

HEAT CONTROLLER, INC.

**Installation, Operation and
Maintenance Manual**

**GeoLogix®
HTS Series Split System,
Two Stage, 2-5 Tons**

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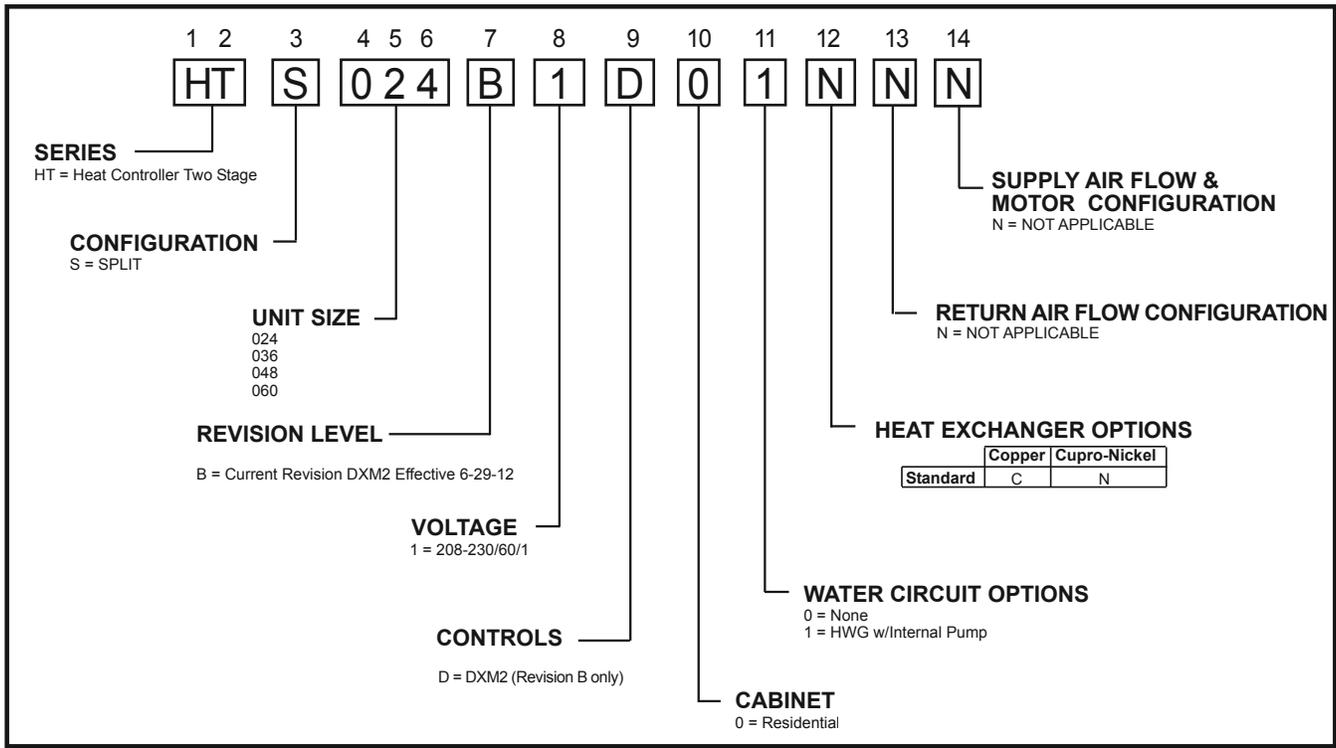
THE QUALITY LEADER IN CONDITIONING AIR

Residential Split - 60Hz R410A
Rev.: 03 August, 2012

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Model Nomenclature : for Indoor Split Series



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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! Verify refrigerant type before proceeding. Units are shipped with R-410A refrigerants. The unit label will indicate which refrigerant is provided. The EarthPure® Application and Service Manual should be read and understood before attempting to service refrigerant circuits with R-410A

⚠ WARNING! ⚠

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

⚠ 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. Horizontal equipment is designed for installation above false ceiling or in a ceiling plenum. Other unit configurations are typically installed in a mechanical room. The installation site chosen should include adequate service clearance around the unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check the system before operation.

Prepare units for installation as follows:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Keep the cabinet covered with the original packaging until installation is complete and all plastering, painting, etc. is finished.
3. Verify refrigerant tubing is free of kinks or dents and that it does not touch other unit components.

4. Inspect all electrical connections. Connections must be clean and tight at the terminals.
5. Loosen compressor bolts on units equipped with compressor spring vibration isolation until the compressor rides freely on the springs. Remove shipping restraints.
6. Locate and verify any hot water generator (HWG) or other accessory kit located in the compressor section.

⚠ CAUTION! ⚠

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.

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Equipment Selection

NOTICE! AHRI matched systems are required for warranty and applicable federal tax credits.

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.

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 R-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 - HTS GeoLogix®

HCI split system heat pumps are rated in the AHRI directory with a specific indoor coil match. GeoLogix® (HTS) models are rated with Heat Controller WDG Series air handlers and MWG Series coils as shown in Table 1a. Other brands of air handlers may attain the same AHRI ratings providing that the specifications meet or exceed those listed in Table 1a AND Table 1b. However, for warranty and federal tax credits, an AHRI matched system is required. An ECM motor and TXV is required. Cap tubes and fixed orifices are not acceptable. PSC fans may be used if matched to Table 1b, but will not meet AHRI ratings. If using PSC fan, compressor section must be operated as a single stage unit (i.e. wired for either 1st stage or 2nd stage). Without the ability to vary the airflow, supply air temperatures may not be acceptable if the compressor is allowed to change stages when used with a PSC fan motor.

Table 1a: WDG/MWG Indoor Section Matches for AHRI Ratings

Compressor Section Model	024	036	048	060
Indoor Section Model	024	036	048	060
Refrigerant	HFC-410A			
Metering Device	TXV (required)			
Air Coil Type	N	N	N	N
Rows	2	2	2	3
Dimensions	14 x 17	24 x 17	24 x 17	24 x 17
Cabinet Configuration	Upflow/Downflow/Horizontal (Multipoise)			
WDG Series Fan Motor Type - HP	ECM - 1/2	ECM - 1/2	ECM - 1	ECM - 1

Table 1b: Tranquility®27 Air Handler Characteristics for Brands other than Above Models

Model*	Nominal Tons*	Evaporator Temp (°F)	CFM	Capacity (MBtuh)**
024 - Part Load	1.5	50	530	19.2 - 22.4
024 - Full Load	2.0	52	880	24.2 - 28.2
036 - Part Load	2.5	51	700	25.2 - 29.2
036 - Full Load	3.0	50	1200	34.5 - 40.1
048 - Part Load	3.5	47	1000	34.3 - 39.9
048 - Full Load	4.0	48	1650	46.3 - 53.8
060 - Full Load	5.0	48	1850	54.5 - 63.3

* Nominal tons are at AHRI/ISO 13256-1 GLHP conditions. Two-stage units may be operated in single-stage mode if desired, where smaller capacity is required. For example, a model 024 may be used as a 1-1/2 ton unit if "locked" into 1st stage operation only. If PSC fan is used, unit must be "locked" into either 1st or 2nd stage. An ECM fan is required for two-stage operation and for AHRI ratings. Size air handler for "Full Load" if operating in two-stage mode.

**When selecting an air handler based upon the above conditions, choose entering WB temperature of 67°F. Use evaporator temperature, CFM and capacity requirements as listed above. The air handler capacity must be at least at the minimum capacity shown in the table in order for the AHRI rating condition to be valid. See Figure 1 for an example selection.

Equipment Selection

Air Handler Selection Example

Figure 1 shows a typical performance table for a heat pump air handler. Suppose the evaporator temperature required is 50°F, the capacity required is 35,000 Btuh and the airflow required is 1,200 CFM. Each evaporator temperature listed in the table shows three wet bulb temperatures. As recommended in the table notes above, select the 67°F WB column. At 1,200 CFM, the model 003 capacity is 36 MBtuh, which is higher than the minimum capacity required of 35,000 Btuh. In this example, model 003 would be the appropriate match.

Figure 1: Selecting Air Handler

UNIT SIZE	EVAPORATOR AIR CFM BF	COIL REFRIGERANT TEMPERATURE (°F)														
		35			40			45			50			55		
		Evaporator Air — Entering Wet-Bulb Temperature (°F)														
003	800	72	67	62	72	67	62	72	67	62	72	67	62	72	67	62
	0.20	59	48	38	53	42	32	46	35	24	39	27	20	30	18	16
	1000	68	56	45	61	49	37	54	41	29	45	32	25	35	22	20
	0.22	32	34	37	29	31	33	26	28	28	23	24	25	19	20	20
	1200	75	62	49	68	54	42	60	45	34	50	36	29	40	25	23
005	1400	35	39	42	32	36	38	29	32	33	26	28	29	22	23	23
	0.27	80	67	54	73	59	46	64	49	38	54	39	32	43	28	27
	750	38	43	47	35	39	43	32	36	37	28	32	32	24	26	27
	0.04	61	49	39	55	43	33	48	37	27	41	29	20	33	21	17
	950	27	27	28	24	25	25	21	22	22	18	18	18	15	15	15
006	1150	74	60	48	67	53	40	59	45	33	50	35	25	39	24	21
	0.06	32	34	35	29	30	31	25	26	27	22	23	23	18	18	19
	1500	89	72	57	79	63	48	69	52	38	58	41	31	44	29	25
	0.07	37	39	41	33	35	36	29	31	32	25	26	27	20	22	22
	1700	103	84	66	92	73	56	81	61	46	67	48	39	52	34	31
006	0.10	43	46	49	38	41	44	34	37	39	29	32	33	25	27	27
	1050	110	89	71	99	78	60	86	65	49	72	51	42	56	37	35
	0.01	45	50	53	41	45	48	36	39	42	31	34	36	27	29	30
	1300	77	62	50	69	55	43	61	47	35	52	38	27	41	27	22
	0.02	34	36	37	31	32	33	27	28	29	23	25	24	20	20	20
006	1750	100	82	65	90	71	55	79	60	45	66	47	37	49	32	27
	0.04	42	45	47	37	40	42	33	35	37	29	31	32	23	25	24
	2050	117	96	77	106	84	65	93	71	53	78	56	46	60	40	34
	0.05	48	53	57	44	48	52	39	43	46	34	38	39	29	31	31
	2300	126	103	83	114	91	71	99	76	59	84	60	50	65	44	39
006	0.06	52	58	63	48	53	57	43	47	51	37	42	43	33	35	35
	0.06	132	108	87	119	95	75	105	80	63	88	63	54	70	47	42
		55	62	68	50	57	61	45	51	54	40	45	46	35	39	38

= Gross cooling capacity (MBtuh)
 = Sensible heat capacity (MBtuh)
 BF = Bypass factor

Installation

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

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

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 unbrazed 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 R-410A refrigerant. If line set cannot be replaced, it must be thoroughly flushed before installing new compressor section. R-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

The HTS indoor compressor section 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 2 for an illustration of a typical installation. Refer to "Physical Dimensions" section for dimensional data. Conform to the following guidelines when selecting unit location:

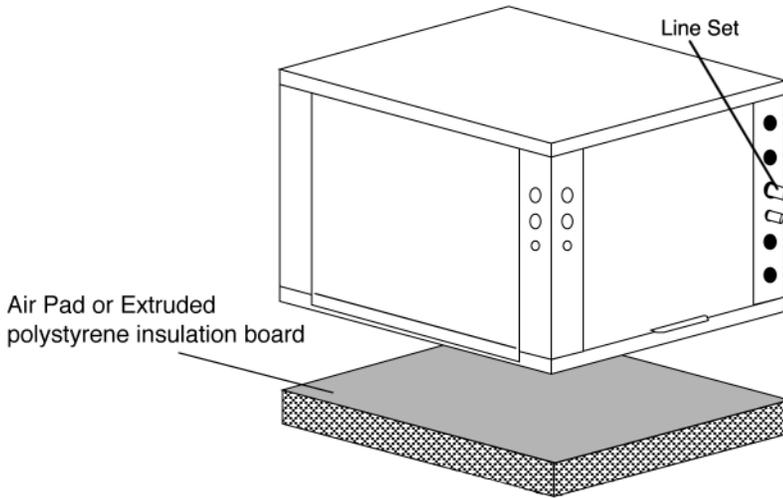
1. Install the unit on a piece of rubber, neoprene or other mounting pad material for sound isolation. The pad should be at least 3/8" [10mm] to 1/2" [13mm] in thickness. Extend the pad beyond all four edges of the unit.
2. Provide adequate clearance for maintenance and service. Do not block access panels with piping, conduit or other materials.
3. Provide access for servicing the compressor and coils without removing the unit.
4. Provide an unobstructed path to the unit within the closet or mechanical room. Space should be sufficient to allow removal of the unit, if necessary.
5. In limited side access installations, pre-removal of the control box side mounting screws will allow control box removal for future servicing (R22 units only).
6. Provide access to water valves and fittings and screwdriver access to the unit side panels and all electrical connections.

