Split Products

Tranquility® Digital Split Indoor (TES) Series

Tranquility® Digital Split Outdoor (TEP) Series

Indoor and Outdoor Split Geothermal Heat Pumps

Installation, Operation & Maintenance Instructions

97B0047N05

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ClimateMaster
Geothermal Heating & Cooling

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Model Nomenclature: for Indoor Split Series

1 2	3	4 5 6	7	8	9	10	11	12	13	14	15
TE	S	0 2 6	B	G	D	0	2	C	N	N	S

SERIES (1–2)
TE = Tranquility® Digital

CONFIGURATION (3)
S = SPLIT (Indoor)

UNIT SIZE (4–6)
026
038
049
064

REVISION LEVEL (7)
B = Current Revision

VOLTAGE (8)
G = 208-230/60/1

CONTROLS (9)
D = DXM2
B = DXM2 w/Disconnect
4 = DXM2 w/Secure Start

CABINET (10)
0 = Residential

WATER CIRCUIT OPTIONS (11)
0 = None
vFlow:
1 = Internal Flow Controller Standard Head – Closed Loop (available for unit sizes 026 and 038 only)
2 = Internal Flow Controller High Head - Closed Loop
5 = Motorized Modulating Valve (Central Pumping Applications) - Closed Loop
6 = Motorized Modulating Valve (Ground Water Applications) - Open Loop

HEAT EXCHANGER OPTIONS (12)

	Copper	Cupro-Nickel
HWG w/Pump (Standard)	C	N
No-HWG	A	J

FUTURE (13)
N = NOT APPLICABLE

FUTURE (14)
N = NOT APPLICABLE

STANDARD (15)
S = Standard

In Position 11 and 12, only the following combinations are available:

With HWG	Without HWG	Description
1C	1A	Internal Flow Controller Standard Head with Copper Water Coil
2C	2A	Internal Flow Controller High Head with Copper Water Coil
5C	5A	Motorized Modulating Valve with Copper Water Coil
6N	6J	Motorized Modulating Valve with Cupro-Nickel Water Coil
0C	0A	No vFlow with Copper Water Coil
0N	0J	No vFlow with Cupro-Nickel Water Coil

1 2	3	4 5 6	7	8	9	10	11	12	13	14	15
TE	P	0 2 6	B	G	D	0	2	A	N	N	S

SERIES (1–2)
TE = Tranquility® Digital

CONFIGURATION (3)
P = Protective Cabinet (Outdoor)

UNIT SIZE (4–6)
026
038
049
064

REVISION LEVEL (7)
B = Current Revision

VOLTAGE (8)
G = 208-230/60/1

CONTROLS (9)
D = DXM2

CABINET (10)
0 = Residential

WATER CIRCUIT OPTIONS (11)
vFlow:
1 = Internal Flow Controller Standard Head – Closed Loop (available for unit sizes 026 and 038 only)
2 = Internal Flow Controller High Head - Closed Loop

HEAT EXCHANGER OPTIONS (12)
A = Non-HWG w/Copper

FUTURE (13)
N = NOT APPLICABLE

FUTURE (14)
N = NOT APPLICABLE

STANDARD (15)
S = Standard

Safety

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

⚠ 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 packaging of each unit, and inspect each unit for damage. Insure that the carrier makes proper notation of any shortages or damage on all copies of the freight bill and completes a common carrier inspection report. Concealed damage not discovered during unloading must be reported to the carrier within 15 days of receipt of shipment. If not filed within 15 days, the freight company can deny the claim without recourse. Note: It is the responsibility of the purchaser to file all necessary claims with the carrier. Notify your equipment supplier of all damage within fifteen (15) days of shipment.

Storage
Equipment should be stored in its original packaging in a clean, dry area. Store units in an upright position at all times. Stack units a maximum of 3 units high.

Unit Protection
Cover units on the job site with either the original packaging or an equivalent protective covering. Cap the open ends of pipes stored on the job site. In areas where painting, plastering, and/or spraying has not been completed, all due precautions must be taken to avoid physical damage to the units and contamination by foreign material. Physical damage and contamination may prevent proper start-up and may result in costly equipment clean-up.

Examine all pipes, fittings, and valves before installing any of the system components. Remove any dirt or debris found in or on these components.

Pre-Installation
Installation, Operation, and Maintenance instructions are provided with each unit. The installation site chosen should include adequate service clearance around the unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check the system before operation.

Prepare units for installation as follows:
1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Keep the cabinet covered with the original packaging until installation is complete and all plastering, painting, etc. is finished.
3. Verify refrigerant tubing is free of kinks or dents and that it does not touch other unit components.
4. Inspect all electrical connections. Connections must be clean and tight at the terminals.
5. Locate and verify any hot water generator (HWG) or other accessory kit located in the compressor section.

⚠ 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.

Equipment Selection

General

Proper indoor coil selection is critical to system efficiency. Using an older-model coil can affect efficiency and may not provide the customer with rated or advertised EER and COP. Coil design and technology have dramatically improved operating efficiency and capacity in the past 20 years. Homeowners using an older coil are not reaping these cost savings and comfort benefits. NEVER MATCH AN R-22 INDOOR COIL WITH AN HFC-410A COMPRESSOR SECTION.

Newer indoor coils have a larger surface area, enhanced fin design, and grooved tubing. These features provide a larger area for heat transfer, improving efficiency and expanding capacity. Typical older coils may only have one-third to one-half the face area of these redesigned coils.

Indoor Coil Selection - Tranquility® (TES & TEP)

ClimateMaster split system heat pumps are rated in the AHRI directory with a specific indoor coil match. Tranquility® models are rated with Tranquility® Air Handlers and Cased Coils.

Communicating System

To receive full benefits of the 4-wire communicating system, always select a Tranquility® Digital Air Handler with AXM Control and an iGate™ Communicating Thermostat (ATC32) with Tranquility® Digital Splits (TES/TEP).

Indoor/Outdoor Application

Select Tranquility® Digital INDOOR Split (TES) with Tranquility® Digital Air Handler or cased coil for applications with a compressor and air handler/coil used indoors.

Select Tranquility® Digital OUTDOOR Split (TEP) with Tranquility® Digital Air Handler or cased coil applications with an outdoor compressor section and air handler/coil used indoors.

Table 1: Tranquility® Split System AHRI Rated Components

Compressor Section	Air Handler	Cased Coil
TES/P026	TAH026	TAC026
TES/P038	TAH038	TAC038
TES/P049	TAH049	TAC049
TES/P064	TAH064	TAC064

Installation

The installation of geothermal 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.

Removing Existing Condensing Unit (Where Applicable)

1. Pump down condensing unit. Close the liquid line service valve of existing condensing unit and start compressor to pump refrigerant back into compressor section. Then, close suction service valve while compressor is still running to trap refrigerant in outdoor section. Immediately kill power to the condensing unit.
2. Disconnect power and low voltage and remove old condensing unit. Cut or unbraze line set from unit. Remove condensing unit.
3. If condensing unit is not operational or will not pump down, refrigerant should be recovered using appropriate equipment.
4. Replace line set, especially if upgrading system from R-22 to HFC-410A refrigerant. If line set cannot be replaced, it must be thoroughly flushed before installing new compressor section. HFC-410A compressors use POE oil instead of mineral oil (R-22 systems). Mineral oil is not compatible with POE oil, and could cause system damage if not completely flushed from the line set.

“Indoor” Compressor Section Location

Both “indoor” and “outdoor” versions of the geothermal split system compressor section are available. “Indoor” version is not designed for outdoor installation. Locate the unit in an INDOOR area that allows enough space for service personnel to perform typical maintenance or repairs without removing unit. Units are typically installed in a mechanical room or closet. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air). Consideration should be given to access for easy removal of service access panels. Provide sufficient room to make water, electrical, and line set connections.

Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. Refer to Figure 1 for an illustration of a typical installation. Refer to “Physical Dimensions” section for dimensional data. Conform to the following guidelines when selecting unit location:

1. Install the unit on a piece of rubber, neoprene or other mounting pad material for sound isolation. The pad should be at least 3/8” [10mm] to 1/2” [13mm] in thickness. Extend the pad beyond all four edges of the unit.
2. Provide adequate clearance for maintenance and service. Do not block access panels with piping, conduit or other materials.
3. Provide access for servicing the compressor and heat exchanger without removing the unit.
4. Provide an unobstructed path to the unit within the closet or mechanical room. Space should be sufficient to allow removal of the unit, if necessary.
5. Provide access to water valves and fittings and screwdriver access to the unit side panels and all electrical connections.

“Outdoor” Compressor Section Location

Locate the unit in an outdoor area that allows easy loop and lineset access and also has enough space for service personnel to perform typical maintenance or repairs. The “outdoor” compressor section is usually installed on a condenser pad directly outside the lineset access into the building. The loop access end should be located away from the building. Conform to the following guidelines when selecting unit location:

1. Provide adequate access for loop trench excavation.
2. Locate unit directly outside lineset penetration if possible. Utilize existing condenser pad where possible.
3. Provide access for servicing and maintenance.

“Outdoor” compressor section may be mounted on a vibration isolation pad with loop access hole as shown in Figure 3. When mounting on an existing concrete condenser pad, 3” [76 mm] holes should be bored through the pad to accommodate the pipe (1-¼” - 32mm) and insulation (½” [13mm] wall thickness). Figure 3 illustrates location and dimensions of the holes required.

Air Handler Installation

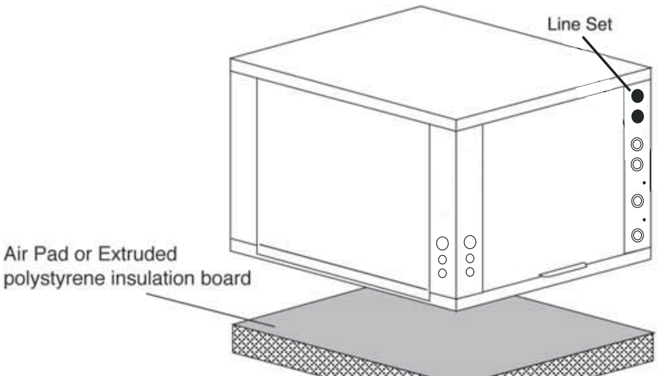
This manual specifically addresses the compressor section of the system. Air handler location and installation should be according to the instructions provided with the air handling unit (Tranquility® Digital Air Handler)

⚠ CAUTION! ⚠

CAUTION! To avoid equipment damage to TES/TEP units with expansion tank, DO NOT allow system water pressure to exceed 145 psi [1000 kPa]. The expansion tank used in TES/TEP units has a maximum working water pressure of 145 psi [1000 kPa]. Any pressure in excess of 145 psi [1000 kPa] may damage the expansion tank.

Installation

Figure 1: TES Installation

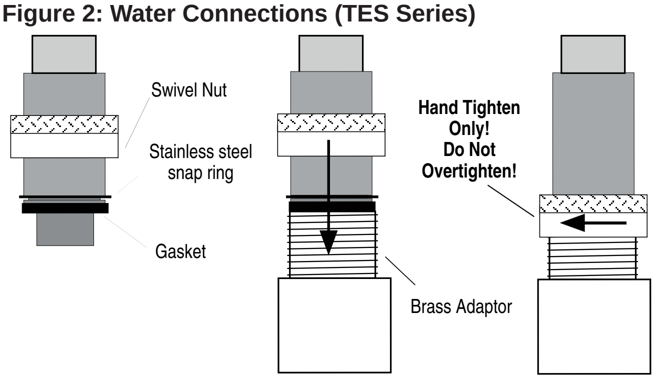


Water Connections

Residential models utilize swivel piping fittings for water connections that 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. Check for burrs and ensure 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.

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!

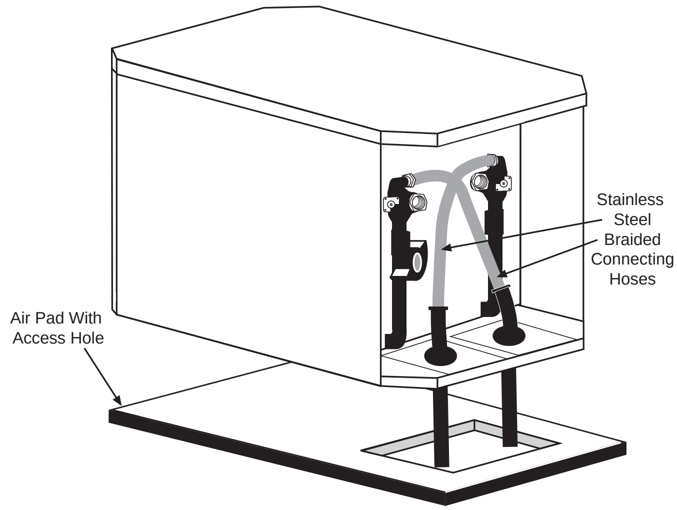
Figure 2: Water Connections (TES Series)

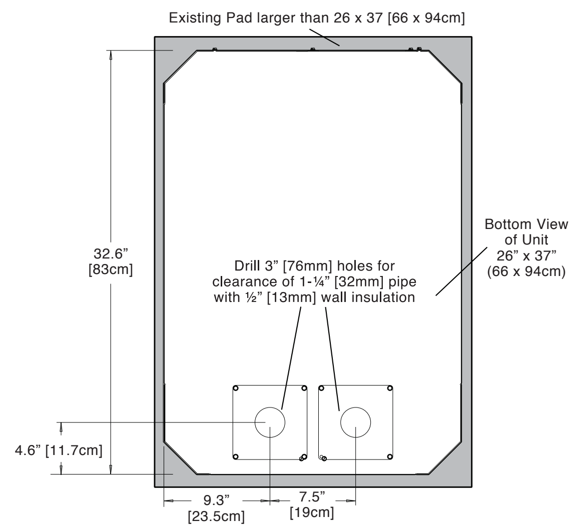


⚠ WARNING! ⚠

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.

Figure 3: TEP Installation

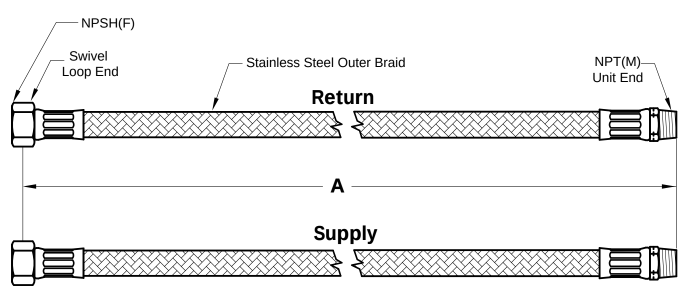




NOTE: Outdoor Unit Water Connections

TEP026 and 038 units are shipped with ¾” stainless steel braided hoses connected to unit piping. Field connection end of hoses are gaskated female swivel.

TEP049 and 064 units are shipped with 1” stainless steel braided hoses connected to unit piping. Field connection end of hoses are gasketed female swivel.



vFlow™ Heat Pump Applications Overview

Optional vFlow Internal Variable Water-flow Control
vFlow is an efficient means of circulating water (or water plus antifreeze) using internal factory installed variable speed pump or modulating motorized valve. vFlow technology improves performance of the unit by reducing the amount of energy required to flow water throughout the geothermal heat pump system and also reduces the space, cost, and labor required to install external water flow control mechanisms (such as pumps, flow controllers, solenoid, and flow control valves)

vFlow™ Configurations:

1) **Internal Flow Controller - For Closed Loop Applications**
   This is the most common configuration for closed loops. With this factory-installed option, the unit is built with an Internal Variable Speed Pump and other components to flush and operate the unit correctly (including an expansion tank, flush ports and flushing valves). The pump speed is controlled by the DXM2 control based on the difference in entering and leaving water temperatures (ΔT). The Internal Flow Controller pump includes an internal check valve for multiple unit installations. A copper water coil is standard with this option.

   Note: Internal Flow Controllers are also very suitable for multiple unit installations depending on pump performance requirements.

2) **Internal Modulating Motorized Valve – For Large Closed Loop Applications (external central pumping)**
   Primarily for use on multi-unit closed loop applications with central pumping. With this factory-installed option, the unit includes a low pressure drop modulating motorized valve that is controlled by the DXM2 microprocessor control based on the difference in the entering and leaving water temperatures (ΔT). A Copper Water Coil is standard with this option. The modulating valve in this option has a higher Cv than the open loop option.

3) **Internal Modulating Motorized Valve - For Open Loop Applications (TES Models Only)**
   For use on open loop applications. With this factory-installed option, the unit is built with an internal modulating motorized valve controlled by the Communicating DXM2 control board based on entering and leaving water temperatures (ΔT). A low Cv modulating motorized valve is used for this application to provide more precise control against the higher system pressure differential of open loop applications. A Cupro-Nickel water coil comes standard with this option.

Details on these options are included in the following sections on ground loop and ground water applications.

Figure 4a: Typical Closed-Loop Application (with Internal Flow Controller Shown)

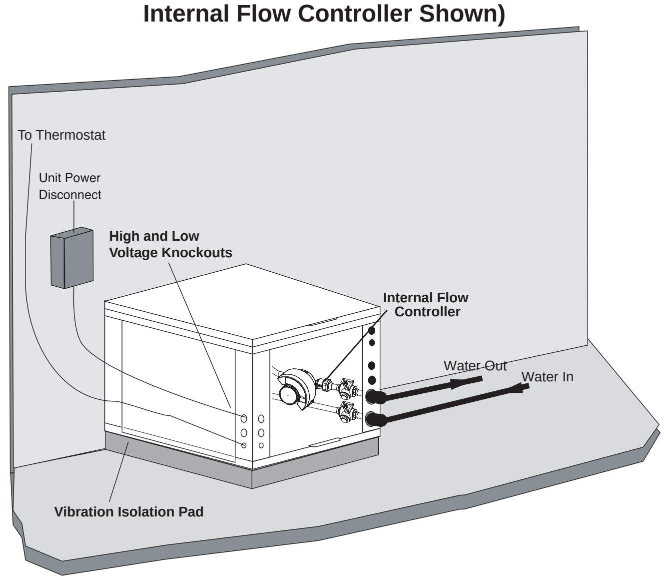
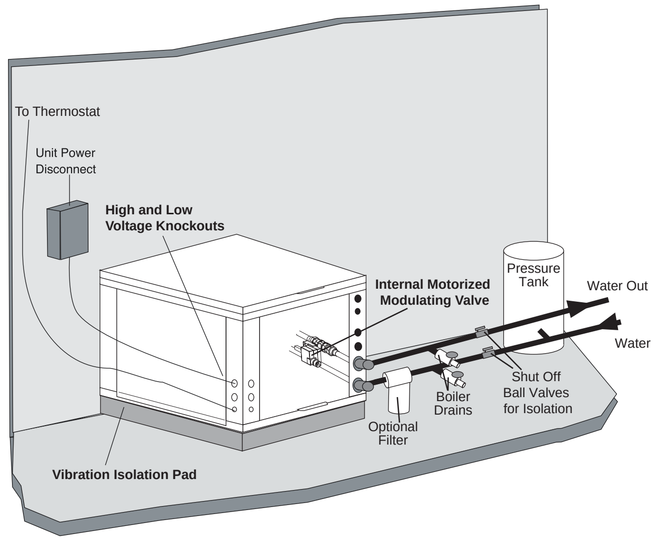


Figure 4b: Typical Open Loop Application (with Internal Modulating Motorized Valve Shown)

For use on applications using external source for flow



⚠ 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.

Closed Loop Heat Pump Applications with Internal Flow Controller

Units with internal flow control come with a built-in variable speed pump, an expansion tank, flushing ports and three-way valves (used to flush the unit). The variable speed pump is controlled by the Communicating DXM2 board based on the difference between the entering and leaving water temperature (ΔT). When entering water temperatures are abnormally low for cooling, or abnormally high for heating, the DXM2 controller will modulate the water flow to maintain a constant leaving water temperature which will allow the unit to operate properly under those conditions. The internal expansion tank helps to maintain constant loop pressure despite the natural expansion and contraction of the loop as the seasons and loop temperatures vary. The expansion tank also helps to avoid flat loop callbacks.

Pre-Installation

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

Piping Installation

The typical closed loop ground source system is shown in Figures 4a. All earth loop piping materials should be limited to polyethylene fusion only for in-ground sections of the loop and it is also recommended for inside piping. 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 ground loop applications. 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.

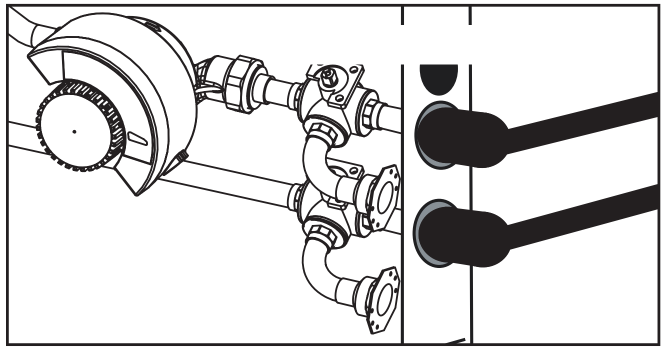
Test individual horizontal loop circuits before backfilling. Test vertical U-bends and pond loop assemblies prior to installation. Pressures of at least 100 psi [689 kPa] should be used when testing. Do not exceed the pipe pressure rating. Test entire system when all loops are assembled.

The following section will help to guide you through flushing a unit with internal flow control.

Water Pressure Schrader Ports

The pressure ports built in to the unit are provided as a means of measuring pressure drop through the water-to-refrigerant heat exchanger. The water pressure ports are schrader ports smaller than refrigerant schrader ports. They are the same size as tire schrader ports. A digital pressure gauge is recommended for taking pressure readings through these ports. The water flow through the unit can be determined by measuring the water pressure at the "water pressure out" port and subtracting it from the water pressure at the "water pressure in" port. Comparing the pressure differential to the pressure drop table (table13:) in this manual will determine the flow rate through the unit.

Figure 5: Internal Flow Controller



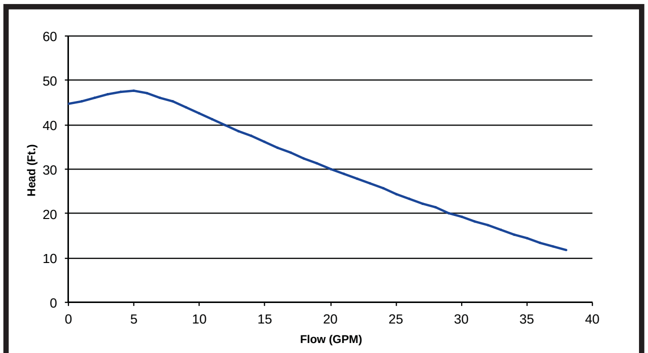
⚠ NOTICE! ⚠

NOTICE! If installing MULTIPLE vFlow® Internal Variable Speed Flow Controller units (in parallel) on one loop, please refer to section 'Multiple Unit Piping and Flushing' (later in this document).

Digital Pressure Gauge

Closed Loop Heat Pump Applications with Internal Flow Controller

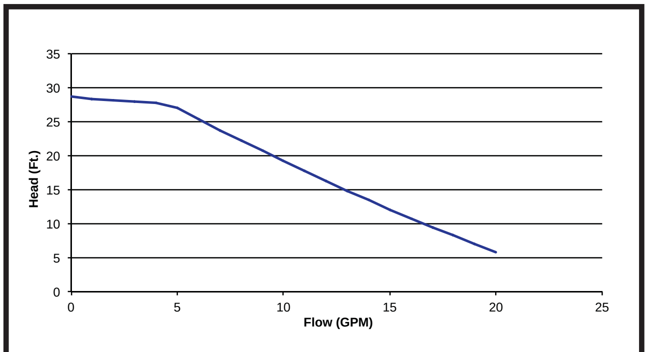
Figure 6a: Magna Geo 25-140 Internal Flow Controller Pump Performance



GPM	Head (ft)
0.0	44.7
1.0	45.4
2.0	46.1
3.0	46.8
4.0	47.5
5.0	47.7
6.0	47.1
7.0	46.1
8.0	45.3
9.0	43.9
10.0	42.6
11.0	41.2
12.0	39.9

GPM	Head (ft)
13.0	38.7
14.0	37.4
15.0	36.1
16.0	34.9
17.0	33.7
18.0	32.5
19.0	31.3
20.0	30.1
21.0	28.9
22.0	27.8
23.0	26.7
24.0	25.6
25.0	24.5

Figure 6b: UPM Geo 25-85 Internal Flow Controller Pump Performance



GPM	Head (ft)
0.00	28.7
1.00	28.4
2.00	28.1
3.00	27.9
4.00	27.7
5.00	27.0
6.00	25.3
7.00	23.7
8.00	22.2
9.00	20.6
10.00	19.1

GPM	Head (ft)
11.00	17.7
12.00	16.2
13.00	14.8
14.00	13.4
15.00	12.1
16.00	10.8
17.00	9.5
18.00	8.2
19.00	7.0
20.00	5.8

Flushing the Earth Loop

Once piping is completed between the unit and the ground loop, final purging and charging of the loop is needed.

A flush cart (at least a 1.5 hp [1.1kW] pump) is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop itself. Antifreeze solution is used in most areas to prevent freezing. All air and debris must be removed from the earth loop piping system before operation, **Flush the loop with a high volume of water at a high velocity (2 fps [0.6 m/s] in all piping)**, using a filter in the loop return line, of the flush cart to eliminate debris from the loop system. See Table 2 for flow rate required to attain 2fps [0.6 m/s]. The steps below must be followed for proper flushing.

Table 2: Minimum Flow Required to Achieve 2 ft/sec (0.6 m/s) velocity

PE Pipe Size	Flow (GPM)
3/4"	4 [4.3 L/M per KW]
1"	6 [6.5 L/M per KW]
1 1/4"	10 [10.8 L/M per KW]
1 1/2"	13 [14.0 L/M per KW]
2"	21 [22.6 L/M per KW]

Units with internal variable speed pumps also include a check valve internal to the pump. It is not possible to flush backwards through this pump. Care must be taken to connect the flush cart hoses so that the flush cart discharge is connected to the “water in” flushing valve of the heat pump.

Loop Fill
Fill loop (valve position A, see Figure 8a) with water from a garden hose through flush cart before using flush cart pump to ensure an even fill and increase flushing speed. When water consistently returns back to the flush reservoir, switch to valve position B (Figure 8b).

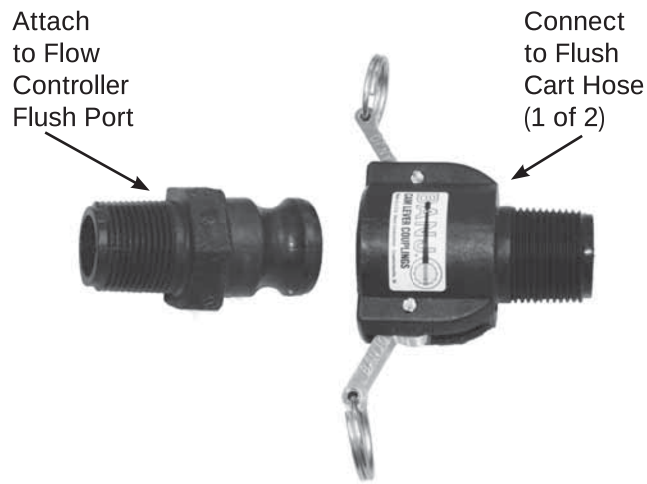
Isolate expansion tank for flushing procedure using the ball valve. During dead heading of flush cart pump, isolation will prevent compression of bladder in the expansion tank and flush cart fluid level dropping below available capacity.

Figure 7a: Typical Cleanable Flush Cart Strainer (100 mesh [0.149mm])

⚠ WARNING! ⚠

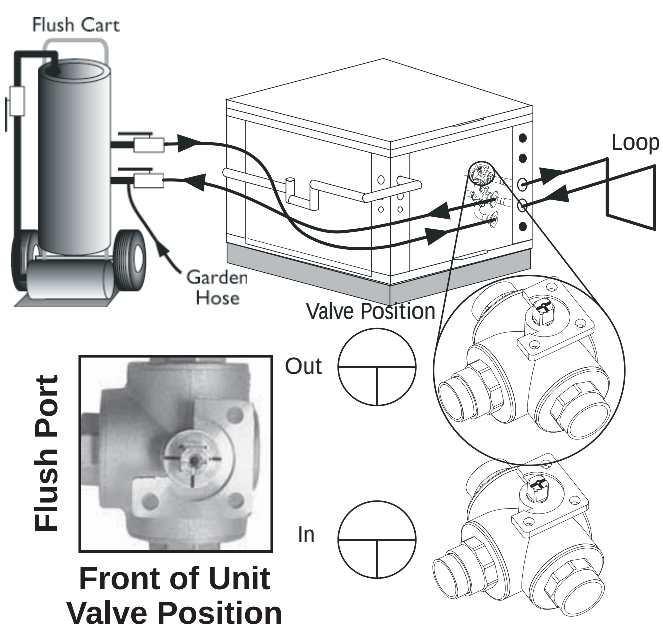
WARNING! Disconnect electrical power source to prevent injury or death from electrical shock.

Figure 7b: Cam Fittings for Flush Cart Hoses



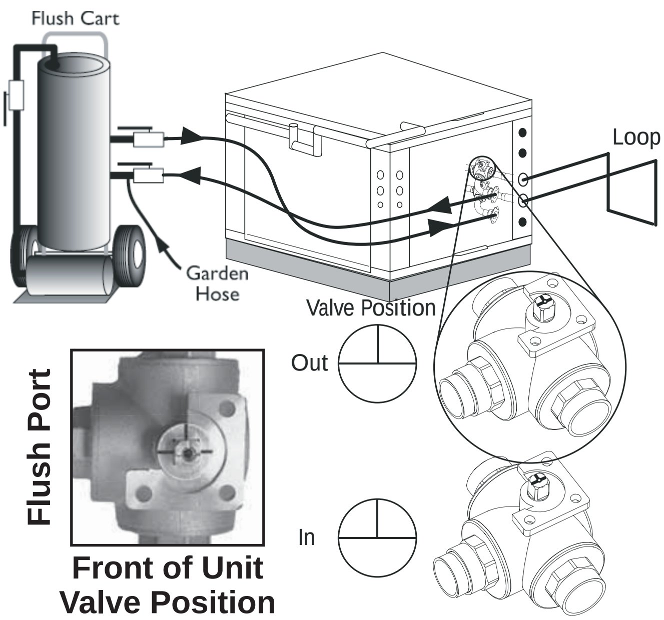
NOTICE: A hydrostatic pressure test is required on ALL piping, especially underground piping before final backfill per IGSHPA and the pipe manufacturers recommendations.

Figure 8a: Valve Position A - Loop Fill/Flush



Flushing the Earth Loop

Figure 8b: Valve Position B - Unit Fill / Flush



Unit Fill

Unit fill valves should be switched to Position B while flush cart is pumping to fill the unit heat exchanger (see Figure 8b). The valves position should be maintained until water is consistently returned into the flush reservoir.

