

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



**Residential EarthPure®
Water-to-Water
Water-Source Heat Pumps
Installation, Operation &
Maintenance Instructions
97B0099N01
Revised: January 26, 2017**

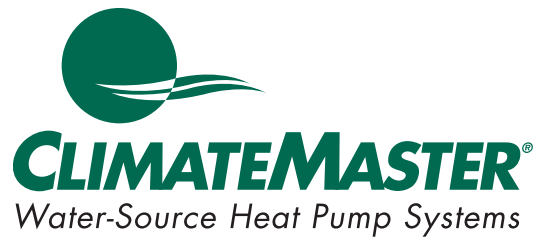
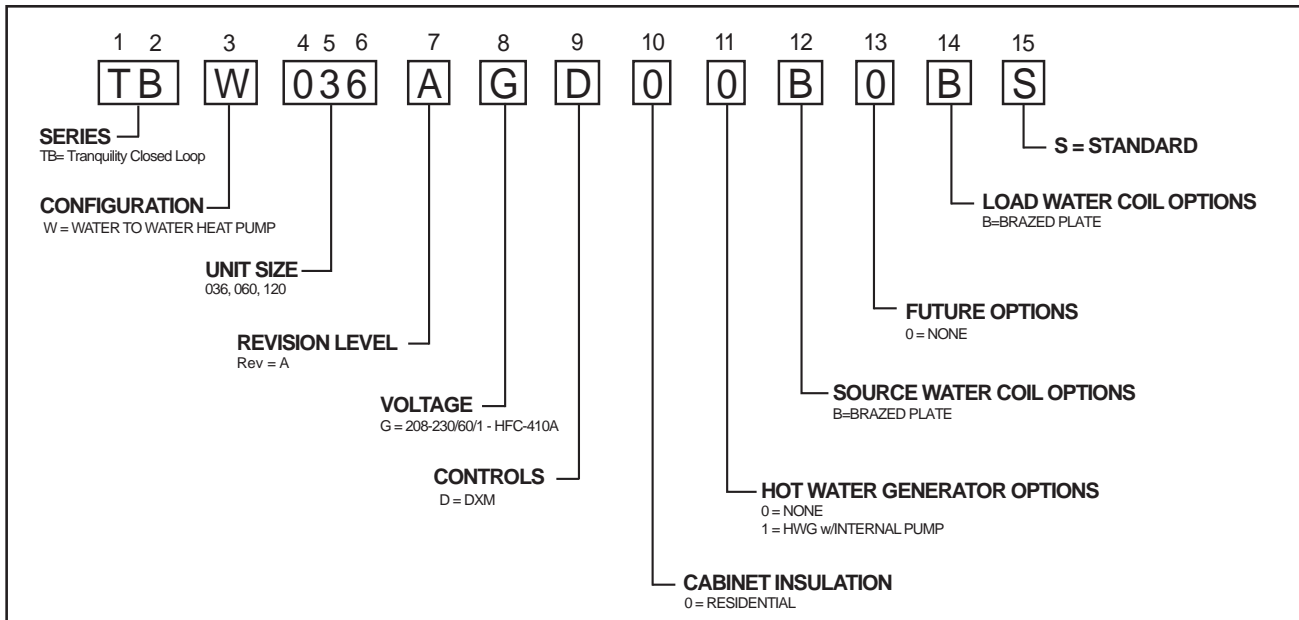


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Model Nomenclature



⚠ 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.

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

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 may cause equipment damage.