Air Handler and Coil Installation

This manual specifically addresses the compressor section of the system. Air handler and coil location and installation should be according to the instructions provided with the air handling/coil unit.

Installation

Figure 2: HTS Installation



External Flow Controller Mounting

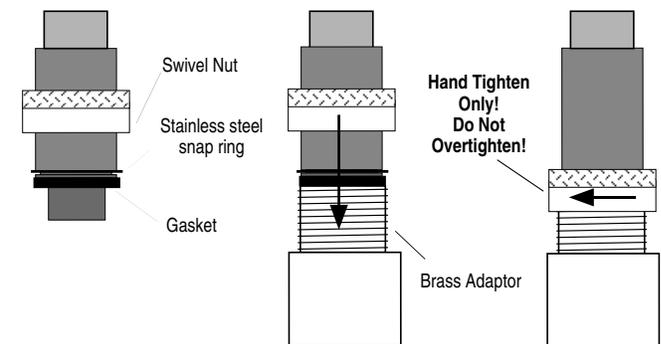
The Flow Controller can be mounted beside the unit as shown in Figure 4. Review the Flow Controller installation manual for more details.

Water Connections-Residential (Distributor) Models

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. Insure that the rubber seal is in the swivel connector prior to attempting any connection (rubber seals are shipped attached to the swivel connector). **DO NOT OVER TIGHTEN** or leaks may occur.

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 3: Water Connections (Indoor Compressor Section)



GROUND-LOOP HEAT PUMP APPLICATIONS

⚠ CAUTION! ⚠

CAUTION! The following instructions represent industry accepted installation practices for closed loop earth coupled heat pump systems. Instructions are provided to assist the contractor in installing trouble free ground loops. These instructions are recommendations only. State/provincial and local codes **MUST** be followed and installation **MUST** conform to **ALL** applicable codes. It is the responsibility of the installing contractor to determine and comply with **ALL** applicable codes and regulations.

Pre-Installation

Prior to installation, locate and mark all existing underground utilities, piping, etc. Install loops for new construction before

sidewalks, patios, driveways, and other construction has begun. During construction, accurately mark all ground loop piping on the plot plan as an aid in avoiding potential future damage to the installation.

Piping Installation

The typical closed loop ground source system is shown in Figure 3. All earth loop piping materials should be limited to polyethylene fusion only for in-ground sections of the loop. Galvanized or steel fittings should not be used at any time due to their tendency to corrode. All plastic to metal threaded fittings should be avoided due to their potential to leak in earth coupled applications. A flanged fitting should be substituted. P/T plugs should be used so that flow can be measured using the pressure drop of the unit heat exchanger.

Ground-Loop Heat Pump Applications

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

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

Flushing the Earth Loop

Once piping is completed between the unit, Flow Controller and the ground loop (Figure 4), the loop is ready for final purging and charging. A flush cart with at least a 1.5 hp [1.1 kW] pump is required to achieve enough fluid velocity in the loop piping system to purge air and dirt particles. An antifreeze solution is used in most areas to prevent freezing. All air and debris must be removed from the earth loop piping before operation. Flush the loop with a high volume of water at a minimum velocity of 2 fps (0.6 m/s) in all piping. The steps below must be followed for proper flushing.

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

Note: This fluid level drop is your only indication of air in the loop.

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

Loop static pressure will fluctuate with the seasons.

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

Antifreeze

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

Calculation is as follows:

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

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced under the water level to prevent fumes. Calculate the total volume of fluid in the piping system. Then use the percentage by volume shown in Table 2 for the amount of antifreeze needed. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

Low Water Temperature Cutout Setting - DXM2 Control

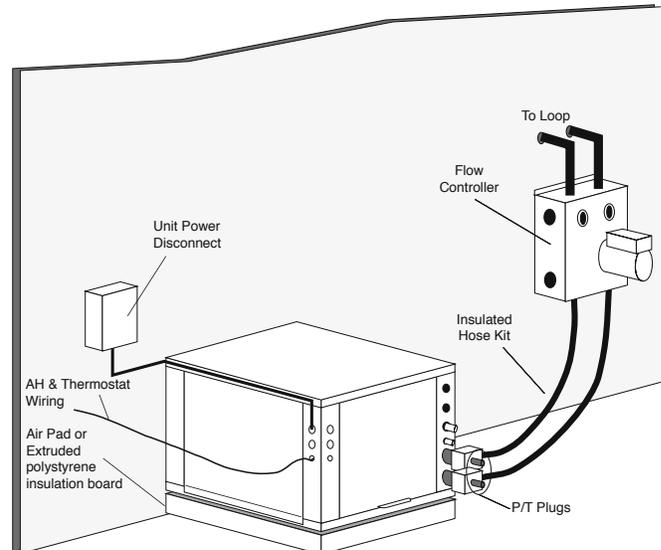
When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 13°F [-10.6°C]) set point and avoid nuisance faults (see “Low Water Temperature Cutout Selection” in this manual). **NOTE: Low water temperature operation requires extended range equipment.**

Ground-Loop Heat Pump Applications

Table 2: Approximate Fluid Volume (U.S. gal. [L]) per 100' of Pipe

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

Figure 4: Loop Connection (Indoor Compressor Section)



NOTICE! Cabinet opening around loop piping (outdoor compressor section) must be sealed to prevent entry of rodents that could potentially damage unit wiring by chewing on the insulation.

Table 3: Antifreeze Percentages by Volume

Type	Minimum Temperature for Low Temperature Protection			
	10°F [-12.2°C]	15°F [-9.4°C]	20°F [-6.7°C]	25°F [-3.9°C]
Methanol	25%	21%	16%	10%
100% USP food grade Propylene Glycol	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

* Must not be denatured with any petroleum based product

Ground-Water Heat Pump Applications -Compressor Section Only

Open Loop - Ground Water Systems ("Indoor" Compressor Section Only)

The "outdoor" version of the compressor section may not be used with open loop systems due to potential freezing of water piping. Typical open loop piping is shown in Figure 9. Shut off valves should be included for ease of servicing. Boiler drains or other valves should be "tee'd" into the lines to allow acid flushing of the heat exchanger. Shut off valves should be positioned to allow flow through the coax via the boiler drains without allowing flow into the piping system. P/T plugs should be used so that pressure drop and temperature can be measured. Piping materials should be limited to copper or PVC SCH80. Note: Due to the pressure and temperature extremes, PVC SCH40 is not recommended.

Water quantity should be plentiful and of good quality. Consult Table 4 for water quality guidelines. The unit can be ordered with either a copper or cupro-nickel water heat exchanger. Consult Table 4 for recommendations. Copper is recommended for closed loop systems and open loop ground water systems that are not high in mineral content or corrosiveness. In conditions anticipating heavy scale formation or in brackish water, a cupro-nickel heat exchanger is recommended. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, an open loop system is not recommended. Heat exchanger coils may over time lose heat exchange capabilities due to build up of mineral deposits. Heat exchangers must only be serviced by a qualified technician, as acid and special pumping equipment is required. Desuperheater coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional acid flushing. In some cases, the desuperheater option should not be recommended due to hard water conditions and additional maintenance required.

Water Quality Standards

Table 4 should be consulted for water quality requirements. Scaling potential should be assessed using the pH/Calcium hardness method. If the pH <7.5 and the Calcium hardness is less than 100 ppm, scaling potential is low. If this method yields numbers out of range of those listed, the Ryznar Stability and Langelier Saturation indices should be calculated. Use the appropriate scaling surface temperature for the application, 150°F [66°C] for direct use (well water/ open loop) and DHW (desuperheater); 90°F [32°F] for indirect use. A monitoring plan should be implemented in these probable scaling situations. Other water quality issues such as iron fouling, corrosion prevention and erosion and clogging should be referenced in Table 4.

Expansion Tank and Pump

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

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 expansion tank requirements.

Motorized Modulating Water Control Valve

Note the placement of the water control valve in figure 9. Always maintain water pressure in the heat exchanger by placing the water control valve(s) on the discharge line to prevent mineral precipitation during the off-cycle. Pilot operated slow closing valves are recommended to reduce water hammer. If water hammer persists, a mini-expansion tank can be mounted on the piping to help absorb the excess hammer shock. This valve regulates the flow using entering and leaving water delta-T of the system. Entering and leaving water temperature is read on the communicating thermostat or configuration/diagnostic service tool. Further details on valve operation are described later in this manual.

Ground-Water Heat Pump Applications

Water Coil Low Temperature Limit Setting

For all open loop systems the 30°F [-1.1°C] FP1 setting (factory setting-water) should be used to avoid freeze damage to the unit. See “Low Water Temperature Cutout Selection” in this manual for details on the low limit setting.

⚠ CAUTION! ⚠

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

To manually open the internal modulating motorized water valve in HTS024 - 048 push down on the handle to unlock it. Then rotate the handle to the open position as shown in Figure 9a. 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 HTS060, push down on the lock release button while turning the handle to the open position as shown in Figure 9a. 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 9: Water Well Connections

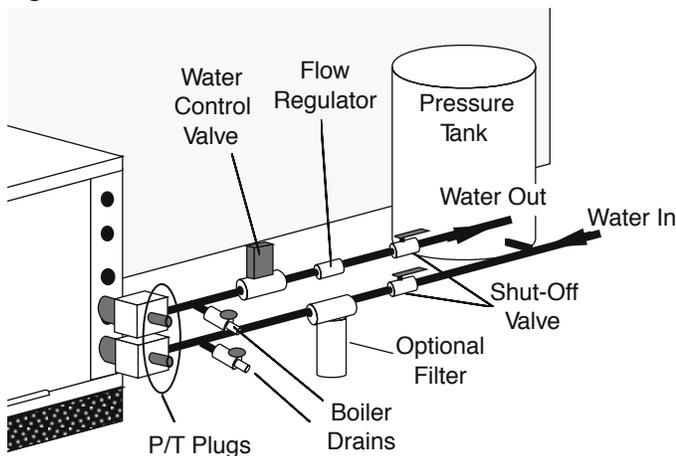
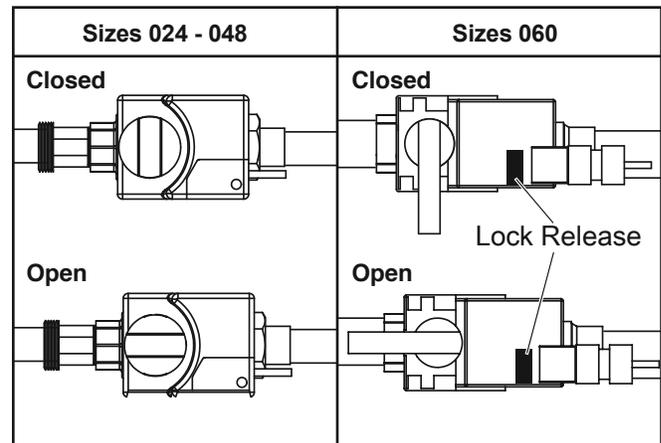


Figure 9a: Optional Modulating Motorized Valve Positions



Optional Modulating Motorized Valve - For Open Loop Applications

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.

