressure and temperatures. Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

If the refrigerant circuit is opened for any reason, a new liquid line filter-drier must be installed.

Troubleshooting Form

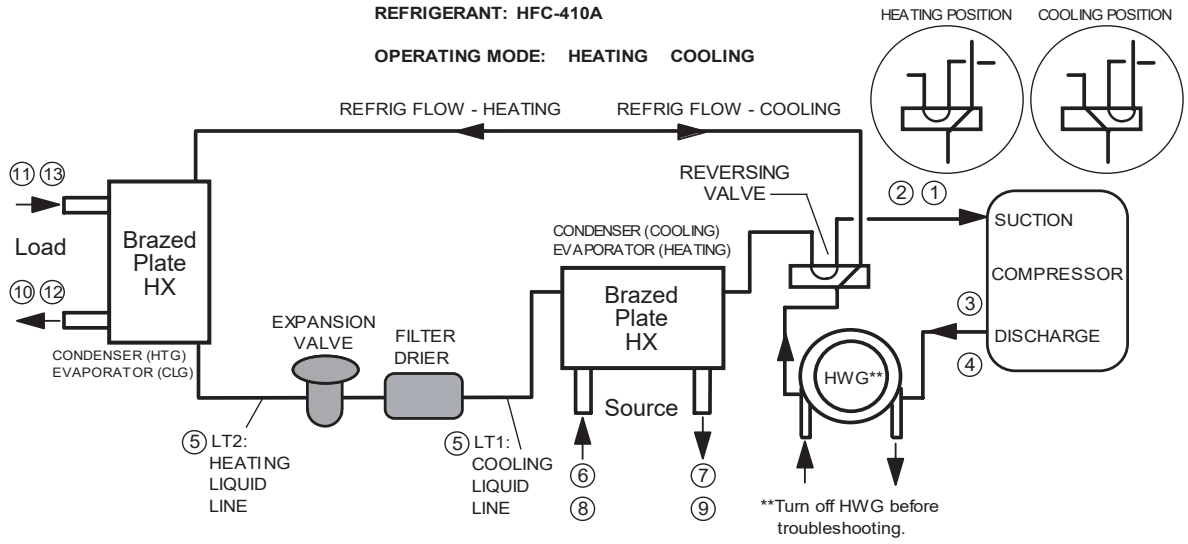
CLIMATEMASTER
A NIBE GROUP MEMBER

Water-to-Water Units

Customer: _____ Loop Type: _____ Startup Date: _____

Model #: _____ Serial #: _____ Antifreeze Type & %: _____

Complaint: _____



	Description	Heating	Cooling	Notes	
	Voltage				
	Compressor Amps				
1	Suction Temp				
2	Suction Press				
2a	Saturation Temp				
2b	Superheat				
3	Discharge Temp				
4	Discharge Press				
4a	Saturation Temp				
4b	Subcooling				
5	Liquid Line Temp				
6	Source Water In Tmp				
7	Source Water Out Tmp			H Temp Diff. =	C Temp Diff. =
8	Source Water In Pres				
9	Source Water Out Pres				
9a	Press Drop				
9b	Flow Rate GPM [l/s]				
10	Load Water In Temp				
11	Load Water Out Temp			H Temp Diff. =	C Temp Diff. =
12	Load Water In Pres				
13	Load Water Out Pres				
13a	Press Drop				
13b	Flow Rate GPM [l/s]				

Heat of Extraction (Absorption) or Heat of Rejection:

HE or HR =

Fluid Factor: (for Btuh)	Fluid Factor: (for kW)
500 (Water); 485 (Antifreeze)	4.18 (Water); 4.05 (Antifreeze)

_____ **Flow Rate x** _____ **Temp. Diff x** _____ **Fluid Factor**

CLIMATE MASTER, INC.
LIMITED EXPRESS WARRANTY AND LIMITATION OF LIABILITY AND REMEDIES FOR RESIDENTIAL CLASS PRODUCTS WITH LABOR ALLOWANCE

This Limited Express Warranty And Limitation Of Liability And Remedies Affects Your Legal Rights And Should Be Read Carefully In Its Entirety.

Subject to the terms and conditions below, Climate Master, Inc. ("CM") extends a limited warranty ("Limited Warranty") for Residential Class heating and cooling equipment manufactured or sold by CM ("Products"), that was purchased on or after May 1, 2010 (this would generally include CM Units with serial numbers beginning with "N118" and higher), and installed in a one or two family residential dwelling, for personal, household or family purposes in the United States of America or Canada, ("Application"), to be free from defects and workmanship under normal use and maintenance. If you are unsure if this Limited Warranty applies to a Product you have purchased, contact CM at the phone number or address reflected below.