⚠ CAUTION! ⚠

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

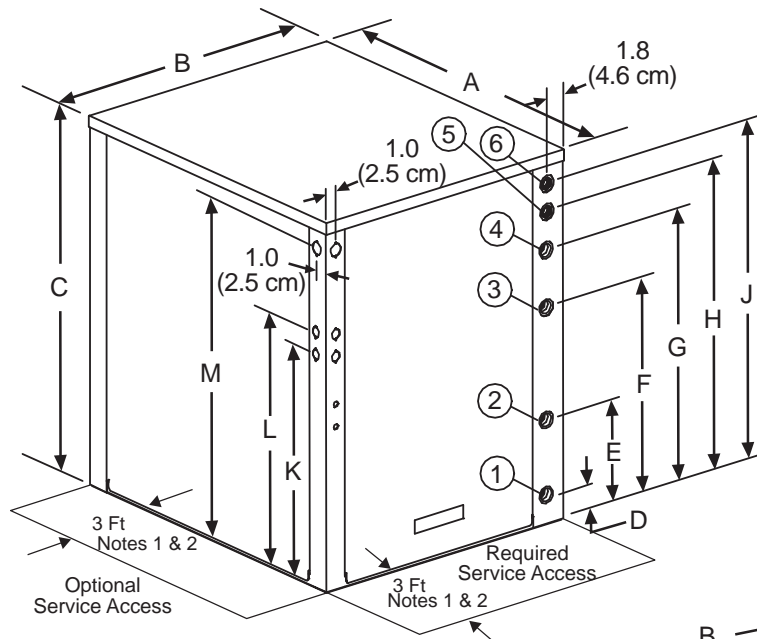
Unit Physical Data

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

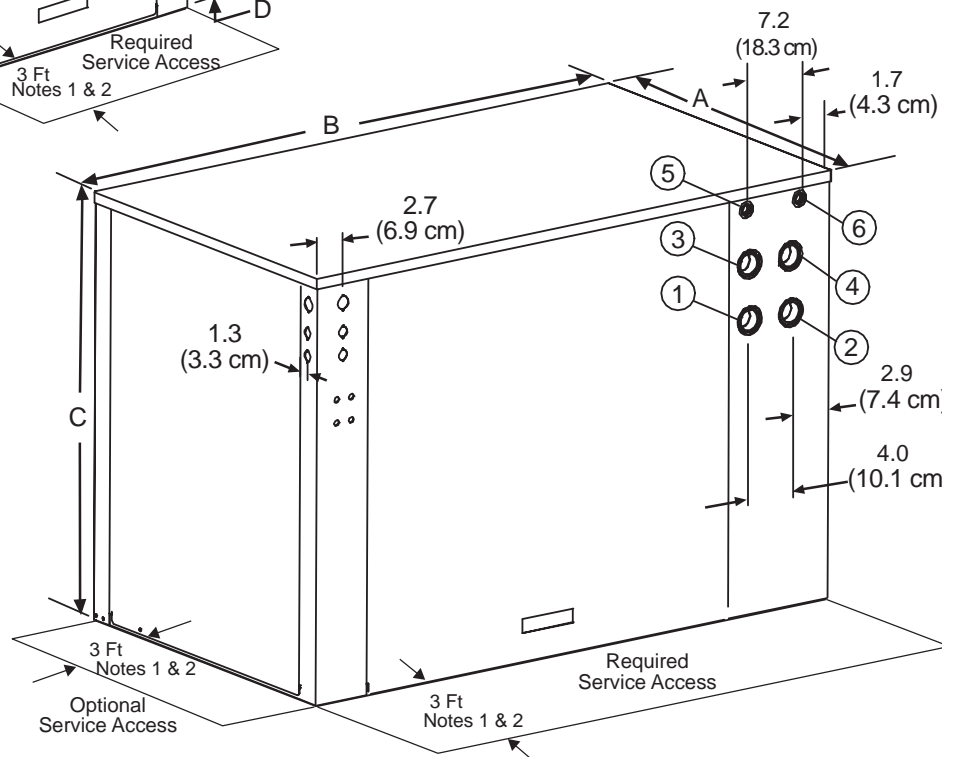
Unit Maximum Water Working Pressure PSIG (kPa)	
Unit	145 [100]
Maximum Water Flow Through Unit GAL (L)	
036	25 [94.6]
060, 120	35 [132.5]

TBW036 - 120 Unit 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			
	A Depth	B Width	C Height	1	2	3	4	5	6	K Low Voltage	L External Pump	M Power Supply	
				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				
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.

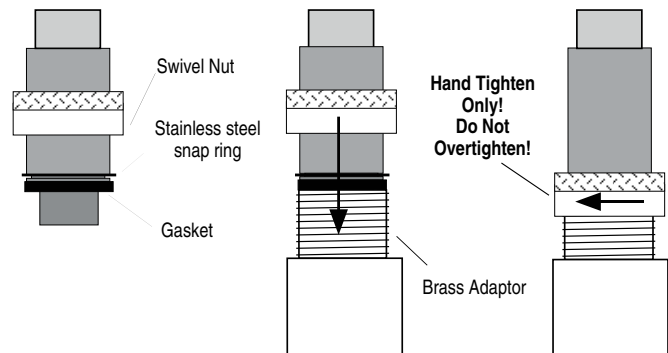
FPT Connections (Size 120)

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 anti-freeze 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

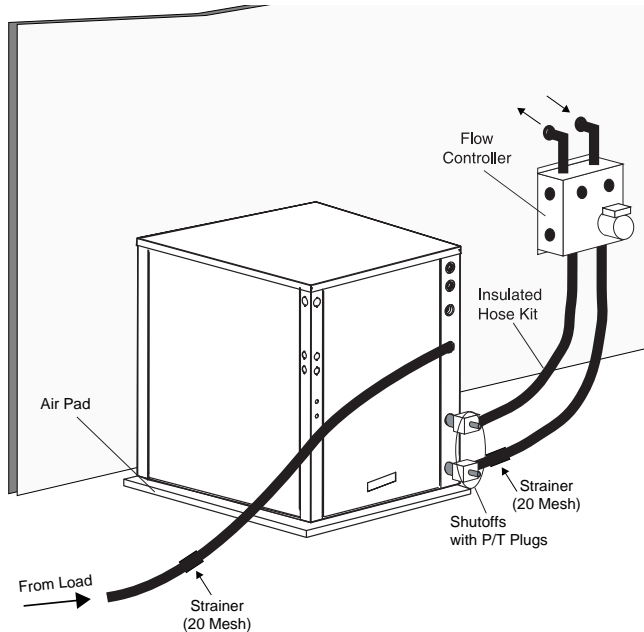
In areas where minimum entering loop temperatures drop below 40°F [5°C] or where piping will be routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze; however your local sales manager should be consulted for the antifreeze best suited to 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 the minimum expected entering loop temperature, the