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.

Water Quality Standards

Table 4: 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 ₂ S)	All	-	<0.5 ppm At H ₂ S>0.2 ppm, avoid use of copper and copper nickel piping or HX's. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are OK to <0.5 ppm.			
Ammonia ion as hydroxide, chloride, nitrate and sulfate compounds	All	-	<0.5 ppm			
Maximum Chloride Levels			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.			

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The Water Quality Table provides water quality requirements for coaxial heat exchangers. When water properties are outside of those 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.

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! R-410A systems operate at higher pressures than R-22 systems. Be certain that service equipment (gauges, tools, etc.) is rated for R-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 12a through 13b illustrate typical installations with the “indoor” and “outdoor” versions of the compressor section matched to either an air handler (fan coil) or add-on furnace coil. Table 4 shows typical line-set diameters at various lengths. Lineset lengths should be kept to a minimum and should always be installed with care to avoid kinking. Line sets over 60 feet [18 meters] long are not recommended due to potential oil transport problems and excessive pressure drop. 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.

A reversible heat pump filter drier is installed on the liquid line inside the compressor section cabinet (R-22 units only). R-410A models 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 linesets should be insulated with a minimum of 1/2” [13mm] thick closed cell insulation. 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 Lineset at the Compressor Section

Braze the line set to the service valve stubs as shown in Figure 10. On installations with long line sets, copper adapters may be needed to connect the larger diameter tube to the stubs. 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.”

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Refrigeration Installation

Figure 10: Braze Instructions

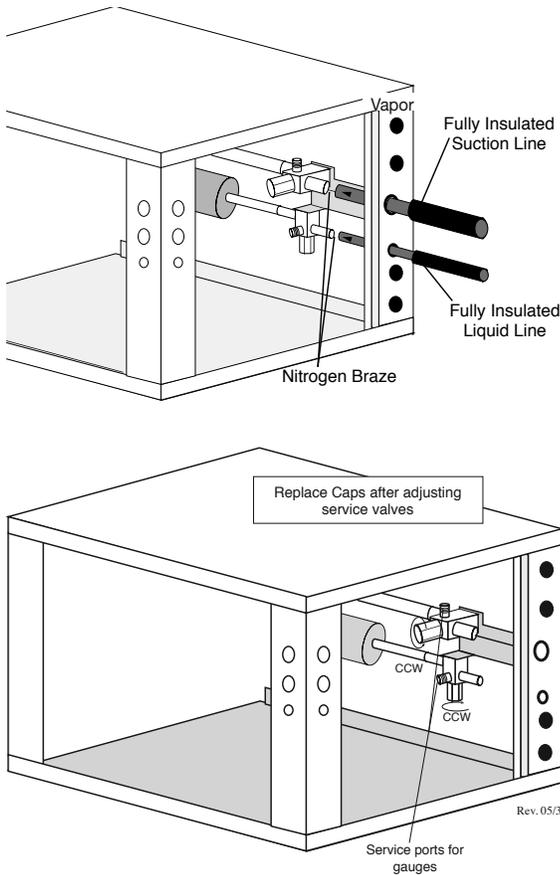


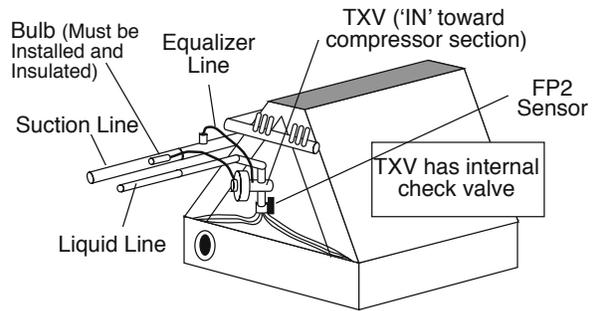
Figure 5: Service Valve Positions

Position	Description	System	Service Port
CCW - Full Out	Operation Position	Open	Closed
CCW - Full Out 1/2 turn CW	Service Position	Open	Open
CW - Full in	Shipping Position	Closed	Open

Installing the Indoor Coil and Lineset

Figure 11 shows the installation of the lineset 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 11. 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.

Figure 11: Air Coil Connection



Add-On Heat Pump Applications

The HWG Series 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 Figures 12b and 13b 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.

The TXV should be brazed into place as shown in Figure 11, keeping the “IN” side toward the compressor section. The TXV has an internal check valve and must be installed in the proper direction for operation. Always keep the valve body cool with a brazing shield and wet rags to prevent damage to the TXV. Attach the bulb to the suction line using the supplied hose clamp. Be careful not to overtighten the clamp and deform the bulb.

NOTICE! The air coil should be thoroughly washed with a filming agent, (dishwasher detergent like Cascade) to help condensate drainage. Apply a 20 to 1 solution of detergent and water. Spray both sides of coil, repeat and rinse thoroughly with water.

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.

Refrigeration Installation

Figure 12: Typical Split/Air Handler Installation (Indoor Compressor Section)

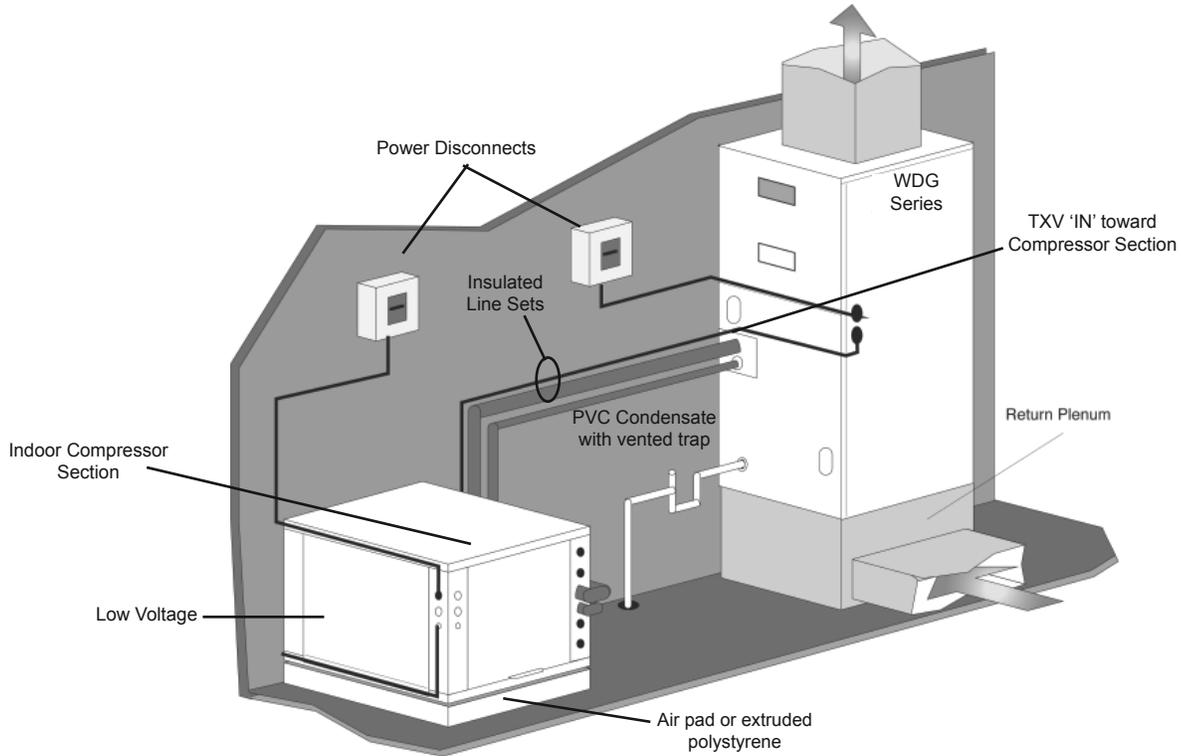
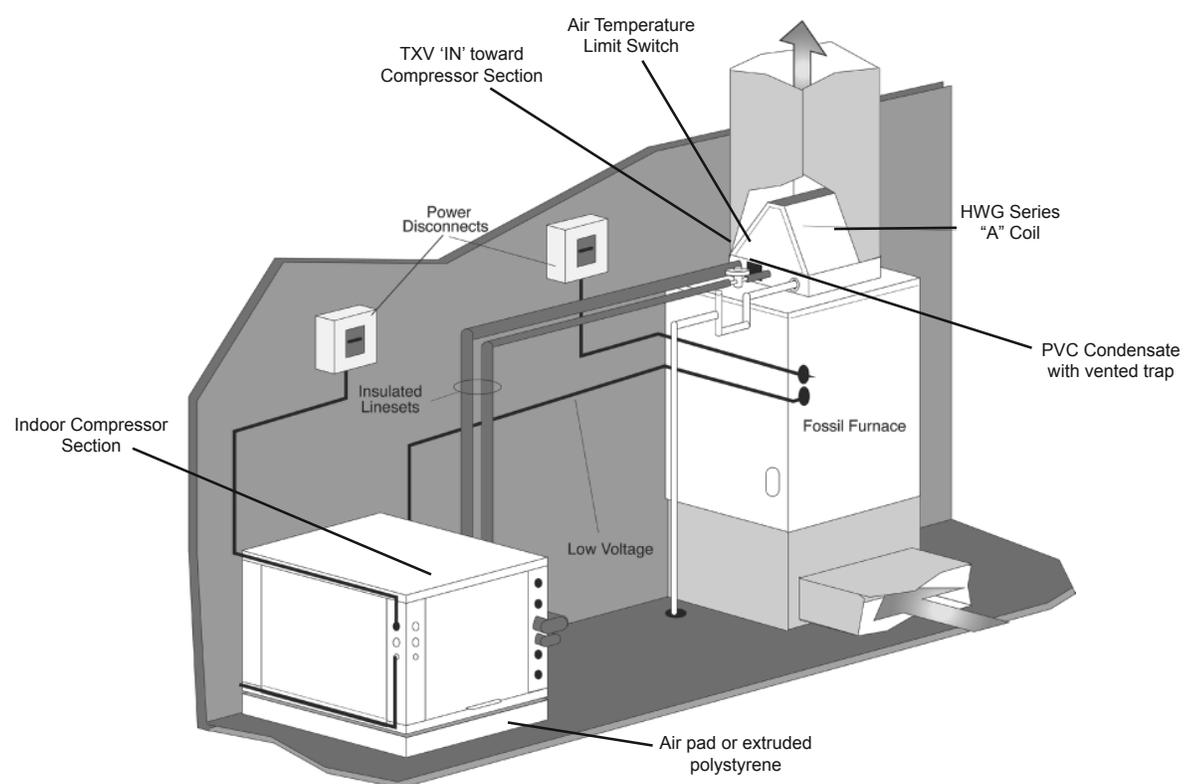


Figure 13: Typical Split/Add-on Coil Fossil Fuel Furnace Installation (Indoor Compressor Section)



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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 5) to prevent false readings on the gauge because of pressure drop through service ports. A vacuum gauge or thermistor capable of accurately measuring the vacuum depth is crucial in determining if the system is ready for charging. If the system meets the requirements in Figure 14, it is ready for charging.