Loop Flush

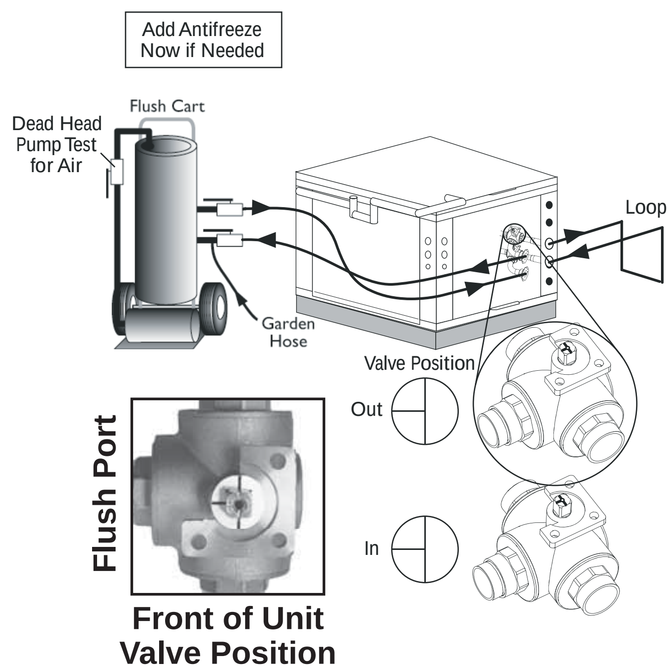
Switch to valve Position A. The supply water may be shut off and the flush cart turned on to begin flushing. Once the flush reservoir is full, do not allow the water level in the flush cart tank to drop below the pump inlet line or air can be pumped back out to the earth loop. Try to maintain a fluid level in the tank above the return tee so that air can not 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 flush cart return valve going into the flush cart reservoir. This process 'dead heads' the pump to 50 psi [345 kPa]. To dead head the pump until maximum pumping pressure is reached, open the valve back up and a pressure surge will be sent through the loop to help purge air pockets from the piping system. Notice the drop in fluid level in the flush cart tank. If all air is purged from the system, the level will drop only 3/8" (1.2 cm) in a 10" [25.4 cm] diameter PVC flush tank (about a half gallon [1.9 liters]) since liquids are incompressible. If the level drops more than this level, flushing should continue since air is still being compressed in the loop fluid. Do this a number of times.

NOTICE: Actual flushing time require will vary for each installation due to piping length, configuration, and flush cart pump capacity. 3/8" (1.2 cm) or less fluid level drop is the <u>ONLY</u> indication that flushing is complete.

Switch valves to Position B to flush the unit. Flush through the unit until all air pockets have been removed.

Move valves to position C. By switching both valves to this position, water will flow through the loop and the unit heat exchanger. Finally, the dead head test should be checked again for an indication of air in the loop. Fluid level drop is your only indication of air in the loop.

Figure 8c: Valve Position C - Full Flush



Pressurize and Operate

As shown in Figure 8e, close the flush cart return valve to pressurize the loop to at least 50 psi [345 kPa], not to exceed 75 psi [517 kPa]. Open the isolation valve to the expansion tank and bleed air from the expansion tank piping using the schraeder valve located in front of the expansion tank. This will allow loop pressure to compress the expansion tank bladder, thus charging the expansion tank with liquid. After pressurizing, close the flush cart supply valve to isolate the flush cart. Move the Flow Controller valves to Position D.

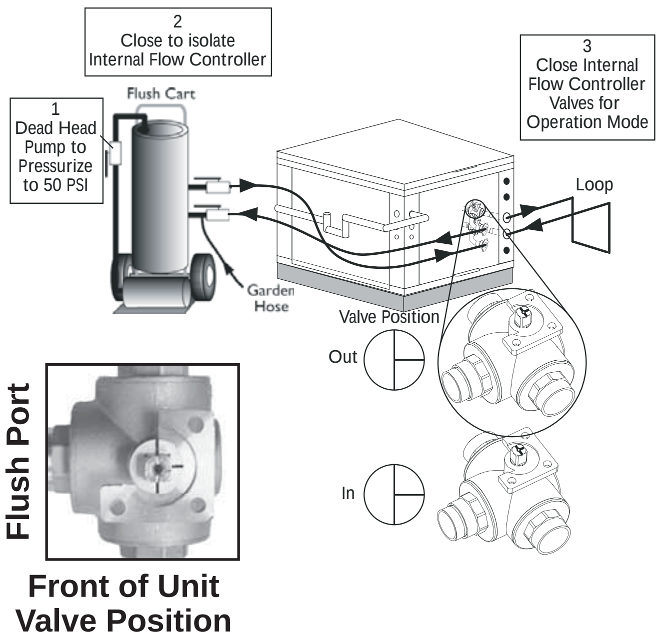
Loop static pressure will fluctuate with the seasons and pressures will be higher in the winter months than during the cooling season. This fluctuation is normal and should be considered when charging the system initially. Unhook

Flushing the Earth Loop

the flush cart from the Internal Flow Controller. Install Flow Controller caps to ensure that any condensation/leakage remains contained within the Flow Controller package.

If the loop pressure is between 50 and 75 psi [345 to 517 kPa] upon completion of flushing, pressures should be sufficient for all seasons.

Figure 8d: Valve Position D - Pressurize and Operation



NOTICE: It is recommended to run the unit in the cooling, then heating mode for 15-20 minutes each to 'temper' the fluid temperature and prepare it for pressurization. This procedure helps prevent the periodic "flat" loop condition of no pressure.

Multiple Unit Piping and Flushing

Often projects require more than one heat pump. Where possible, it makes sense for multiple units to share a common ground loop. Common ground loops for multiple units bring new challenges including the need to avoid backward flow through inactive units, increased pumping requirements, and more complex flushing needs. Three types of multiple unit systems are described below along with guidelines for installation of each type.

vFlow™ internal variable flow technology is a great assist for systems with multiple units. vFlow™ is available in three different configurations:

1. Internal variable-speed pump
2. Internal modulating valve for closed loops
3. Internal modulating valve for open loops

The internal modulating valve for open loops version should never be used on closed loops.

The internal variable speed pump version of vFlow™includes an internal variable speed circulator controlled by the DXM2 microprocessor, internal 3-way flushing valves, an internal bladder type expansion tank, and front-mounted pressure ports that allow access to the pressure drop across the coaxial heat exchanger only. The pump includes an internal check valve. The pump curve for the circulator is shown in Figures 6a,b. The internal expansion tank will operate as a pressure battery for the geothermal system. It will absorb fluid from the loop when loop pressure rises and inject fluid into the loop when loop pressure falls. In this way the expansion tank will help to maintain a more constant loop pressure and avoid flat loops due to seasonal pressure changes in the loop.

When using the internal variable speed pump as the loop pump in multiple unit installations it is important to ensure that the variable speed pump can provide adequate flow through the heat pump against the loop head when all units are operating.

Units with UPM Geo pumps should not be combined with units with Magna Geo pumps on the same loop. UPM Geo units are best suited for small applications with a single geothermal heat pump.

It may be possible to flush a multiple unit system through the unit's flushing valves. Flushing pressure drop of the valve may be calculated to determine if it is acceptable. Engineering data for the 3-way flushing valves can be found in Table 3.

Table 3: Internal 3-Way Flushing Valve Data

Model	Flushing Connection	Straight Flow Cv	90° Flow Cv
TES/P026 - 038	1" FPT	25	10.3
TES/P049 - 064	1" FPT	58	14.5

For example, if a system includes two 2-ton units and four ¾ loop circuits we can calculate the flushing pressure drop as follows. From Table 2 we know that it will take 4 gpm to flush each ¾" circuit. If there is no provision to isolate the circuits for flushing, we will have to flush with a minimum of 4 circuits x 4 gpm/circuit = 16 gpm total. A check of other piping sizes used must be done to ensure that 16 gpm total flow will flush all piping.

Pressure drop through the flushing valve can be calculated using the following formula.

$\Delta P = (GPM/Cv)^2$ where,
ΔP = pressure drop in psi through the valve while flushing
GPM = flushing flow in gallons per minute
Cv = valve Cv in flushing mode

We know from Table 3 that the Cv for the flushing valve in a TES/P026 is 10.3 in the flushing mode (90° flow). Therefore, $\Delta P = (GPM/Cv)^2 = (16/10.3)^2 = 2.4$ psi per valve (there are two flushing valves). So long as the flushing pump is able to provide 16 gpm at the flushing pressure drop of the loop plus the 2.4 x 2 valves = 4.8 psi of the flushing valves, the internal flushing valves may be used. If the flushing pump is not able to overcome the pressure drop of the internal flushing valves, then larger external flushing valves must be used.

Unit Configuration

Multiple vFlow™ units with internal variable-speed flow controller and check valve, piped in parallel sharing a common loop MUST be configured for 'VS PUMP PARALLEL' in Installer Settings Menu.

UNIT CONFIGURATION	
CURRENT CONFIG	TE026
HEAT PUMP FAMILY	TE
HEAT PUMP SIZE	026
BLOWER TYPE	ECM
LOOP CONFIG	VS PUMP PARALLEL
SELECT OPTION ▲▼	
◄ PREVIOUS	SAVE ■

Installer Settings → System Config → Unit Config → Loop Config

Multiple Units with Internal Flow Controllers

The simplest multiple unit system is one with two (or more) units utilizing internal Flow Controllers with no external pumps or flushing valves. In this case the units are piped in parallel and use the internal flushing valves to flush the system. The variable speed pump includes an internal check valve to prevent back (short circuiting) flow through the units.

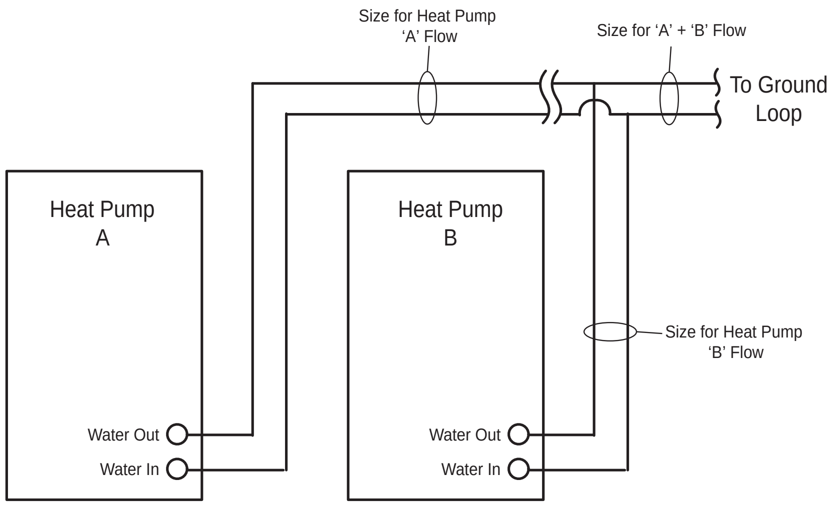
In this case, flush the loop through the internal flushing valves in the unit farthest from the loop first. Once the loop is flushed, then change the internal flushing valves to flush the heat pump. Next, move the flushing cart to the next closest unit to the loop.

Multiple Unit Piping and Flushing

Again, flush the loop through the internal flushing valves. This is important as there may be air/debris in the lines from this unit to the common piping. Once flushing begins the air will be move into the loop and will need to be flushed out. After the loop is flushed through the second unit, change the flushing valves to flush the second unit. This process should be repeated for additional units working from the farthest from the loop to the closest to the loop.

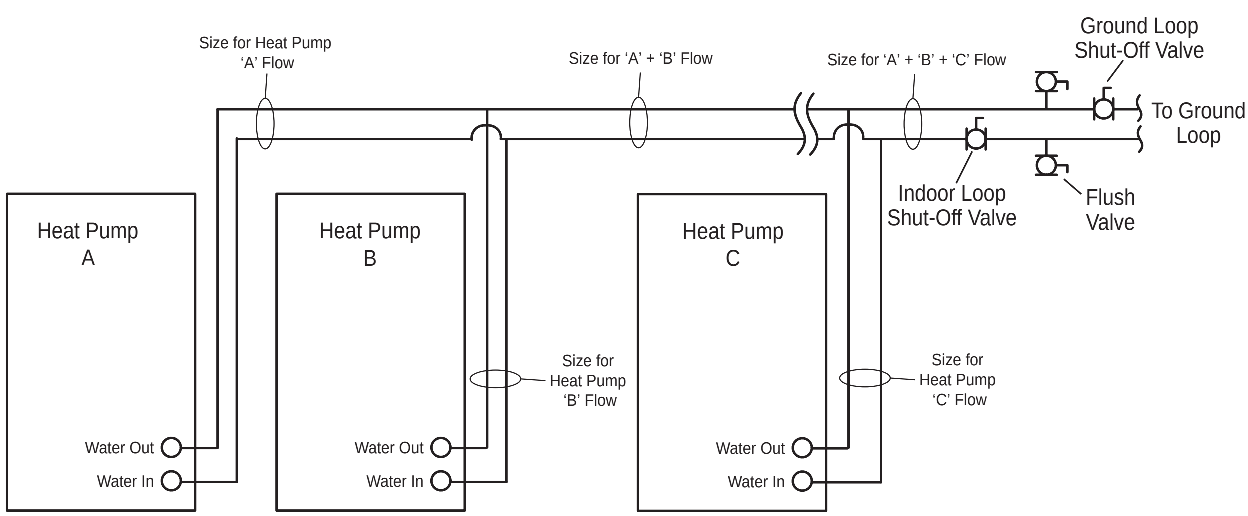
This type of application can generally be employed for systems to 12 tons depending on loop design. However, it is important to perform appropriate calculations to confirm that the variable speed pump can provide adequate flow through all heat pumps against the loop head when all units are operating.

Figure 9a: Multiple Units with Internal Flow Controllers



When the number of units or flushing requirements reaches a point where it is no longer feasible to flush through the internal valves (generally systems of more than 12 tons depending on loop design), external flushing valves should be installed. In this case, three-way flushing valves should be used or additional isolation valves must be installed to be able to isolate the loop during flushing.

Figure 9b: Multiple Units with Internal Flow Controllers and External Flushing Valves



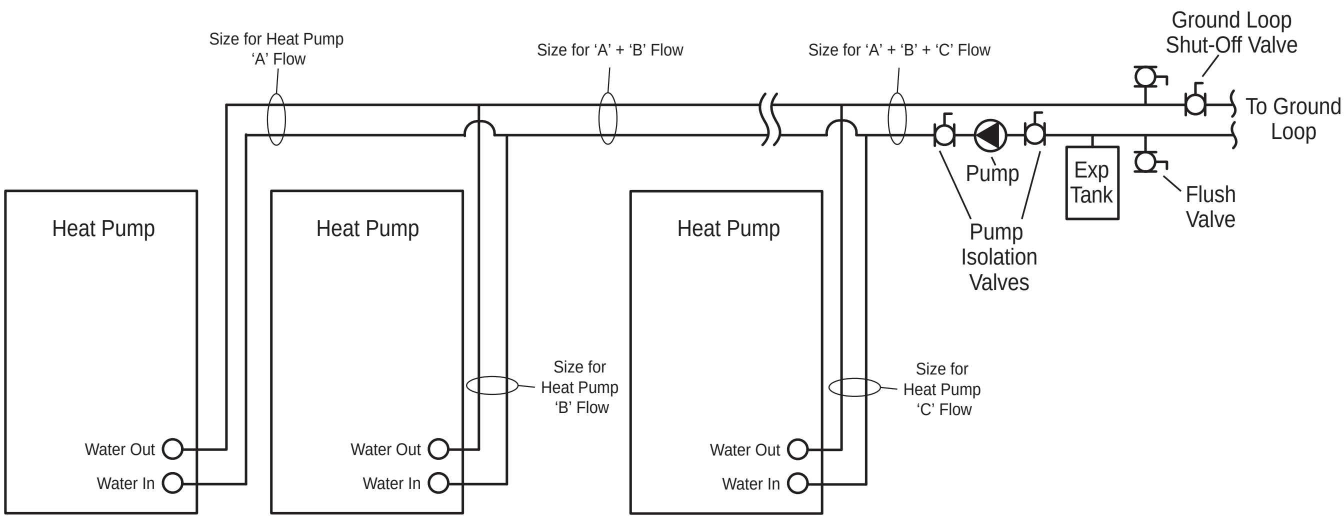
First, flush the ground loop. The installer should close the indoor loop shut-off valve (or the internal flushing valves in all units) and open the ground loop shut-off valve to prevent flow through the indoor loop while flushing the ground loop.

Once the ground loop is flushed, close the ground loop shut-off valve and open the indoor loop valve(s) to flush the units and indoor piping. Remember that there is an internal check valve in the variable speed pump and that backward flow through the unit is not possible.

Multiple Unit Piping and Flushing - Indoor Split (TES Only)

Multiple Units with Internal Modulating Valves and Central Pump
This is an application where multiple units are used in conjunction with a central, variable speed pump. In this case, units with closed loop modulating valves are used (do not use open loop modulating valves on a closed loop system). External flushing valves are required. This application is for larger systems, including commercial.

Figure 9c: Multiple Units with Internal Modulating Valves and Central Pump



Before flushing, the installer should manually open all modulating valves as detailed in Closed Loop – External Central Pumping section of this manual. Next, flush the ground loop. The installer should close a pump isolation valve and open the ground loop shut-off valve to prevent flow through the indoor loop while flushing the ground loop.

Once the ground loop is flushed, close the ground loop shut-off valve and open the pump isolation valve to flush the units and indoor piping. Once the system is flushed remember to return the modulating valves to their normal operating position.

Ground Loop Heat Pump Applications

Antifreeze Selection - General
In areas where minimum entering loop temperatures drop below 40°F [4.4°C] or where piping will be routed through areas subject to freezing, antifreeze is needed. Alcohols and glycols are commonly used as antifreeze solutions. Your local representative should be consulted for the antifreeze best suited to your area. Freeze protection should be maintained to 15°F [8.5°C] below the lowest expected entering loop temperature.

Initially calculate the total volume of fluid in the piping system using Table 4. Then use the percentage by volume shown in Table 5 for the amount of antifreeze. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

Table 4: Fluid Volume

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]
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]
Unit Heat Exchanger	Typical	1.0 [3.8]
Flush Cart Tank	10" Dia x 3ft tall [25.4cm x 91.4cm tall]	10 [37.9]

⚠ WARNING! ⚠

WARNING! Always dilute alcohols with water (at least 50% solution) before using. Alcohol fumes are flammable and can cause serious injury or death if not handled properly.

When handling methanol (or any alcohol), always wear eye protection and rubber gloves as alcohols are easily absorbed through the skin.

Table 5: 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

Contact your ClimateMaster distributor if you have any questions as to antifreeze selection.

⚠ WARNING! ⚠

WARNING! Always use properly marked vehicles (D.O.T. placards), and clean/suitable/properly identified containers for handling flammable antifreeze mixtures. Post and advise those on the jobsite of chemical use and potential dangers of handling and storage.

NOTICE: DO NOT use automotive windshield washer fluid as antifreeze. Washer fluid contains chemicals that will cause foaming.

⚠ CAUTION! ⚠

CAUTION! Always obtain MSDS safety sheets for all chemicals used in ground loop applications including chemicals used as antifreeze.

Antifreeze Charging
It is highly recommended to utilize premixed antifreeze fluid where possible to alleviate many installation problems and extra labor.

The following procedure is based upon pure antifreeze and can be implemented during the Full Flush procedure with three way valves in the Figure 8c - Valve Position C. If a premixed mixture of 15°F [-9.4°C] freeze protection is used, the system can be filled and flushed with the premix directly to prevent handling pure antifreeze during the installation.

1) Flush loop until all air has been purged from system and pressurize to check for leaks before adding any antifreeze.
2) Run discharge line to a drain and hook up antifreeze drum to suction side of pump (if not adding below water level through approved container). Drain flush cart reservoir down to pump suction inlet so reservoir can accept the volume of antifreeze to be added.
3) Calculate the amount of antifreeze required by first calculating the total fluid volume of the loop from Table 4. Then calculate the amount of antifreeze needed using Table 5 for the appropriate freeze protection level. Many southern applications require freeze protection because of exposed piping to ambient conditions.
4) Isolate unit and prepare to flush only through loop (see Figure 8a). Start flush cart, and gradually introduce the required amount of liquid to the flush cart tank (always introduce alcohols under water or use suction of pump to draw in directly to prevent fuming) until attaining the proper antifreeze protection. The rise in flush reservoir level indicates amount of antifreeze added (some carts are marked with measurements in gallons or liters). A ten inch [25.4 cm] diameter cylinder, 3 foot [91.4 cm] tall holds approximately 8 gallons [30.3 liters] of fluid plus the hoses (approx. 2 gallons, [7.6 liters], which equals about

Ground Loop Heat Pump Applications

10 gallons [37.9 liters] total. If more than one tankful is required, the tank should be drained immediately by opening the waste valve of the flush cart noting the color of the discharge fluid. Adding food coloring to the antifreeze can help indicate where the antifreeze is in the circuit and prevents the dumping of antifreeze out the waste port. Repeat if necessary.

5) Be careful when handling methanol (or any alcohol). Always wear eye protection and rubber gloves. The fumes are flammable, and care should be taken with all flammable liquids. Open flush valves to flush through both the unit and the loop and flush until fluid is homogenous and mixed. It is recommended to run the unit in the heating and cooling mode for 15-20 minutes each to 'temper' the fluid temperature and prepare it for pressurization. Devoting this time to clean up can be useful. This procedure helps prevent the periodic "flat" loop condition.
6) Close the flush cart return valve; and immediately thereafter, close the flush cart supply valve, leaving a positive pressure in the loop of approximately 50 psi [345 kPa]. This is a good time to pressure check the system as well. Check the freeze protection of the fluid with the proper hydrometer to ensure that the correct amount of antifreeze has been added to the system. The hydrometer can be dropped into the flush reservoir and the reading compared to Chart 1a for Methanol, 1b for Propylene Glycol, and 1c for Ethanol to indicate the level of freeze protection. Do not antifreeze more than a +10°F [-12.2°C] freeze point. Specific gravity hydrometers are available in the residential price list. Repeat after reopening and flushing for a minute to ensure good second sample of fluid. Inadequate antifreeze protection can cause nuisance low temperature lockouts during cold weather.

⚠ WARNING! ⚠

WARNING! Always dilute alcohols with water (at least 50% solution) before using. Alcohol fumes are flammable and can cause serious injury or death if not handled properly.

When handling methanol (or any alcohol), always wear eye protection and rubber gloves as alcohols are easily absorbed through the skin.

7) Close the flush cart return valve; immediately thereafter, close the flush cart supply valve, shut off the flush cart leaving a positive pressure in the loop of approximately 50-75 psi [345-517 kPa]. Refer to Figure 8d for more details.

Low Water Temperature Cutout Setting - DXM2 Control
When antifreeze is selected, the LT1 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).

Chart 1a: Methanol Specific Gravity

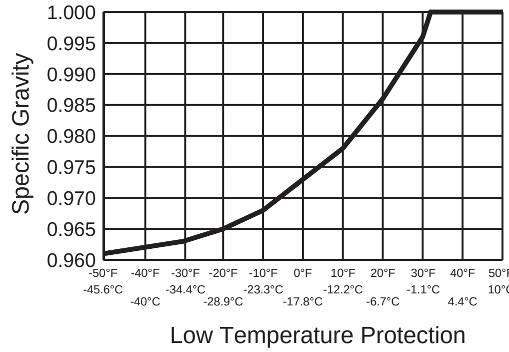


Chart 1b: Propylene Glycol Specific Gravity

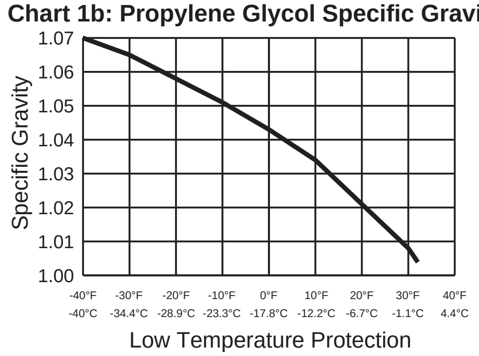


Chart 1c: Ethanol Specific Gravity

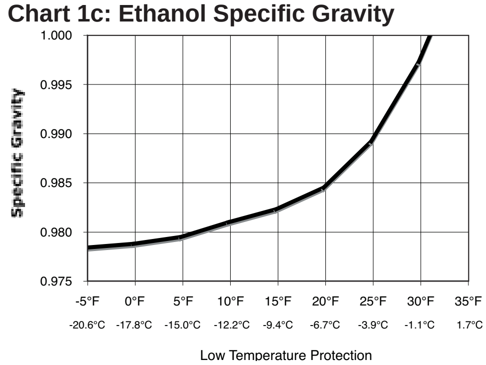
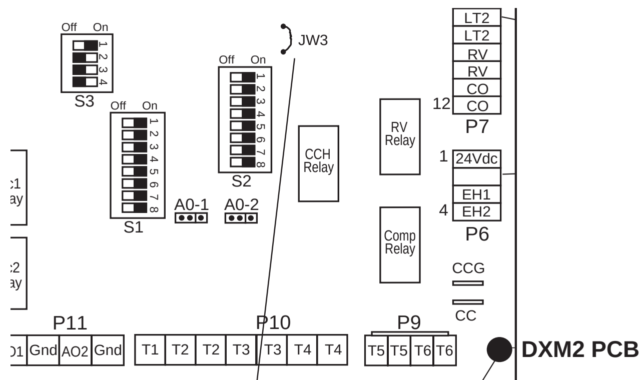


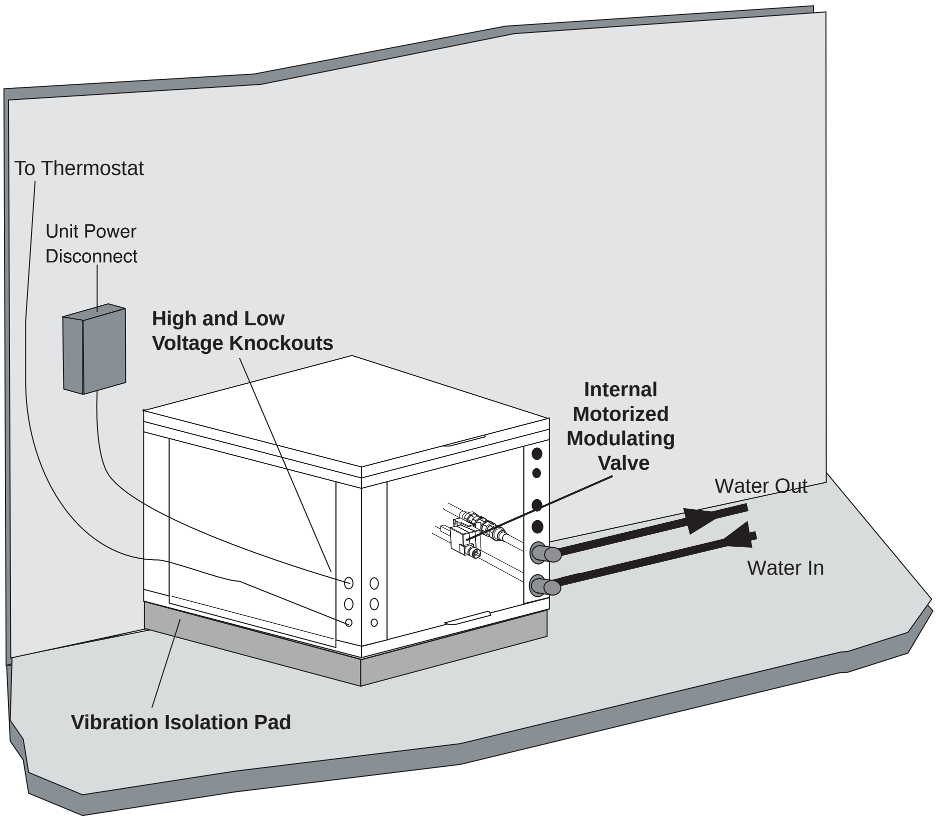
Figure 10: Low Temperature Cutout Selection



JW3-LT1 jumper should be clipped for low temperature operation. Do not clip JW3-LT1 in open loop applications

Closed Loop - External Central Pumping Applications (Indoor Split TES Only)

Figure 11: Typical Closed Loop with Central Pumping Application (with Internal Modulating Motorized Valve Shown)



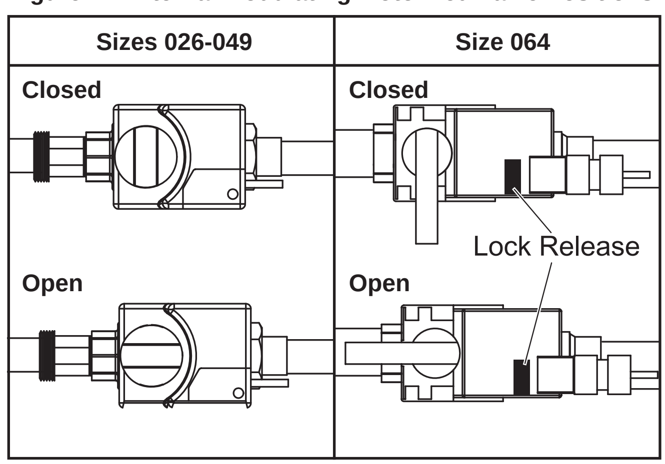
Tranquility® Digital units are available with a modulating water valve option for closed-loop applications with external central pumping (designated by a 5 in the 11th position of the unit model number). With this option, the Modulating Valve is regulated by the Communicating DXM2 board based on entering and leaving water temperature (ΔT). The DXM2 board outputs a 0-10v signal to determine valve position (flow rate). The modulating valve defaults to closed position if it loses signal but still has 24V power running to it. If the motorized modulating valve loses both signal from the DXM2 board AND 24V power, it will remain in the same position it was in when it lost 24V power.

Note: The Cv (flow coefficient) of the valve used in these units is DIFFERENT that the Cv of the valve used in the open loop unit. It is not advisable for use in open loop applications as sound/noise issues may result. Units with the water circuit for closed loop, central pumping option are only available with a copper water coil.

To manually open the internal modulating motorized water valve in TES026 – 049 push down on the handle to unlock it. Then rotate the handle to the open position as shown in Figure 12. This fully opens the valve for flushing. Once flushing is complete, return the valve handle to its normally closed position.

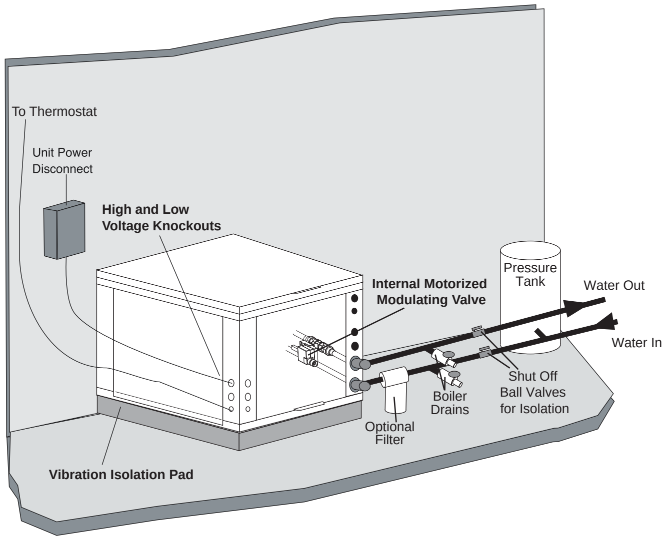
To manually open the internal modulating motorized water valve in TES064, push down on the lock release button while turning the handle to the open position as shown in Figure 12. This fully opens the valve for flushing. Once flushing is complete, press the lock release again and return the valve handle to its normally closed position.