Ground-Loop Heat Pump Applications

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:
 $30^{\circ}\text{F} - 15^{\circ}\text{F} = 15^{\circ}\text{F}$ [$-1^{\circ}\text{C} - 9^{\circ}\text{C} = -10^{\circ}\text{C}$].

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced under the water level to prevent fumes. Calculate the total volume of fluid in the piping system 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



Low Water Temperature Cutout Setting - DXM Control
 When antifreeze is selected, the FP1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10°F [-12.2°C]) set point 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" Dia x 3ft tall [254mm x 91.4cm tall]	10 [37.9]

⚠ CAUTION ⚠

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

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

Water Quality Standards

Table 3: Water Quality Requirements for TBW

This guide is an attempt to give a picture of the resistance of the unit heat exchanger in water to corrosion by some important chemical factors. However, corrosion is actually a very complex process influenced by many different factors in combination. This table is therefore a considerable simplification, and its value should not be overestimated.

Water Containing	Concentration (mg/l or ppm)	Resistance	Explanations:
Alkalinity (HCO ₃ ⁻)	< 70	+	+ Good resistance under normal conditions 0 Corrosion problems possible, particularly when there are other factors rated 0
	70-300	+	
	> 300	+	
Sulfate (SO ₄ ²⁻)	< 70	+	☐ Use is not recommended
	70-300	+	
	> 300	0	
HCO ₃ ⁻ / SO ₄ ²⁻	> 1.0	+	
	< 1.0	+	
Electrical Conductivity	< 10 µS/cm	+	
	10-500 µS/cm	+	
	> 500 µS/cm	+	
pH	< 6.0	0	
	6-7.5	0/+	
	7.5-9.0	+	
	> 9.0	+	
Ammonia (NH ₃)	< 2	+	
	2-20	+	
	> 20	+	
Chlorides (CL ⁻) (140°F maximum)	< 300	+	
Free Chlorine (CL ₂)	< 1	+	
	1-5	+	
	> 5	0/+	
Hydrogen Sulfide	< 0.05	+	
	> 0.05	+	
Free (aggressive) Carbon Dioxide (CO ₂)	< 5	+	
	5-20	+	
	> 20	+	
Total Hardness (°dH)	4.0-8.5	+	
Nitrate (NO ₃)	< 100	+	
	> 100	+	
Iron (Fe)	< 0.2	+	
	> 0.2	+	
Aluminum (Al)	< 0.2	+	
	> 0.2	+	
Manganese (Mn)	< 0.1	+	
	> 0.1	+	

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.

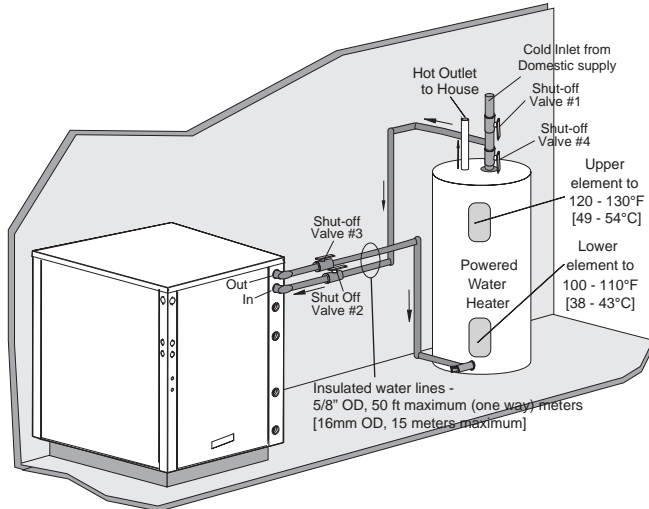
Hot Water Generator

The HWG (Hot Water Generator) or desuperheater option provides considerable operating cost savings by utilizing excess heat energy from the heat pump 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.

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 HWG pump are also built in and factory wired for residential equipment. Figure 3 shows a typical example of HWG water piping connections on a unit with built-in pump. This piping layout minimizes scaling potential.

Electric water heaters are recommended. If a gas, propane, or oil water heater is used, a second preheat tank should be considered (Figure 4). Also, 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.