Figure 14: Evacuation Graph

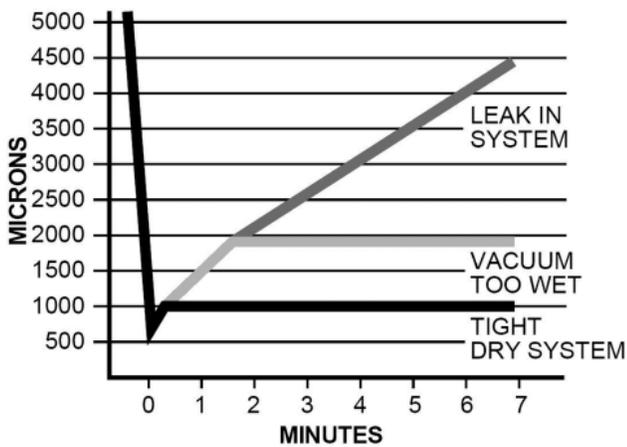


Table 6: R-410A Charging Values

▲ NOTICE! ▲

NOTICE! Use tables 14a to 15 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 4 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 1/2" line. Once the total charge is determined, the factory pre-charge (Table 4) 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 coil.

Refrigeration Installation

Turn service valves full out CCW (see Table 5) 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 14a to 15 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 14a to 15 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 60-70 psig (R-22 systems) or 100-120 psig (R-410A systems). 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 14a to 15 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 14a to 15. 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 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 14a to 15 for superheat ranges at specific entering water conditions.

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 14a to 15.
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 14a or 6b for sub-cooling values at specific entering water temperatures.

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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 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 to 125°F or 150°F. The 150°F setpoint allows more heat storage from the HWG. For example, consider the amount of heat that can be 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 16). If the electric water heater has only a single center element, the dual tank system is recommended to insure a usable entering water temperature for the HWG.

Typically a single tank of at least 50 gallons (189 liters) is used to limit installation costs and space. However, a dual tank, as shown in Figure 16, 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 4 for scaling potential tests.

Figure 15: Typical HWG Installation (Indoor Compressor Section)

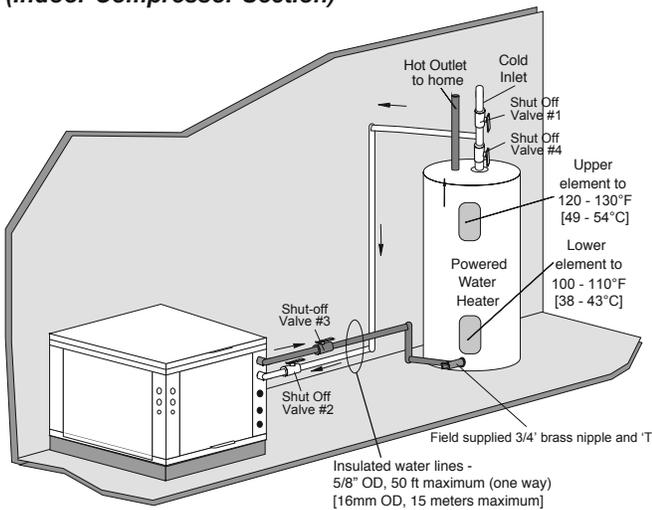
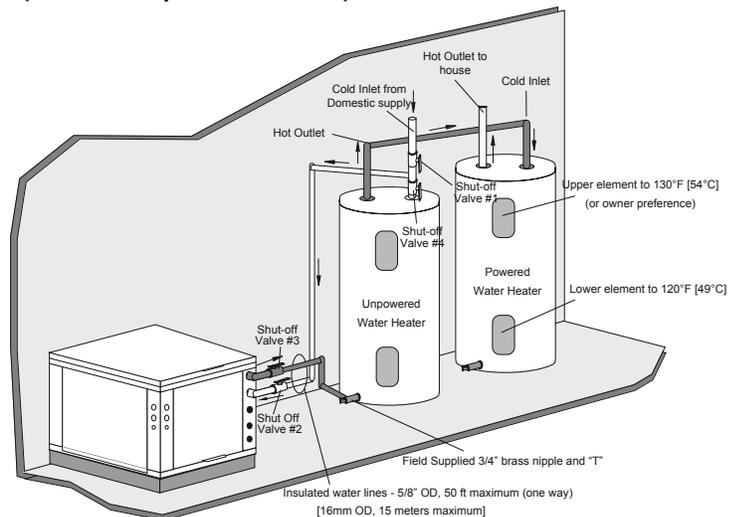


Figure 16: HWG Double Tank Installation (Indoor Compressor Section)



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:

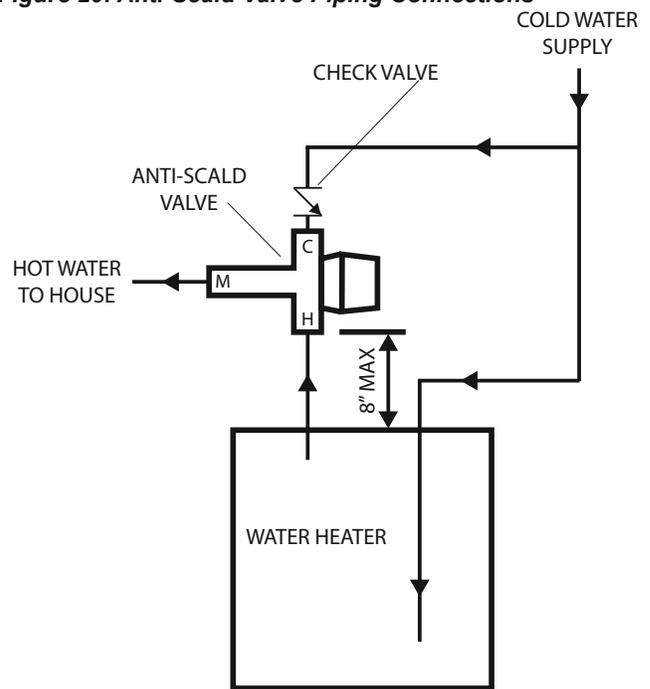
High Water Temperature (>160 °F)	5 flashes
Hot Water Sensor Fault	6 flashes
Compressor Discharge Sensor Fault	6 flashes

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

⚠ WARNING! ⚠

WARNING! USING 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 20: Anti-Scald Valve Piping Connections



⚠ WARNING! ⚠

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

The heat pump, water piping, pump, and hot water tank should be located where the ambient temperature does not fall below 50°F [10°C]. Keep water piping lengths at a minimum. DO NOT use a one way length greater than 50 ft. (one way) [15 m]. See Table 6 for recommended piping sizes and maximum lengths.

All installations must be in accordance with local codes. The installer is responsible for knowing the local requirements, and for performing the installation accordingly. DO NOT activate the HWG until "Initial Start-Up" 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.

Hot Water Generator

HWG Water Piping

- Using at least 1/2" [12.7mm] I.D. copper, route and install the water piping and valves as shown in Figures 15 or 16. 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 15 and 16) or by installing an air vent at the high point of the HWG piping system.
- Insulate all HWG water piping with no less than 3/8" [10mm] wall closed cell insulation.
- Open both shut off valves and make sure the tank drain valve is closed.

Water Tank Refill

- 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.
- Open a hot water faucet to vent air from the system until water flows from faucet; turn off faucet. Open valve #4.
- Depress the hot water tank pressure relief valve handle to ensure that there is no air remaining in the tank.
- Inspect all work for leaks.
- 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 16).
- Replace access cover(s) and restore power or fuel supply.

Initial Start-Up

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

Table 6: HWG Water Piping Sizes and Length

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

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

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

⚠ CAUTION! ⚠

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

⚠ 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.

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 21. Consult Table 7 for correct fuse size.

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.

Table 7: GeoMax 2 (HTS) Electrical Data

Model	Compressor			HWG Pump FLA	External Pump FLA	Total Unit FLA	Min Circuit Amps	Max Fuse/HACR
	RLA	LRA	Qty					
024	10.7	56.0	1	0.4	4.0	15.1	17.8	25
036	17.0	87.0	1	0.4	4.0	21.4	25.7	40
048	21.5	100.0	1	0.4	4.0	25.9	31.3	50
060	26.0	125.0	1	0.4	4.0	30.4	36.9	60

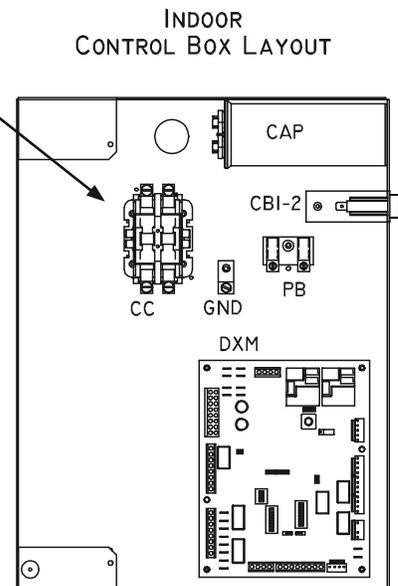
HWG Wiring - Indoor Compressor Section

The hot water generator pump power wiring is disabled at the factory to prevent operating the HWG pump "dry." After all HWG piping is completed and air purged from the water piping, the pump power wires should be applied to terminals on the HWG power block PB2 as shown in the unit wiring diagram. This connection can also serve as a HWG disable when servicing the unit.

Figure 21: R-410A Compressor Section Line Voltage Field Wiring

See unit wiring diagram for additional details.

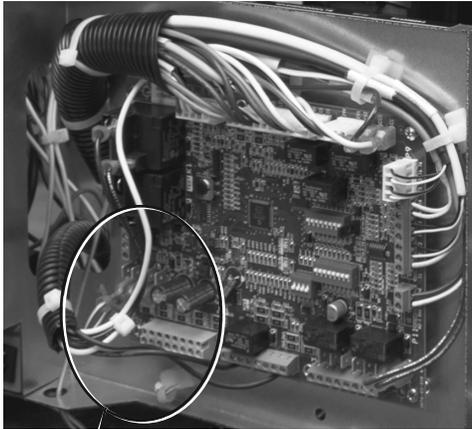
Unit Power Supply (see electrical table for wire and breaker size)



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Electrical - Low Voltage

Figure 22: HTS Low Voltage Field Wiring



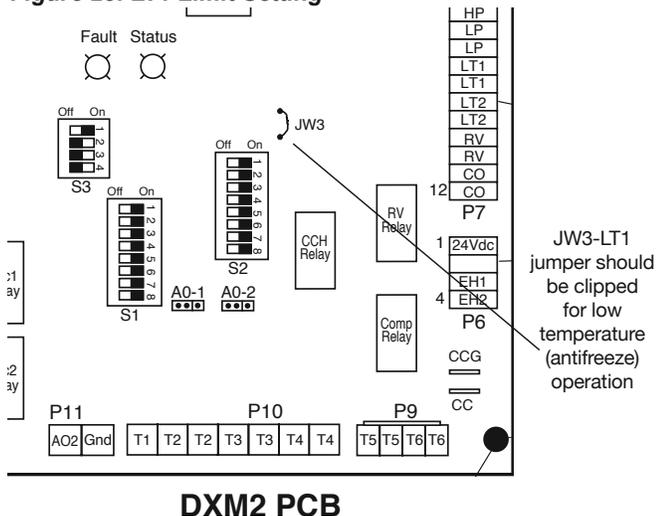
Low Voltage Field Wiring

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 sensing temperature associated with thermistor LT1. Note that the LT1 thermistor is located on the refrigerant line between the coaxial heat exchanger and expansion device (TXV). Therefore, LT1 is sensing refrigerant temperature, not water temperature, which is a better indication of how water flow rate/temperature is affecting the refrigeration circuit.