Figure 12: Internal Modulating Motorized Valve Positions



Open Loop or Ground-Water Heat Pump Applications

Figure 13: Typical Open Loop/Well Application



⚠ CAUTION! ⚠

CAUTION! Refrigerant pressure activated water regulating valves should never be used with this equipment.

Tranquility® Digital Indoor Split (TES) units are available with a water circuit option for open loop applications (designated by a 6 in the 11th position of the unit model number).

The Motorized Modulating Valve is regulated by the Communicating DXM2 board based on entering and leaving water temperature (ΔT). The DXM2 board gives a 0-10v signal to determine flow rate. The motorized modulating valve defaults to closed position if it loses signal but still has 24V power running to it. If the motorized modulating valve loses both signal from the DXM2 board AND 24V power, it will remain in the same position it was in when it lost 24V power. DO NOT USE open loop units in closed loop applications due to significant pressure drop through the open loop motorized modulating valve. This option is only available with Cupro-Nickel Water Coil.

To manually open the internal modulating motorized water valve in TES026 – 049 push down on the handle to unlock it. Then rotate the handle to the open position as shown in Figure 12. This fully opens the valve for flushing. Once flushing is complete, return the valve handle to its normally closed position.

To manually open the internal modulating motorized water valve in TES064, push down on the lock release button while turning the handle to the open position as shown in Figure 12. This fully opens the valve for flushing. Once flushing is complete, press the lock release again and return the valve handle to its normally closed position.

Open Loop - Ground Water Systems

Typical open loop piping is shown in Figure 13. Shut off valves should be included for ease of servicing. Boiler drains or other valves should be “tee’d” into the lines to allow acid flushing of the heat exchanger. Shut off valves should be positioned to allow flow through the coax via the boiler drains without allowing flow into the piping system. Schrader ports built into unit may be used to measure heat exchanger pressure drop. Water temperature can be viewed on the communicating thermostat. Supply and return water piping should be limited to copper, HPDE, or other acceptable high temperature material. Note that PVC or CPVC material is not recommended as they are not compatible with the polyolester oil used in HFC-410A products.

Water quantity should be plentiful and of good quality. Consult Table 6 for water quality requirements. vFlow™ units for open loop applications always come with Cupro-Nickel coils. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, an open loop system is not recommended. Heat exchanger coils may over time lose heat exchange capabilities due to build up of mineral deposits. Heat exchangers must only be serviced by a qualified technician, as acid and special pumping equipment is required. Desuperheater coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional acid flushing. In some cases, the desuperheater option should not be recommended due to hard water conditions and additional maintenance required.

Water Quality Standards

Table 6 should be consulted for water quality requirements. Scaling potential should be assessed using the pH/Calcium hardness method. If the pH <7.5 and the Calcium hardness is less than 100 ppm, scaling potential is low. If this method yields numbers out of range of those listed, a monitoring plan should be implemented in these probable scaling situations. Other water quality issues such as iron fouling, corrosion prevention and erosion and clogging should be referenced in Table 6.

Pressure Tank and Pump

Use a closed, bladder-type pressure tank to minimize mineral formation due to air exposure. The pressure tank should be sized to provide at least one minute continuous run time of the pump using its drawdown capacity rating to prevent pump short cycling. Discharge water from the unit is not contaminated in any manner and can be disposed of in various ways, depending on local building codes (e.g. recharge well, storm sewer, drain field, adjacent stream or pond, etc.). Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning department to assure compliance in your area.

Open Loop or Ground-Water Heat Pump Applications

The pump should be sized to handle the home's domestic water load (typically 5-9 gpm [23-41 l/m]) plus the flow rate required for the heat pump. Pump sizing and expansion tank must be chosen as complimentary items. For example, an expansion tank that is too small can cause premature pump failure due to short cycling. Variable speed pumping applications should be considered for the inherent energy savings and smaller pressure tank requirements.

Water Coil Low Temperature Limit Setting
For all open loop systems the 30°F [-1.1°C] LT1 setting (factory setting-water) should be used to avoid freeze damage to the unit. See "Low Water Temperature Cutout Selection" (Figure 10) in this manual for details on the low limit setting.

Water Quality Standards

Table 6: Water Quality Standards

Water Quality Parameter	HX Material	Closed Recirculating	Open Loop and Recirculating Well		
Scaling Potential - Primary Measurement					
Above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below					
pH/Calcium Hardness Method	All	-	**pH < 7.5 and Ca Hardness <100ppm**		
Index Limits for Probable Scaling Situations - (Operation outside these limits is not recommended)					
Scaling indexes should be calculated at 66°C for direct use and HWG applications, and at 32°C for indirect HX use. A monitoring plan should be implemented.					
Ryznar Stability Index	All	-	**6.0 - 7.5** If >7.5 minimize steel pipe use.		
Langelier Saturation Index	All	-	**-0.5 to +0.5** If <-0.5 minimize steel pipe use. Based upon 66°C HWG and Direct well, 29°C Indirect Well HX		
Iron Fouling					
Iron Fe^{2+} (Ferrous) (Bacterial Iron potential)	All	-	**<0.2 ppm (Ferrous)** If Fe^{2+} (ferrous)>0.2 ppm with pH 6 - 8, O_2<5 ppm check for iron bacteria.		
Iron Fouling	All	-	**<0.5 ppm of Oxygen** Above this level deposition will occur.		
Corrosion Prevention					
pH	All	**6 - 8.5** Monitor/treat as needed	**6 - 8.5** Minimize steel pipe below 7 and no open tanks with pH <8		
Hydrogen Sulfide (H_2S)	All	-	**<0.5 ppm** At H_2S>0.2 ppm, avoid use of copper and copper nickel piping or HX's. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are OK to <0.5 ppm.		
Ammonia ion as hydroxide, chloride, nitrate and sulfate compounds	All	-	**<0.5 ppm**		
Maximum Chloride Levels			Maximum Allowable at maximum water temperature.		
			10°C	24°C	38°C
	Copper	-	<20ppm	NR	NR
	Cupronickel	-	<150 ppm	NR	NR
	304 SS	-	<400 ppm	<250 ppm	<150 ppm
	316 SS	-	<1000 ppm	<550 ppm	< 375 ppm
	Titanium	-	>1000 ppm	>550 ppm	>375 ppm
Erosion and Clogging					
Particulate Size and Erosion	All	<10 ppm of particles and a maximum velocity of 1.8 m/s Filtered for maximum 841 micron [0.84 mm, 20 mesh] size.	<10 ppm (<1 ppm "sandfree" for reinjection) of particles and a maximum velocity of 1.8 m/s. Filtered for maximum 841 micron 0.84 mm, 20 mesh] size. Any particulate that is not removed can potentially clog components.		

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

Rev.: 5/6/2014 S

Notes:

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

Refrigeration Installation

⚠ CAUTION! ⚠

CAUTION! HFC-410A systems operate at higher pressures than R-22 systems. Be certain that service equipment (gauges, tools, etc.) is rated for HFC-410A. Some R-22 service equipment may not be acceptable.

⚠ CAUTION! ⚠

CAUTION! Installation of a factory supplied liquid line bi-directional filter drier is required. Never install a suction line filter in the liquid line.

Line Set Installation

Figures 16a and 16b illustrate typical installations of a compressor section matched to either an air handler (fan coil) or add-on furnace coil. Table 7 shows typical line set diameters at various lengths. Line set lengths should be kept to a minimum and should always be installed with care to avoid kinking. Line sets are limited to 60 feet in length (one way). Line sets over 60 feet void the equipment warranty. If the line set is kinked or distorted, and it cannot be formed back into its original shape, the damaged portion of the line should be replaced. A restricted line set will effect the performance of the system.

Split units are shipped with a filter drier (loose) inside the cabinet that must be installed in the liquid line at the line set. **All brazing should be performed using nitrogen circulating at 2-3 psi [13.8-20.7 kPa] to prevent oxidation inside the tubing. All line sets should be insulated with a minimum of 1/2" [13mm] thick closed cell insulation. Liquid lines should be insulated for sound control purposes. All insulation tubing should be sealed using a UV resistant paint or covering to prevent deterioration from sunlight.**

When passing refrigerant lines through a wall, seal opening with silicon-based caulk. Avoid direct contact with water pipes, duct work, floor joists, wall studs, floors or other structural components that could transmit compressor vibration. Do not suspend refrigerant tubing from joists with rigid straps. Do not attach line set to the wall. When necessary, use hanger straps with isolation sleeves to minimize transmission of line set vibration to the structure.

Installing the Line set at the Compressor Section

Braze the line set to the service valve stubs as shown in Figure 14. Remove the schraeder cores and heat trap the valves to avoid overheating and damage. Nitrogen should be circulated through the system at 2-3 psi **[13.8-20.7 kPa]** to prevent oxidation contamination. Use a low silver phos-copper braze alloy on all brazed connections. **Compressor section is shipped with a factory charge. Therefore, service valves should not be opened until the line set has been leak tested, purged and evacuated**. See "Charging the System."

Installing the Indoor Coil and Line set

Figure 15 shows the installation of the line set and TXV to a typical indoor coil. An indoor coil or air handler (fan coil) with a TXV is required. Coils with cap tubes may not be used. If coil includes removable fixed orifice, the orifice must be removed and a TXV must be installed as shown in Figure 15. Fasten the copper line set to the coil. Nitrogen should be circulated through the system at 2-3 psi **[13.8-20.7 kPa]** to prevent oxidation inside the refrigerant tubing. Use a low silver phos-copper braze alloy on all brazed connections.

Use a brazing shield to protect all heat sensitive and painted parts.

Table 7: Line set Diameters and Charge Information

Model	Factory† Charge (oz) [kg]	Basic** Charge (oz) [kg]	20 Feet [6 meters]		40 Feet [12 meters]		60 Feet* [18 meters]	
			Liquid	Suction	Liquid	Suction	Liquid	Suction
TES/TEP Series								
026	96 [2.72]	81 [2.30]	3/8"	3/4"	3/8"	3/4"	3/8"	3/4"
038	104 [2.95]	89 [2.52]	3/8"	7/8"	3/8"	7/8"	3/8"	7/8"
049	126 [3.75]	111 [3.15]	3/8"	7/8"	3/8"	7/8"	3/8"	7/8"
064	192 [5.44]	162 [4.59]	1/2"	7/8"	1/2"	7/8"	1/2"	7/8"

*** 60 Feet is the maximum line set length.**
**Basic charge includes only the amount required for the condensing unit and the evaporating coil.
An additional amount should be added allowing 0.6oz per ft. for 3/8" [0.6g per cm] and 1.2oz per ft. for 1/2" [1.1g per cm] of line set used.
† Factory charge is preset for 25' [7.6 meters] line set.

Refrigeration Installation

Figure 14: Braze Instructions

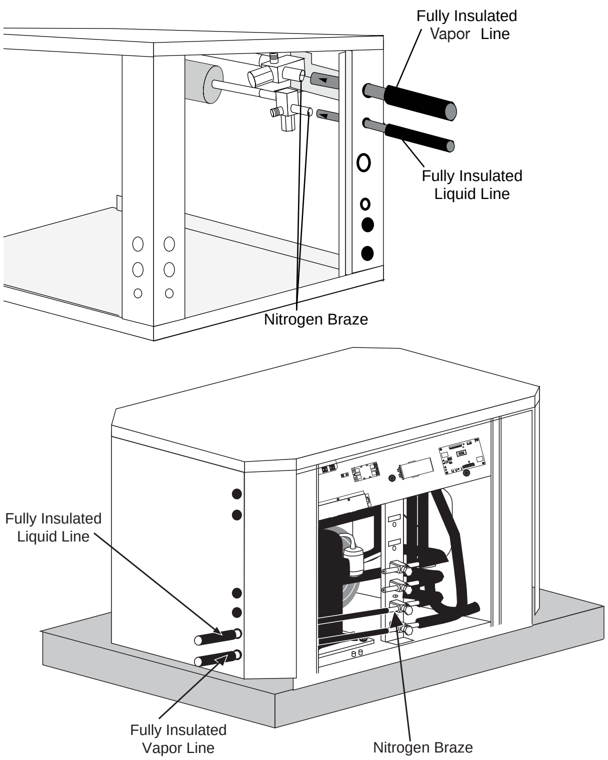


Table 8: Service Valve Positions

Position	Description	System	Service Port
CCW-Full Out	Operation Position	Open	Open
CW-Full In	Shipping Position	Closed	Open

Re-Using Existing Line Set - R-22 to HFC-410A Conversion

New line sets are always recommended, but are required if;

- The previous system had a compressor burn out.
- The existing line set has oil traps.
- The existing line set is larger or smaller than the recommended line set for the HFC-410A system.
- The existing line set is damaged, corroded, or shows signs of abrasion/fatigue

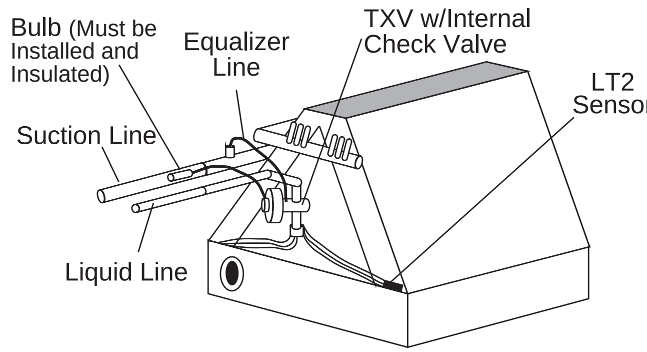
⚠ WARNING! ⚠

WARNING! The Environmental Protection Agency prohibits the intentional venting of HCFC and HFC refrigerants during maintenance, service, repair and disposal of appliance. Approved methods of recovery, recycling or reclaiming must be followed.

⚠ CAUTION! ⚠

CAUTION! This procedure should not be performed on systems which contain containments (Example: compressor burn out).

Figure 15: Air Coil Connection



IMPORTANT: DO NOT perform any brazing with the TXV bulb attached to any line. After brazing operations have been completed, clamp the TXV bulb securely on the suction line at the 10 to 2 o'clock position with the strap provided. Insulate the bulb and line with pressure sensitive tape.

IMPORTANT: TXV sensing bulb should be located on a horizontal section of copper suction line, just outside of coil box. The copper sensing bulb must never be placed on any aluminum tube as this will result in galvanic corrosion and eventual failure of the aluminum tube.

⚠ WARNING! ⚠

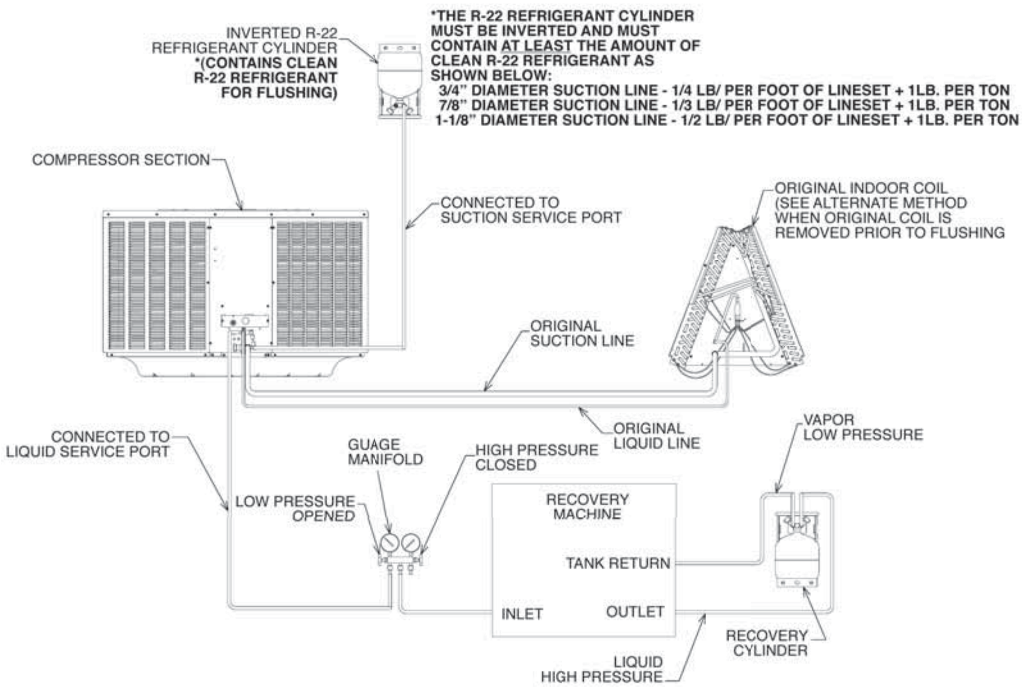
WARNING! If at all possible, it is recommended that a new line set be used when replacing an existing R-22 system with an HFC-410A system. In rare instances where replacing the line set is not possible, the line set must be flushed prior to installation of the HFC-410A system. It is also important to empty all existing traps. Polyolester (POE) oils are used in units charged with HFC-410A refrigerant. Residual mineral oil can act as an insulator on the wall of the coil tubing, hindering proper heat transfer and thus reducing system efficiency and capacity. Another important reason to thoroughly flush the line set is remove any trash and other contaminants that may be present which could clog the thermal expansion valve.
Failure to properly flush the system per the instructions below will void the warranty.

Required Equipment

The following equipment will be required in order to flush the indoor coil and existing line set:

- Two R-22 recovery cylinders
- Refrigerant recovery machine with a pump down feature
- Two sets of gauges (one used for R-22 and one used with the HFC-410A).
- Cylinder of clean R-22 (minimum amount required to adequately flush shown below)

Refrigeration Installation



- 3/4" Diameter suction lines: 1/4 lb. per foot of line set + 1 lb. per ton for indoor coil.
- 7/8" diameter suction lines: 1/3 lb. per foot of line set + 1 lb. per ton for indoor coil
- 1-1/8" diameter suction lines: 1/2 lb. per foot of line set + 1 lb. per ton for indoor coil.

Example: 3-ton system with 40 ft. long line set and 3/4" suction line.
Line set: 1/4 lb./ft. x 40 ft. = 10 lb.
Indoor coil: 1 lb./ton x 3 tons = 3 lbs. (not required if coil is removed and lines are connected together)
Total: 10 lbs. + 3 lbs. = 13 lbs. to adequately flush line set and indoor coil.

The Flushing Procedure

1. Remove the existing R-22 refrigerant by selecting the appropriate procedure stated below.

   If the unit is not operational, follow steps A-E.
   - A.) First, disconnect all power supply to the existing outdoor unit.
   - B.) Connect a clean refrigerant recovery cylinder and the refrigerant recovery machine to the existing unit according to the instructions provided with the recovery machine.
   - C.) Remove all R-22 refrigerant from the existing system.
   - D.) Check the gauges after shutdown to confirm all refrigerant has been completely removed from the entire system.
   - E.) Disconnect the liquid and vapor lines from the existing outdoor unit.

   If the unit is operational, follow steps F- L.
   - F.) First, start the existing R-22 system in the cooling mode and close the liquid line valve.
   - G.) Completely pump all existing R-22 refrigerant into the outdoor unit. It will be necessary to bypass the low pressure switch if the unit is so equipped to ensure that the refrigerant is completely evacuated.)
   - H.) The low side system pressures will eventually reach 0 psig. When this happens, close the vapor line valve and immediately shut the outdoor unit off.
   - I.) Check the gauges after shutdown to confirm that the valves are not allowing refrigerant to leak back into the low side of the system.
   - J.) Disconnect power to the indoor furnace or air-handler to kill low voltage to the outdoor unit.
   - K.) Disconnect the power supply wiring from the existing outdoor unit.
   - L.) Unsweat the liquid and vapor lines from the existing outdoor unit.
2. Remove the existing outdoor unit.
3. Set the new HFC-410A unit in place and braze the liquid and vapor lines to the unit connections. Connect the low voltage and line voltage to the new outdoor unit. Do not turn on power supply to the unit and do not open the outdoor unit service valves at this time.
4. The indoor coil can be left in place for the flushing process or removed.
5. If the indoor coil is removed, the suction and liquid line must be connected together on the indoor coil end. See illustration for recommended method for connecting these together.
6. If the indoor coil is left in place during flushing, removing

Refrigeration Installation

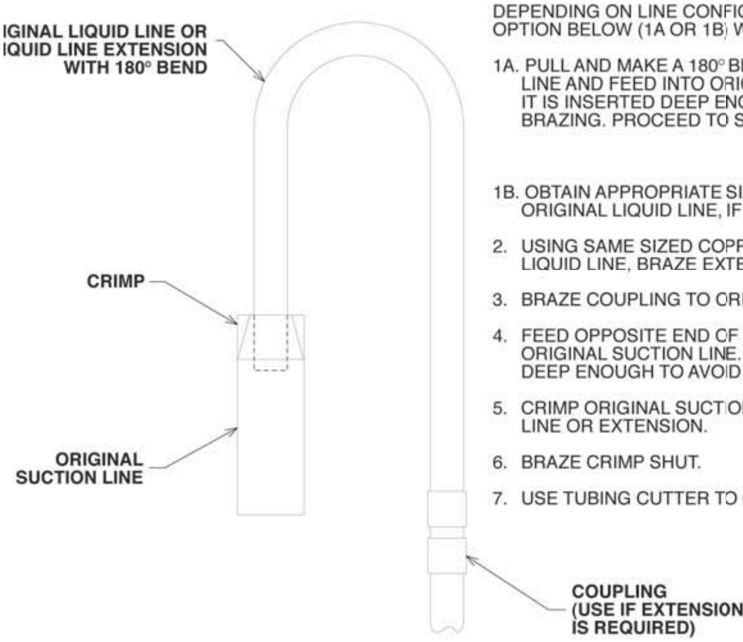
the existing refrigerant flow control orifice or thermal expansion valve prior to flushing is highly recommended to assure proper flushing. Use a field-provided fitting or piece of copper tubing to reconnect the lines where the thermal expansion valve was removed.

7. Remove the pressure tap valve cores from the outdoor unit's service valves.
8. Connect an R-22 cylinder of clean R-22 refrigerant to the vapor service valve. (see "Required Equipment Section" for minimum required amount of R-22 for adequate flushing)
9. Connect the low pressure side of an R-22 gauge set to the liquid line valve.
10. Connect a hose from the recovery machine with an empty recovery drum to the common port of the gauge set.
11. Set the recovery machine for liquid recovery and start the machine.
12. Open the gauge set low side valve. This will allow the recovery machine to pull a vacuum on the existing system line set.
13. Make sure to invert the cylinder of clean R-22 refrigerant and open the cylinder's valve to allow liquid refrigerant to flow into the system through the vapor line valve. (This should allow the refrigerant to flow from the cylinder and through the line set before it enters the recovery machine.) The cylinder should not be inverted if it is the type with separate liquid and vapor valves. Use the liquid valve on the cylinder in this case, keeping the cylinder upright.
14. Once the liquid refrigerant has been completely recovered, switch the recovery machine to vapor recovery so that the R-22 vapor can be completely recovered.

IMPORTANT! Always remember, every time the system is flushed you must always pull a vacuum with a recovery machine on the system at the end of each procedure. (If desired, a second flushing with clean refrigerant may be performed if insufficient amounts of mineral oil were removed during the initial flush.)

15. Tightly close the valve on the inverted R-22 cylinder and the gauge set valves.
16. Completely pump all remaining R22 refrigerant out of the recovery machine and turn the machine off.
17. Before removing the recovery machine, R-22 refrigerant cylinder and gauges, break the vacuum on the refrigerant lines and indoor coil using dry-nitrogen.
18. Unsweat the liquid and vapor lines from the old indoor coil or from each other and install a new matched HFC-410A indoor coil, connecting the flushed refrigerant lines to the new coil using field supplied connectors and tubing.
19. Reinstall pressure tap valve cores into unit service valves.
20. Pressurize the lines and coil and check for leaks in the line set connection points using a soap solution.
21. Thoroughly evacuate the line set and indoor coil per the instructions found in this manual.
22. Open the liquid and vapor service valves, releasing the HFC-410A refrigerant contained in the outdoor unit into the evacuated line set and indoor coil.
23. Energize the system and adjust the refrigerant charge according to the charging procedures found in this manual.

ALTERNATE METHOD



DEPENDING ON LINE CONFIGURATION, CHOOSE THE APPROPRIATE OPTION BELOW (1A OR 1B) WHICH BEST FITS THE SYSTEM.

1A. PULL AND MAKE A 180° BEND IN THE ORIGINAL LIQUID LINE AND FEED INTO ORIGINAL SUCTION LINE. MAKE SURE IT IS INSERTED DEEP ENOUGH TO AVOID PLUGGING DURING BRAZING. PROCEED TO STEP 5.

OR

1B. OBTAIN APPROPRIATE SIZED COUPLING FOR ORIGINAL LIQUID LINE, IF EXTENSION IS REQUIRED.

2. USING SAME SIZED COPPER TUBING AS THE ORIGINAL LIQUID LINE, BRAZE EXTENSION TO COUPLING.
3. BRAZE COUPLING TO ORIGINAL LIQUID LINE.
4. FEED OPPOSITE END OF LIQUID LINE EXTENSION INTO ORIGINAL SUCTION LINE. MAKE SURE IT IS INSERTED DEEP ENOUGH TO AVOID PLUGGING DURING BRAZING.
5. CRIMP ORIGINAL SUCTION LINE ONTO ORIGINAL LIQUID LINE OR EXTENSION.
6. BRAZE CRIMP SHUT.
7. USE TUBING CUTTER TO CUT TUBES.

Refrigeration Installation

FP2 Sensor Installation
Sensor Installation
An LT2 air coil low temperature protection sensor is factory installed on the TAH air handler and is available as an option for the TAC cased coils. Install the LT2 sensor on the cased coil as indicated in Figure 15 of this manual using thermal compound and the supplied mounting clip. Ensure that the sensor makes good thermal contact and insulate the sensor. Optional LT2 sensor kit may be ordered using part number S17S0031N12.

Air coil low temperature protection will not be active if this sensor is installed incorrectly or is not installed.

Add-On Heat Pump Applications
The indoor coil should be located in the supply side of the furnace to avoid condensation damage to the furnace heat exchanger for add-on heat pump applications. A high temperature limit switch should be installed as shown in Figure 16b just upstream of the coil to de-energize the compressor any time the furnace is energized to avoid blowing hot air directly into the coil, elevating refrigerant pressures during operation. The heat pump will trip out on high pressure lockout without some method of disengaging the compressor during furnace operation. Alternatively, some thermostats with “dual fuel” mode will automatically de-energize the compressor when second stage (backup) heat is required.

NOTICE! To obtain maximum performance of a newly manufactured air coil it should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. A thorough water rinse should follow.

Evacuation and Charging the Unit
LEAK TESTING - The refrigeration line set must be pressurized and checked for leaks before evacuating and charging the unit. To pressurize the line set, attach refrigerant gauges to the service ports and add an inert gas (nitrogen or dry carbon dioxide) until pressure reaches 60-90 psig [413-620 kpa]. Never use oxygen or acetylene to pressure test. Use a halogen leak tester or a good quality bubble solution to detect leaks on all connections made in the field. Check the service valve ports and stem for leaks. If a leak is found, repair it and repeat the above steps. For safety reasons do not pressurize system above 150 psig [1034 kpa]. System is now ready for evacuation and charging.
Turn service valves full out CCW (see Table 8) and then turn back in one-half turn to open service ports. Add the required refrigerant so that the total charge calculated for the unit and line set is now in the system. Open the service valve fully counter clockwise so that the stem will backseat and prevent leakage through the schrader port while it is not in use. Start unit in the heating mode and measure superheat and subcooling values after 5 minutes of run time. See tables 15a-d for superheat and sub-cooling values. Superheat is measured using suction temperature and pressure at the compressor suction line. Subcooling should be measured using the liquid line temperature immediately outside the compressor section cabinet and either the liquid line service valve pressure or the compressor discharge pressure. Note that different values from tables 15a-d will be obtained due to the pressure losses through the condenser heat exchanger. Adding refrigerant will increase sub-cooling while superheat should remain fairly constant allowing for a slight amount of hunting in TXV systems. This increase in subcooling will require 5 minutes or so of operation before it should be measured. After values are measured, compare to the chart and go to “FINAL EVALUATION.”

PARTIAL CHARGE METHOD - Open service valve fully counterclockwise and then turn back in one-half turn to open service port. Add vaporized (Gas) into the suction side of the compressor until the pressure in the system reaches approximately 100-120 psig [689-827 kpa]. Never add liquid refrigerant into the suction side of a compressor. Start the unit in heating and add gas to the suction port at a rate not to exceed five pounds [2.27 kg] per minute. Keep adding refrigerant until the complete charge has been entered. Superheat is measured using suction temperature and pressure at the compressor suction line. Subcooling should be measured using the liquid line temperature immediately outside the compressor section cabinet and either the liquid line service valve pressure or the compressor discharge pressure. Note that different values from tables 15a-d will be obtained due to the pressure losses through the condenser heat exchanger. Adding refrigerant will increase sub-cooling while superheat should remain fairly constant allowing for a slight amount of hunting in TXV systems. This increase in subcooling will require 5 minutes or so of operation before it should be measured. After values are measured, compare to the chart and go to “FINAL EVALUATION.”

FINAL EVALUATION -In a split system, cooling subcooling values can be misleading depending on the location of the measurement. Therefore, it is recommended that charging be monitored in the heating mode. Charge should be evaluated by monitoring the subcooling in the heating mode. After initial check of heating sub-cooling, shut off unit and allow to sit 3-5 minutes until pressures equalize. Restart unit in the cooling mode and check the cooling superheat against Tables 15a-d. If unit runs satisfactorily, charging is complete. If unit does not perform to specifications the cooling TXV (air coil side) may need to be readjusted (if possible) until the cooling superheat values are met.

Checking Superheat and Subcooling

Determining Superheat:
1. Measure the temperature of the suction line at a point near the expansion valve bulb.
2. Determine the suction pressure by attaching refrigeration

Refrigeration Installation

gauges to the suction schrader connection at the compressor.
3. Convert the pressure obtained in step 2 to saturation temperature (boiling point) by using the pressure/ temperature conversion table on the gauge set.
4. Subtract the temperature obtained in step 3 from step 1. The difference will be the superheat of the unit or the total number of degrees above saturation temperature. Refer to Tables 15a-d for superheat ranges at specific entering water conditions.

Example:
The temperature of the suction line at the sensing bulb is 50°F [10° C]. The suction pressure at the compressor is 110 psig [758 kpa] which is equivalent to 36°F [2° C] saturation temperature from the HFC-410A press/temp conversion table on the gauge set. 36°F [2° C] subtracted from
50°F [10° C] = 14°F [8° C] Superheat.