Figure 3: Typical HWG Installation

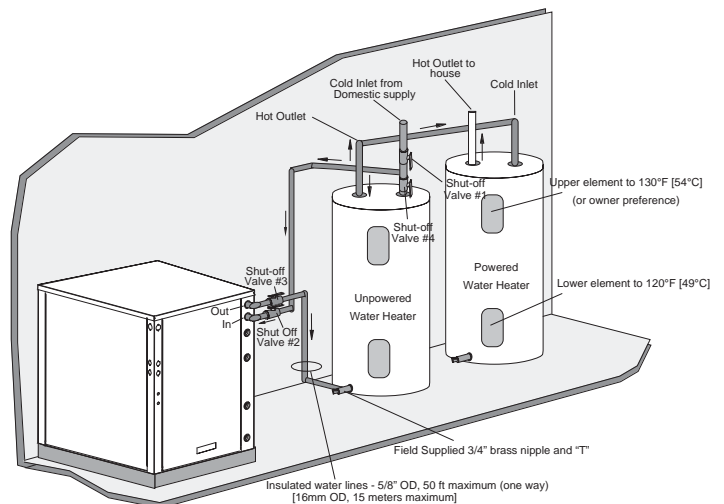


Typically a single tank of at least 52 gallons (235 liters) is used to limit installation costs and space. However, a dual tank, as shown in Figure 4, is the most efficient system, providing the maximum storage and temperate source water to the HWG.

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.

HFC-410A systems inherently have a lower hot gas temperature than R-22 systems because the equipment is more efficient (i.e. less waste heat is available). It is possible that energy could be transferred from the water heater to the hot gas line instead of from the hot gas line to the water heater during certain times of the year. To prevent this from occurring, a temperature switch will deactivate the pump at those conditions that typically occur in the cooling mode with low entering water temperatures.

Figure 4: HWG Double Tank Installation



Hot Water Generator

Installation

The HWG has two temperature sensors factory connected to HWG circuit board at PI. NEVER DISCONNECT, RELOCATE OR REMOVE SENSORS! HWT is located on the HWG heat exchanger “Water In” line. If the HWG is connected incorrectly or if circulation is reversed, the HWG will not operate. Full load conditions could drive hot water tank temperatures far above safe temperature levels if the sensors have been disconnected or removed.

The heat pump, water piping, pump, and hot water tank must be located where the ambient temperature is not subject to freezing. Keep water piping lengths at a minimum. DO NOT use a one way length greater than 50 ft. [15 m].

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 connect the pump wiring until “Initial Start-Up” section, below. Powering the pump before all installation steps are completed may damage the pump.

Water Tank Preparation

1. Turn off power or fuel supply to the hot water tank.
2. Connect 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 5/8” O.D. copper, route and install the water piping, valves and air vent as shown in Figures 3 or 4. 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 3 or 4).
2. Insulate all HWG water piping with no less than 3/8” [10mm] wall closed cell insulation.
3. Open both shut off valves and make sure the tank drain valve is closed.

⚠ 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.

Water Tank Refill

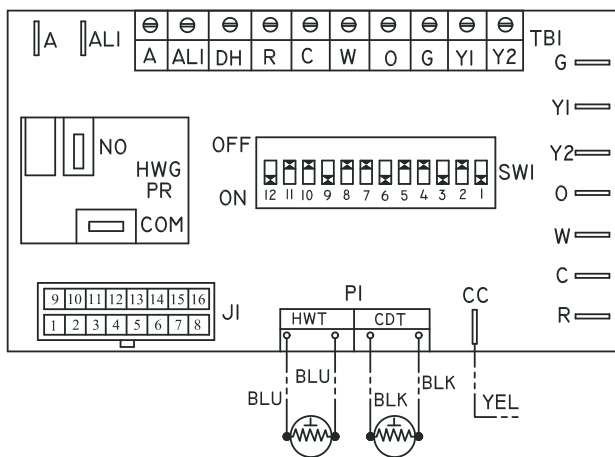
1. Close valve #4. Ensure that the HWG valves (valves #2 and #3) are open. Open the cold water supply (valve #1) to fill the tank through the HWG piping. This will purge air from the HWG piping.
2. Open a hot water faucet to vent air from the system until water flows from faucet; turn off faucet. Open 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 (Fig 4).
6. Replace access cover(s) and restore power or fuel supply.

Hot Water Generator

Initial Start-Up (After unit checkout and start-up procedure is complete)

1. Make sure all valves in the HWG water circuit are fully open.
2. Energize the HWG by flipping DIP switch 12 to "off" position.

Logic - For pump to operate, Hot Water Temperature (HWT) must be $\leq 125^{\circ}\text{F}$ (52°C), Compressor Discharge Temperature (CDT) must be $\geq 125^{\circ}\text{F}$ (52°C), both conditions are needed for PR relay contacts to close and pump to run.



HWG BOARD DIP SWITCH SETTINGS

HWG PUMP TEST		HWG TEMP		HWG STATUS	
SW10		SW11		SW12	
ON	PUMP TEST	ON	150F	ON	DISABLED
OFF	NORM	OFF	125F	OFF	ENABLED

3. Turn on the heat pump and allow it to run for 10-15 minutes.
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.

Electrical - Line Voltage

⚠ CAUTION! ⚠

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

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 4) 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.