This Limited Warranty DOES NOT cover commercial applications of the Products. Commercial applications include any application other than installation in a one or two family residential dwelling for personal, household or family purposes. Refer to ClimateMaster Commercial Limited Express Warranty for details. Full copies are available for download at ClimateMaster.com .

This Limited Warranty provides a complete statement of CM's responsibilities to purchasers of the Products. No oral or written statement made by CM, any person or entity associated with CM or by any person or entity claiming to be associated with CM, including but not limited to statements made in sales literature, catalogs, or agreements to purchase or install the Products, is intended to provide an express or implied warranty of any kind and does not form a part of the basis of the bargain. Further, no such statement shall operate to extend, alter or modify the scope or terms of this Limited Warranty.

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, OF MERCHANTABILITY OF THE PRODUCTS OR OF THE PRODUCTS FOR ANY PARTICULAR PURPOSE.

TERM: This Limited Warranty shall commence on the earliest to occur of the following dates: (i) proof of date of first occupancy; (ii) proof of date of start-up of the Product by a qualified and trained HVAC contractor; or (iii) six (6) months from the shipment date of the Product from CM if items (i) or (ii) are not available ("Warranty Inception Date"). The Limited Warranty shall extend as follows:

Costs of Repair or Replacement of Covered Product Parts

(1) Ten (10) years from the Warranty Inception date for air conditioning, heating and/or heat pump units built or sold by CM ("CM Units");
(2) Ten (10) years from the Warranty Inception Date for thermostats, auxiliary electric heaters, water storage tanks, and geothermal pumping modules built or sold by CM, when installed with CM Units;
(3) One (1) year from the date of shipment from CM for any other accessories or parts built or sold by CM, when installed with CM Units; and
(4) Ninety (90) days from the date of shipment from CM for all repair or replacement parts that are not supplied under this warranty.

Costs of Labor to Install Repaired or Replaced Covered Product Parts

(1) Five (5) years from the Warranty Inception Date for CM Units;
(2) Five years from the Warranty Inception Date for thermostats, auxiliary electric heaters, water storage tanks, and geothermal pumping modules built or sold by CM, when installed with CM Units

This Limited Warranty does not cover labor costs for installation of other accessories or parts built or sold by CM or any repaired or replacement parts that are not supplied under this Limited Warranty.

WHO IS COVERED: This Limited Warranty is provided only to the original owner of the one or two family residential dwelling in which the Products are first installed. This Limited Warranty is not transferrable. CM reserves the right to request any documentation necessary in its sole discretion to determine the date of purchase and occupancy of the residential dwelling or the date of installation and start-up of the Product(s). For the avoidance of any doubt, this Limited Warranty shall not extend to, and shall provide no remedies whatsoever for, any distributor or installer of the Products.

CLAIM PROCESS: To make a claim under this warranty, the Product or parts must be returned to CM in Oklahoma City, Oklahoma, freight prepaid, no later than ninety (90) days after the date of the failure of the part. If CM determines the Product or part to be defective and covered by this Limited Warranty, CM will either repair or replace the Product or part and send it to a CM-recognized distributor, dealer or service organization, F.O.B. CM, Oklahoma City, Oklahoma, freight prepaid. The Limited Warranty on any Product or part repaired or replaced under this Limited Warranty extends only through the original warranty period.

WHAT IS COVERED: Subject to the Term, this Limited Express Warranty covers the: (i) the cost of repair or replacement of any covered Product or Product parts; and (ii) the cost of labor incurred by CM authorized service personnel in connection with the installation of a repaired or replaced covered Product or Product part.

If a Product part is not available, CM will, at its option, provide a free suitable substitute part or provide a credit in the amount of the then factory selling price for a new suitable substitute part to be used by the claimant towards the retail purchase price of a new CM product. All labor costs are subject and limited to amounts specifically set forth in the then existing labor allowance\ schedule provided by CM's Warranty Department. Actual labor costs are not covered by this Limited Warranty to the extent they: (i) exceed the amount allowed under the allowance schedule; (ii) are not specifically provided for in the allowance schedule; (iii) are not performed by CM authorized service personnel; (iv) are incurred in connection installation of a part not covered by this Limited Warranty; or (v) are incurred outside the Term.

WHAT IS NOT COVERED: This Limited 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, or rating labels, have been removed or defaced; (5) Products on which payment to CM, or to the owner's seller or installing contractor, is in default; (6) Products which have not been installed and maintained by a qualified and trained HVAC contractor; (7) Products installed in violation of applicable building codes or regulations including but not limited to wiring or voltage conditions; (8) Products subjected to accident, misuse, negligence, abuse, fire, flood, freezing, lightning, unauthorized alteration, misapplication, contaminated or corrosive air or liquid supply, operation at abnormal air or liquid temperatures or flow rates, or opening of the refrigerant circuit by unqualified personnel; (9) mold, fungus or bacteria damages; (10) corrosion or abrasion of the Product; (11) products supplied by others; (12) Products that have been operated in a manner contrary to CM's printed instructions; (13) Products which have insufficient performance as a result of improper system design, sizing or the improper application, installation, or use of CM's products; (14) electricity or fuel costs, or any increases or unrealized savings in same, for any reason whatsoever; or (15) operating any water storage tanks when they are empty or partially empty (i.e. dry firing), at temperatures exceeding the maximum setting of the operating or high limit controls, at pressures greater than those shown on the rating label, with non-potable water, with alterations or attachments (including energy savings devises) not specifically authorized in writing by CM, or without the free circulation of water. CM may request written documentation showing compliance with the above limitations.