Determining Sub-Cooling:
1. Measure the temperature of the liquid line on the smaller refrigerant line (liquid line) just outside of the cabinet. This location will be adequate for measurement in both modes unless a significant temperature drop in the liquid line is anticipated.
2. Determine the condensor pressure (high side) by attaching refrigerant gauges to the schrader connection on the liquid line service valve. If the hot gas discharge line of the compressor is used, refer to the appropriate column in Tables 15a-d.
3. Convert the pressure obtained in step 2 to the saturation temperature by using the press/temp conversion table on the gauge set.
4. Subtract the temperature of Step 3 from the temperature of Step 1. The difference will be the sub-cooling value for that unit (total degrees below the saturation temperature). Refer to Tables 15a-d for sub-cooling values at specific entering water temperatures.

Example:
The condenser pressure at the service port is 335 psig [2310 kpa], which is equivalent to 104°F [40° C] saturation temperature. Discharge pressure is 365 psig [2517 kpa] at the compressor (109°F [43° C] saturation temperature). Measured liquid line temperature is 100°F [38° C].
100°F [38° C] subtracted from 104°F [40° C] = 4° F [2° C] sub-cooling (9° F [50° C] if using the compressor discharge pressure).

Refrigeration Installation

Figure 16a: Typical Split/Air Handler Installation

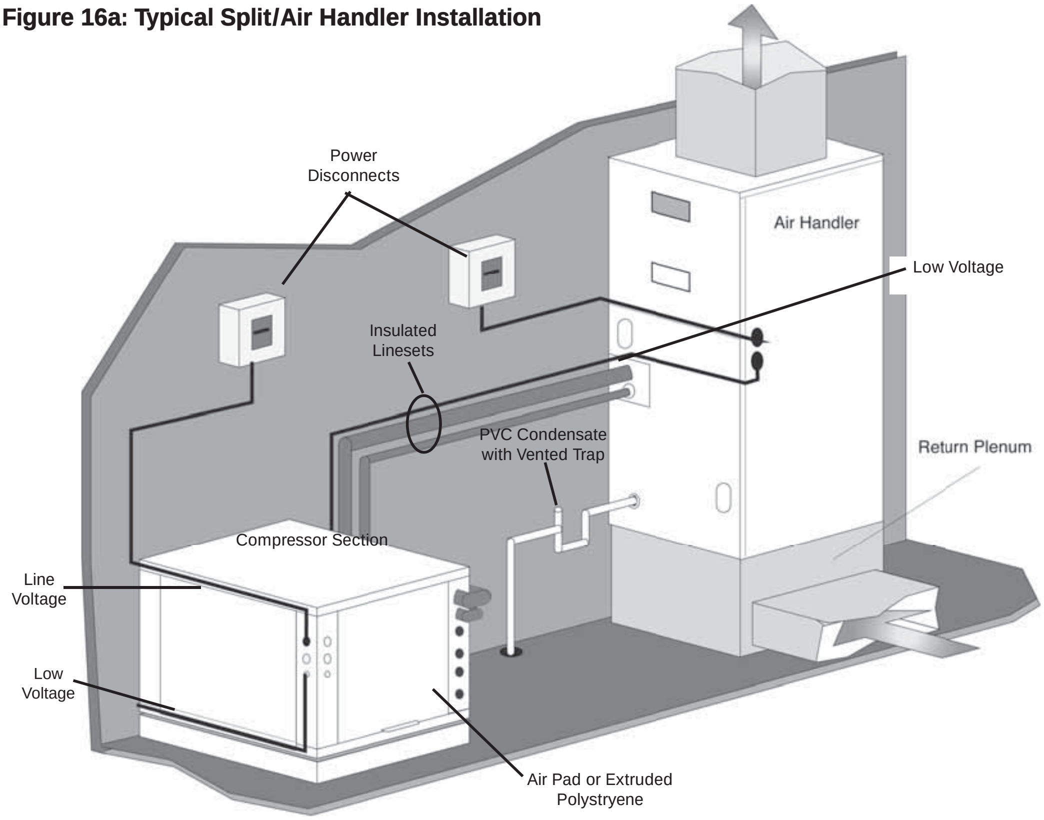
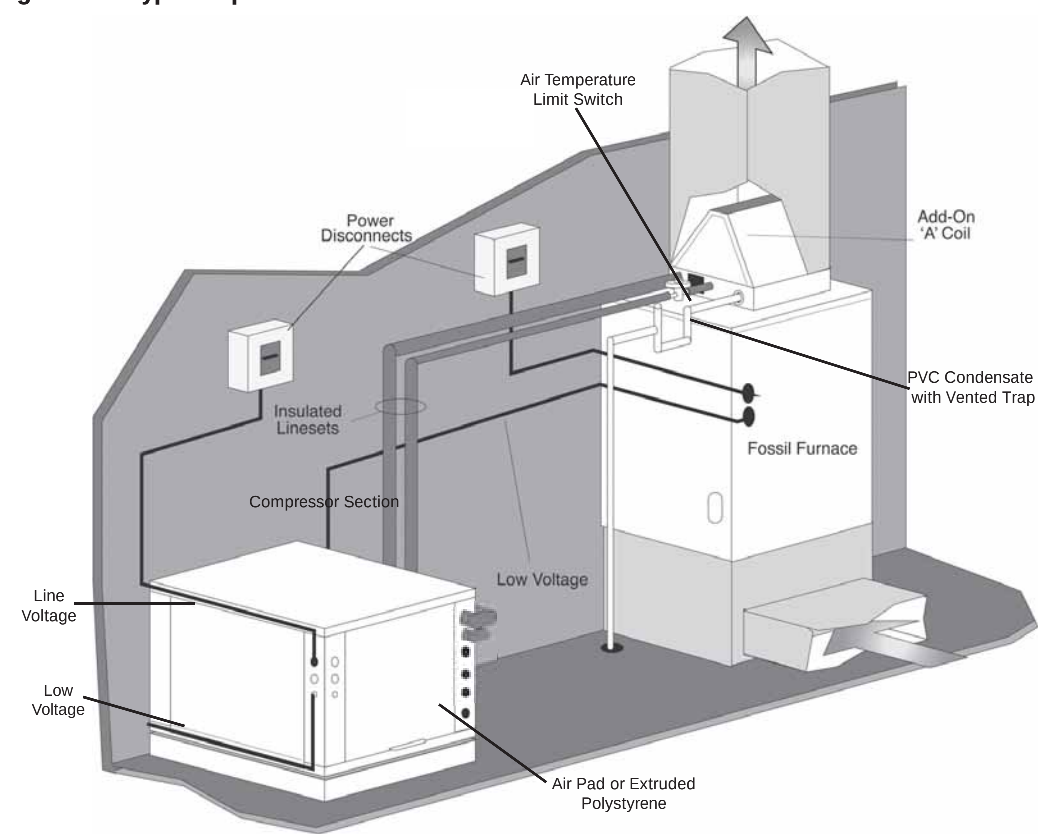


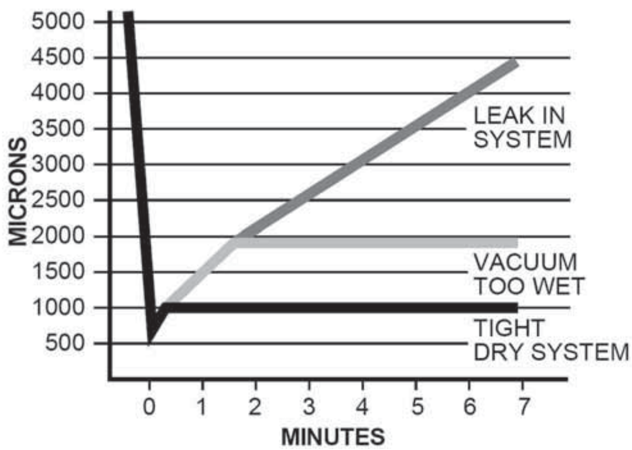
Figure 16b: Typical Split/Add-on Coil Fossil Fuel Furnace Installation



Refrigeration Installation

Evacuation Of The Lineset And Coil
The line set and coil must be evacuated to at least 500 microns to remove any moisture and noncondensables. Evacuate the system through both service ports in the shipping position (full CW in - see table 8) to prevent false readings on the gauge because of pressure drop through service ports. A vacuum gauge or thermistor capable of accurately meausuring the vacuum depth is crucial in determining if the system is ready for charging. If the system meets the requirements in Figure 17, it is ready for charging.

Figure 17: Evacuation Graph



⚠ NOTICE! ⚠

NOTICE: Use tables 15a-d for superheat/subcooling values. These tables use discharge pressure (converted to saturation temperature) and liquid line temperature for subcooling calculations. If using liquid line pressure, subtract 3°F from the table values.

Charging The System
There are two methods of charging a refrigerant system. One method is the total charge method, where the volume of the system is determined and the refrigerant is measured and added into the evacuated system. The other method is the partial charge method where a small initial charge is added to an evacuated system, and remaining refrigerant added during operation.

Total Charge Method - See Table 7 for the compressor section basic charge. For line sets with 3/8” liquid lines add 0.6 ounces of refrigerant to the basic charge for every installed foot of liquid line [0.6 grams per cm]. Add 1.2 oz. per foot [1.1 grams per cm] if using l/2” line. Once the total charge is determined, the factory pre-charge (Table 7) is subtracted and the remainder is the amount needed to be added to the system. This method should be used with the AHRI matched air handler or cased coil.

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. Actual HWG water heating capacities are provided in the appropriate heat pump performance data.

Heat pumps equipped with the HWG option (indoor model only) 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 18 shows a typical example of HWG water piping connections on a unit with built-in circulating pump. This piping layout reduces scaling potential.

The temperature set point of the HWG is field selectable on DXM2 to 125°F or 150°F . The 150°F set point allows more heat storage from the HWG. For example, consider the amount of heat that can be generated by the HWG when using the 125°F set point, versus the amount of heat that can be generated by the HWG when using the 150°F set point.

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 set point, 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 set point, 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 set point.

This example ignored standby losses of the tank. When those losses are considered the additional savings are even greater.

Electric water heaters are recommended. If a gas, propane, or oil water heater is used, a second preheat tank must be installed (Figure 19). 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 52 gallons (235 liters) is used to limit installation costs and space. However, a dual tank, as shown in Figure 19, 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. Consult Table 6 for scaling potential tests.

⚠ WARNING! ⚠

WARNING! A 150°F SETPOINT MAY LEAD TO SCALDING OR BURNS. THE 150°F SET POINT MUST ONLY BE USED ON SYSTEMS THAT EMPLOY AN APPROVED ANTI-SCALD VALVE.

Figure 18: Typical HWG Installation (Indoor Compressor Section)

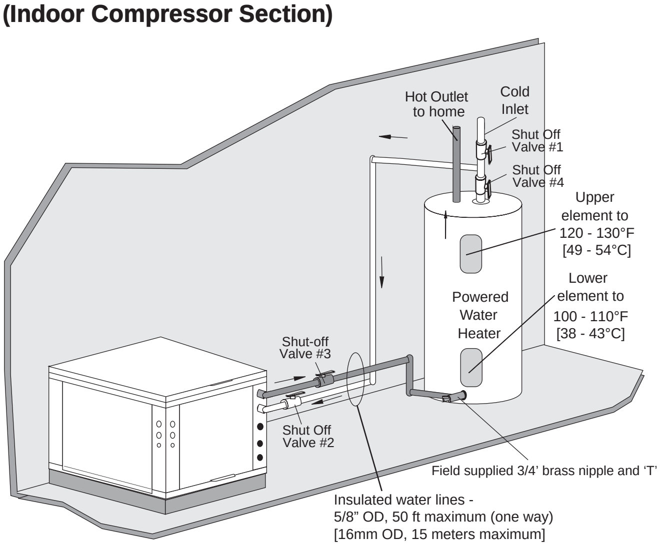
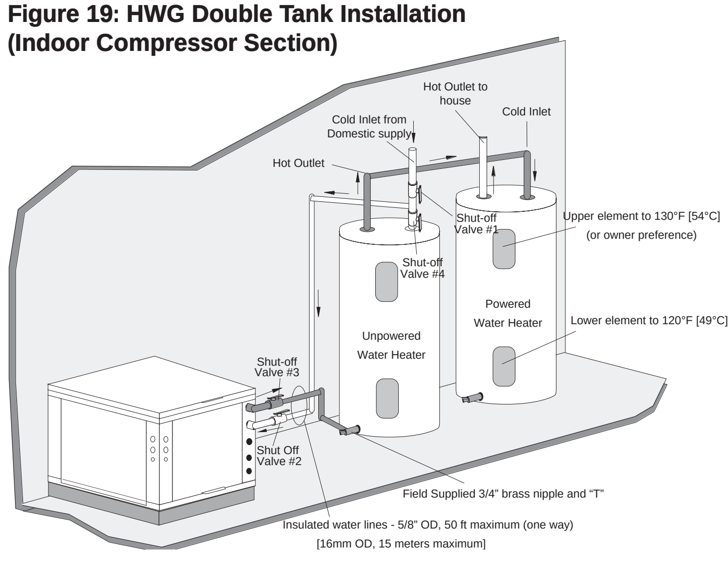


Figure 19: HWG Double Tank Installation (Indoor Compressor Section)



Hot Water Generator

Installation
The HWG is controlled by two sensors and the DXM2 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 DISCONNECTED OR REMOVED.

The DXM2 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 status LED will slowly flash (On 1 second, Off 1 second).

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

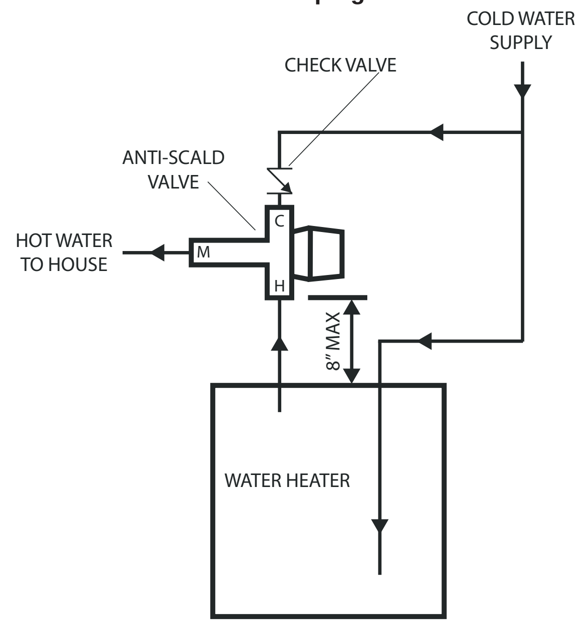
High Water Temperature (>160ºF)	5 flashes
Hot Water Sensor Fault	6 flashes
Compressor Discharge Sensor Fault	6 flashes

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 A 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 20a: Anti-Scald Valve Piping Connections



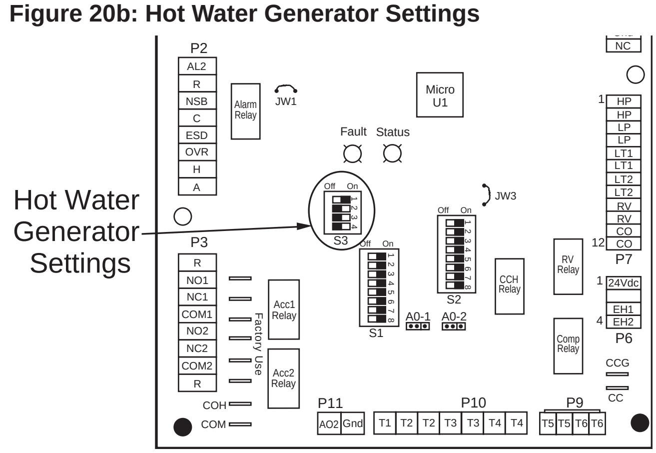
Hot Water Generator settings are determined by DIP switches 3-2, 3-3, and 3-4.

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 set point temperature. It provides for selection of the HWG operating set point. 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 20b: Hot Water Generator Settings



Hot Water Generator

For Indoor and Outdoor Compressor Section

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 9 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 energize the pump until "water tank refill" section, below is completed. 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 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 5/8" [16mm] O.D. copper, route and install the water piping and valves as shown in Figures 18 or 19. 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 18 and 19) 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" [10mm] 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 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 19).
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 the heat pump power and remote HWG power "on" and switch dip switch DIP 3.4 on the HWG controller to the "on" (enabled) position to activate the HWG.
3. The HWG pump should not run if the compressor is not running.
4. The temperature difference between the water entering and leaving the HWG should be approximately 5-10 °F [3-6 °C].
5. Allow the unit to operate for 20 to 30 minutes insure that it is functioning properly.
6. Always turn dip switch DIP 3.4 on the HWG controller to the "off" (disabled) position to deactivate the HWG when servicing the outdoor compressor section.

Table 9: HWG Water Piping Size and Length

Unit Nominal Tonnage	Nominal HWG Flow (gpm)	1/2" Copper (max length*)	3/4" Copper (max length*)
1.5	0.6	50	-
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.

Hot Water Generator Module Refrigeration Installation For Outdoor Compressor Section Only

General Information
The HWG Module consists of an all-copper, vented double-wall heat exchanger and a water-cooled water circulating pump. The pump is controlled by a microprocessor in the HWG module. Power for the pump is provided from a remote 115 vac power source.

Location/Mounting
The HWG module should be mounted as close to the heat pump outdoor section as possible, in order to minimize the length of refrigerant run. Indoor mounting is preferred, where practical, to reduce the likelihood of freezing ambient temperature. It is recommended that the HWG module be mounted above the system compressor in order to promote proper oil movement and drain-down. **This means that the HWG module can be wall mounted in any orientation except for stubs up.** Mounting should be accomplished by fastening the HWG module cabinet to the wall or other selected vertical surface. Mounting holes are provided at the rear of the unit. Any fastener suitable for supporting a 12 pound [5.4] vertical load is acceptable.

The HWG, water piping 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 9 for maximum water piping 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

SPECIAL NOTE: The selected mounting location and orientation must allow the circulator pump to be positioned with the motor shaft horizontal. **DO NOT install the Heat Recovery Unit flat on its back.**

Refrigerant Line Installation
Before starting the installation into the refrigerant circuit, inspect and note the condition and performance of the heat pump. Disconnect power to the heat pump outdoor unit. Any system deficiencies must be corrected prior to installing the HWG module. Addition of the unit will not correct system problems. Record the suction and discharge pressures and compressor amperage draw. These will be used for comparison with system operation after the refrigerant line installation is complete and before the water line installation is performed.

Install the Add-On HWG Kit
Locate the HWG as close to the water heater as possible. Install the lineset to the desuperheater valves in the outdoor compressor section and the refrigerant line connections on the HWG. Maximum length should be 30 feet one way. Evacuate the lineset to 500 microns through the hot gas valves in the outdoor unit. Open the HWG valves in the compressor section up fully (and close the desuperheater bypass valve). See Figures 21a through 21d. Check the lineset for leaks. Verify that lineset tubing is completely insulated with a minimum 1/2” thick closed cell and painted to prevent deterioration of the insulation due to ultra violet light and weather. Make the connections with high temperature solder or brazing rod. The recommended refrigerant line size is dependent on the one way distance between the Heat Recovery Unit and the compressor; and the size of the system. Use Table 10 as a guideline.

Wiring
Refer to Wire Diagrams for Remote HWG Wiring.

NOTICE! Make sure the compressor discharge line is connected to the “Hot Gas In” stub on the Heat Recovery Unit.

⚠ WARNING! ⚠

WARNING! The HWG module is an appliance that operates in conjunction with the heat pump system, the hot water system and the electrical system. Installation should only be performed by skilled technicians with appropriate training and experience. The installation must be in compliance with local codes and ordinances. Local plumbing and electrical building codes take precedence over instructions contained herein. The Manufacturer accepts no liability for equipment damaged and/or personal injury arising from improper installation of the HWG module.

⚠ CAUTION! ⚠

CAUTION! The HWG module must be installed in an area that is not subject to freezing temperatures.

⚠ CAUTION! ⚠

CAUTION! Locate Refrigerant lines to avoid accidental damage by lawnmowers or children.

Hot Water Generator Module Refrigeration Installation

Outdoor Compressor Section Only

Figure 21a: Outdoor Compressor Section HWG Installation

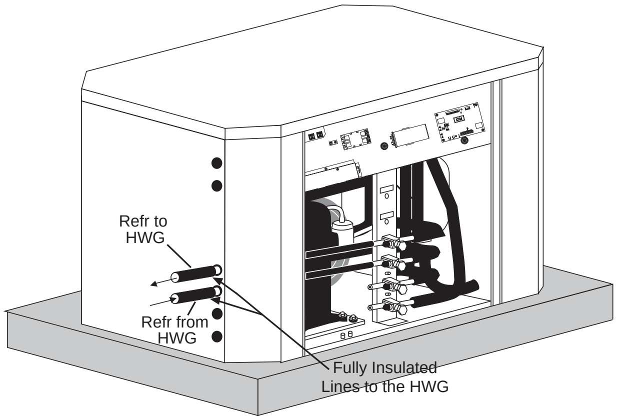


Figure 21b: Remote HWG Module

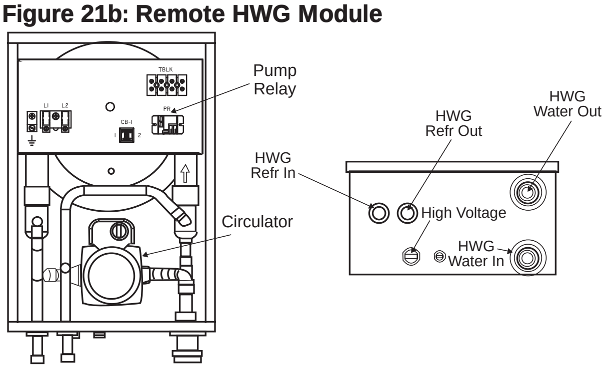


Figure 21c: HWG Bypass Valve

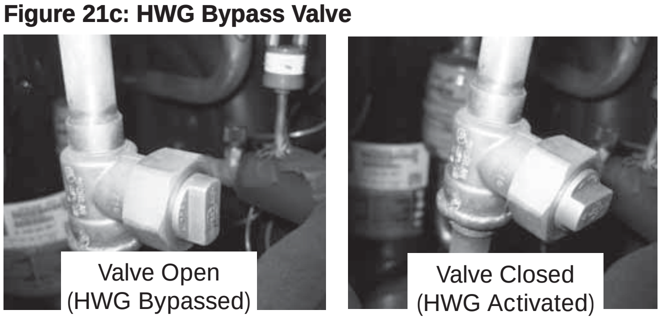


Figure 21d: HWG Service Valves

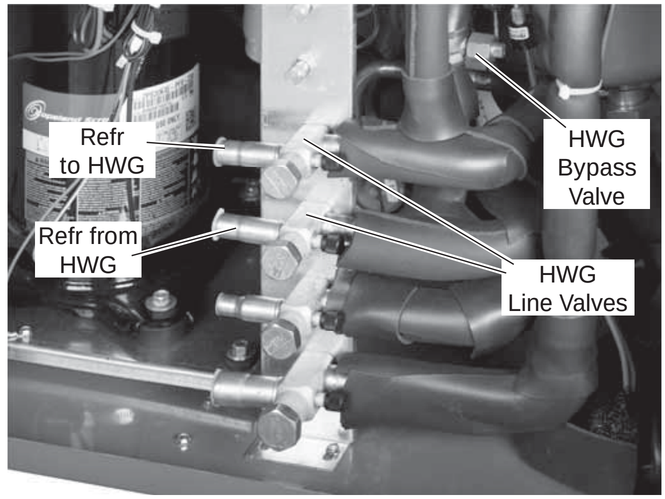


Table 10: HWG Refrigerant Line Sizing

Capacity	Line Set Size		
	1/2" OD	5/8" OD	3/4" OD
2 Ton	Up to 16 ft. [4.9m]	Up to 30 ft. [9.1m]	N/A
3 Ton	Up to 9 ft. [2.7m]	Up to 25 ft. [7.6m]	Up to 30 ft. [9.1m]
4 Ton	Up to 5 ft. [1.5m]	Up to 13 ft. [4.0m]	Up to 30 ft. [9.1m]
5 Ton	N/A	Up to 9 ft. [2.7m]	Up to 25 ft. [7.6m]

Electrical - Line Voltage

⚠ WARNING! ⚠

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

⚠ CAUTION! ⚠

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

Electrical - Line Voltage
All field installed wiring, including electrical ground, must comply with the National Electrical Code as well as all applicable local codes. Refer to the unit electrical data for fuse sizes. Consult wiring diagram for field connections that must be made by the installing (or electrical) contractor.

All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

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

Power Connection
Line voltage connection is made by connecting the incoming line voltage wires to the “L” side of the contactor as shown in Figures 22 and 23. Consult Table 9a-g for correct fuse size.

208/230 Volt Operation
Verify transformer tap with air handler wiring diagram to ensure that the transformer tap is set to the correct voltage, 208V or 230V.

Table 9a: Electrical Data (TES standard)

Model	Compressor			HWG Pump FLA	Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR
	RLA	LRA	Qty				
026	11.7	58.3	1	0.5	12.2	15.1	25
038	15.3	83.0	1	0.5	15.8	19.6	30
049	21.2	104.0	1	0.5	21.7	27.0	45
064	27.1	152.9	1	0.5	27.6	34.3	60

Rated Voltage of 208/230/60/1 Min/Max Voltage of 197/252
All fuses Class RK-5

Table 9b: Electrical Data (TES with Magna-Geo Flow Controller)

Model	Compressor			Loop Pump FLA	HWG Pump FLA	Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR
	RLA	LRA	Qty					
026	11.7	58.3	1	1.7	0.5	13.9	16.8	25
038	15.3	83.0	1	1.7	0.5	17.5	21.3	35
049	21.2	104.0	1	1.7	0.5	23.4	28.7	45
064	27.1	152.9	1	1.7	0.5	29.3	36.0	60

Rated Voltage of 208/230/60/1 Min/Max Voltage of 197/252
All fuses Class RK-5

Table 9c: Electrical Data (TES with UPM-Geo Flow Controller)

Model	Compressor			HWG Pump FLA	Loop Pump FLA	Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR
	RLA	LRA	Qty					
026	11.7	58.3	1	0.5	0.7	12.9	15.8	25
038	15.3	83.0	1	0.5	0.7	16.5	20.3	35

Rated Voltage of 208/230/60/1 Min/Max Voltage of 197/252
All fuses Class RK-5

Electrical - Line Voltage

Table 9d: Electrical Data (TES with Modulating Valve)

Model	Compressor			HWG Pump FLA	Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR
	RLA	LRA	Qty				
026	11.7	58.3	1	0.5	12.2	15.1	25
038	15.3	83.0	1	0.5	15.8	19.6	30
049	21.2	104.0	1	0.5	21.7	27.0	45
064	27.1	152.9	1	0.5	27.6	34.3	60

Rated Voltage of 208/230/60/1 Min/Max Voltage of 197/252
All fuses Class RK-5

Table 9e: Electrical Data (TEP with Magna-Geo Flow Controller)

Model	Compressor			Loop Pump FLA	Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR
	RLA	LRA	Qty				
026	11.7	58.3	1	1.7	13.4	16.3	25
038	15.3	83.0	1	1.7	17.0	20.8	35
049	21.2	104.0	1	1.7	22.9	28.2	45
064	27.1	152.9	1	1.7	28.8	35.6	60

Rated Voltage of 208/230/60/1 Min/Max Voltage of 197/252
All fuses Class RK-5

Table 9f: Electrical Data (TEP with UPM-Geo Flow Controller)

Model	Compressor			Loop Pump FLA	Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR
	RLA	LRA	Qty				
026	11.7	58.3	1	0.7	12.4	15.3	25
038	15.3	83.0	1	0.7	13.0	19.8	35

Rated Voltage of 208/230/60/1 Min/Max Voltage of 197/252
All fuses Class RK-5

Table 9g: Hot Water Generator Electrical Data

HWG Module	Voltage	Pump FLA	Total FLA	Min Circuit Amps
AHWG1AARS	115/60/1	0.52	0.52	1.20
AHWG1AGRS	208/230/60/1	0.40	0.40	0.90

Electrical - Power Wiring

Figure 18: Indoor Compressor Section (TES) Line Voltage Field Wiring

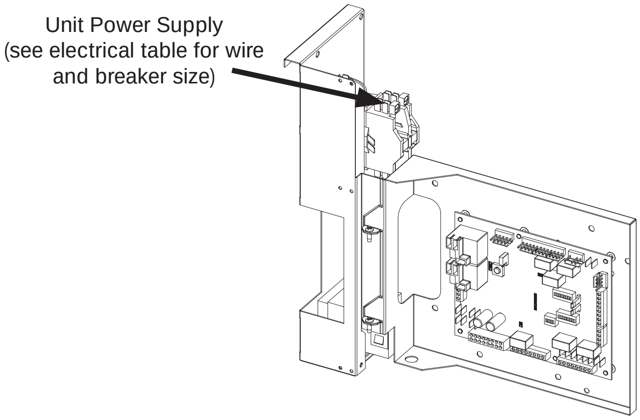
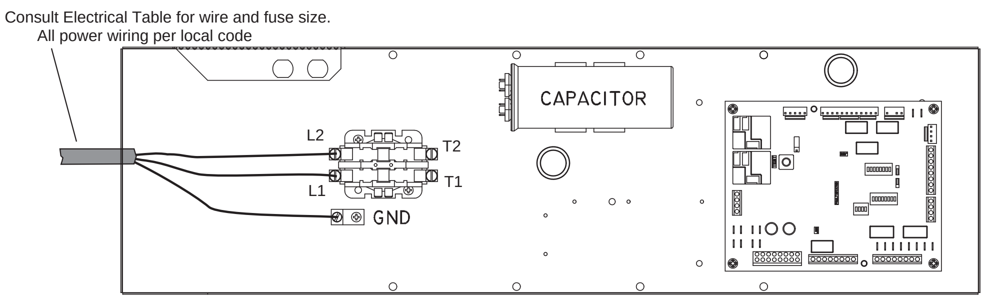


Figure 19: Outdoor Compressor Section (TEP) Line Voltage Field Wiring



ELECTRICAL - HWG WIRING

208-230 Volt Operation
Verify transformer tap with air handler wiring diagram to insure that the transformer tap is set to the correct voltage, 208V or 230V.

See wire diagrams for 115 and 230V.

HWG Module Wiring - For "Outdoor" Compressor Section
The HWG module should be wired to a 115 vac power supply as shown in the wire diagrams. A safety disconnect should be installed at the HWG module as required by code to allow servicing of the module. DO NOT energize the pump until all HWG piping is completed and air is purged from the water piping to avoid running the pump "dry".