⚠ WARNING! ⚠

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

⚠ 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.

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 4) 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 4: 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.

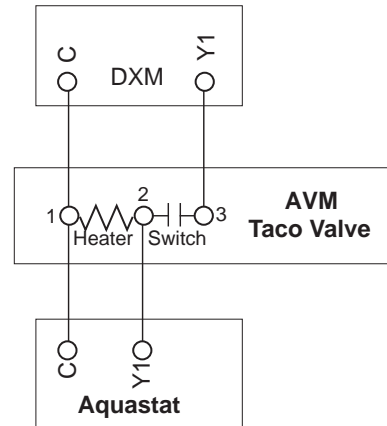
Electrical - Low Voltage Wiring

Low Voltage Wiring

Unit is typically controlled by field installed and wired aquastat and mode changeover switch (R to O is cooling mode). Wire to DXM P1 terminals, use minimum 18GA Class II wire.

Note: Do not close up unit until checkout is completed.

Figure 5: AVM Valve Wiring

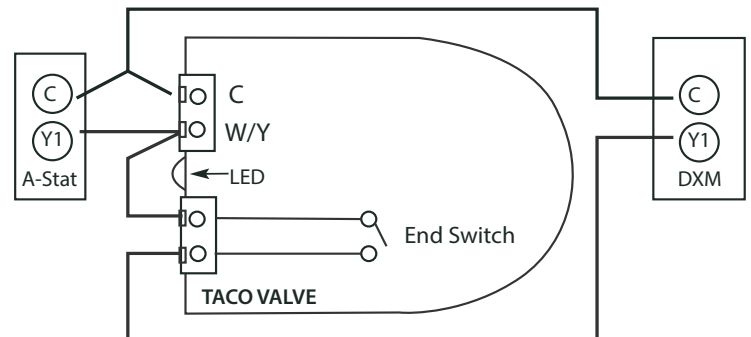


Water Solenoid Valves

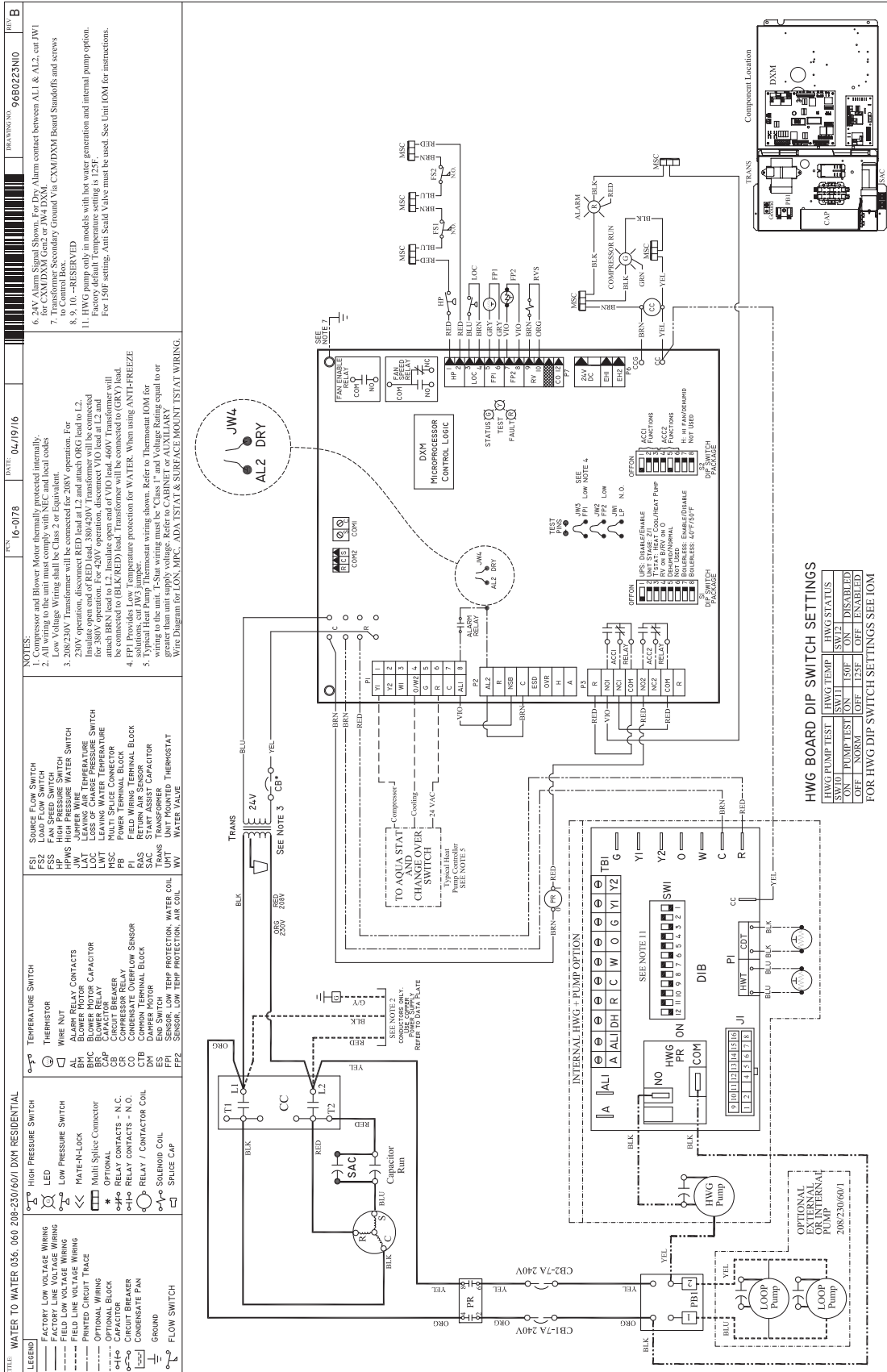
An external solenoid valve(s) (with end switch so valve is fully open before compressor starts) should be used. Valve should also be normally closed type so water flows through only when unit is operating. A slow closing valve may be required to help reduce water hammer. Typical wiring for a 24VAC external solenoid valve. Figures 5 or 6 illustrate typical slow closing water control valve wiring for Taco zone sentry series (ClimateMaster P/N AMV...) and Taco SBV series valves. Slow closing valves take approximately 60 seconds to open (very little water will flow before 45 seconds). Once fully open, an end switch closure allows the compressor to be energized. 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 aquastat