The factory setting for LT1 is for systems using water (30°F [-1.1°C] refrigerant temperature). In low water temperature (extended range) applications with antifreeze (most ground loops), jumper JW3 should be clipped as shown in Figure 23 to change the setting to 10°F [-12.2°C] refrigerant 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].

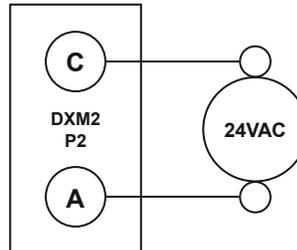
Figure 23: LT1 Limit Setting



Accessory Connections

A terminal paralleling the compressor contactor coil has been provided on the DXM2 control. Terminal "A" is designed to control accessory devices. Note: This terminal should be used only with 24 Volt signals and not line voltage. Terminal "A" is energized with the compressor contactor.

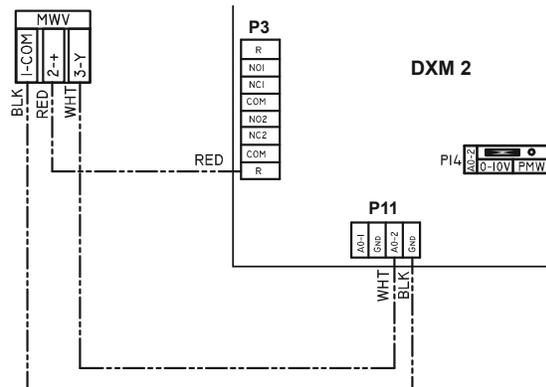
Figure 23a: Accessory Wiring Terminal Strip



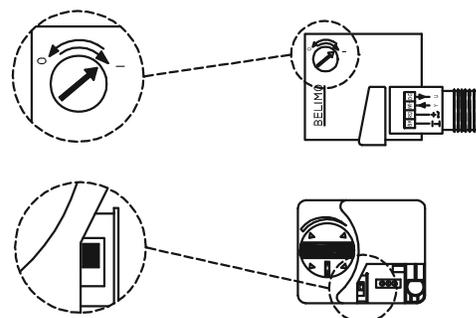
Motorized Modulating Water Control Valve - Open Loop Ground Water Systems Only

An external valve should be used on ground water systems to shut off flow when the compressor is not operating. Valve kit AMMV4D is available for use with HTS024-048, and kit AMMV5E is used with HTS060. See Figure 23b or the unit wiring diagram for valve wiring detail. Further details on valve operation are described later in this manual.

Figure 23b: Motorized Modulating Water Control Valve - Open Loop Ground Water Systems Only



For MWV option, place jumper on 0-10V pins. Ensure actuator direction switch is set as shown.



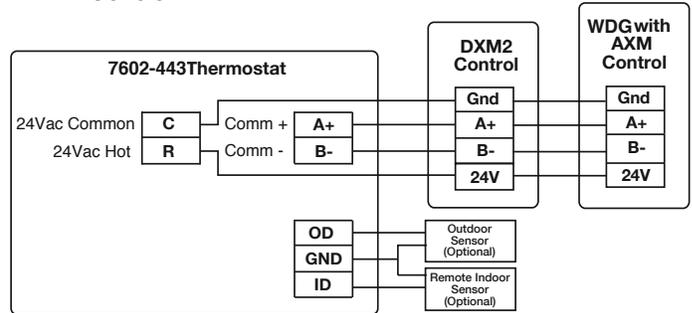
Electrical - Thermostat Wiring

Thermostat Installation

The thermostat should be located on an interior wall in a larger room, away from supply duct drafts. DO NOT locate the thermostat in areas subject to sunlight, drafts or on external walls. The wire access hole behind the thermostat may in certain cases need to be sealed to prevent erroneous temperature measurement. Position the thermostat back plate against the wall so that it appears level and so the thermostat wires protrude through the middle of the back plate. Mark the position of the back plate mounting holes and drill holes with a 3/16" (5mm) bit. Install supplied anchors and secure plate to the wall. Thermostat wire must be 18 AWG wire. Wire the appropriate thermostat as shown in Figure 24 or 25 to the low voltage terminal strip on the DXM2 control board. 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 (7602-443) is highly recommended for on-site, easier configuration, monitoring and diagnosis. An optional outdoor temperature sensor is available.

The 7602-452 sensor is a thermistor, used as an accessory for thermostat model 7602-443. This sensor provides outdoor air temperature information for the control system, as well as an indication of outdoor temperature on the display screen.

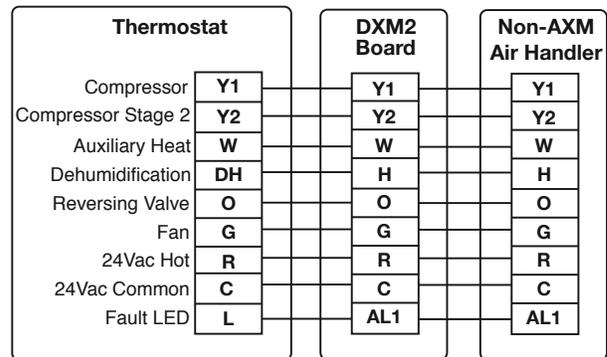
Figure 24: Communicating Thermostat Connection to DXM2 Control



Thermostat Connections

- C 24V Common for Control Circuit
- R 24V Supply for Control Circuit
- A+ Communications (Positive)
- B- Communications (Negative)
- GND Ground
- OD Outdoor Temperature Sensor
- ID Indoor Temperature Sensor

Figure 25: Conventional 3 Heat / 2 Cool Thermostat Connection to DXM2 and Non-AXM Air Handler



Notes:

- 1) ECM automatic dehumidification mode operates with dehumidification airflows in the cooling mode when the dehumidification output from thermostat is active. Normal heating and cooling airflows are not affected.
- 2) DXM2 board DIP switch S2-7 must be in the auto dehumidification mode for automatic dehumidification

⚠ CAUTION! ⚠

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

⚠ CAUTION! ⚠

CAUTION! Either a communicating thermostat (7602-443) or configuration tool (7602-444) MUST be used to configure and diagnose this unit.

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DXM2 Controls

DXM2 Control

DXM2 is the next generation in controls is capable of 2-way communication between itself and smart components, like the communicating thermostat, fan motor and configuration/ diagnostic tool.

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

For details on user settings, refer to User Manual (part #:

For details on Installer settings (not to be used by consumers), refer to Installer manual (part #:

For details on installer/service settings on the configuration/ diagnostic tool, refer to operation manual (part #:

For further details on the DXM2 control, refer to the DXM2 Application, Operation and Maintenance Manual and it is shipped with the unit)

Thermostat compatibility

It is **strongly recommended** that GeoMax2 communicating thermostat be used with DXM2 control, to ensure easy configuration, monitoring and diagnostics, in PLAIN English, on the thermostat. For example, Airflow can NOT be configured without a communicating thermostat or Configuration/ Diagnostic tool for use with GeoMax2.

Field Configuration Options - Note: In the following field configuration options, jumper wires should be clipped 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°C or -12°C] (refrigerant temperature).

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

A0-2: Configure Modulating Valve (field installed accessory)

Set A0-2 jumper to "IOV" if using Modulating Motorized Valve as field installed accessory

DIP Switches - For residential applications, all configuration can be performed in PLAIN ENGLISH on the thermostat. No DIP switch changes are required and no LEDs to be observed.

⚠ CAUTION! ⚠

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

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 pushbutton, the DXM2 control enters a 20 minute test mode period in which all time delays are sped up 15 times.

Figure 26: Test Mode Button

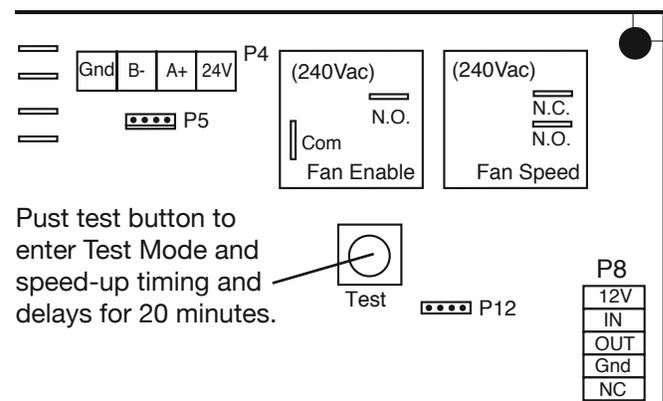
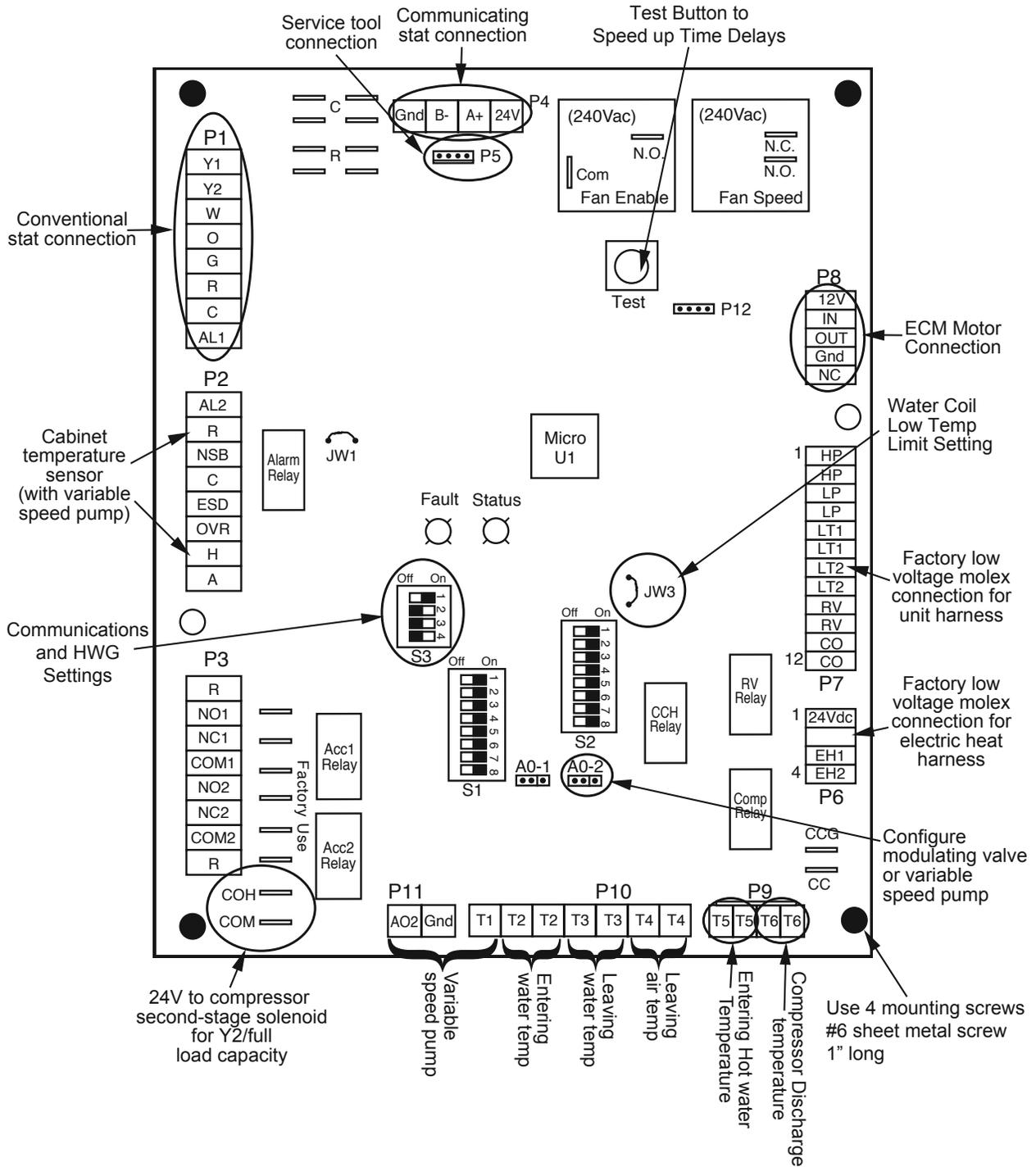


Table 8: Unit Operation

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

Figure 26a: DXM2 Layout and Connections



Unit Commissioning And Operating Conditions

Operating Limits

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

Power Supply – Voltage utilization shall comply with AHRI standard 110.