Electrical - Low Voltage Wiring

Figure 20: TES Low Voltage Field Wiring

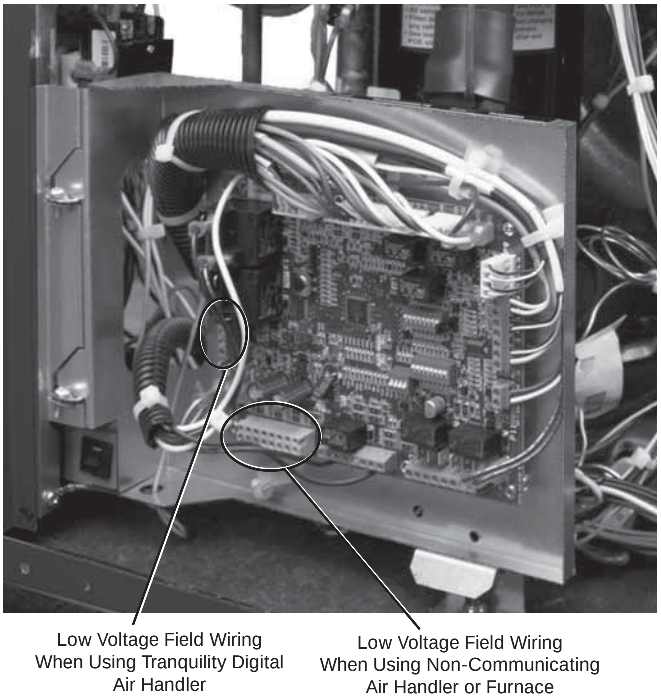
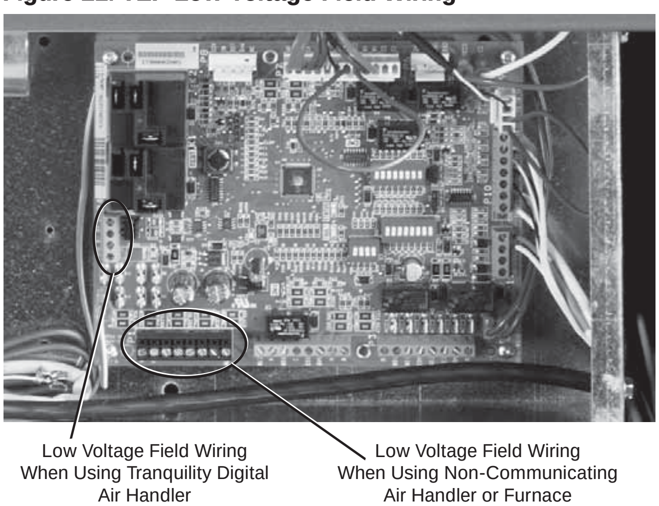
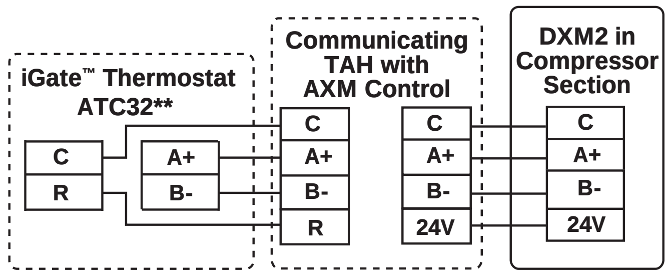


Figure 21: TEP Low Voltage Field Wiring



Connection to ATC communicating thermostat and AXM Communicating control in Tranquility® Digital Air Handler
AXM control in Tranquility® Digital Air Handler allows 4-wire connection with Communicating DXM2 board and Communicating ATC Thermostat.

Figure 22a: Connection to iGate™ communicating thermostat and AXM Communicating control in Tranquility® Digital Air Handler

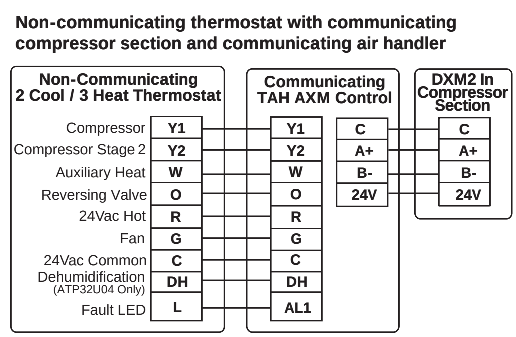


Thermostat Connections

C	24V Common for Control Circuit
R	24V Supply for Control Circuit
A+	Communications (Positive)
B –	Communications (Negative)

NOTE: 4-wire connections can ONLY be used when communicating air handler and iGate™ communicating thermostat is used. Thermostat can be connected either to the air handler (AXM) control or compressor section (DXM2) control, when all are communicating.

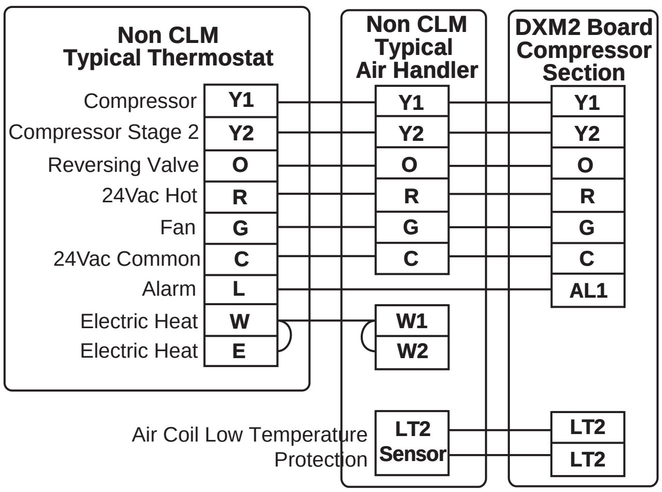
Figure 22b: Connection to Non-Communicating thermostat and AXM communicating control in Tranquility® Digital Air Handler:



When a non-communicating thermostat will be used to control the system a ClimateMaster ATC32U02 thermostat must be connected so that proper system communications and operation are maintained. The ATC32U02 may be installed at an inconspicuous location near the air handler and wired to the TB1 terminal strip of the AXM control board. The ATC32U02 should be set to the OFF mode.

Electrical - Thermostat Wiring

Figure 22c: Connection to non-Communicating thermostat and non-communicating Air Handler/Furnace:



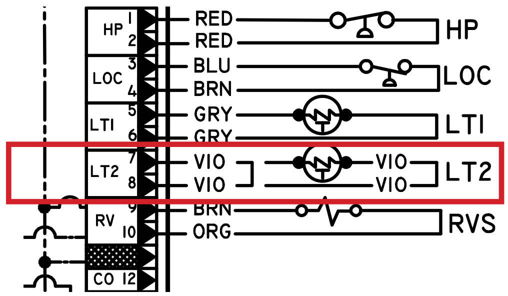
Note: Air coil low temperature protection will not be active if LT2 sensor is not installed or is not installed correctly.

LT2 Sensor

An LT2 air coil low temperature protection sensor is factory installed on the TAH air handler and is available as an option for the TAC cased coils. Install the LT2 sensor on the cased coil as indicated in Figure 15 of this manual using thermal compound and the supplied mounting clip. Ensure that the sensor makes good thermal contact and insulate the sensor. Optional LT2 sensor kit may be ordered using part number S17S0031N12.

Mount the LT2 sensor to the cased coil. On the DXM2 in the compressor section, clip the VIO wires (see diagram) and wire the violet leads from LT2 sensor to the violet leads clipped in the on the DXM2 board.

Figure 23: DXM2 LT2 VIO Connection



Thermostat Installation

The thermostat should be located on an interior wall in a larger room, away from supply duct drafts. DO NOT locate the thermostat in areas subject to sunlight, drafts or on external walls. The wire access hole behind the thermostat may in certain cases need to be sealed to prevent erroneous temperature measurement due to air infiltration through the wall cavity. Thermostat wire must be 18 AWG or larger wire. Wire the appropriate thermostat as shown in Figures 22a-c. Practically any heat pump thermostat will work with these units, provided it has the correct number of heating and cooling stages. However, using the communicating thermostat (ATC32U**) is highly recommended for on-site, easier configuration, monitoring and diagnosis.

⚠ CAUTION! ⚠

CAUTION! Refrigerant pressure activated water regulating valves should never be used with ClimateMaster equipment.

⚠ CAUTION! ⚠

CAUTION! If communicating thermostat is not installed, a communicating service tool must be used to configure and diagnose this system.

DXM2 Controls

DXM2 iGate™ Controller DXM2 is the next generation in controls and is capable of 2-way communication with smart components, like the communicating iGate™ thermostat, ECM fan motor, Variable-Speed Pump and configuration/ diagnostic tool.

For most residential applications, configuration, monitoring and diagnostics can all be done from the thermostat/ service tool so there's no need to read LEDs and change DIP switches.

For details on user settings, refer to iGate™ Communicating Thermostat User Manual (part # 97B0055N02).

For details on Installer settings, refer to iGate™ Communicating Thermostat Installer manual (part # 97B0055N03).

For details on installer/service settings on the iGate™ configuration/diagnostic tool, refer to operation manual (part # 97B0106N01).

For further details on the DXM2 control, refer to the DXM2 Application, Operation and Maintenance Manual (part # 97B0003N15). The DXM2 AOM is shipped with each unit.

Thermostat compatibility
It is strongly recommended that iGate™ Communicating Thermostat (ATC32U**) or iGate™ configuration/ diagnostic tool (ACDU**) be used with DXM2 control, to ensure easy configuration, monitoring and diagnostics. For example, Airflow CAN NOT be configured without either the communicating thermostat or configuration/ diagnostic tool

Field Hardware Configuration Options - Note: In the following field hardware configuration options, changes should be made ONLY when power is removed from the DXM2 control.

Water coil low temperature limit setting: Jumper 3 (JW3-LT1 Low Temp) provides field selection of temperature limit setting for LT1 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature).

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

A0-2: Configure Modulating Valve or Variable-Speed Pump (Internal water flow Models Only)

A0-2 jumper (Figure 25) Factory Set to “IOV” if using Internal Modulating Motorized Valve or “PMW” if using Internal Variable-Speed Pump. This applies only to units with Internal Water Flow Control.

⚠ CAUTION! ⚠

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

DIP Switches – There's no need to change the DIP switches settings on Residential units. All DIP switches in S1 and S2 should be “on”. In S3, S3-1 should be “on” and the rest should be “off”. For more details on DIP switches, refer to the DXM2 AOM (part # 97B0003N15).

DXM2 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.

Test Mode Button
Test mode allows the service technician to check the operation of the control in a timely manner. By momentarily pressing the TEST push button, the DXM2 control enters a 20 minute test mode period in which all time delays are sped up 15 times.

Figure 24: Test Mode Button

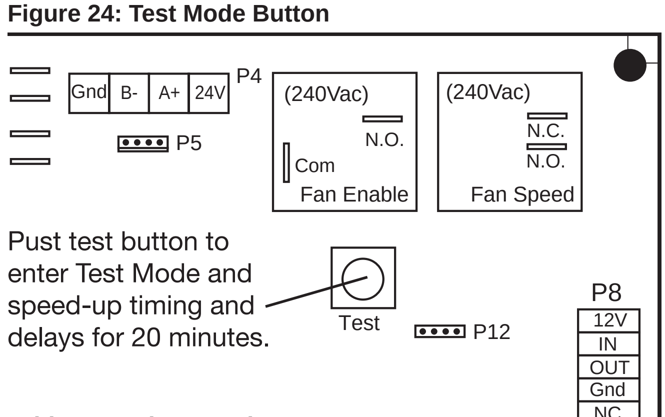


Table 10: Unit Operation

Conventional T-stat signal (Non-Communicating)	Unit
	ECM fan
G	Fan only
G, Y1	Stage 1 heating[1]
G, Y1, Y2	Stage 2 heating[1]
G, Y1, Y2, W	Stage 3 heating[1]
G, W	Emergency heat
G, Y1, O	Stage 1 cooling[2]
G, Y1, Y2, O	Stage 2 cooling[2]

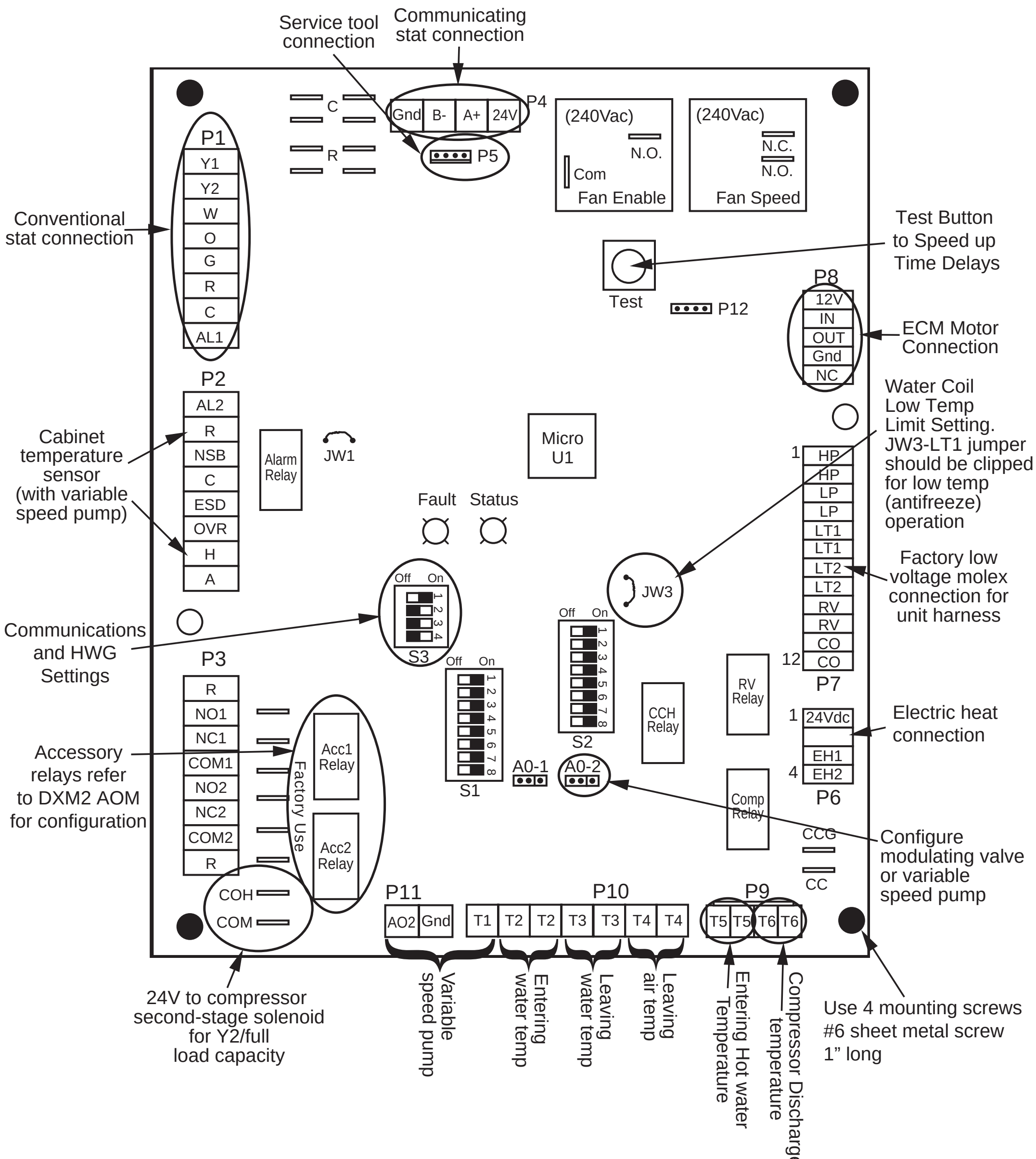
1 Stage 1 = 1st stage compressor, 1st stage fan operation
Stage 2 = 2nd stage compressor, 2nd stage fan operation
Stage 3 = 2nd stage compressor, auxiliary electric heat, 3rd stage fan operation
2 Stage 1 = 1st stage compressor, 1st stage fan operation, reversing valve
Stage 2 = 2nd stage compressor, 2nd stage fan operation, reversing valve

DXM2 Layout and Connections

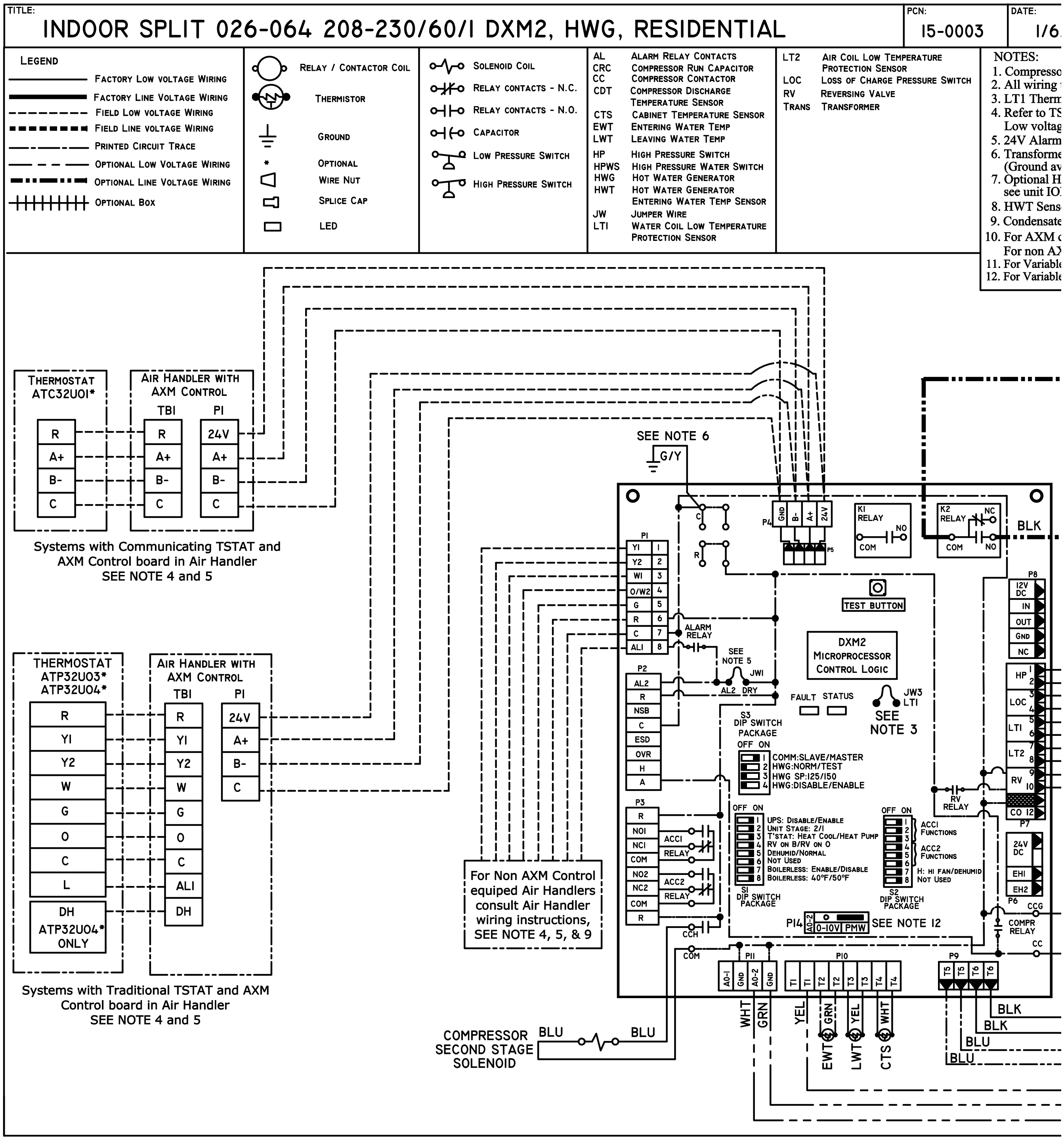
Low Water Temperature Cutout Selection
The DXM2 control allows the field selection of low water (or water-antifreeze solution) temperature limit by clipping jumper JW3, which changes the fault cutout temperature associated with thermistor LT1. Note that the LT1 thermistor is located on the refrigerant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

The factory setting for LT1 is for systems using water (30°F [-1.1°C] refrigerant temperature cutout or fallout). In low water temperature (extended range) applications with antifreeze (most ground loops), jumper JW3 should be clipped as shown in Figure 25 to change the setting to 10°F [-12.2°C] refrigerant cutout or fallout temperature, a more suitable temperature when using an antifreeze solution. All residential units include water/refrigerant circuit insulation to prevent internal condensation, which is required when operating with entering water temperatures below 59°F [15°C].

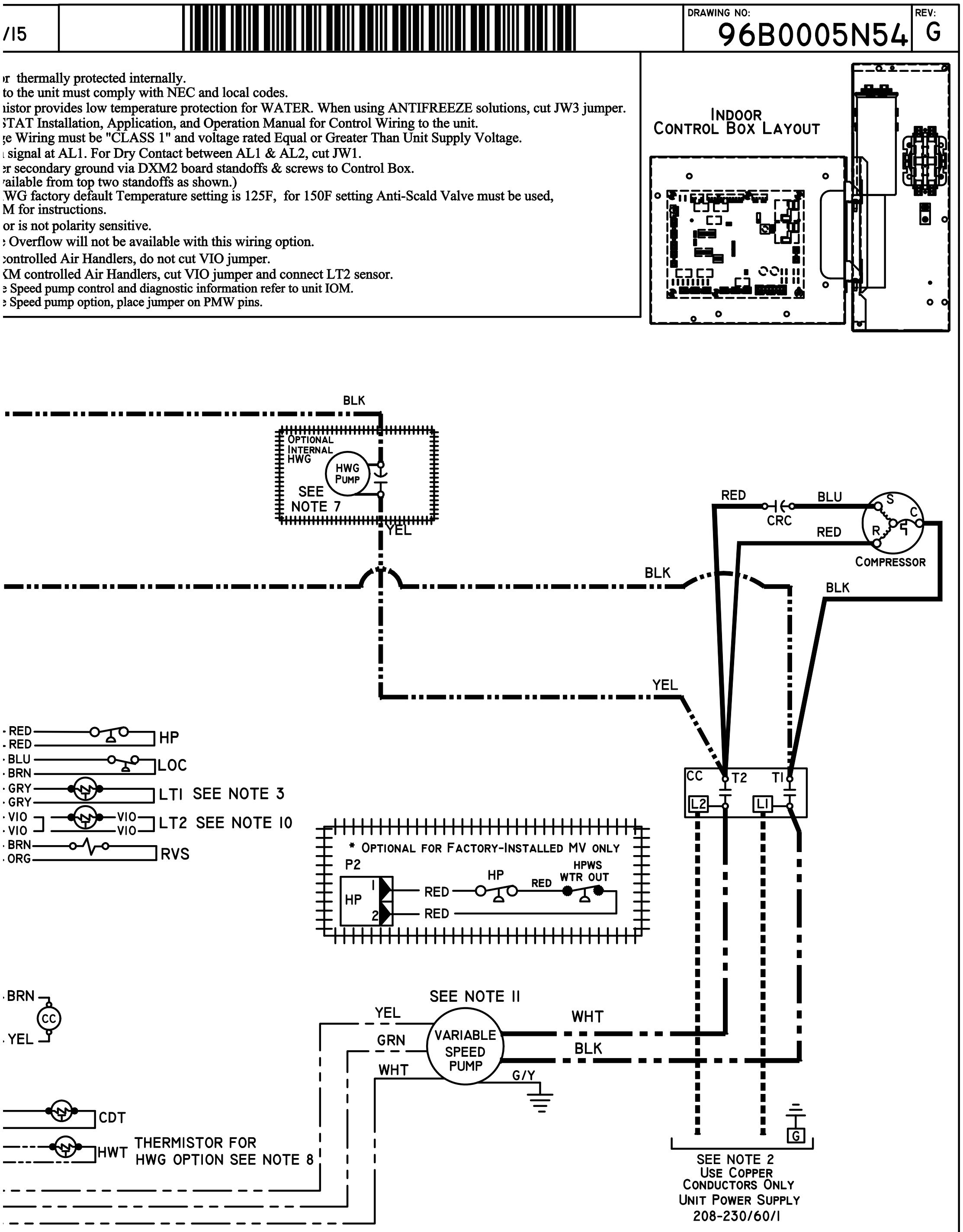
Figure 25: DXM2 Layout and Connections

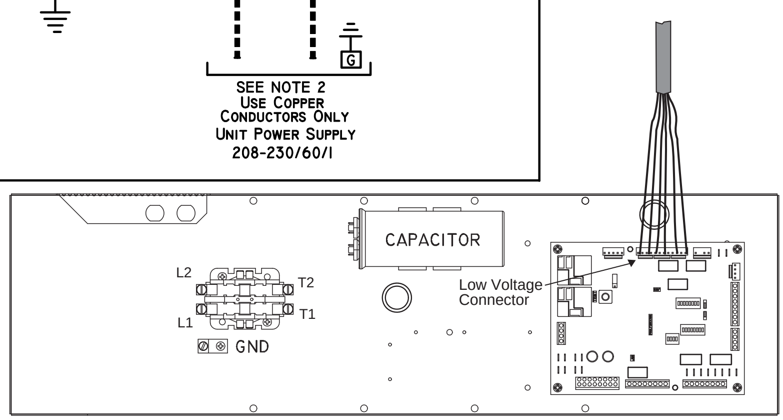


Indoor Split (TES) DXM2 Wiring Diagram with Internal Flow Controller - 96B0005N54

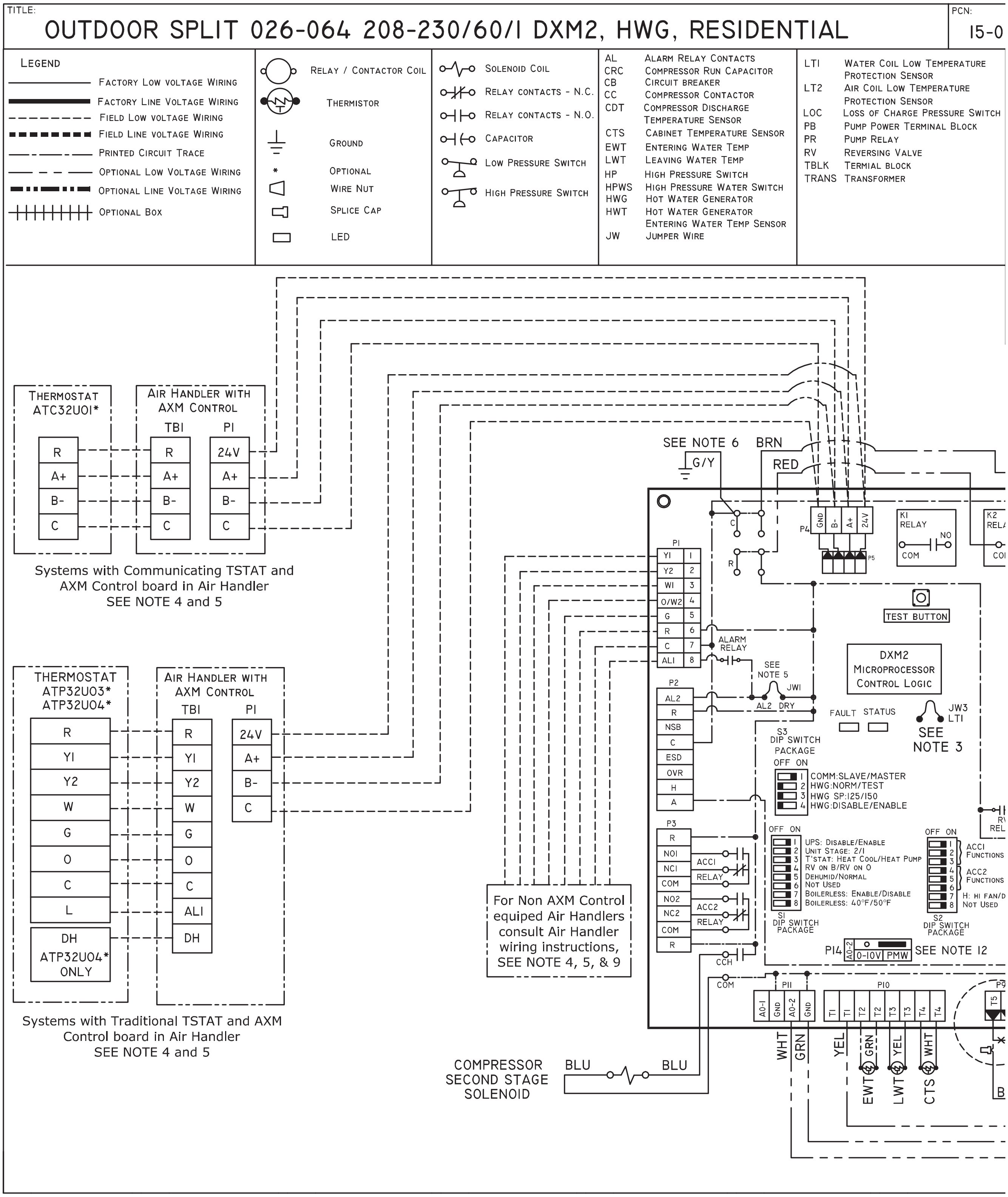


Indoor Split (TES) DXM2 Wiring Diagram with Internal Flow Controller - 96B0005N54





Outdoor Split (TEP) DXM2 Wiring Diagram with Internal Flow Controller - 96B0005N65

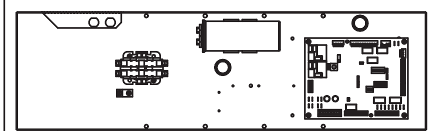


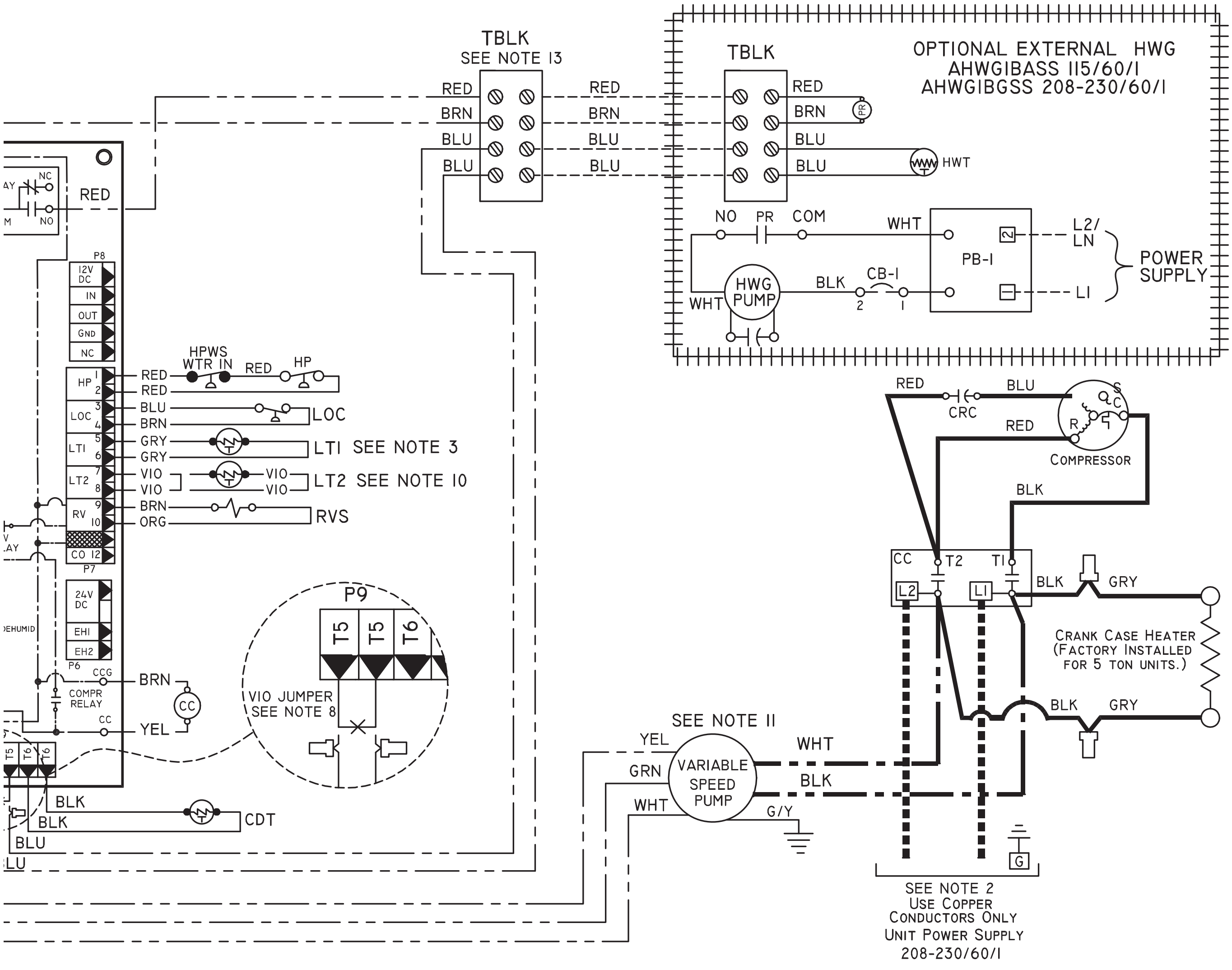
Outdoor Split (TEP) DXM2 Wiring Diagram with Internal Flow Controller - 96B0005N65