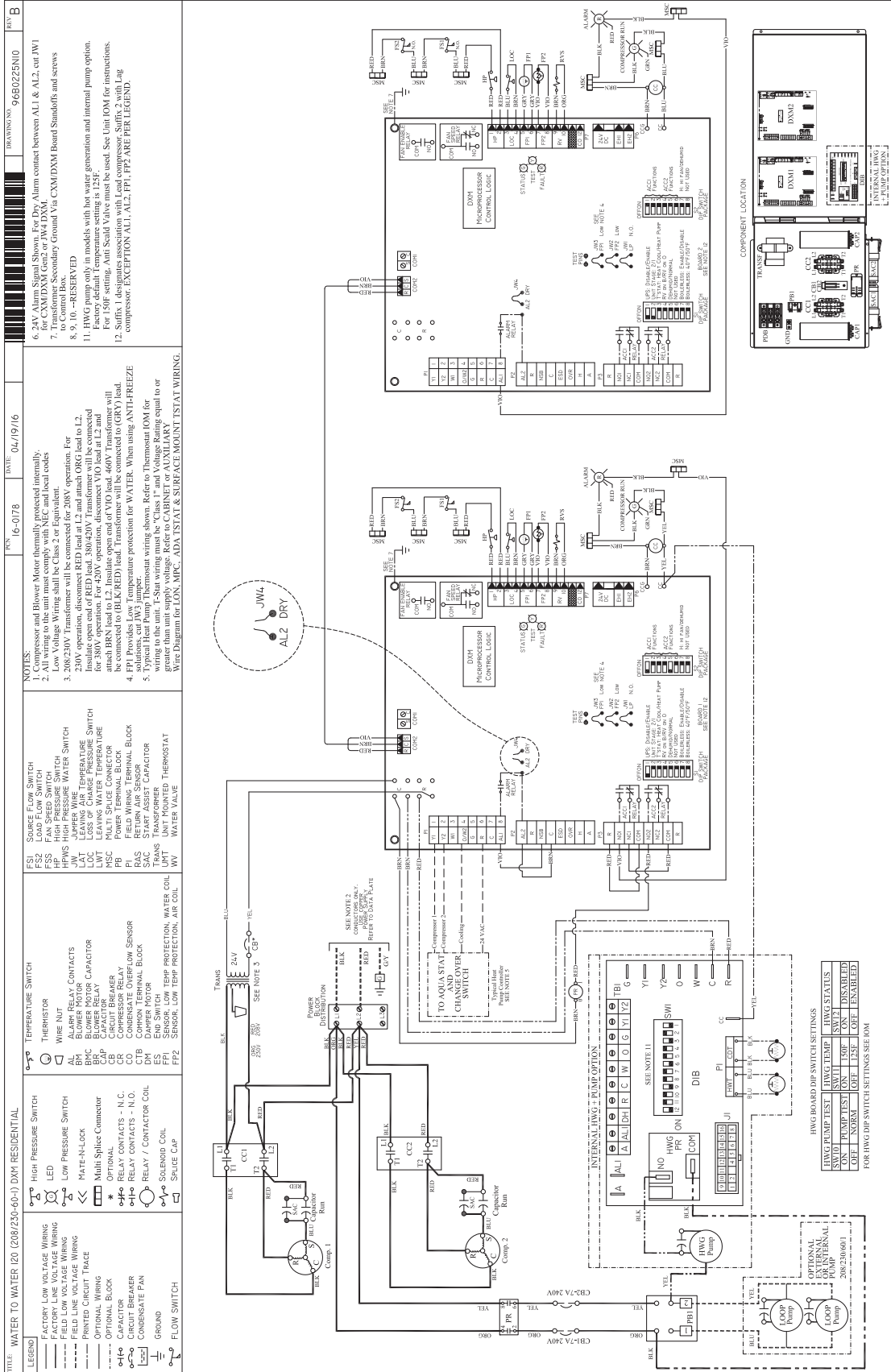
Figure 6: Taco SBV Valve Wiring



TBW036 & TBW060 Electrical Wiring Diagram - 96B0223N10



TBW120 Electrical Wiring Diagram - 96B0225N10



DXM CONTROLS

DXM Control - For detailed control information, see the DXM AOM (part #97B0003N13)

Table 3b: DXM LED And Alarm Relay Operations

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

- Slow Flash = 1 flash every 2 seconds
- Fast Flash = 2 flashes every 1 second
- Flash code 2 = 2 quick flashes, 10 second pause, 2 quick flashes, 10 second pause, etc.
- On pulse 1/3 second; off pulse 1/3 second

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

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

Field Configuration Options - Note: In the following field configuration options, jumper wires should be clipped ONLY when power is removed from the DXM control. LT1 and LT2 sensors are on the refrigerant lines; LT1 is between source HX and TXV; LT2 is between TXV and Load HX. Both sense refrigerant temperature, not water, which is a better indication of how water flow and temperature is affecting the refrigeration circuit.

Source Water low temperature limit setting: Jumper 3 (JW3-LT1 Low Temp) provides field selection of temperature limit setting for LT1 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature). Not Clipped = 30°F [-1°C]. Clipped = 10°F [-12°C]. Must use antifreeze if clipped.

Load Water low temperature limit setting:

Jumper 2 (JW2-LT2 Low Temp) provides field selection of temperature limit setting for LT2 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature).

Note: This jumper should only be clipped under extenuating circumstances, as recommended by ClimateMaster technical services.

Not Clipped = 30°F [-1°C]. Clipped = 10°F [-12°C]. Must use antifreeze if clipped.

Alarm relay setting: Jumper 4 (JW4-AL2 Dry) provides field selection of the alarm relay terminal AL2 to be jumpered to 24VAC or to be a dry contact (no connection). Not Clipped = AL2 connected to R. Clipped = AL2 dry contact (no connection).

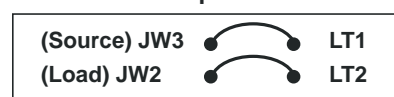
Low pressure normally open: Jumper 1 (JW1-LP norm open) provides field selection for low pressure input to be normally closed or normally open. Not Clipped = LP normally closed. Clipped = LP normally open.

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

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

- 1.1** - Unit Performance Sentinel (UPS) disable: DIP Switch 1.1 provides field selection to disable the UPS feature. On = Enabled. Off = Disabled.