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 Table 9a for operating limits.

Table 9a: Building Operating Limits

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

Commissioning Conditions

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

Notes:

1. Conditions in Table 9b are not normal or continuous operating conditions. Minimum/maximum limits are start-up conditions to bring the building space up to occupancy temperatures. Units are not designed to operate under these conditions on a regular basis.
2. Voltage utilization complies with AHRI Standard 110.

Table 9b: Building Commissioning Limits

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

Unit Start-Up and Operating Conditions

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 9a and 9b.
- Low water temperature cutout: Verify that low water temperature cut-out on the DXM2 control is properly set.
- Unit fan: Manually rotate fan to verify free rotation and insure that blower wheel is secured to the motor shaft. Be sure to remove any shipping supports if needed. DO NOT oil motors upon start-up. Fan motors are pre-oiled at the factory. Check unit fan speed selection and compare to design requirements.
- Condensate line: Verify that condensate trap is installed and pitched.
- HWG pump is disconnected unless piping is completed and air has been purged from the system.
- Water flow balancing: Record inlet and outlet water temperatures for each heat pump upon startup. This check can eliminate nuisance trip outs and high velocity water flow that could erode heat exchangers.
- Unit air coil and filters: Insure that filter is clean and accessible. Clean air coil of all manufacturing oils.
- Unit controls: Verify that DXM2 field selection options are properly set. Low voltage wiring is complete.
- 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 longevity of hoses and fittings (see Table 4).
- 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.
- System controls: Verify that system controls function and operate in the proper sequence.
- Low water temperature cutout: Verify that low water temperature cut-out controls are 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." Blower should start.
2. Balance air flow at registers.
3. Adjust all valves to their full open position. Turn on the line power to all heat pump units.
4. Room temperature should be within the minimum-maximum ranges of Table 9b. During start-up checks, loop water temperature entering the heat pump should be between 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) water temperature. When any one of these factors is at a minimum or maximum level, the other factor must be at normal level to insure proper unit operation.
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.

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).

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

- c. Verify that the compressor is on and that the water temperature fall (heating mode) is within normal range.
 - d. 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.
10. BE CERTAIN TO FILL OUT AND RETURN ALL WARRANTY REGISTRATION PAPERWORK.

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: $HR = TD \times GPM \times 500$ (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 12.

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: $HE = TD \times GPM \times 500$ (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 12.

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

NOTE: To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended.

▲ WARNING! ▲

WARNING! When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with energized equipment.

▲ CAUTION! ▲

CAUTION! Verify that ALL water 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.

HEAT CONTROLLER, INC. WATER-SOURCE HEAT PUMPS

Residential Split - 60Hz R410A
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Unit Operating Conditions

Table 12: Two-Stage HFC-410A Compressor Section Coax Water Pressure Drop

Model	GPM	Pressure Drop (psi)			
		30°F	50°F	70°F	90°F
026	4.0	1.5	1.3	1.1	1.0
	6.0	3.1	2.6	2.3	2.1
	7.0	4.1	3.4	3.0	2.7
	8.0	5.1	4.3	3.8	3.4
038	4.0	1.2	1.0	0.8	0.6
	6.0	2.6	2.5	2.3	2.1
	8.0	4.5	4.2	4.0	3.7
	9.0	5.7	5.2	4.8	4.4
049	5.5	1.1	0.9	0.8	0.7
	8.3	2.2	2.1	2.0	1.8
	11.0	3.9	3.6	3.2	3.1
	12.0	4.5	4.2	3.8	3.5
064	7.0	0.5	0.3	0.2	0.1
	10.5	1.9	1.8	1.7	1.6
	14.0	3.9	3.5	3.2	2.9
	15.0	4.8	4.3	3.9	3.5

Table 13: Water Temperature Change Through Heat Exchanger

Water Flow, gpm (l/m)	Rise, Cooling °F (°C)	Drop, Heating °F (°C)
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton (3.9 l/m per kw)	9 - 12 (5 - 6.7)	4 - 8 (2.2 - 4.4)
For Open Loop: Ground Water Systems at 1.5 gpm per ton (2.0 l/m per kw)	20 - 26 (11.1 - 14.4)	10 - 17 (5.6 - 9.4)

Table 14a: Size 024 HTS Two-Stage R-410A Typical Unit Operating Pressures and Temperatures

Entering Water Temp °F	Water Flow GPM/ton	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*	1.5	122-132	159-179	13-18	9-14	16.7-18.7	18-24	77-87	278-298	4-9	10-15	5.9-7.9	18-24
	2.25	122-132	146-166	13-18	7-12	12.3-14.3	19-25	79-89	280-300	4-9	10-15	4.2-6.2	19-25
	3	122-132	132-152	14-19	7-12	7.9-9.9	19-25	82-92	282-302	4-9	10-15	2.7-4.7	20-26
50	1.5	132-142	186-206	8-13	8-13	16.3-18.3	18-24	107-117	314-334	6-11	13-18	8.9-10.9	25-31
	2.25	132-142	172-192	8-13	6-11	12.1-14.1	19-25	111-121	315-335	6-11	13-18	6.7-8.7	26-32
	3	132-142	158-178	8-13	6-11	7.8-9.8	19-25	115-125	317-337	6-11	13-18	4.5-6.5	26-32
70	1.5	139-149	281-301	7-12	8-13	15.7-17.7	18-24	139-149	350-370	7-12	15-20	11.3-13.3	31-38
	2.25	139-149	267-287	7-12	8-13	11.6-13.6	18-24	145-155	352-372	7-12	15-20	8.5-10.5	32-39
	3	139-149	253-273	7-12	7-12	7.6-9.6	18-24	152-162	354-374	7-12	15-20	5.8-7.8	32-39
90	1.5	141-151	374-394	7-12	9-14	14.6-16.6	17-23	177-187	392-412	9-14	17-22	14.4-16.4	37-45
	2.25	141-151	360-380	7-12	9-14	10.7-12.7	17-23	181-191	397-417	10-15	17-22	10.8-12.8	38-46
	3	141-151	346-366	7-12	8-13	6.9-8.9	17-23	186-196	402-422	11-16	17-22	7.1-9.1	38-46
110	1.5	145-155	473-493	7-12	10-15	13.6-15.6	16-22	Operation Not Recommended					
	2.25	145-155	458-478	7-12	10-15	9.9-11.9	16-22						
	3	145-155	441-461	7-12	9-14	6.2-8.2	16-22						

*Based on 15% methanol antifreeze solution

Table 14b: Size 036 HTS Two-Stage R-410A Typical Unit Operating Pressures and Temperatures

Entering Water Temp °F	Water Flow GPM/ton	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*	1.5	122-132	153-173	18-23	9-14	22.1-24.1	19-25	71-81	263-283	5-10	2-5	8.1-10.1	17-23
	2.25	121-131	145-165	18-23	8-13	16.8-18.8	20-26	75-85	267-287	5-10	2-5	5.9-7.9	18-24
	3	121-131	135-155	18-23	8-13	10.5-12.5	20-26	78-88	270-290	5-10	2-5	3.7-5.7	19-25
50	1.5	131-141	222-242	13-18	10-15	21.9-23.9	19-25	103-113	292-312	6-11	2.5-7	11.5-13.5	23-29
	2.25	130-140	208-228	13-18	9-14	16.1-18.1	20-26	107-117	296-316	6-11	2.5-7	8.6-10.6	24-30
	3	130-140	194-214	14-19	9-14	10.3-12.3	20-26	112-122	301-321	6-11	2.5-7	5.7-7.7	24-30
70	1.5	138-148	299-319	8-13	13-18	21.5-23.5	19-25	134-144	322-342	7-12	2.5-7	14.5-16.5	28-35
	2.25	137-147	280-300	8-13	12-17	15.8-17.8	20-26	140-150	328-358	7-12	2.5-7	11.1-13.1	29-36
	3	137-147	263-283	8-13	12-17	10-12	20-26	146-156	334-354	7-12	2.5-7	7.7-9.7	30-37
90	1.5	142-152	388-408	6-11	13-18	20.5-22.5	18-24	172-182	360-380	8-13	2.5-7	20.5-22.5	36-44
	2.25	142-152	367-387	7-12	8-13	14.9-16.9	18-24	184-194	369-389	8-13	2.5-7	15-17	37-45
	3	142-152	347-367	7-12	8-13	9.3-11.3	18-24	196-206	378-398	8-13	2.5-7	10-12	39-47
110	1.5	147-157	486-506	6-11	13-18	19-21	18-24	Operation Not Recommended					
	2.25	147-157	465-475	7-12	8-13	14-16	18-24						
	3	147-157	444-464	7-12	8-13	9-11	18-24						

*Based on 15% methanol antifreeze solution

Unit Operating Conditions

Table 14c: Size 048 HTS Two-Stage R-410A Typical Unit Operating Pressures and Temperatures

Entering Water Temp °F	Water Flow GPM/ton	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*	1.5	112-122	187-207	18-23	23-28	20.7-22.7	19-25	66-76	261-281	8-13	5-10	8-10	18-24
	2.25	111-121	167-187	18-23	21-26	15.5-17.5	19-25	69-79	264-284	8-13	5-10	6-8	19-25
	3	111-121	147-167	18-23	20-25	10.2-12.2	19-25	72-82	267-287	8-13	5-10	4-6	19-25
50	1.5	125-135	245-265	13-18	19-24	20.9-22.9	20-26	93-103	289-309	7-12	5-10	11.5-13.5	23-29
	2.25	123-133	227-247	13-18	18-23	15.6-17.6	20-26	98-108	295-315	7-12	5-10	8.7-10.7	24-30
	3	122-132	208-228	14-19	16-21	10.2-12.2	20-26	103-113	301-321	7-12	5-10	5.9-7.9	25-31
70	1.5	133-143	314-334	9-14	17-22	20.5-22.5	20-26	123-133	319-339	7-12	5-10	15-17	28-35
	2.25	132-142	294-314	9-14	16-21	15.2-17.2	20-26	130-140	329-349	7-12	5-10	11.5-13.5	29-36
	3	131-141	274-294	10-15	14-19	9.9-11.9	20-26	137-147	336-356	7-12	5-10	7.9-9.9	30-37
90	1.5	138-148	401-421	8-13	16-21	19.2-21.2	19-25	167-177	365-385	7-12	5-10	19.6-21.6	37-45
	2.25	137-147	379-399	8-13	15-20	14.3-16.3	19-25	177-187	374-394	7-12	5-10	15-17	38-46
	3	136-146	357-377	9-14	13-18	9.3-11.3	19-25	187-197	388-408	7-12	5-10	10.3-12.3	39-47
110	1.5	144-154	502-522	8-13	14-19	18-20	18-24	Operation Not Recommended					
	2.25	143-153	477-497	8-13	13-18	13.3-15.3	18-24						
	3	142-152	452-472	9-14	12-17	8.5-10.5	18-24						