	DATE:	DRAWING NO:	REV:
128	03/10/15	96B0005N65	B

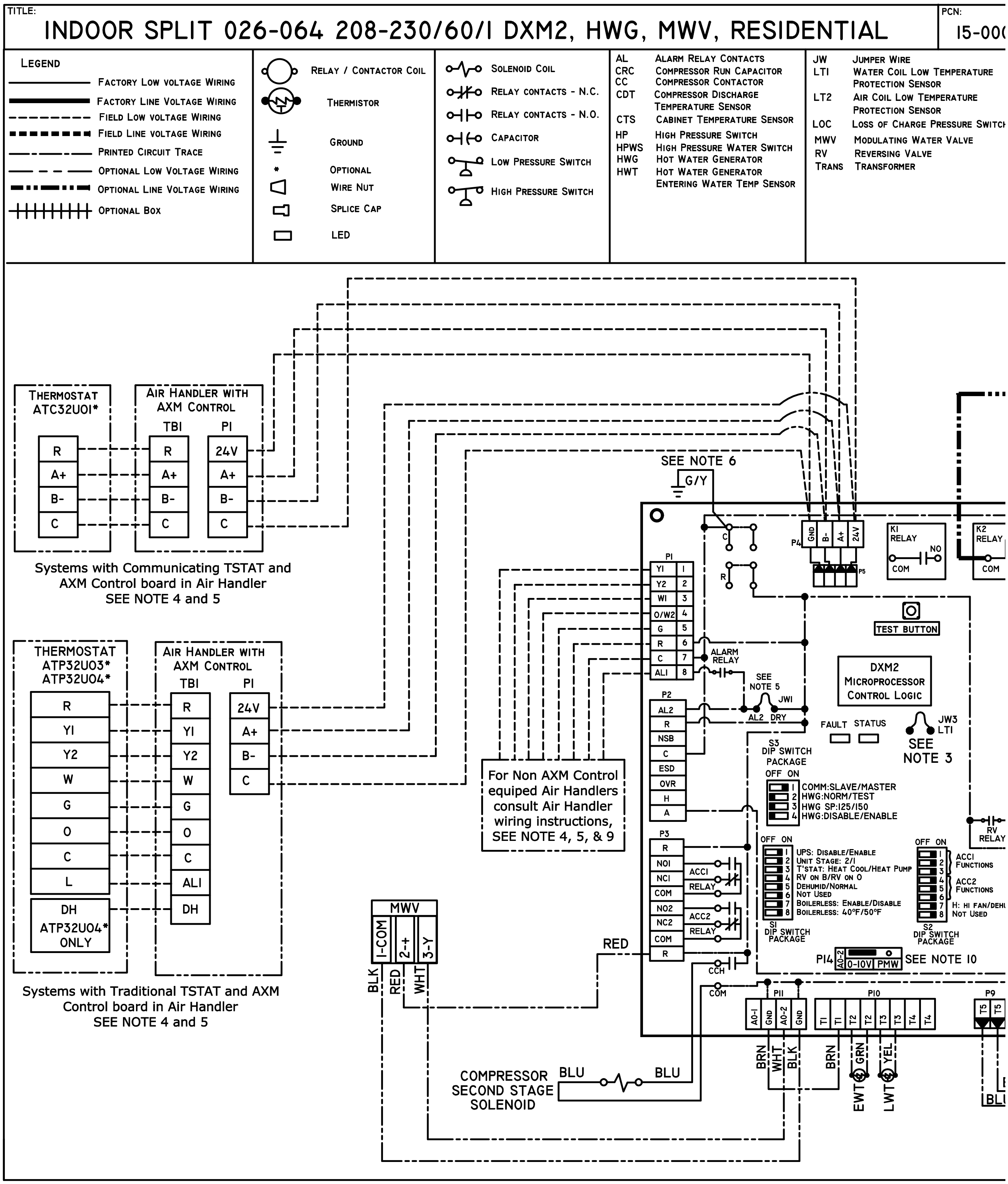
NOTES:
1. Compressor thermally protected internally.
2. All wiring to the unit must comply with NEC and local codes.
3. LT1 Thermistor provides low temperature protection for WATER. When using ANTIFREEZE solutions, cut JW3 jumper. For outdoor splits using antifreeze (JW3 clipped) , the loop must be protected to a minimum temperature of 20F
4. Refer to TSTAT Installation, Application, and Operation Manual for Control Wiring to the unit. Low voltage Wiring must be "CLASS 1" and voltage rated Equal or Greater Than Unit Supply Voltage.
5. 24V Alarm signal at AL1. For Dry Contact between AL1 & AL2, cut JW1.
6. Transformer secondary ground via DXM2 board standoffs & screws to Control Box. (Ground available from top two standoffs as shown.)
7. Optional HWG factory default Temperature setting is 125F, for 150F setting Anti-Scald Valve must be used, see unit IOM for instructions.
8. For outdoor splits, used with the HWG Kit, cut and strip the VIO jumper. HWT Sensor is not polarity sensitive. Using field supplied thermostat wire connect cut VIO wires to the HWT Sensor in the Hot Water Generator Kit.
9. Condensate Overflow will not be available with this wiring option.
10. For AXM controlled Air Handlers, do not cut VIO jumper. For non AXM controlled Air Handlers cut VIO jumper and connect LT2 sensor.
11. For Variable Speed pump control and diagnostic information refer to unit IOM.
12. For Variable Speed pump option, place jumper on PMW pins.
13. Factory supplied terminal block in HWG kit. To be installed in outdoor split control box.

Outdoor Control Box Layout





Indoor Split (TES) DXM2 Wiring Diagram with Motorized Modulating Water Valve - 96B0005N63



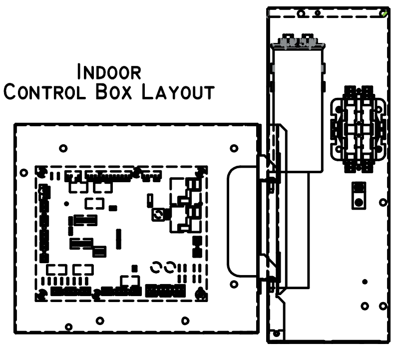
Indoor Split (TES) DXM2 Wiring Diagram with Motorized Modulating Water Valve - 96B0005N63

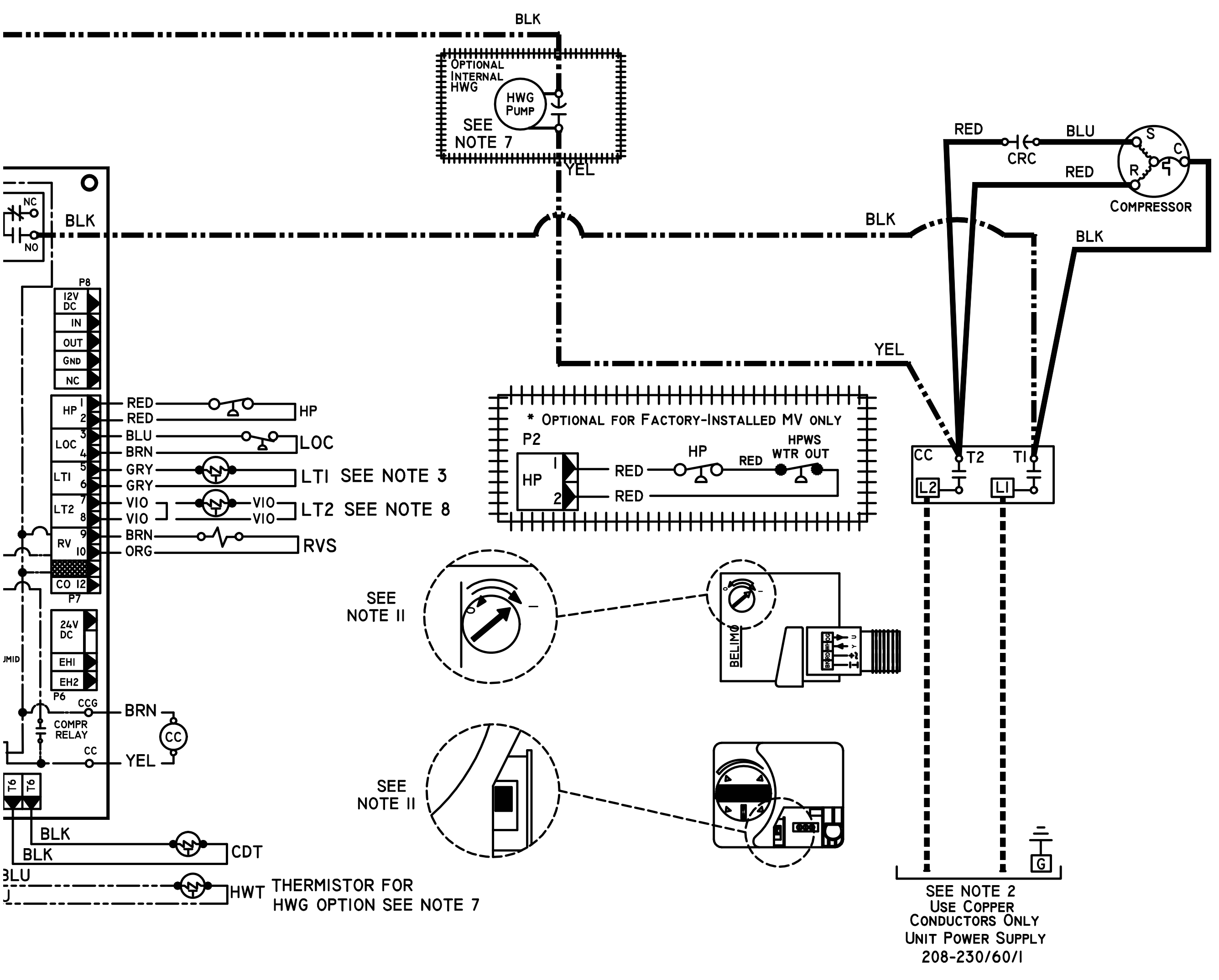
	DATE:	DRAWING NO:	REV:
03	1/6/15	96B0005N63	C

NOTES:

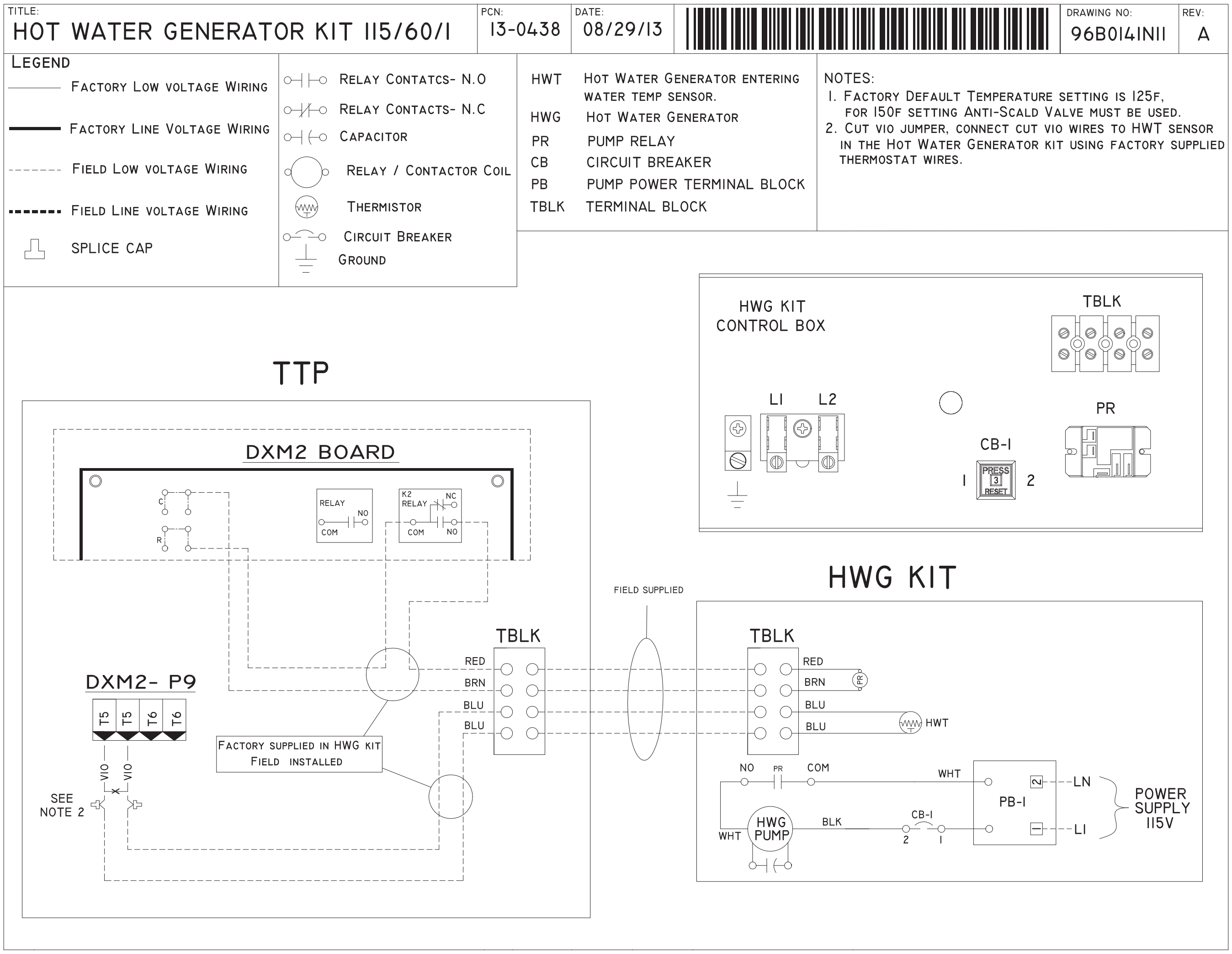
1. Compressor thermally protected internally.
2. All wiring to the unit must comply with NEC and local codes.
3. LT1 Thermistor provides low temperature protection for WATER. When using ANTIFREEZE solutions, cut JW3 jumper.
4. Refer to TSTAT Installation, Application, and Operation Manual for Control Wiring to the unit. Low voltage Wiring must be "CLASS 1" and voltage rated Equal or Greater Than Unit Supply Voltage.
5. 24V Alarm signal at AL1. For Dry Contact between AL1 & AL2, cut JW1.
6. Transformer secondary ground via DXM2 board standoffs & screws to Control Box. (Ground available from top two standoffs as shown.)
7. HWG and Heat Exchanger pump only in models with Hot Water Generator option. Factory default Temperature setting is 125F, for 150F setting Anti-Scald Valve must be used, see unit IOM for instructions.
8. For AXM controlled Air Handlers, do not cut VIO jumper. For non AXM controlled Air Handlers see Outdoor or Indoor Split IOM for wiring instructions.
9. Condensate Overflow will not be available with this wiring option.
10. For Modulating Water Valve option, place jumper on 0-10v pins.
11. For MWV option, ensure actuator direction switch is set as shown.

Indoor Control Box Layout





115V Hot Water Generator Wiring Diagram - 96B0141N11



230V Hot Water Generator Wiring Diagram - 96B0141N12

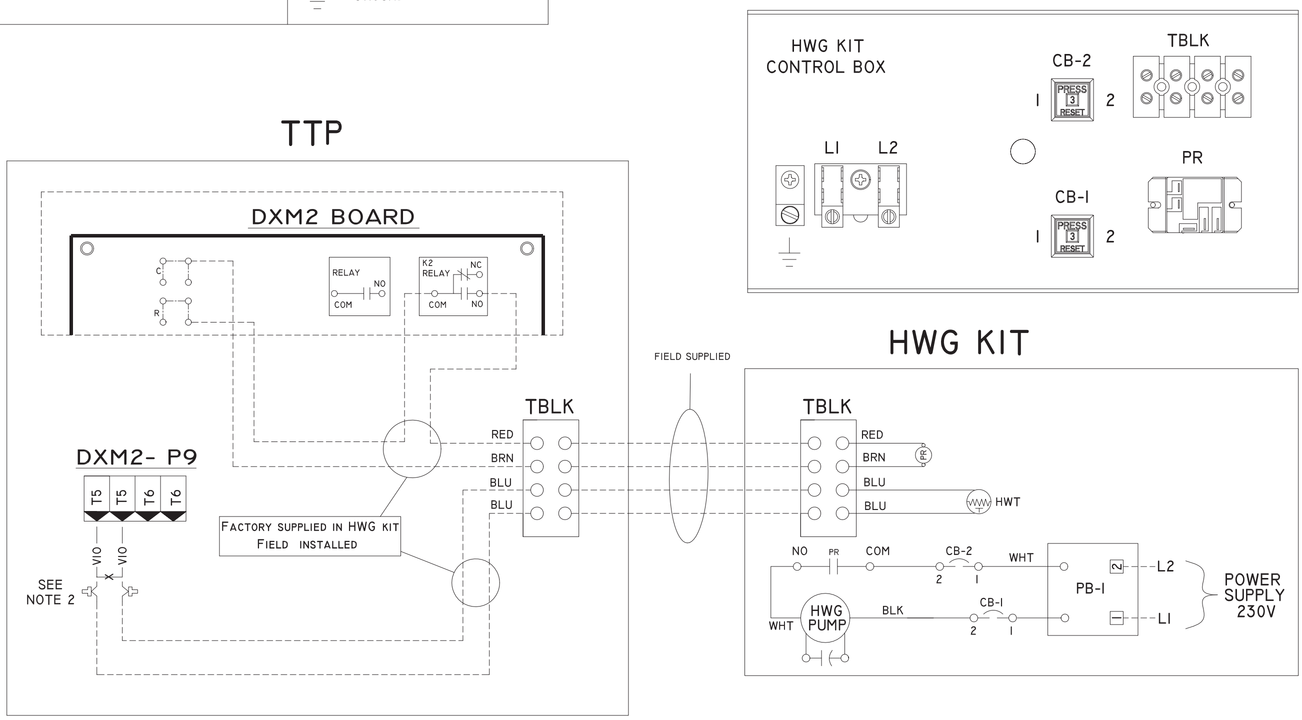
TITLE:	PCN:	DATE:	DRAWING NO:	REV:
HOT WATER GENERATOR KIT 230/60/1	13-0438	8-29-13	96B0141N12	A

LEGEND

- Factory Low voltage Wiring
- Factory Line Voltage Wiring
- Field Low voltage Wiring
- Field Line voltage Wiring
- SPLICE CAP
- Relay Contatcs- N.O
- Relay Contacts- N.C
- Capacitor
- Relay / Contactor Coil
- Thermistor
- Circuit Breaker
- Ground

HWT	Hot Water Generator entering water temp sensor.
HWG	Hot Water Generator
PR	PUMP RELAY
CB	CIRCUIT BREAKER
PB	PUMP POWER TERMINAL BLOCK
TBLK	TERMINAL BLOCK

NOTES:
1. Factory Default Temperature setting is 125F, for 150F setting Anti-Scald Valve must be used.
2. Cut vio jumper, connect cut vio wires to HWT sensor in the Hot Water Generator kit using factory supplied thermostat wires.



Unit Starting and Operating Conditions

Operating Limits

Environment – TES Units are designed for indoor installation only. Never install in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air). Power Supply – A voltage variation of +/– 10% of nameplate utilization voltage is acceptable.

Determination of operating limits is dependent primarily upon three factors: 1) return air temperature. 2) water temperature, and 3) ambient temperature. When any one of these factors is at minimum or maximum levels, the other two factors should be at normal levels to insure proper unit operation. Extreme variations in temperature and humidity and/or corrosive water or air will adversely affect unit performance, reliability, and service life. Consult Tables 11a-d for operating limits.

Table 11a: Building Operating Limits - TES

Operating Limits	TES	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45ºF [7ºC]	39ºF [4ºC]
Rated ambient air, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	130ºF [54ºC]	85ºF [29ºC]
Min. entering air, DB/WB	65/45ºF [18/7ºC]	50ºF [10ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	100/75ºF [38/24ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

Created: 2 Aug., 2012B

Table 11b: Building Operating Limits - TEP

Operating Limits	TEP	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	-10ºF [-23ºC]	-10ºF [-23ºC]
Rated ambient air, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	130ºF [54ºC]	85ºF [29ºC]
Min. entering air, DB/WB	65/45ºF [18/7ºC]	50ºF [10ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	100/75ºF [38/24ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

Created: 2 Aug., 2012B

Commissioning Limits

Consult Tables 11a-d for the particular model. Starting conditions vary depending upon model and are based upon the following notes:

Notes:

1. Commissioning limits in Tables 11a-d are not normal or continuous operating conditions. Minimum/maximum limits are start-up conditions to bring the building space up to occupancy temperatures. Units are not designed to operate under these conditions on a regular basis.
2. Voltage utilization range complies with AHRI Standard 110.

Table 11c: Building Commissioning Limits - TES

Commissioning Limits	TES	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45ºF [7ºC]	39ºF [4ºC]
Rated ambient air, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	130ºF [54ºC]	85ºF [29ºC]
Min. entering air, DB/WB	60ºF [16ºC]	40ºF [4.5ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	110/83ºF [43/28ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

Created: 2 Aug., 2012B

Table 11d: Building Commissioning Limits - TEP

Commissioning Limits	TEP	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	-10ºF [-23ºC]	-10ºF [-23ºC]
Rated ambient air, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	130ºF [54ºC]	85ºF [29ºC]
Min. entering air, DB/WB	60ºF [16ºC]	40ºF [4.4ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	110/83ºF [43/28ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

Created: 2 Aug., 2012B

Unit Start-Up and Operating Conditions

⚠ WARNING! ⚠

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

Unit and System Checkout
BEFORE POWERING SYSTEM, please check the following:

UNIT CHECKOUT

- ❑ Shutoff valves: Insure that all isolation valves are open.
- ❑ Line voltage and wiring: Verify that voltage is within an acceptable range for the unit and wiring and fuses/breakers are properly sized. Verify that low voltage wiring is complete.
- ❑ Unit control transformer: Insure that transformer has the properly selected voltage tap. Residential 208/230V units are factory wired for 230V operation unless specified otherwise.
- ❑ Loop/water piping is complete and purged of air. Water/piping is clean.
- ❑ Antifreeze has been added if necessary.
- ❑ Entering water and air: Insure that entering water and air temperatures are within operating limits of Tables 11a-d
- ❑ Low water temperature cutout: Verify that low water temperature cut-out on the DXM2 control is properly set.
- ❑ HWG is switched off at SW 3-4 unless piping is completed and air has been purged from the system.
- ❑ Unit air coil and filters: Insure that filter is clean and accessible and that air coil is clean of all manufacturing oils
- ❑ Unit controls: Verify that DXM2 field selection options are properly set.
- ❑ Blower CFM and Water ΔT is set on communicating thermostats or diagnostic tool.
- ❑ Service/access panels are in place.

SYSTEM CHECKOUT

- ❑ System water temperature: Check water temperature for proper range and also verify heating and cooling set points for proper operation.
- ❑ System pH: Check and adjust water pH if necessary to maintain a level between 6 and 8.5. Proper pH promotes system longevity (see Table 6).
- ❑ System flushing: Verify that all air is purged from the system. Air in the system can cause poor operation or system corrosion. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Some antifreeze solutions may require distilled water.
- ❑ Internal Flow Controller: Verify that it is purged of air and in operating condition.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out controls are set properly (LT1 - JW3).
- ❑ Miscellaneous: Note any questionable aspects of the installation.

⚠ CAUTION! ⚠

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

⚠ CAUTION! ⚠

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

Unit Start-up Procedure

1. Turn the thermostat fan position to “ON.” System blower should start.
2. Turn blower off.
3. Ensure all valves are adjusted to their full open position. Ensure line power to the heat pump is on.
4. Room temperature should be within the minimum-maximum ranges listed in the unit IOM. During start-up checks, loop water temperature entering the heat pump should be between 30°F [-1°C] and 95°F [35°C].
5. It is recommended that water-to-air units be first started in the cooling 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.
6. Two factors determine the operating limits of geothermal heat pumps, (a) return air temperature, and (b) entering water temperature. When either of the factors is at a minimum or maximum level, the other factor must be at normal levels to insure proper unit operation.
   a. Place the unit in Manual Operation. When in manual mode activate Y1,Y2, and O to initiate the cooling mode. Also manually increase CFM until desired cooling CFM is achieved. Next adjust pump speed % until desired loop temperature difference (leaving water temperature minus entering water temperature) is achieved. (For modulating valve adjust valve %).

INSTALLER SETTINGS

THERMOSTAT CONFIG
SYSTEM CONFIG
ACCESSORY CONFIG
INPUT DEALER INFO
HUMIDITY CONFIG
TEMPERATURE ALGORITHM
DEMAND REDUCTION CNFG
SERVICE MODE
RESTORY DEFAULTS

ATC32U01
SELECT OPTION ▲▼
◀ PREVIOUS

Unit Start-Up Procedure

SERVICE MODE	
MANUAL OPERATION	
CONTROL DIAGNOSTICS	
DIPSWITCH CONFIG	
FAULT HISTORY	
CLEAR FAULT HISTORY	
SELECT OPTION ▲▼	
◄ PREVIOUS	SELECT ■

MANUAL OPERATING MODE			
Y1	COMM	OUTPUT	OFF
Y2	COMM	OUTPUT	OFF
W	COMM	OUTPUT	OFF
O	COMM	OUTPUT	OFF
G	COMM	OUTPUT	OFF
H	COMM	OUTPUT	OFF
DH	COMM	OUTPUT	OFF
ECM	AIRFLOW		0
PUMP	SPEED		0%
TEST	MODE		OFF
SELECT OPTION ▲▼			
◄ PREVIOUS			SELECT ■

b. Check for cool air delivery at the unit grille within a few minutes after the unit has begun to operate.

NOTE: Units have a five minute time delay in the control circuit that can be bypassed on the DXM2 control board by placing the unit in the “Test” mode as shown in the unit IOM. Check for normal air temperature drop of 15°F to 25°F (cooling mode).

c. Verify that the compressor is on and that the water temperature rise (cooling mode) is within normal range.

Table 12a: Water-Temperature Rise

Water Flow, gpm (l/m)	Rise, Cooling °F
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton (3.9 l/m per kw)	9 - 12
For Open Loop: Ground Water Systems at 1.5 gpm per ton (2.0 l/m per kw)	20 - 26

d. Check the elevation and cleanliness of the condensate lines. Dripping may be a sign of a blocked line. Check that the condensate trap is filled to provide a water seal.

e. Turn thermostat to “OFF” position. A hissing noise indicates proper functioning of the reversing valve.

7. Allow five (5) minutes between tests for pressure to equalize before beginning heating test.
   a. Go into Manual Mode activate Y1, and Y2 for Heating. Also manually increase CFM until desired heating CFM is achieved. Next adjust pump speed % until desired loop temperature difference (entering water temperature minus leaving water temperature) is achieved. (For modulating valve adjust valve %).

   b. Check for warm air delivery at the unit grille within a few minutes after the unit has begun to operate.

NOTE: Units have a five minute time delay in the control circuit that can be bypassed on the DXM2 control board by placing the unit in the “Test” mode as shown in the unit IOM. Check for normal air temperature rise of 20°F to 30°F (heating mode).

c. Verify that the compressor is on and that the water temperature fall (heating mode) is within normal range.

Table 12b: Water-Temperature Fall

Water Flow, gpm (l/m)	Drop, Heating °F
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton (3.9 l/m per kw)	4 - 8
For Open Loop: Ground Water Systems at 1.5 gpm per ton (2.0 l/m per kw)	10 - 17

e. Check for vibration, noise, and water leaks.

8. If unit fails to operate properly, perform troubleshooting analysis (see troubleshooting section in the unit IOM). If the check described fails to reveal the problem and the unit still does not operate, contact a trained service technician to insure proper diagnosis and repair of the equipment.
9. When testing is complete, exit the Installer Menu and set thermostat to maintain desired comfort level for normal operation.

Unit performance may be verified by calculating the unit heat of rejection and heat of extraction. Heat of Rejection (HR) can be calculated and compared to the performance data pages in this IOM. The formula for HR is as follows: HR = TD x GPM x 500 (or 485 for anti-freeze solutions), where TD is the temperature difference between the entering and leaving water, and GPM is the flow rate in U.S. GPM determined by comparing the unit heat exchanger pressure drop to Table 13.

Heat of Extraction (HE) can also be calculated and compared to the performance data pages in this IOM. The formula for HE is as follows: HE = TD x GPM x 500 (or 485 for anti-freeze solutions), where TD is the temperature difference between the entering and leaving water, and GPM is the flow rate in U.S. GPM determined by comparing the unit heat exchanger pressure drop to Table 13.

If performance during any mode appears abnormal, refer to the DXM2 section or troubleshooting section of this manual.

Air Coil–To obtain maximum performance of a newly manufactured air coil it should be cleaned before startup. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. A thorough water rinse should follow.

⚠ 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.