- 1.2** - Compressor relay staging operation: DIP 1.2 provides selection of compressor relay staging operation. The compressor relay can be selected to turn on with a stage 1 or stage 2 call from the thermostat. This is used with dual stage units (2 compressors where 2 DXM controls are being used) or with master/slave applications. In master/slave applications, each compressor and fan will stage according to its appropriate DIP 1.2 setting. If set to stage 2, the compressor will have a 3 second on-delay before energizing during a Stage 2 demand. Also, if set for stage 2, the alarm relay will NOT cycle during test mode. On = Stage 1. Off = Stage 2.

Low Water Temperature Cutouts



DXM Board

DXM Controls

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

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

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

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

1.7 - Boilerless operation: DIP 1.7 provides selection of boilerless operation. In boilerless mode, the compressor is only used for heating when LT1 is above the temperature specified by the setting of DIP 1.8. Below DIP 1.8 setting, the compressor is not used and the control goes into emergency heat mode, staging on EH1 and EH2 to provide heating.
 On = normal. Off = Boilerless operation.

1.8 - Boilerless changeover temperature: DIP 1.8 provides selection of boilerless changeover temperature set point. Note that the LT1 thermistor is sensing refrigerant temperature between the source heat exchanger and the expansion device (TXV or cap tube). Therefore, the 50°F [10°C] setting is not 50°F [10°C] water, but approximately 60°F [16°C] EWT.
 On = 50°F [10°C]. Off = 40°F [16°C].

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

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

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

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

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

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

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

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

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

Table 3c: Accessory DIP Switch Settings

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

All other DIP combinations are invalid

Safety Features - DXM Controls

Safety Features – DXM Control -

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

Anti-short cycle protection: The control features a 5 minute anti-short cycle protection for the compressor. Note: The 5 minute anti-short cycle also occurs at power up.