*Based on 15% methanol antifreeze solution

Table 14d: Size 060 HTS Two-Stage R-410A Typical Unit Operating Pressures and Temperatures

Entering Water Temp °F	Water Flow GPM/ton	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*	1.5	117-127	160-180	16-21	8-13	17.5-19.5	16-22	66-76	282-302	9-15	8-13	8-10	21-27
	2.25	116-126	133-153	17-22	6-11	11.9-13.9	16-22	69-79	285-305	9-15	8-13	6-8	21-27
	3	115-125	125-145	18-23	5-10	6.3-8.3	16-22	72-82	289-309	9-15	9-14	4-6	22-28
50	1.5	126-136	228-248	8-13	8-13	19.8-21.8	20-26	95-105	318-338	9-15	12-17	11.3-13.3	27-33
	2.25	124-134	212-232	11-16	6-11	14.2-16.2	20-26	100-110	321-341	9-15	12-17	8.5-10.5	28-34
	3	123-133	195-215	14-19	5-10	8.5-10.5	20-26	105-115	324-344	9-15	12-17	5.7-7.7	30-36
70	1.5	130-140	305-325	8-13	10-15	20.3-22.3	21-27	128-138	360-380	8-14	12-17	14-16	33-38
	2.25	129-139	286-306	9-14	9-14	14.8-16.8	21-27	133-143	364-384	8-14	12-17	10.6-12.6	34-40
	3	128-138	266-286	11-16	7-12	9.3-11.3	21-27	139-149	368-388	8-14	12-17	7.3-9.3	35-41
90	1.5	133-143	398-418	8-13	10-15	19.4-21.4	20-26	173-183	407-427	8-14	13-18	18.2-20.2	42-50
	2.25	132-142	376-396	8-13	9-14	14.1-16.1	20-26	177-187	411-431	8-14	13-18	13.9-15.9	43-51
	3	132-142	354-374	8-13	7-12	8.8-10.8	20-26	182-192	415-435	8-14	14-19	9.6-11.6	44-52
110	1.5	138-148	505-525	6-11	10-15	18.3-20.3	19-25	Operation Not Recommended					
	2.25	137-147	483-503	6-11	9-14	13.3-15.3	19-25						
	3	136-146	459-479	6-11	8-13	8.3-10.3	19-25						

*Based on 15% methanol antifreeze solution

Preventive Maintenance

Water Coil Maintenance

(Direct ground water applications only)

If the system is installed in an area with a known high mineral content (125 P.P.M. or greater) in the water, it is best to establish a periodic maintenance schedule with the owner so the coil can be checked regularly. Consult the well water applications section of this manual for a more detailed water coil material selection. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. Therefore, 1.5 gpm per ton [2.0 l/m per kW] is recommended as a minimum flow. Minimum flow rate for entering water temperatures below 50°F [10°C] is 2.0 gpm per ton [2.6 l/m per kW].

Water Coil Maintenance

(All other water loop applications)

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

Hot Water Generator Coils

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

Filters

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

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

Condensate Drain

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

Compressor

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

Fan Motors

Consult air handler I.O.M. for maintenance requirements.

Air Coil

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

Cabinet - Indoor Compressor Section

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

Refrigerant System

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

Basic Troubleshooting Information

General Troubleshooting

Basic DXM2 board troubleshooting in general is best summarized as simply verifying inputs and outputs. After this process has been verified, confidence in board operation is confirmed and the trouble must be else where. Below are some general guidelines required for developing training materials and procedures when applying the DXM2 Control.

DXM2 Field Inputs

All conventional inputs are 24VAC from the thermostat and can be verified using a voltmeter between C and Y1, Y2, W, O, and G.

Sensor Inputs

All sensor inputs are 'paired wires' connecting each component with the board. Therefore continuity on pressure switches can be checked at the board connector.

The thermistor resistance should be measured with the connector removed so that only the impedance of the thermistor is measured. If desired, this reading can be compared to the chart shown in the thermistor section of this manual based upon the actual temperature of the thermistor clip. An ice bath can be used to check calibration of a thermistor if needed.

DXM2 Outputs

The compressor relay is 24VAC and can be verified using a voltmeter. The Alarm Relay can either be 24VAC as shipped or dry contacts (measure continuity during fault) for use with DDC by clipping the J4 jumper. Electric heat outputs are 24VDC and require a voltmeter set for DC to verify operation. When troubleshooting, measure from 24VDC terminal to EH1 or EH2 terminals.

Test Mode

Test Mode can be entered for 20 minutes by pressing the Test button. For Diagnostic ease at a conventional thermostat, the Alarm Relay will also cycle during test mode. The Alarm Relay will cycle on and off similar to the Fault LED to indicate a code representing the last fault, at the thermostat. Test Mode can also be entered and exited by cycling the G input, 3 times within a 60 second time period.

Sensor: Nominal resistance at various temperatures

Temp (°C)	Temp (°F)	Resistance (kOhm)	Temp (°C)	Temp (°F)	Resistance (kOhm)
-17.8	0.0	85.34	55	131.0	2.99
-17.5	0.5	84.00	56	132.8	2.88
-16.9	1.5	81.38	57	134.6	2.77
-12	10.4	61.70	58	136.4	2.67
-11	12.2	58.40	59	138.2	2.58
-10	14.0	55.30	60	140.0	2.49
-9	15.8	52.38	61	141.8	2.40
-8	17.6	49.64	62	143.6	2.32
-7	19.4	47.05	63	145.4	2.23
-6	21.2	44.61	64	147.2	2.16
-5	23.0	42.32	65	149.0	2.08
-4	24.8	40.15	66	150.8	2.01
-3	26.6	38.11	67	152.6	1.94
-2	28.4	36.18	68	154.4	1.88
-1	30.2	34.37	69	156.2	1.81
0	32.0	32.65	70	158.0	1.75
1	33.8	31.03	71	159.8	1.69
2	35.6	29.50	72	161.6	1.64
3	37.4	28.05	73	163.4	1.58
4	39.2	26.69	74	165.2	1.53
5	41.0	25.39	75	167.0	1.48
6	42.8	24.17	76	168.8	1.43
7	44.6	23.02	77	170.6	1.39
8	46.4	21.92	78	172.4	1.34
9	48.2	20.88	79	174.2	1.30
10	50.0	19.90	80	176.0	1.26
11	51.8	18.97	81	177.8	1.22
12	53.6	18.09	82	179.6	1.18
13	55.4	17.26	83	181.4	1.14
14	57.2	16.46	84	183.2	1.10
15	59.0	15.71	85	185.0	1.07
16	60.8	15.00	86	186.8	1.04
17	62.6	14.32	87	188.6	1.01
18	64.4	13.68	88	190.4	0.97
19	66.2	13.07	89	192.2	0.94
20	68.0	12.49	90	194.0	0.92
21	69.8	11.94	91	195.8	0.89
22	71.6	11.42	92	197.6	0.86
23	73.4	10.92	93	199.4	0.84
24	75.2	10.45	94	201.2	0.81
25	77.0	10.00	95	203.0	0.79
26	78.8	9.57	96	204.8	0.76
27	80.6	9.16	97	206.6	0.74
28	82.4	8.78	98	208.4	0.72
29	84.2	8.41	99	210.2	0.70
30	86.0	8.06	100	212.0	0.68
31	87.8	7.72	101	213.8	0.66
32	89.6	7.40	102	215.6	0.64
33	91.4	7.10	103	217.4	0.62
34	93.2	6.81	104	219.2	0.60
35	95.0	6.53	105	221.0	0.59
36	96.8	6.27	106	222.8	0.57
37	98.6	6.01	107	224.6	0.55
38	100.4	5.77	108	226.4	0.54
39	102.2	5.54	109	228.2	0.52
40	104.0	5.33	110	230.0	0.51
41	105.8	5.12	111	231.8	0.50
42	107.6	4.92	112	233.6	0.48
43	109.4	4.72	113	235.4	0.47
44	111.2	4.54	114	237.2	0.46
45	113.0	4.37	115	239.0	0.44
46	114.8	4.20	116	240.8	0.43
47	116.6	4.04	117	242.6	0.42
48	118.4	3.89	118	244.4	0.41
49	120.2	3.74	119	246.2	0.40
50	122.0	3.60	120	248.0	0.39
51	123.8	3.47	121	249.8	0.38
52	125.6	3.34	122	251.6	0.37
53	127.4	3.22	123	253.4	0.36
54	129.2	3.10			

Advanced Troubleshooting and Configuration Information

General

To properly configure and troubleshoot advanced control features, and to aid in troubleshooting basic control features, a communicating thermostat or diagnostic tool with similar capabilities should be used.

System Configuration

All factory installed DXM2 controls have their basic configuration parameters set as part of the factory manufacturing and test process. The System Configuration option under the communicating thermostat Installer menu provides the installer with the ability to adjust ECM target airflows for each operating mode, set control options, setup the loop configuration and parameters, and configure field replacement controls.

Airflow Selection – The Airflow Selection menu allows the installer to adjust the ECM target airflow for each control operating mode, as well as independently set the heating and cooling blower off delays.

ECM Airflows – Independent airflow selections may be made for each stage of heating operation, each stage of cooling operation with and without dehumidification, as well as constant fan operation. The DXM2 control has set minimum and maximum airflow limits for each operating mode, based on the unit configuration that may not be changed.

Non-ECM Configuration – If the DXM2 is not configured to control an ECM blower, the airflow selections will not be available on the Airflow Selection menu.

Heating / Cooling Off Delays – The heating and cooling mode blower off delay times may be independently adjusted by the user. Each delay time may be set between 0 and 255 seconds.

Option Selection – The Option Selection menu allows the installer to set selected control options.

LT2 Setpoint – The LT2 setpoint should be set to ANTI-FREEZE ONLY when the unit is configured as a water-to-water unit with anti-freeze in the load side loop. For ALL other unit configurations, the LT2 setpoint should be set to WATER.

Motorized Valve – The Motorized Valve option should be set to ON when a motorized water valve with end switch wired to the DXM2 Y1 is used with a communicating thermostat. For all other system configurations, the Motorized Valve option should be set to OFF.

Unit Configuration – Selections under the Unit Configuration menu are normally set at the factory as a normal part of the manufacturing and test process. This menu allows the configuration to be modified for special applications, or to configure field replacement controls. The Unit Configuration menu provides the ability to select the Heat Pump Family,

Unit Size, Blower Type, and Loop Type. The Heat Pump Family, Unit Size, and Blower Type are needed to properly operate any particular unit configuration, especially those with ECM blowers.

Heat Pump Family – When replacing a control in the field, the Heat Pump Family value must be set for proper blower and loop operation. The valid family values (HTS, HE, etc.) are available for the user to scroll through to select the proper value.

Heat Pump Size – When replacing a control in the field, the Heat Pump Size value must be set for proper blower operation. After a Heat Pump Family has been selected, the valid Heat Pump Size values will be available for the user to scroll through to select the proper value.

Blower Type – When replacing a control in the field, the Blower Type value must be set for proper operation. The valid Blower Type values will be available for the user to scroll through to select the appropriate value from No Blower, ECM Blower, or PSC configurations.