Unit Operating Conditions

Table 13: Coax Water Pressure Drop

Model	GPM	Pressure Drop (psi)			
		30°F	50°F	70°F	90°F
026	2.3	0.5	0.4	0.4	0.4
	3.0	0.7	0.6	0.6	0.6
	3.4	0.8	0.7	0.7	0.7
	4.5	1.1	1.0	1.0	0.9
	6.0	1.7	1.6	1.5	1.4
038	3.0	0.9	0.8	0.8	0.8
	4.5	1.5	1.3	1.2	1.2
	6.0	2.2	1.9	1.8	1.7
	6.8	2.6	2.2	2.1	2.0
	9.0	3.9	3.4	3.1	3.0
049	4.5	0.2	0.1	0.1	0.1
	6.0	0.9	0.7	0.7	0.7
	6.8	1.2	1.0	0.9	0.9
	9.0	2.1	1.9	1.7	1.7
	12.0	3.8	3.5	3.3	3.2
064	6.0	0.9	0.2	0.2	0.3
	7.5	1.7	0.9	0.7	0.8
	9.0	2.5	1.5	1.3	1.4
	11.3	3.7	2.6	2.3	2.3
	12.0	4.1	3.0	2.6	2.6
	15.0	6.1	4.7	4.1	4.0

Table 14: Water Temperature Change Through Heat Exchanger

Water Flow, gpm (l/m)	Rise, Cooling °F	Drop, Heating °F
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton (3.9 l/m per kw)	9 - 12	4 - 9
For Open Loop: Ground Water Systems at 1.5 gpm per ton (2.0 l/m per kw)	18 - 24	7 - 19

Table 15a: Size 026 Two-Stage HFC-410A Typical Unit Operating Pressures and Temperatures

Entering Water Temp °F	Water Flow GPM	Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
		Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	1.7	128-138	214-234	14-19	15-20	40.0	18-24	70-80	280-300	2-7	6-11	7.3-9.3	14-20
	1.7	128-138	214-234	14-19	15-20	40.0	18-24	72-82	280-300	3-8	6-11	6.0-8.0	14-20
	1.7	128-138	214-234	14-19	15-20	40.0	18-24	75-85	280-300	3-8	6-11	4.7-6.7	14-20
50	3	128-138	216-236	13-18	15-20	18.0-20.0	18-24	105-115	310-330	4-9	6-11	10.1-12.1	19-25
	3.4	128-138	214-234	14-19	15-20	20.0	18-24	105-115	310-330	5-10	6-11	8.4-10.4	19-25
	3.4	128-138	214-234	14-19	15-20	20.0	18-24	110-120	310-330	6-11	6-11	6.6-8.6	19-25
70	3	131-141	290-310	12-17	15-20	17.3-19.3	17-23	130-140	340-360	11-16	7-12	12.8-14.8	23-28
	4.5	131-141	290-310	12-17	14-19	14.3-16.3	17-23	130-140	340-360	13-18	7-12	10.6-12.6	23-28
	6	131-141	275-295	12-17	13-18	11.3-13.3	17-23	132-142	340-360	15-20	8-13	8.3-10.3	23-28
90	3	138-148	410-430	11-16	18-23	16.5-18.5	16-22	145-155	360-380	22-27	10-15	25.0	26-32
	4.5	138-148	410-430	11-16	16-21	13.6-15.6	16-22	145-155	360-380	22-27	10-15	25.0	26-32
	6	138-148	390-410	11-16	15-20	10.7-12.7	16-22	145-155	360-380	22-27	10-15	25.0	26-32
110	3	142-152	480-500	10-15	19-24	15.0-17.0	16-22	145-155	360-380	22-27	10-15	45.0	45.0
	4.5	142-152	465-485	11-16	17-22	13.1-15.1	16-22	145-155	360-380	22-27	10-15	45.0	45.0
	6	142-152	451-471	11-16	16-21	10.3-12.3	16-22	145-155	360-380	22-27	10-15	45.0	45.0

*Based on 15% methanol antifreeze solution

Table 15b: Size 038 Two-Stage HFC-410A Typical Unit Operating Pressures and Temperatures

Entering Water Temp °F	Water Flow GPM	Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
		Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	2.5	125-135	210-230	15-20	13-18	40.0	17-23	67-77	274-294	8-13	1-6	8.3-10.3	15-21
	2.5	125-135	210-230	15-20	13-18	40.0	17-23	71-81	278-298	9-14	1-6	6.2-8.2	16-22
	2.5	125-135	210-230	15-20	13-18	40.0	17-23	75-85	282-302	9-14	1-6	4.0-6.0	16-22
50	4.5	125-135	216-236	15-20	13-18	21.0-23.0	17-23	95-105	304-324	11-16	1-6	10.7-12.7	21-27
	4.9	125-135	210-230	15-20	13-18	20.0	17-23	100-110	308-328	12-17	1-6	7.9-8.9	21-27
	4.9	125-135	210-230	15-20	13-18	20.0	17-23	104-114	311-331	12-17	1-6	5.2-7.2	21-27
70	4.5	130-140	290-310	14-19	15-20	20.4-22.4	17-23	123-133	331-351	14-19	1-6	13.5-15.5	26-32
	6.75	130-140	274-294	14-19	12-18	15.1-17.1	17-23	127-137	335-355	16-21	1-6	10.1-12.1	26-32
	9	129-139	256-276	14-19	9-14	9.7-11.7	17-23	132-142	340-360	17-22	1-6	6.7-8.7	26-32
90	4.5	137-147	410-430	14-19	17-22	19.6-21.6	15-21	142-152	350-370	20-25	1-6	25.0	30-36
	6.75	137-147	390-410	14-19	14-19	14.5-16.5	15-21	142-152	350-370	20-25	1-6	25.0	30-36
	9	137-147	370-390	13-18	11-16	9.3-11.3	15-21	142-152	350-370	20-25	1-6	25.0	30-36
110	4.5	141-151	476-496	13-18	17-22	19.2-21.2	15-21	142-152	350-370	20-25	1-6	45.0	30-36
	6.75	141-151	457-477	13-18	14-19	14.1-16.1	15-21	142-152	350-370	20-25	1-6	45.0	30-36
	9	141-151	439-459	13-18	11-16	9.0-11.0	15-21	142-152	350-370	20-25	1-6	45.0	30-36

*Based on 15% methanol antifreeze solution

Unit Operating Conditions

Table 15c: Size 049 Two-Stage HFC-410A Typical Unit Operating Pressures and Temperatures

Entering Water Temp °F	Water Flow GPM	Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
		Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	3.1	117-127	222-242	16-21	12-17	40.0	17-23	63-73	277-297	9-14	2-7	8.2-10.2	15-21
	3.1	117-127	222-242	16-21	12-17	40.0	17-23	66-76	280-300	10-15	2-7	6.1-8.1	15-21
	3.1	117-127	222-242	16-21	12-17	40.0	17-23	68-78	285-305	11-16	2-7	4.0-6.0	16-22
50	6	118-128	224-244	16-21	12-17	19.9-21.9	17-23	96-106	312-332	16-21	2-7	10.9-12.9	20-26
	6.2	117-127	222-242	16-21	12-17	20.0	17-23	100-110	316-336	16-21	2-7	8.1-10.1	21-27
	6.2	117-127	222-242	16-21	12-17	20.0	17-23	103-113	320-340	17-22	2-7	5.4-7.4	21-27
70	6	125-130	300-320	15-20	13-18	19.5-21.5	16-22	120-130	339-359	27-32	3-8	13.6-15.6	25-31
	9	125-130	280-300	15-20	10-15	14.4-16.4	16-22	122-132	341-361	27-32	3-8	10.1-12.1	25-31
	12	123-133	260-180	15-20	7-12	9.3-11.3	16-22	124-134	344-364	27-32	3-8	6.5-8.5	25-31
90	6	132-142	419-439	15-20	15-20	19.0-21.0	15-21	138-148	359-379	40-45	4-9	25.0	27-33
	9	130-140	396-419	15-20	12-17	13.8-15.8	15-21	138-148	359-379	40-45	4-9	25.0	27-33
	12	129-139	374-394	15-20	9-14	8.8-10.8	15-21	138-148	359-379	40-45	4-9	25.0	27-33
110	6	137-147	490-510	15-20	16-21	16-21	14-20	138-148	359-379	40-45	4-9	45.0	27-33
	9	135-145	464-484	15-20	13-18	13-18	14-20	138-148	359-379	40-45	4-9	45.0	27-33
	12	133-143	442-462	15-20	10-15	10-15	14-20	138-148	359-379	40-45	4-9	45.0	27-33

*Based on 15% methanol antifreeze solution

Table 15d: Size 064 Two-Stage HFC-410A Typical Unit Operating Pressures and Temperatures

Entering Water Temp °F	Water Flow GPM	Full Load Cooling - without HWG active						Full Load Heating - without HWG active					
		Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
30*	3.8	118-128	222-242	15-20	10-15	40.0	20-26	65-75	286-306	7-12	2-8	8.0-10.0	18-24
	3.8	118-128	222-242	15-20	10-15	40.0	20-26	69-79	290-310	7-12	2-8	7.0-9.0	18-24
	3.8	118-128	222-242	15-20	10-15	40.0	20-26	71-81	290-310	7-12	2-8	4.0-6.0	18-24
50	7.5	118-128	223-243	15-20	10-15	19.4-21.4	20-26	98-108	323-343	6-11	3-8	10.6-12.6	24-30
	7.6	118-128	222-242	15-20	10-15	20.0	20-26	102-112	323-343	7-12	3-8	7.9-9.9	24-30
	7.6	118-128	222-242	15-20	10-15	20.0	20-26	105-115	330-350	8-13	3-8	5.2-7.2	24-30
70	7.5	125-135	290-310	11-16	14-19	19.0-21.0	19-25	126-136	355-375	11-16	4-9	13.4-15.4	29-35
	11.25	125-135	280-300	11-16	11-16	13.9-15.9	19-25	130-140	360-380	13-18	4-9	10.0-12.0	29-35
	15	124-134	260-280	13-18	8-13	9.0-11.0	19-25	134-144	367-387	15-20	4-9	6.5-8.5	29-35
90	7.5	132-142	420-440	10-15	19-24	18.3-20.3	18-24	142-152	370-390	20-25	4-9	25.0	32-38
	11.25	131-141	410-430	10-15	16-21	13.4-15.4	18-24	142-152	370-390	20-25	4-9	25.0	32-38
	15	130-140	400-420	11-16	14-19	9.0-11.0	18-24	142-152	370-390	20-25	4-9	25.0	32-38
110	7.5	18-24	490-510	8-13	22-27	17.9-19.9	18-24	142-152	370-390	20-25	4-9	45.0	32-38
	11.25	18-24	490-510	9-14	20-25	13.1-15.1	18-24	142-152	370-390	20-25	4-9	45.0	32-38
	15	18-24	490-510	10-15	18-23	8.3-10.3	18-24	142-152	370-390	20-25	4-9	45.0	32-38

*Based on 15% methanol antifreeze solution

Table 16: Antifreeze Correction Table

Antifreeze Type	Antifreeze %	Cooling			WPD Corr. Fct. EWT 40°F
		EWT 40°F			
		Total Cap	Sens Cap	Power	
Propylene Glycol	15	0.968	0.968	0.990	1.210
	25	0.947	0.947	0.983	1.360
Methanol	15	0.968	0.968	0.990	1.160
	25	0.949	0.949	0.984	1.220
Ethanol	15	0.944	0.944	0.983	1.300
	25	0.917	0.917	0.974	1.360
Ethylene Glycol	15	0.980	0.980	0.994	1.120
	25	0.966	0.966	0.990	1.200

Table 17a: Performance Data — TES/TEP Model 026 with TAH-Full Load

950 CFM Nominal (Rated) Airflow Heating, 850 CFM Nominal (Rated) Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	Cooling - EAT 80/67°F												Heating - EAT 70°F											
	GPM	WPD		CFM	TC	SC	kW	HR	EER	LWT	TTS HWC	TTP HWC	GPM	WPD		CFM	HC	kW	HE	COP	LAT	LWT	TTS HWC	TTP HWC
		PSI	FT											PSI	FT									
20	1.4	0.6	1.4	690	28.9	17.9	1.16	32.9	25.0	70.0	1.4	1.3	6.0	3.7	8.6	770	15.8	1.54	10.5	3.0	89.0	16.5	1.5	1.5
	1.4	0.6	1.4	850	29.8	20.0	1.22	33.9	24.4	70.0	1.4	1.3	6.0	3.7	8.6	950	16.1	1.46	11.2	3.2	85.7	16.3	1.6	1.5
30	1.7	0.5	1.1	690	28.9	17.9	1.16	32.9	25.0	70.0	1.3	1.3	3.0	1.1	2.5	770	18.0	1.58	12.6	3.3	91.6	21.6	1.6	1.6
	1.7	0.5	1.2	850	29.8	20.0	1.22	33.9	24.4	70.0	1.4	1.3	3.0	1.1	2.5	950	18.4	1.50	13.3	3.6	88.0	21.1	1.7	1.6
	1.7	0.5	1.2	690	28.9	17.9	1.16	32.9	25.0	70.0	1.3	1.3	4.5	2.0	4.6	770	19.1	1.59	13.6	3.5	92.9	23.9	1.8	1.7
	1.7	0.5	1.2	850	29.8	20.0	1.22	33.9	24.4	70.0	1.4	1.3	4.5	2.0	4.6	950	19.5	1.51	14.4	3.8	89.0	23.6	1.9	1.8
	1.7	0.5	1.2	690	28.9	17.9	1.16	32.9	25.0	70.0	1.3	1.3	6.0	3.1	7.1	770	19.6	1.60	14.2	3.6	93.6	25.3	1.8	1.7
	1.7	0.5	1.2	850	29.8	20.0	1.22	33.9	24.4	70.0	1.4	1.3	6.0	3.1	7.1	950	20.1	1.52	14.9	3.9	89.6	25.0	1.9	1.8
40	2.3	0.5	1.2	690	28.9	17.9	1.16	32.9	25.0	70.0	1.3	1.2	3.0	0.9	2.0	770	21.2	1.62	15.7	3.8	95.5	29.6	2.0	1.9
	2.3	0.5	1.2	850	29.8	20.0	1.22	33.9	24.4	70.0	1.4	1.3	3.0	0.9	2.0	950	21.7	1.54	16.4	4.1	91.1	29.0	2.1	2.0
	2.3	0.5	1.2	690	28.9	17.9	1.16	32.9	25.0	70.0	1.3	1.2	4.5	1.6	3.8	770	22.3	1.64	16.7	4.0	96.9	32.6	2.1	2.0
	2.3	0.5	1.2	850	29.8	20.0	1.22	33.9	24.4	70.0	1.4	1.3	4.5	1.6	3.8	950	22.9	1.56	17.5	4.3	92.3	32.2	2.2	2.1
	2.3	0.5	1.2	690	28.9	17.9	1.16	32.9	25.0	70.0	1.3	1.2	6.0	2.6	6.0	770	22.9	1.65	17.3	4.1	97.6	34.2	2.2	2.1
	2.3	0.5	1.2	850	29.8	20.0	1.22	33.9	24.4	70.0	1.4	1.3	6.0	2.6	6.0	950	23.5	1.57	18.1	4.4	92.9	34.0	2.3	2.2
50	3.0	0.7	1.6	690	28.7	17.8	1.20	32.8	24.0	71.8	1.5	1.4	3.0	0.7	1.6	770	24.0	1.67	18.3	4.2	98.9	37.8	2.4	2.3
	3.0	0.7	1.6	850	29.5	19.9	1.26	33.8	23.4	72.5	1.5	1.4	3.0	0.7	1.6	950	24.6	1.59	19.1	4.5	93.9	37.2	2.5	2.4
	3.4	0.8	1.8	690	28.9	17.9	1.16	32.9	25.0	70.0	1.3	1.3	4.5	1.4	3.2	770	25.1	1.70	19.3	4.3	100.2	41.4	2.5	2.4
	3.4	0.8	1.8	850	29.8	20.0	1.22	33.9	24.4	70.0	1.4	1.3	4.5	1.4	3.2	950	25.7	1.61	20.2	4.7	95.1	41.0	2.6	2.5
	3.4	0.8	1.8	690	28.9	17.9	1.16	32.9	25.0	70.0	1.3	1.3	6.0	2.3	5.2	770	24.4	1.68	18.6	4.2	99.3	43.8	2.6	2.5
	3.4	0.8	1.8	850	29.8	20.0	1.22	33.9	24.4	70.0	1.4	1.3	6.0	2.3	5.2	950	25.0	1.60	19.5	4.6	94.3	38.5	2.7	2.6
60	3.0	0.7	1.6	690	27.6	17.4	1.32	32.1	20.9	81.4	1.8	1.7	3.0	0.7	1.5	770	26.4	1.73	20.5	4.5	101.8	46.3	2.7	2.6
	3.0	0.7	1.6	850	28.4	19.5	1.39	33.1	20.4	82.1	1.9	1.8	3.0	0.7	1.5	950	27.1	1.64	21.5	4.8	96.4	45.7	2.8	2.7
	4.5	1.3	3.0	690	28.4	17.7	1.23	32.6	23.2	74.5	1.5	1.5	4.5	1.3	2.9	770	27.5	1.75	21.6	4.6	103.1	50.4	2.9	2.8
	4.5	1.3	3.0	850	29.3	19.8	1.29	33.7	22.7	75.0	1.6	1.5	4.5	1.3	2.9	950	28.2	1.66	22.5	5.0	97.5	50.0	3.0	2.9
	6.0	2.0	4.6	690	28.8	17.8	1.18	32.8	24.5	70.9	1.4	1.3	6.0	2.0	4.7	770	28.1	1.76	22.1	4.7	103.8	52.6	3.0	2.9
	6.0	2.0	4.6	850	29.6	19.9	1.24	33.9	23.9	71.3	1.4	1.3	6.0	2.0	4.7	950	28.8	1.67	23.1	5.1	98.0	52.3	3.1	2.9
70	3.0	0.6	1.4	690	26.3	17.0	1.47	31.3	17.9	90.9	2.3	2.2	3.0	0.6	1.5	770	28.6	1.77	22.6	4.7	104.4	55.0	3.1	2.9
	3.0	0.6	1.4	850	27.1	19.0	1.55	32.4	17.5	91.6	2.4	2.3	3.0	0.6	1.5	950	29.3	1.68	23.5	5.1	98.5	54.3	3.2	3.0
	4.5	1.2	2.8	690	27.3	17.3	1.36	31.9	20.1	84.2	1.9	1.8	4.5	1.2	2.7	770	29.7	1.80	23.5	4.8	105.7	59.5	3.3	3.1
	4.5	1.2	2.8	850	28.1	19.3	1.43	32.9	19.6	84.6	2.0	1.9	4.5	1.2	2.7	950	30.4	1.71	24.5	5.2	99.6	59.1	3.4	3.2
	6.0	1.9	4.4	690	27.7	17.5	1.31	32.2	21.1	80.7	1.8	1.7	6.0	1.9	4.4	770	30.2	1.81	24.1	4.9	106.4	62.0	3.4	3.2
	6.0	1.9	4.4	850	28.5	19.5	1.38	33.2	20.7	81.1	1.9	1.8	6.0	1.9	4.4	950	30.9	1.72	25.1	5.3	100.2	61.6	3.5	3.3
80	3.0	0.7	1.6	690	25.0	16.5	1.64	30.6	15.2	100.4	3.0	2.9	3.0	0.7	1.5	770	30.5	1.82	24.3	4.9	106.7	63.8	3.4	3.2
	3.0	0.7	1.6	850	25.7	18.4	1.73	31.6	14.8	101.0	3.1	2.9	3.0	0.7	1.5	950	31.3	1.73	25.4	5.3	100.5	63.1	3.5	3.3
	4.5	1.2	2.8	690	25.9	16.8	1.52	31.1	17.1	93.8	2.5	2.4	3.4	0.8	1.8	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	4.5	1.2	2.8	850	26.7	18.8	1.60	32.1	16.7	94.3	2.6	2.5	3.4	0.8	1.8	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
	6.0	1.8	4.2	690	26.4	17.0	1.45	31.4	18.2	90.5	2.3	2.2	3.4	0.8	1.8	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	6.0	1.8	4.2	850	27.2	19.0	1.53	32.4	17.8	90.8	2.4	2.3	3.4	0.8	1.8	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
90	3.0	0.7	1.6	690	23.6	15.9	1.84	29.9	12.8	110.0	3.7	3.5	2.1	0.5	1.2	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	3.0	0.7	1.6	850	25.3	18.2	1.79	31.4	14.1	110.6	3.3	3.1	2.1	0.5	1.2	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
	4.5	1.2	2.8	690	24.5	16.3	1.70	30.3	14.4	103.5	3.2	3.0	2.1	0.5	1.2	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	4.5	1.2	2.8	850	25.3	18.2	1.79	31.4	14.1	103.9	3.3	3.1	2.1	0.5	1.2	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
	6.0	1.8	4.2	690	25.0	16.5	1.63	30.6	15.3	100.2	2.9	2.8	2.1	0.5	1.2	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	6.0	1.8	4.2	850	25.7	18.4	1.72	31.6	15.0	100.5	3.0	2.9	2.1	0.5	1.2	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
100	3.0	0.7	1.6	690	22.5	15.4	2.08	29.6	10.8	119.8	4.5	4.2	1.5	0.4	0.9	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	3.0	0.7	1.6	850	23.2	17.2	2.19	30.7	10.6	120.4	4.6	4.4	1.5	0.4	0.9	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
	4.5	1.2	2.8	690	23.3	15.8	1.91	29.8	12.2	113.2	3.9	3.7	1.5	0.4	0.9	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	4.5	1.2	2.8	850	23.9	17.6	2.01	30.8	11.9	113.7	4.0	3.8	1.5	0.4	0.9	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
	6.0	1.8	4.2	690	23.7	15.9	1.83	29.9	12.9	110.0	3.7	3.5	1.5	0.4	0.9	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	6.0	1.8	4.2	850	24.4	17.8	1.93	31.0	12.6	110.3	3.8	3.6	1.5	0.4	0.9	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
110	3.0	0.7	1.6	690	21.8	15.1	2.37	29.8	9.2	129.9	5.3	5.1	1.1	0.3	0.7	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	3.0	0.7	1.6	850	22.4	16.8	2.49	30.9	9.0	130.6	5.5	5.2	1.1	0.3	0.7	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
	4.5	1.1	2.5	690	22.2	15.3	2.17	29.6	10.3	123.2	4.7	4.5	1.1	0.3	0.7	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	4.5	1.1	2.5	850	22.9	17.1	2.28	30.7	10.0	123.6	4.9	4.7	1.1	0.3	0.7	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
	6.0	1.7	3.9	690	22.6	15.4	2.07	29.6	10.9	119.9	4.5	4.2	1.1	0.3	0.7	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	6.0	1.7	3.9	850	23.2	17.2	2.18	30.6	10.6	120.2	4.6	4.4	1.1	0.3	0.7	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
120	3.0	0.5	1.2	690	21.6	14.9	2.72	30.8	7.9	140.6	6.3	6.0	0.9	0.1	0.2	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	3.0	0.5	1.2	850	22.2	16.7	2.86	31.9	7.8	141.3	6.5	6.2	0.9	0.1	0.2	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
	4.5	1.0	2.3	690	21.6	15.0	2.47	30.1	8.8	133.4	5.6	5.3	0.9	0.1	0.2	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	4.5	1.0	2.3	850	22.3	16.7	2.60	31.1	8.6	133.8	5.8	5.5	0.9	0.1	0.2	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4
	6.0	1.7	3.9	690	21.8	15.1	2.36	29.8	9.2	129.9	5.3	5.1	0.9	0.1	0.2	770	31.0	1.83	24.7	5.0	107.2	65.0	3.5	3.3
	6.0	1.7	3.9	850	22.4	16.8	2.48	30.9	9.0	130.3	5.5	5.2	0.9	0.1	0.2	950	31.7	1.74	25.8	5.3	100.9	65.0	3.6	3.4

Interpolation is permissable, extrapolation is not. All performance data is based upon the lower voltage of dual voltage rated units. See performance correction tables for operating conditions other than those listed above. Data shown is for units equipped with vFlow technology, flow is controlled to maintain a minimum LWT 70 F degrees in cooling and maximum 65 F degrees in heating. Contact the factory for performance data of non-vFlow units.

Table 17b: Performance Data — TES/TEP Model 038 with TAH- Full Load

1000 CFM Nominal Airflow Heating, 1000 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	Cooling - EAT 80/67°F												Heating - EAT 70°F											
	GPM	WPD PSI	WPD FT	CFM	TC	SC	kW	HR	EER	LWT	TTS HWC	TTP HWC	GPM	WPD PSI	WPD FT	CFM	HC	kW	HE	COP	LAT	LWT	TTS HWC	TTP HWC
20	2.0	1.4	3.3	1010	41.9	25.8	1.68	47.6	24.9	70.0	1.8	1.7	9.0	8.3	19.2	1010	23.9	2.12	16.7	3.3	91.9	16.3	2.0	1.9
	2.0	1.4	3.3	1250	43.1	28.8	1.77	49.1	24.3	70.0	1.9	1.8	9.0	8.3	19.2	1250	24.5	2.01	17.6	3.6	88.1	16.1	2.1	2.0
30	2.5	1.2	2.7	1010	41.9	25.8	1.68	47.6	24.9	70.0	1.8	1.7	4.5	2.6	6.0	1010	26.0	2.15	18.7	3.6	93.9	21.7	2.3	2.2
	2.5	1.2	2.7	1250	43.1	28.8	1.77	49.1	24.3	70.0	1.9	1.8	4.5	2.6	6.0	1250	26.6	2.04	19.7	3.8	89.7	21.3	2.4	2.3
	2.5	1.2	2.7	1010	41.9	25.8	1.68	47.6	24.9	70.0	1.8	1.7	6.8	4.6	10.6	1010	27.1	2.17	19.7	3.7	94.9	24.2	2.5	2.4
	2.5	1.2	2.7	1250	43.1	28.8	1.77	49.1	24.3	70.0	1.9	1.8	6.8	4.6	10.6	1250	27.7	2.06	20.7	3.9	90.6	23.9	2.6	2.5
	2.5	1.2	2.7	1010	41.9	25.8	1.68	47.6	24.9	70.0	1.8	1.7	9.0	6.9	16.0	1010	27.7	2.18	20.2	3.7	95.4	25.5	2.5	2.4
	2.5	1.2	2.7	1250	43.1	28.8	1.77	49.1	24.3	70.0	1.9	1.8	9.0	6.9	16.0	1250	28.3	2.07	21.3	4.0	91.0	25.3	2.6	2.5
40	3.3	1.3	2.9	1010	41.9	25.8	1.68	47.6	24.9	70.0	1.8	1.7	4.5	2.0	4.7	1010	29.5	2.21	21.9	3.9	97.0	30.2	2.8	2.7
	3.3	1.3	2.9	1250	43.1	28.8	1.77	49.1	24.3	70.0	1.9	1.8	4.5	2.0	4.7	1250	30.2	2.10	23.0	4.2	92.4	29.8	2.9	2.8
	3.3	1.3	2.9	1010	41.9	25.8	1.68	47.6	24.9	70.0	1.8	1.7	6.8	3.8	8.8	1010	30.7	2.24	23.1	4.0	98.2	33.2	3.0	2.9
	3.3	1.3	2.9	1250	43.1	28.8	1.77	49.1	24.3	70.0	1.9	1.8	6.8	3.8	8.8	1250	31.5	2.13	24.2	4.3	93.3	32.9	3.1	2.9
	3.3	1.3	2.9	1010	41.9	25.8	1.68	47.6	24.9	70.0	1.8	1.7	9.0	5.9	13.6	1010	31.4	2.25	23.7	4.1	98.8	34.7	3.1	2.9
	3.3	1.3	2.9	1250	43.1	28.8	1.77	49.1	24.3	70.0	1.9	1.8	9.0	5.9	13.6	1250	32.1	2.14	24.8	4.4	93.8	34.5	3.2	3.0
50	4.5	1.7	3.9	1010	41.7	25.7	1.70	47.5	24.5	71.1	1.8	1.7	4.5	1.7	3.9	1010	32.9	2.29	25.1	4.2	100.2	38.8	3.3	3.1
	4.5	1.7	3.9	1250	42.9	28.8	1.79	49.0	24.0	71.8	1.9	1.8	4.5	1.7	3.9	1250	33.7	2.17	26.3	4.6	95.0	38.3	3.4	3.2
	4.9	1.9	4.5	1010	41.9	25.8	1.68	47.6	24.9	70.0	1.8	1.7	6.8	3.3	7.6	1010	34.3	2.32	26.4	4.3	101.5	42.2	3.5	3.3
	4.9	1.9	4.5	1250	43.1	28.8	1.77	49.1	24.3	70.0	1.9	1.8	6.8	3.3	7.6	1250	35.1	2.20	27.6	4.7	96.0	41.9	3.6	3.4
	4.9	1.9	4.5	1010	41.9	25.8	1.68	47.6	24.9	70.0	1.8	1.7	9.0	5.2	11.9	1010	35.0	2.34	27.0	4.4	102.1	44.0	3.6	3.4
	4.9	1.9	4.5	1250	43.1	28.8	1.77	49.1	24.3	70.0	1.9	1.8	9.0	5.2	11.9	1250	35.8	2.22	28.3	4.7	96.6	43.7	3.7	3.5
60	4.5	1.5	3.5	1010	40.5	25.5	1.87	46.9	21.7	80.9	2.5	2.4	4.5	1.5	3.5	1010	36.2	2.36	28.2	4.5	103.2	47.5	3.8	3.6
	4.5	1.5	3.5	1250	41.7	28.5	1.97	48.4	21.2	81.5	2.6	2.5	4.5	1.5	3.5	1250	37.1	2.24	29.4	4.9	97.5	46.9	3.9	3.7
	6.8	2.9	6.8	1010	41.4	25.7	1.75	47.4	23.7	74.0	2.0	1.9	6.8	2.9	6.8	1010	37.7	2.40	29.5	4.6	104.6	51.2	4.0	3.8
	6.8	2.9	6.8	1250	42.6	28.7	1.84	48.9	23.2	74.5	2.1	2.0	6.8	2.9	6.8	1250	38.6	2.28	30.8	5.0	98.6	50.9	4.1	3.9
	9.0	4.7	10.8	1010	41.8	25.8	1.69	47.6	24.7	70.6	1.8	1.7	9.0	4.7	10.8	1010	38.5	2.41	30.2	4.7	105.3	53.3	4.1	3.9
	9.0	4.7	10.8	1250	43.0	28.8	1.78	49.1	24.2	70.9	1.9	1.8	9.0	4.7	10.8	1250	39.4	2.29	31.6	5.0	99.2	53.0	4.2	4.0
70	4.5	1.5	3.4	1010	39.1	25.1	2.07	46.2	18.9	90.5	3.3	3.1	4.5	1.5	3.4	1010	39.4	2.43	31.1	4.7	106.1	56.2	4.3	4.0
	4.5	1.5	3.4	1250	40.2	28.0	2.18	47.7	18.5	91.2	3.4	3.2	4.5	1.5	3.4	1250	40.3	2.31	32.4	5.1	99.9	55.6	4.4	4.2
	6.8	2.8	6.4	1010	40.2	25.4	1.93	46.7	20.8	83.8	2.7	2.6	6.8	2.8	6.4	1010	40.9	2.47	32.4	4.8	107.5	60.4	4.5	4.2
	6.8	2.8	6.4	1250	41.3	28.4	2.03	48.2	20.4	84.3	2.8	2.7	6.8	2.8	6.4	1250	41.9	2.35	33.8	5.2	101.0	60.0	4.6	4.4
	9.0	4.4	10.1	1010	40.7	25.5	1.86	47.0	21.8	80.4	2.4	2.3	9.0	4.4	10.1	1010	41.6	2.50	33.1	4.9	108.2	62.6	4.5	4.3
	9.0	4.4	10.1	1250	41.8	28.5	1.96	48.5	21.3	80.8	2.5	2.4	9.0	4.4	10.1	1250	42.6	2.37	34.5	5.3	101.6	62.3	4.7	4.5
80	4.5	1.5	3.4	1010	37.5	24.5	2.30	45.3	16.3	100.1	4.2	4.0	4.5	1.5	3.4	1010	42.3	2.51	33.7	4.9	108.8	65.0	4.6	4.4
	4.5	1.5	3.4	1250	38.6	27.4	2.42	46.8	15.9	100.8	4.3	4.1	4.5	1.5	3.4	1250	43.3	2.38	35.2	5.3	102.1	64.4	4.8	4.6
	6.8	2.7	6.2	1010	38.6	24.9	2.14	45.9	18.1	93.6	3.6	3.4	4.7	1.6	3.6	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	6.8	2.7	6.2	1250	39.8	27.8	2.25	47.4	17.7	94.1	3.7	3.5	4.7	1.6	3.6	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
	9.0	4.2	9.7	1010	39.2	25.1	2.06	46.2	19.0	90.3	3.2	3.0	4.7	1.6	3.6	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	9.0	4.2	9.7	1250	40.3	28.0	2.17	47.7	18.6	90.6	3.3	3.1	4.7	1.6	3.6	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
90	4.5	1.5	3.5	1010	35.7	23.9	2.57	44.5	13.9	109.8	5.2	5.0	2.8	0.9	2.0	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	4.5	1.5	3.5	1250	38.0	27.2	2.50	46.5	15.2	110.4	4.7	4.5	2.8	0.9	2.0	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
	6.8	2.7	6.2	1010	36.9	24.3	2.38	45.0	15.6	103.3	4.5	4.3	2.8	0.9	2.0	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	6.8	2.7	6.2	1250	38.0	27.2	2.50	46.5	15.2	103.8	4.7	4.5	2.8	0.9	2.0	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
	9.0	4.1	9.5	1010	37.5	24.6	2.29	45.4	16.4	100.1	4.2	4.0	2.8	0.9	2.0	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	9.0	4.1	9.5	1250	38.6	27.4	2.41	46.8	16.0	100.4	4.3	4.1	2.8	0.9	2.0	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
100	4.5	1.5	3.4	1010	33.9	23.3	2.87	43.7	11.8	119.4	6.4	6.1	2.0	0.6	1.4	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	4.5	1.5	3.4	1250	34.9	26.1	3.02	45.2	11.5	120.1	6.6	6.3	2.0	0.6	1.4	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
	6.8	2.7	6.1	1010	35.1	23.7	2.66	44.2	13.2	113.1	5.6	5.3	2.0	0.6	1.4	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	6.8	2.7	6.1	1250	36.1	26.5	2.80	45.7	12.9	113.5	5.8	5.5	2.0	0.6	1.4	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
	9.0	4.1	9.4	1010	35.7	24.0	2.56	44.5	14.0	109.9	5.2	5.0	2.0	0.6	1.4	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	9.0	4.1	9.4	1250	36.8	26.8	2.69	46.0	13.7	110.2	5.4	5.1	2.0	0.6	1.4	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
110	4.5	1.4	3.2	1010	32.1	22.8	3.21	43.0	10.0	129.1	7.8	7.4	1.6	0.3	0.8	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	4.5	1.4	3.2	1250	33.0	25.4	3.38	44.5	9.8	129.8	8.1	7.7	1.6	0.3	0.8	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
	6.8	2.6	5.9	1010	33.3	23.1	2.98	43.4	11.2	122.9	6.9	6.5	1.6	0.3	0.8	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	6.8	2.6	5.9	1250	34.2	25.9	3.14	44.9	10.9	123.3	7.1	6.7	1.6	0.3	0.8	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
	9.0	4.0	9.2	1010	33.9	23.3	2.87	43.7	11.8	119.7	6.5	6.2	1.6	0.3	0.8	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	9.0	4.0	9.2	1250	34.9	26.1	3.02	45.2	11.5	120.0	6.7	6.4	1.6	0.3	0.8	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
120	4.5	1.1	2.6	1010	30.3	22.3	3.60	42.6	8.4	138.9	9.4	8.9	1.3	0.1	0.1	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	4.5	1.1	2.6	1250	31.2	24.9	3.79	44.1	8.2	139.6	9.7	9.2	1.3	0.1	0.1	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
	6.8	2.4	5.5	1010	31.5	22.6	3.34	42.9	9.4	132.7	8.3	7.9	1.3	0.1	0.1	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	6.8	2.4	5.5	1250	32.4	25.2	3.52	44.4	9.2	133.1	8.6	8.2	1.3	0.1	0.1	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7
	9.0	3.9	8.9	1010	32.0	22.8	3.22	43.0	10.0	129.6	7.8	7.4	1.3	0.1	0.1	1010	42.5	2.52	33.9	4.9	108.9	65.0	4.7	4.5
	9.0	3.9	8.9	1250	33.0	25.4	3.39	44.5	9.7	129.9	8.1	7.7	1.3	0.1	0.1	1250	43.5	2.39	35.3	5.3	102.2	65.0	4.9	4.7