In connection with repair or replacement of covered Product parts, CM is not responsible for: (1) the costs of any fluids, refrigerant or system components supplied by others, or associated labor to repair or replace the same, which is incurred as a result of repair or replacement of a covered Product part; (2) the costs of labor, refrigerant, materials or service incurred in diagnosis and removal of a covered Product part subject to repair or replacement under this Limited Warranty; (3) shipping costs incurred in sending a claimed defective part from the installation site to CM; (4) shipping costs to return a claimed defective part from CM to the installation site if the part is not covered by this Limited Warranty; (5) removal or disposal costs associated with the repair or replacement of covered Product Parts; or (6) the costs of normal maintenance.

OTHER WARRANTY LIMITATION: This Limited Warranty is given in lieu of all other warranties express or implied, in law or in fact. If, notwithstanding the disclaimers contained herein, it is determined that other warranties apply, any such warranty, including without limitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited in time to the Term of this Limited Warranty

LIMITATION OF REMEDIES: In the event of a breach of the Limited Warranty, a claimant's remedies will be limited to repair or replacement of a 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, 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 ANY ACTION FOR BREACH OF CONTRACT, BREACH OF ANY WARRANTY, PATENT INFRINGEMENT, OR FOR CM'S NEGLIGENCE OR IN STRICT LIABILITY. NO ACTION ARISING OUT OF ANY CLAIMED BREACH OF THIS LIMITED WARRANTY MAY BE BROUGHT MORE THAN ONE (1) YEAR AFTER THE CAUSE OF ACTION HAS ARISEN.

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, INCIDENTAL, SPECIAL AND/OR PUNITIVE DAMAGES BASED ON ANY THEORY IN CONTRACT, BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, PATENT INFRINGEMENT, OR IN TORT, WHETHER FOR CM's NEGLIGENCE OR AS STRICT LIABILITY AND REGARDLESS OF WHETHER CM IS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

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

Climate Master, Inc. • Customer Service • 7300 SW 44th Street • Oklahoma City, Oklahoma 73179 • (405) 745-6000 • e-service@climatemaster.com

NOTE: Some states or Canadian provinces do not allow the exclusion or limitation of implied warranties or the limitation of incidental or consequential damages for certain products supplied to consumers, or the limitation of liability for personal injury, so the above limitations and exclusions may be limited in their application to you. When the implied warranties are not allowed to be excluded in their entirety, they will be limited to the duration of the applicable written warranty. This warranty gives you specific legal rights, which may vary depending on local law. IF ANY PRODUCT TO WHICH THIS LIMITED WARRANTY APPLIES IS DETERMINED TO BE A "CONSUMER PRODUCT" UNDER THE MAGNUSON-MOSS WARRANTY ACT (15 U.S.C.A. §2301, ET SEQ.) OR OTHER APPLICABLE LAW, THE FOREGOING DISCLAIMER OF IMPLIED WARRANTIES SHALL NOT APPLY TO YOU, AND ALL IMPLIED WARRANTIES ON THIS PRODUCT, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR THE PARTICULAR PURPOSE, SHALL APPLY FOR THE SAME TERM SET FORTH ABOVE (ONE YEAR) AS PROVIDED UNDER APPLICABLE LAW. The portions of this Limited Warranty and limitation of liability shall be considered fully severable, and all portions which are not disallowed by applicable law shall remain in full force and effect.

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. Refer to your local laws for your specific rights under this Limited Warranty.

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

Rev.: 3/20
Part No.: RP851

Notes:

Revision History

Date	Page #	Description
December 15, 2022	All	Upgraded DXM2 to DXM2.5 unit controls
October 5, 2021	Pages 11-13	Updated Water Quality Requirements
August 21, 2018	Page 4	Added Warning
January 26, 2017	Page 14	Add Caption
January 4, 2016	Pages 6, 10, 25, 36	Edits to Strainer chart, update to new AHRI logo
November 20, 2015	All	First Published

97B0099N01

CLIMATEMASTER
A NIBE GROUP MEMBER

7300 S.W. 44th Street
Oklahoma City, OK 73179
Phone: 405-745-6000
Fax: 405-745-6058
climatemaster.com