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

Fault Retry: In Fault Retry mode, the Status LED begins slowly flashing to signal that the control is trying to recover from a fault input. The control will stage off the outputs and then “try again” to satisfy the thermostat input call. Once the thermostat input call is satisfied, the control will continue on as if no fault occurred. If 3 consecutive faults occur without satisfying the thermostat input call, the control will go into “lockout” mode. The last fault causing the lockout will be stored in memory and can be viewed at the “fault” LED (DXM board). Note: LT1/LT2 faults are factory set at only one try.

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

Lockout with emergency heat: If DXM is configured for heat pump thermostat type (DIP 1.3), emergency heat will become active if O/W2 is energized.

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

High pressure lockout code = 2

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

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

Low pressure lockout code = 3

Source water low temperature (LT1): The LT1 thermistor temperature must be below the selected low temperature limit setting for 30 continuous seconds during a compressor run cycle to be recognized as a LT1 fault. The LT1 input is bypassed for the initial 120 seconds of a compressor run cycle. LT1 is set at the factory for one try. Therefore, the control will go into lockout mode once the LT1 fault has occurred.

LT1 lockout code = 4

Load water low temperature (LT2): The LT2 thermistor temperature must be below the selected low temperature limit setting for 30 continuous seconds during a compressor run cycle to be recognized as a LT2 fault. The LT2 input is bypassed for the initial 60 seconds of a compressor run cycle. LT2 is set at the factory for one try. Therefore, the control will go into lockout mode once the LT2 fault has occurred.

LT2 lockout code = 5

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

CO lockout code = 6

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

Over/under voltage shut down code = 7

Unit Performance Sentinel-UPS (patent pending):

The UPS feature indicates when the heat pump is operating inefficiently. A UPS condition exists when:

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

Safety Features - DXM Controls

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

UPS warning code = 8

Swapped LT1/LT2 thermistors: During test mode, the control monitors to see if the LT1 and LT2 thermistors are in the appropriate places. If the control is in test mode, the control will lockout with code 9 after 30 seconds if:

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

Swapped LT1/LT2 thermistor code = 9.

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

DXM CONTROLS

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

The green status LED and red fault LED on the DXM board advise the technician of the current status of the DXM control. The status LED will indicate the current mode that the DXM control is in. The fault LED will ALWAYS flash a code representing the LAST fault in memory. If there is no fault in memory, the fault LED will flash Code 1. The yellow test LED will turn on when in test mode.

DXM Control Start-up Operation - The control will not operate until all inputs and safety controls are checked for normal conditions. The compressor will have a 5 minute anti-short cycle delay at power-up. The first time after power-up that there is a call for compressor, the compressor will follow a 5 to 80

second random start delay. After the random start delay and anti-short cycle delay, the compressor relay will be energized. On all subsequent compressor calls, the random start delay is omitted.

Safety Features

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 -7/27° C	20/80 -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

BEFORE POWERING SYSTEM, please check the following:

⚠ 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.

Note: The manufacturer strongly recommends all piping connections, both internal and external to the unit, be pressure tested by an appropriate method prior to any finishing of the interior space or before access to all connections is limited. Test pressure may not exceed the maximum allowable pressure for the unit and all components within the water system. The manufacturer will not be responsible or liable for damages from water leaks due to inadequate or lack of a pressurized leak test, or damages caused by exceeding the maximum pressure rating during installation.

UNIT 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 DXM 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 DXM 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) [0.84mm] 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 (DIB-Switch 12 is "On") unit start up.
- ❑ **Miscellaneous:** Note any questionable aspects of the installation.

⚠ 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! ⚠

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:

$$HE = TD \times GPM \times 500$$
 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]

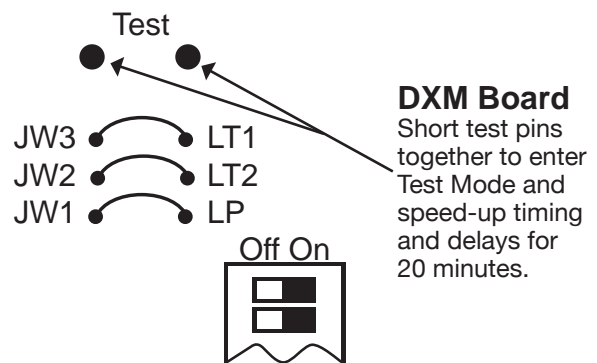
Table 8: Water Pressure Drop TBW036-120

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 DXM PCB as shown in Figure 8. See controls description for detailed features of the control.

Figure 8: Test Pins



Unit Start Up Procedure

⚠ 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.

- 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:
$$\text{HR} = \text{TD} \times \text{GPM} \times 500$$
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.
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:
$$\text{HR} = \text{TD} \times \text{GPM} \times 500$$
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:
$$\text{HE} = \text{TD} \times \text{GPM} \times 500$$
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	Super-heat °F	Sub-cooling °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

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	Super-heat °F	Sub-cooling °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		
120		148-158	405-420	13-23	6-18	8-21		