Interpolation is permissable, extrapolation is not. All performance data is based upon the lower voltage of dual voltage rated units. See performance correction tables for operating conditions other than those listed above. Data shown is for units equipped with vFlow technology, flow is controlled to maintain a minimum LWT 70 F degrees in cooling and maximum 65 F degrees in heating. Contact the factory for performance data of non-vFlow units.

Table 17c: Performance Data — TES/TEP Model 049 with TAH- Full Load

1650 CFM Nominal (Rated) Airflow Heating, 1550 CFM Nominal (Rated) Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	Cooling - EAT 80/67°F												Heating - EAT 70°F											
	GPM	WPD		CFM	TC	SC	kW	HR	EER	LWT	TTS HWC	TTP HWC	GPM	WPD		CFM	HC	kW	HE	COP	LAT	LWT	TTS HWC	TTP HWC
		PSI	FT											PSI	FT									
20	2.5	0.2	0.5	1250	52.3	31.6	2.33	60.2	22.5	70.0	2.2	2.1	12.0	5.3	12.1	1340	33.0	3.15	22.2	3.1	92.8	16.3	3.2	3.0
	2.5	0.2	0.5	1550	53.8	35.3	2.45	62.1	22.0	70.0	2.3	2.2	12.0	5.3	12.1	1650	33.7	2.99	23.5	3.3	88.9	16.1	3.3	3.1
30	3.1	0.2	0.5	1250	52.3	31.6	2.33	60.2	22.5	70.0	2.2	2.1	6.0	1.2	2.8	1340	36.0	3.19	25.1	3.3	94.9	21.6	3.4	3.2
	3.1	0.2	0.4	1550	53.8	35.3	2.45	62.1	22.0	70.0	2.3	2.2	6.0	1.2	2.8	1650	36.9	3.03	26.5	3.6	90.7	21.2	3.5	3.3
	3.1	0.2	0.4	1250	52.3	31.6	2.33	60.2	22.5	70.0	2.2	2.1	9.0	2.8	6.4	1340	37.6	3.21	26.6	3.4	96.0	24.1	3.4	3.2
	3.1	0.2	0.4	1550	53.8	35.3	2.45	62.1	22.0	70.0	2.3	2.2	9.0	2.8	6.4	1650	38.5	3.05	28.1	3.7	91.6	23.8	3.5	3.3
	3.1	0.2	0.4	1250	52.3	31.6	2.33	60.2	22.5	70.0	2.2	2.1	12.0	4.7	10.8	1340	38.4	3.22	27.4	3.5	96.5	25.4	3.5	3.3
	3.1	0.2	0.4	1550	53.8	35.3	2.45	62.1	22.0	70.0	2.3	2.2	12.0	4.7	10.8	1650	39.3	3.06	28.9	3.8	92.1	25.2	3.6	3.4
40	4.1	0.3	0.8	1250	52.3	31.6	2.33	60.2	22.5	70.0	2.2	2.1	6.0	1.0	2.3	1340	40.9	3.25	29.8	3.7	98.3	30.1	3.6	3.4
	4.1	0.3	0.8	1550	53.8	35.3	2.45	62.1	22.0	70.0	2.3	2.2	6.0	1.0	2.3	1650	41.9	3.09	31.4	4.0	93.5	29.5	3.7	3.5
	4.1	0.3	0.8	1250	52.3	31.6	2.33	60.2	22.5	70.0	2.2	2.1	9.0	2.4	5.6	1340	42.7	3.29	31.5	3.8	99.5	33.0	3.7	3.5
	4.1	0.3	0.8	1550	53.8	35.3	2.45	62.1	22.0	70.0	2.3	2.2	9.0	2.4	5.6	1650	43.7	3.12	33.1	4.1	94.5	32.7	3.8	3.6
	4.1	0.3	0.8	1250	52.3	31.6	2.33	60.2	22.5	70.0	2.2	2.1	12.0	4.2	9.7	1340	43.6	3.30	32.4	3.9	100.2	34.6	3.8	3.6
	4.1	0.3	0.8	1550	53.8	35.3	2.45	62.1	22.0	70.0	2.3	2.2	12.0	4.2	9.7	1650	44.7	3.13	34.0	4.2	95.1	34.3	3.9	3.7
50	6.0	0.9	2.0	1250	52.2	31.6	2.34	60.2	22.3	70.1	2.3	2.2	6.0	0.9	2.0	1340	45.6	3.33	34.3	4.0	101.5	38.6	3.9	3.7
	6.0	0.9	2.0	1550	53.7	35.3	2.46	62.1	21.8	70.7	2.4	2.3	6.0	0.9	2.0	1650	46.7	3.16	35.9	4.3	96.2	38.0	4.0	3.8
	6.2	0.9	2.2	1250	52.3	31.6	2.33	60.2	22.5	70.0	2.2	2.1	9.0	2.2	5.1	1340	47.5	3.36	36.1	4.1	102.8	42.0	4.0	3.8
	6.2	0.9	2.2	1550	53.8	35.3	2.45	62.1	22.0	70.0	2.3	2.2	9.0	2.2	5.1	1650	48.6	3.19	37.8	4.5	97.3	41.6	4.1	3.9
	6.2	0.9	2.2	1250	52.3	31.6	2.33	60.2	22.5	70.0	2.2	2.1	12.0	3.9	9.0	1340	48.5	3.38	37.0	4.2	103.5	43.8	4.1	3.9
	6.2	0.9	2.2	1550	53.8	35.3	2.45	62.1	22.0	70.0	2.3	2.2	12.0	3.9	9.0	1650	49.7	3.21	38.7	4.5	97.9	43.6	4.2	4.0
60	6.0	0.8	1.8	1250	51.0	31.2	2.56	59.7	20.0	79.9	2.8	2.7	6.0	0.8	1.9	1340	50.0	3.41	38.4	4.3	104.6	47.2	4.3	4.0
	6.0	0.8	1.8	1550	52.5	34.9	2.69	61.7	19.5	80.6	2.9	2.8	6.0	0.8	1.9	1650	51.2	3.24	40.1	4.6	98.7	46.6	4.4	4.2
	9.0	2.0	4.7	1250	51.9	31.5	2.40	60.1	21.6	73.4	2.4	2.3	9.0	2.0	4.7	1340	51.9	3.45	40.1	4.4	105.9	51.1	4.4	4.1
	9.0	2.0	4.7	1550	53.4	35.2	2.53	62.0	21.1	73.8	2.5	2.4	9.0	2.0	4.7	1650	53.2	3.28	42.0	4.7	99.8	50.7	4.5	4.3
	12.0	3.6	8.4	1250	52.3	31.6	2.34	60.2	22.4	70.0	2.2	2.1	12.0	3.6	8.4	1340	52.9	3.47	41.1	4.5	106.6	53.2	4.5	4.2
	12.0	3.6	8.4	1550	53.8	35.3	2.46	62.2	21.9	70.4	2.3	2.2	12.0	3.6	8.4	1650	54.2	3.30	42.9	4.8	100.4	52.8	4.6	4.4
70	6.0	0.8	1.8	1250	49.3	30.6	2.82	59.0	17.5	89.7	3.6	3.4	6.0	0.8	1.8	1340	54.0	3.50	42.1	4.5	107.3	56.0	4.6	4.4
	6.0	0.8	1.8	1550	50.7	34.2	2.97	60.9	17.1	90.3	3.7	3.5	6.0	0.8	1.8	1650	55.3	3.32	43.9	4.9	101.0	55.4	4.8	4.6
	9.0	2.0	4.5	1250	50.5	31.1	2.64	59.5	19.1	83.2	3.0	2.9	9.0	2.0	4.5	1340	55.8	3.54	43.7	4.6	108.6	60.3	4.8	4.6
	9.0	2.0	4.5	1550	52.0	34.7	2.78	61.5	18.7	83.7	3.1	2.9	9.0	2.0	4.5	1650	57.1	3.36	45.7	5.0	102.1	59.9	5.0	4.8
	12.0	3.5	8.1	1250	51.1	31.3	2.56	59.8	20.0	80.0	2.8	2.7	12.0	3.5	8.1	1340	56.7	3.56	44.6	4.7	109.2	62.6	4.9	4.7
	12.0	3.5	8.1	1550	52.5	34.9	2.69	61.7	19.5	80.3	2.9	2.8	12.0	3.5	8.1	1650	58.0	3.38	46.5	5.0	102.6	62.2	5.1	4.8
80	6.0	0.8	1.8	1250	47.2	29.7	3.13	57.9	15.1	99.3	4.4	4.1	6.0	0.8	1.8	1340	57.4	3.58	45.2	4.7	109.7	64.9	5.0	4.8
	6.0	0.8	1.8	1550	48.6	33.2	3.29	59.8	14.8	99.9	4.5	4.3	6.0	0.8	1.8	1650	58.8	3.40	47.2	5.1	103.0	64.3	5.2	4.9
	9.0	1.9	4.4	1250	48.7	30.3	2.92	58.6	16.7	93.0	3.8	3.6	6.3	0.9	2.1	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	9.0	1.9	4.4	1550	50.1	33.9	3.07	60.6	16.3	98.6	3.9	3.7	6.3	0.9	2.1	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
	12.0	3.4	7.9	1250	49.4	30.6	2.81	58.9	17.6	89.8	3.5	3.3	6.3	0.9	2.1	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	12.0	3.4	7.9	1550	50.8	34.2	2.96	60.9	17.2	90.1	3.6	3.4	6.3	0.9	2.1	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
90	6.0	0.8	1.9	1250	44.8	28.6	3.49	56.7	12.8	108.9	5.4	5.1	3.8	0.3	0.7	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	6.0	0.8	1.9	1550	47.8	32.8	3.41	59.4	14.0	109.5	4.9	4.7	3.8	0.3	0.7	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
	9.0	1.9	4.4	1250	46.4	29.3	3.24	57.5	14.3	102.8	4.7	4.5	3.8	0.3	0.7	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	9.0	1.9	4.4	1550	47.8	32.8	3.41	59.4	14.0	103.2	4.9	4.7	3.8	0.3	0.7	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
	12.0	3.3	7.7	1250	47.2	29.7	3.13	57.9	15.1	99.6	4.5	4.2	3.8	0.3	0.7	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	12.0	3.3	7.7	1550	48.6	33.2	3.29	59.8	14.8	100.0	4.6	4.4	3.8	0.3	0.7	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
100	6.0	0.8	1.9	1250	42.1	27.4	3.90	55.4	10.8	118.5	6.7	6.3	2.7	0.2	0.4	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	6.0	0.8	1.9	1550	43.3	30.6	4.11	57.3	10.5	119.1	6.9	6.6	2.7	0.2	0.4	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
	9.0	1.9	4.3	1250	43.9	28.2	3.63	56.2	12.1	112.5	5.9	5.6	2.7	0.2	0.4	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	9.0	1.9	4.3	1550	45.1	31.5	3.82	58.2	11.8	112.9	6.1	5.8	2.7	0.2	0.4	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
	12.0	3.3	7.6	1250	44.7	28.6	3.50	56.6	12.8	109.4	5.5	5.2	2.7	0.2	0.4	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	12.0	3.3	7.6	1550	46.0	31.9	3.68	58.6	12.5	109.8	5.7	5.4	2.7	0.2	0.4	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
110	6.0	0.8	1.8	1250	39.2	26.2	4.38	54.2	9.0	128.1	8.2	7.8	2.1	0.1	0.3	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	6.0	0.8	1.8	1550	40.4	29.3	4.61	56.1	8.8	128.7	8.5	8.1	2.1	0.1	0.3	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
	9.0	1.8	4.3	1250	41.1	27.0	4.08	55.0	10.1	122.2	7.3	6.9	2.1	0.1	0.3	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	9.0	1.8	4.3	1550	42.2	30.1	4.29	56.9	9.8	122.6	7.5	7.1	2.1	0.1	0.3	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
	12.0	3.3	7.5	1250	42.0	27.4	3.92	55.4	10.7	119.2	6.8	6.4	2.1	0.1	0.3	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	12.0	3.3	7.5	1550	43.2	30.6	4.13	57.3	10.5	119.5	7.0	6.7	2.1	0.1	0.3	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
120	6.0	0.7	1.6	1250	36.3	24.9	4.94	53.1	7.3	137.7	10.1	9.6	1.7	0.1	0.3	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	6.0	0.7	1.6	1550	37.3	27.9	5.20	55.1	7.2	138.4	10.4	9.9	1.7	0.1	0.3	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
	9.0	1.8	4.1	1250	38.1	25.7	4.59	53.8	8.3	131.9	8.8	8.4	1.7	0.1	0.3	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	9.0	1.8	4.1	1550	39.2	28.7	4.83	55.7	8.1	132.4	9.1	8.6	1.7	0.1	0.3	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1
	12.0	3.2	7.4	1250	39.0	26.1	4.42	54.1	8.8	129.0	8.3	7.9	1.7	0.1	0.3	1340	57.7	3.58	45.4	4.7	109.8	65.0	5.2	5.0
	12.0	3.2	7.4	1550	40.2	29.2	4.65	56.0	8.6	129.3	8.6	8.2	1.7	0.1	0.3	1650	59.0	3.40	47.4	5.1	103.1	65.0	5.4	5.1

Interpolation is permissable, extrapolation is not. All performance data is based upon the lower voltage of dual voltage rated units. See performance correction tables for operating conditions other than those listed above. Data shown is for units equipped with vFlow technology, flow is controlled to maintain a minimum LWT 70 F degrees in cooling and maximum 65 F degrees in heating. Contact the factory for performance data of non-vFlow units.

Table 17d: Performance Data — TES/TEP Model 064 - Full Load

2050 CFM Nominal (Rated) Airflow Heating, 1825 CFM Nominal (Rated) Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	Cooling - EAT 80/67°F												Heating - EAT 70°F											
	GPM	WPD PSI	WPD FT	CFM	TC	SC	kW	HR	EER	LWT	TTS HWC	TTP HWC	GPM	WPD PSI	WPD FT	CFM	HC	kW	HE	COP	LAT	LWT	TTS HWC	TTP HWC
20	3.0	0.1	0.2	1480	63.4	39.5	2.92	73.3	21.7	70.0	2.7	2.6	15.0	7.3	16.8	1660	41.0	3.92	27.6	3.1	92.9	16.3	3.7	3.5
	3.0	0.1	0.2	1825	65.2	44.1	3.07	75.7	21.2	70.0	2.8	2.7	15.0	7.3	16.8	2050	42.0	3.72	29.3	3.3	89.0	16.1	3.8	3.6
30	3.8	0.1	0.2	1480	63.4	39.5	2.92	73.3	21.7	70.0	2.7	2.6	7.5	1.7	3.9	1660	44.6	3.99	31.0	3.3	94.9	21.7	3.9	3.7
	3.8	0.1	0.2	1825	65.2	44.1	3.07	75.7	21.2	70.0	2.8	2.7	7.5	1.7	3.9	2050	45.7	3.79	32.7	3.5	90.6	21.3	4.0	3.8
	3.8	0.1	0.2	1480	63.4	39.5	2.92	73.3	21.7	70.0	2.7	2.6	11.3	3.7	8.6	1660	46.5	4.03	32.7	3.4	95.9	24.2	4.0	3.8
	3.8	0.1	0.2	1825	65.2	44.1	3.07	75.7	21.2	70.0	2.8	2.7	11.3	3.7	8.6	2050	47.5	3.83	34.5	3.6	91.5	23.9	4.1	3.9
	3.8	0.1	0.2	1480	63.4	39.5	2.92	73.3	21.7	70.0	2.7	2.6	15.0	6.1	14.1	1660	47.4	4.06	33.6	3.4	96.5	25.5	4.0	3.8
	3.8	0.1	0.2	1825	65.2	44.1	3.07	75.7	21.2	70.0	2.8	2.7	15.0	6.1	14.1	2050	48.6	3.86	35.4	3.7	91.9	25.3	4.1	3.9
40	5.0	0.1	0.2	1480	63.4	39.5	2.92	73.3	21.7	70.0	2.7	2.6	7.5	1.2	2.7	1660	50.6	4.14	36.5	3.6	98.2	30.3	4.2	4.0
	5.0	0.1	0.2	1825	65.2	44.1	3.07	75.7	21.2	70.0	2.8	2.7	7.5	1.2	2.7	2050	51.8	3.93	38.4	3.9	93.4	29.8	4.3	4.1
	5.0	0.1	0.2	1480	63.4	39.5	2.92	73.3	21.7	70.0	2.7	2.6	11.3	3.1	7.1	1660	52.7	4.19	38.4	3.7	99.4	33.2	4.3	4.0
	5.0	0.1	0.2	1825	65.2	44.1	3.07	75.7	21.2	70.0	2.8	2.7	11.3	3.1	7.1	2050	54.0	3.98	40.4	4.0	94.4	32.8	4.4	4.2
	5.0	0.1	0.2	1480	63.4	39.5	2.92	73.3	21.7	70.0	2.7	2.6	15.0	5.3	12.2	1660	53.9	4.22	39.5	3.7	100.1	34.7	4.4	4.1
	5.0	0.1	0.2	1825	65.2	44.1	3.07	75.7	21.2	70.0	2.8	2.7	15.0	5.3	12.2	2050	55.1	4.01	41.5	4.0	94.9	34.5	4.5	4.3
50	7.5	0.9	2.0	1480	63.3	39.5	2.93	73.3	21.6	69.5	2.7	2.6	7.5	0.9	2.0	1660	56.5	4.29	41.8	3.9	101.5	38.8	4.5	4.2
	7.5	0.9	2.0	1825	65.1	44.1	3.08	75.7	21.2	70.2	2.8	2.7	7.5	0.9	2.0	2050	57.8	4.07	43.9	4.2	96.1	38.3	4.6	4.4
	7.6	0.9	2.1	1480	63.4	39.5	2.92	73.3	21.7	70.0	2.7	2.6	11.3	2.6	6.1	1660	58.8	4.35	44.0	4.0	102.8	42.2	4.6	4.4
	7.6	0.9	2.1	1825	65.2	44.1	3.07	75.7	21.2	70.0	2.8	2.7	11.3	2.6	6.1	2050	60.2	4.13	46.1	4.3	97.2	41.8	4.8	4.6
	7.6	0.9	2.1	1480	63.4	39.5	2.92	73.3	21.7	70.0	2.7	2.6	15.0	4.7	10.8	1660	60.0	4.38	45.1	4.0	103.5	44.0	4.7	4.5
	7.6	0.9	2.1	1825	65.2	44.1	3.07	75.7	21.2	70.0	2.8	2.7	15.0	4.7	10.8	2050	61.4	4.16	47.2	4.3	97.7	43.7	4.9	4.7
60	7.5	0.8	1.7	1480	61.5	39.0	3.20	72.4	19.2	79.3	3.3	3.1	7.5	0.8	1.7	1660	62.0	4.43	46.9	4.1	104.6	47.5	4.9	4.7
	7.5	0.8	1.7	1825	63.3	43.6	3.37	74.8	18.8	79.9	3.4	3.2	7.5	0.8	1.7	2050	63.5	4.21	49.1	4.4	98.7	46.9	5.1	4.8
	11.3	2.4	5.5	1480	62.7	39.4	3.01	73.0	20.8	72.9	2.8	2.7	11.3	2.4	5.5	1660	64.4	4.50	49.1	4.2	105.9	51.3	5.1	4.9
	11.3	2.4	5.5	1825	64.6	44.0	3.17	75.4	20.4	73.4	2.9	2.8	11.3	2.4	5.5	2050	65.9	4.27	51.4	4.5	99.8	50.9	5.3	5.0
	15.0	4.3	10.0	1480	63.3	39.5	2.92	73.3	21.7	69.8	2.6	2.5	15.0	4.3	10.0	1660	65.6	4.53	50.2	4.2	106.6	53.3	5.2	5.0
	15.0	4.3	10.0	1825	65.2	44.1	3.07	75.6	21.2	70.1	2.7	2.6	15.0	4.3	10.0	2050	67.2	4.30	52.5	4.6	100.3	53.0	5.4	5.1
70	7.5	0.7	1.7	1480	59.5	38.3	3.52	71.5	16.9	89.1	4.2	4.0	7.5	0.7	1.7	1660	67.1	4.57	51.5	4.3	107.4	56.3	5.3	5.1
	7.5	0.7	1.7	1825	61.2	42.8	3.71	73.8	16.5	89.7	4.3	4.1	7.5	0.7	1.7	2050	68.6	4.34	53.8	4.6	101.0	55.6	5.5	5.2
	11.3	2.3	5.3	1480	60.9	38.8	3.31	72.1	18.4	82.8	3.6	3.4	11.3	2.3	5.3	1660	69.3	4.62	53.5	4.4	108.6	60.5	5.6	5.3
	11.3	2.3	5.3	1825	62.6	43.4	3.48	74.5	18.0	83.2	3.7	3.5	11.3	2.3	5.3	2050	70.9	4.39	55.9	4.7	102.0	60.1	5.8	5.5
	15.0	4.1	9.5	1480	61.5	39.0	3.20	72.4	19.2	79.7	3.3	3.1	15.0	4.1	9.6	1660	70.4	4.65	54.5	4.4	109.2	62.7	5.7	5.4
	15.0	4.1	9.5	1825	63.3	43.6	3.37	74.8	18.8	80.0	3.4	3.2	15.0	4.1	9.6	2050	72.0	4.42	56.9	4.8	102.5	62.4	5.9	5.6
80	7.5	0.8	1.8	1480	57.1	37.3	3.92	70.4	14.5	98.8	5.2	5.0	7.5	0.8	1.8	1660	71.3	4.68	55.3	4.5	109.8	65.2	5.9	5.6
	7.5	0.8	1.8	1825	58.7	41.6	4.13	72.8	14.2	99.4	5.4	5.1	7.5	0.8	1.8	2050	73.0	4.44	57.8	4.8	103.0	64.6	6.1	5.8
	11.3	2.3	5.2	1480	58.7	37.9	3.66	71.2	16.0	92.6	4.5	4.3	7.7	0.9	2.0	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	11.3	2.3	5.2	1825	60.4	42.4	3.85	73.5	15.7	93.1	4.7	4.5	7.7	0.9	2.0	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
	15.0	4.1	9.4	1480	59.4	38.3	3.53	71.5	16.8	89.5	4.2	4.0	7.7	0.9	2.0	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	15.0	4.1	9.4	1825	61.1	42.7	3.72	73.8	16.4	89.8	4.3	4.1	7.7	0.9	2.0	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
90	7.5	0.8	1.9	1480	54.2	36.0	4.40	69.2	12.3	108.4	6.5	6.2	4.6	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	7.5	0.8	1.9	1825	57.7	41.2	4.29	72.3	13.5	109.1	5.8	5.5	4.6	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
	11.3	2.3	5.3	1480	56.1	36.8	4.08	70.0	13.8	102.4	5.6	5.3	4.6	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	11.3	2.3	5.3	1825	57.7	41.2	4.29	72.3	13.5	102.9	5.8	5.5	4.6	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
	15.0	4.0	9.3	1480	57.0	37.2	3.93	70.4	14.5	99.4	5.2	5.0	4.6	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	15.0	4.0	9.3	1825	58.6	41.6	4.14	72.7	14.2	99.7	5.4	5.1	4.6	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
100	7.5	0.9	2.0	1480	50.7	34.5	4.98	67.7	10.2	118.1	7.8	7.4	3.3	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	7.5	0.9	2.0	1825	52.2	38.5	5.24	70.1	10.0	118.7	8.1	7.7	3.3	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
	11.3	2.3	5.3	1480	53.0	35.5	4.60	68.7	11.5	112.2	7.0	6.6	3.3	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	11.3	2.3	5.3	1825	54.5	39.6	4.84	71.0	11.3	112.6	7.2	6.8	3.3	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
	15.0	4.0	9.3	1480	54.0	35.9	4.43	69.1	12.2	109.2	6.5	6.2	3.3	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	15.0	4.0	9.3	1825	55.6	40.1	4.66	71.5	11.9	109.5	6.7	6.4	3.3	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
110	7.5	0.8	1.8	1480	46.6	32.7	5.67	65.9	8.2	127.6	9.4	8.9	2.6	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	7.5	0.8	1.8	1825	47.9	36.5	5.97	68.3	8.0	128.2	9.7	9.2	2.6	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
	11.3	2.2	5.2	1480	49.2	33.8	5.23	67.0	9.4	121.9	8.4	8.0	2.6	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	11.3	2.2	5.2	1825	50.6	37.8	5.50	69.4	9.2	122.3	8.7	8.3	2.6	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
	15.0	4.0	9.2	1480	50.5	34.4	5.02	67.6	10.1	119.0	7.9	7.5	2.6	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	15.0	4.0	9.2	1825	51.9	38.4	5.28	69.9	9.8	119.3	8.2	7.8	2.6	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
120	7.5	0.6	1.3	1480	41.6	30.5	6.49	63.8	6.4	137.0	11.1	10.6	2.1	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	7.5	0.6	1.3	1825	42.8	34.0	6.83	66.1	6.3	137.6	11.5	10.9	2.1	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
	11.3	2.0	4.7	1480	44.7	31.9	5.99	65.1	7.5	131.5	10.1	9.6	2.1	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	11.3	2.0	4.7	1825	46.0	35.6	6.30	67.5	7.3	132.0	10.4	9.9	2.1	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8
	15.0	3.8	8.8	1480	46.1	32.5	5.74	65.7	8.0	128.8	9.6	9.1	2.1	0.1	0.2	1660	71.4	4.69	55.5	4.5	109.9	65.0	5.9	5.6
	15.0	3.8	8.8	1825	47.5	36.3	6.04	68.1	7.9	129.1	9.9	9.4	2.1	0.1	0.2	2050	73.1	4.45	57.9	4.8	103.0	65.0	6.1	5.8

Interpolation is permissable, extrapolation is not. All performance data is based upon the lower voltage of dual voltage rated units. See performance correction tables for operating conditions other than those listed above. Data shown is for units equipped with vFlow technology, flow is controlled to maintain a minimum LWT 70 F degrees in cooling and maximum 65 F degrees in heating. Contact the factory for performance data of non-vFlow units.