Loop Configuration – When replacing a control in the field, the Loop Configuration value must be set for proper operation. The valid Loop Configuration values will be available for the user to scroll through to select the appropriate value from VS PUMP, MOD VALVE, or OTHER.

Loop Configuration – The Loop Configuration menu allows the installer to set the operating parameters for either an internal flow center, or a proportional water valve, depending on the unit configuration.

Heating Delta T – The Heating Delta T option allows the target delta T (EWT – LWT) value selection for operating in the heating mode. The DXM2 control has set minimum and maximum delta T limits that may not be changed.

Cooling Delta T – The Cooling Delta T option allows the target delta T (LWT – EWT) value selection for operating in the cooling mode. The DXM2 control has set minimum and maximum delta T limits that may not be changed.

Cooling Delta T – The Cooling Delta T option allows the target delta T (LWT – EWT) value selection for operating in the cooling mode. The DXM2 control has set minimum and maximum delta T limits that may not be changed.

Advanced Troubleshooting and Configuration Information

Service Mode

The Service Mode provides the installer with several functions for troubleshooting, including Manual Operation, Control Diagnostics, Control Configuration, and Fault History.

Manual Operation – The Manual Operation mode allows the installer to bypass normal thermostat timings and operating modes, to directly activate the thermostat inputs to the DXM2, activate the DXM2 Test mode, and directly control the ECM blower, internal flow center, and proportional valve.

Control Diagnostics – The Control Diagnostics menus allow the installer to see the current status of all DXM2 control switch inputs, values of all temperature sensor inputs, control voltage, ECM blower, internal flow center, and proportional valve operating status and parameters.

Dipswitch Configuration – The Dipswitch Configuration menus allow the installer to easily see the current DXM2 control configuration.

Fault History – In addition to the fault code, the DXM2 stores the status of all control inputs and outputs when a fault condition is detected. The fault history covering the last five lockout conditions is stored and may be retrieved from the DXM2. After a specific fault in the fault history is selected, the operating mode and time when the fault occurred are displayed, with options to select specific control status values when the lockout occurred.

Fault Temp Conditions – This option displays the DXM2 temperature and voltage values when the lockout occurred.

Fault Flow Conditions – This option displays the DXM2 ECM blower, pump, and valve operating parameters when the lockout occurred.

Fault I/O Conditions – This option displays the status of the DXM2 physical and communicated inputs and the relay outputs when the lockout occurred.

Fault Configuration Conditions – This option displays the status of the DXM2 option selections when the lockout occurred.

Fault Possible Causes – This option displays a list of potential causes of the stored fault.

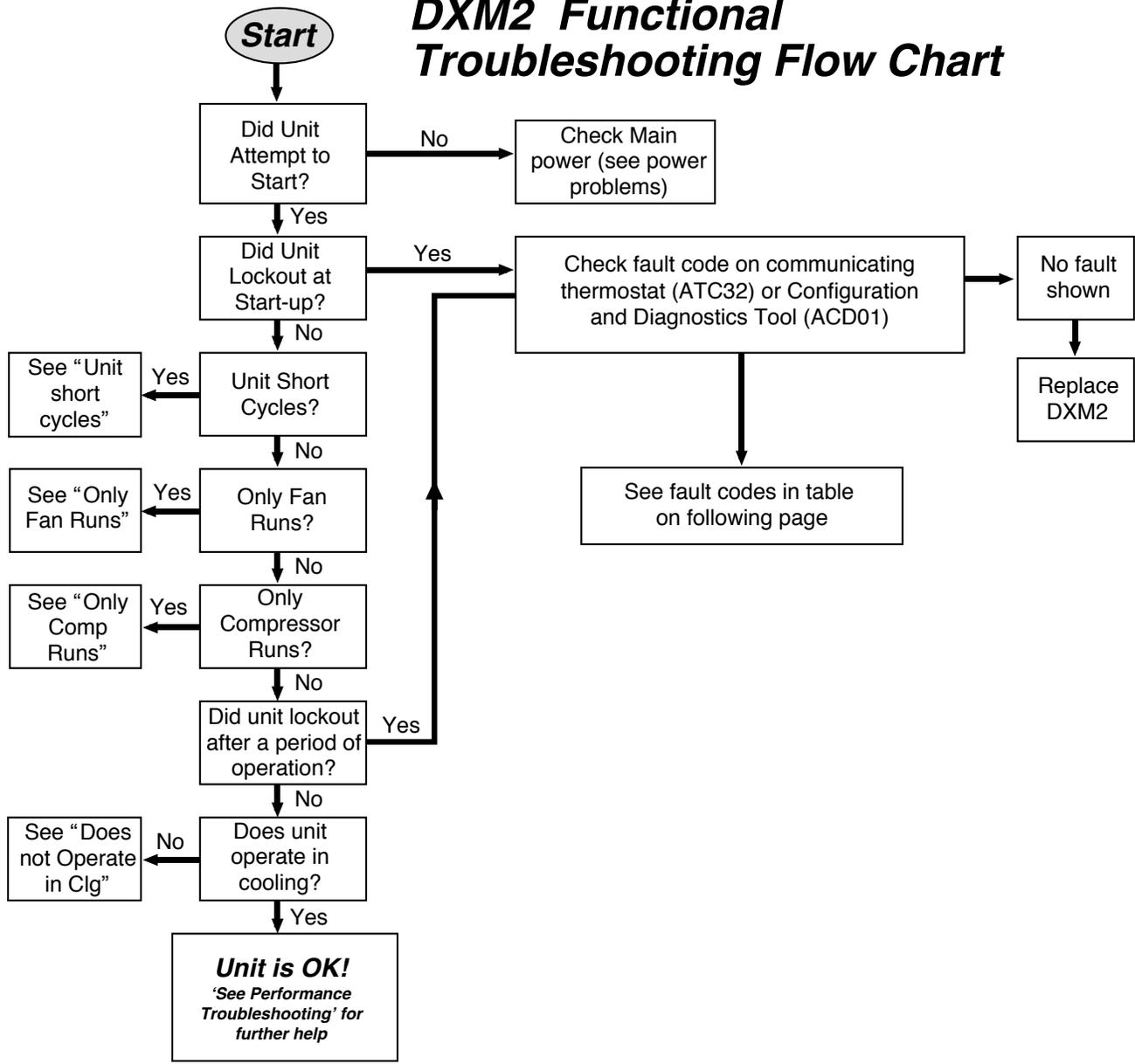
Clear Fault History – The Clear Fault History option allows the fault history stored in the non-volatile memory of the DXM2 to be cleared.

DXM2 Process Flow Chart

⚠ WARNING! ⚠

WARNING! HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING. Failure to disconnect power before servicing can cause severe personal injury or death.

DXM2 Functional Troubleshooting Flow Chart



Functional Troubleshooting

Fault	Htg	Clg	Possible Cause	Solution
Main Power Problems	X	X	Green status LED off	Check Line Voltage circuit breaker and disconnect Check for line voltage between L1 and L2 on the contactor Check for 24VAC between R and C on DXM Check primary/secondary voltage on transformer
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting Check water flow adjust to proper flow rate
		X	Water temperature out of range in cooling	Bring water temp within design parameters
HP Fault Code 2 High Pressure	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace Check fan motor operation and airflow restrictions Dirty air coil- construction dust etc. Too high of external static. Check static vs blower table
	X		Air temperature out of range in heating	Bring return air temp within design parameters
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table
	X	X	Bad HP switch	Check switch continuity and operation - Replace
	X		Frozen water heat exchanger	Thaw heat exchanger
	X	X	Bad HPWS Switch	Replace HPWS Switch
	X	X	Insufficient charge	Check for refrigerant leaks
LP/LOC Fault-Code 3 Low Pressure/Loss of Charge	X		Compressor pump down at start-up	Check charge and start-up water flow
LT1 Fault - Code 4 Water Low Temperature	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting Plugged strainer or filter - clean or replace Check water flow adjust to proper flow rate
	X		Inadequate anti-freeze level	Check antifreeze density with hydrometer
	X		Improper low temperature setting (30°F vs 10°F)	Clip LT1 jumper for antifreeze (10°F) use
	X		Water temperature out of range	Bring water temp within design parameters
	X	X	Bad thermistor	Check temp and impedance correlation per chart
LT2 Fault - Code 5 Low Air Temperature		X	Reduced or no air flow in cooling	Check for dirty air filter and clean or replace Check fan motor operation and airflow restrictions Too high of external static - check static vs blower table
		X	Air temperature out of range	Too much cold vent air - bring entering air temp within design parameters
		X	Improper low temperature setting (30°F vs 10°F)	Normal airside applications will require 30°F only
	X	X	Bad thermistor	Check temp and impedance correlation per chart
Condensate Fault-Code 6 High Condensate Level	X	X	Blocked drain	Check for blockage and clean drain
	X	X	Improper trap	Check trap dimensions and location ahead of vent Check for piping slope away from unit
		X	Poor drainage	Check slope of unit toward outlet Poor venting - check vent location
		X	Moisture on sensor	Check for moisture shorting to air coil
	X	X	Plugged air filter	Replace air filter
	X	X	Restricted return air flow	Find and eliminate restriction - increase return duct and/or grille size
Over/Under Voltage-Code 7 (Auto Resetting)	X	X	Under voltage	Check power supply and 24VAC voltage before and during operation Check power supply wire size Check compressor starting. Need hard start kit? Check 24VAC and unit transformer tap for correct power supply voltage
	X	X	Over voltage	Check power supply voltage and 24VAC before and during operation. Check 24VAC and unit transformer tap for correct power supply voltage
Unit Performance Sentinel-Code 8	X		Heating Mode LT2>125°F	Check for poor air flow or overcharged unit
		X	Cooling Mode LT1>125°F OR LT2< 40°F	Check for poor water flow, or air flow
Swapped Thermistor Code 9	X	X	LT1 and LT2 swapped	Reverse position of thermistors
ECM Fault - Code 10	X	X	Blower does not operate	Check blower line voltage Check blower low voltage wiring
			Blower operating with incorrect airflow	Wrong unit size selection Wrong unit family selection Wrong motor size Incorrect blower selection

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Functional Troubleshooting

Fault	Htg	Clg	Possible Cause	Solution
IFC Fault Code 13 Internal Flow Controller Fault	X	X	Improper output setting	Verify the AO-2 jumper is in the PWM position
			No pump output signal	Check DC voltage between A02 and GND - should be between 0.5 and 10 VDC with pump active
			Low pump voltage	Check line voltage to the pump
			No pump feedback signal	Check DC voltage between T1 and GND. Voltage should be between 3 and 4 VDC with pump OFF, and between 0 and 2 VDC with the pump ON
			Bad pump RPM sensor	Replace pump if the line voltage and control signals are present at the pump, and the pump does not operate
ESD - ERV Fault (DXM Only) Green Status LED Code 3	X	X	ERV unit has fault (Rooftop units only)	Troubleshoot ERV unit fault
No Fault Code Shown	X	X	No compressor operation	See 'Only Fan Operates'
	X	X	Compressor overload	Check and replace if necessary
	X	X	Control board	Reset power and check operation
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter
	X	X	Unit in 'Test Mode'	Reset power or wait 20 minutes for auto exit
	X	X	Unit selection	Unit may be oversized for space - check sizing for actual load of space
	X	X	Compressor overload	Check and replace if necessary
Only Fan Runs	X	X	Thermostat position	Insure thermostat set for heating or cooling operation
	X	X	Unit locked out	Check for lockout codes - reset power
	X	X	Compressor overload	Check compressor overload - replace if necessary
	X	X	Thermostat wiring	Check thermostat wiring at DXM2 - put in Test Mode and jumper Y1 and R to give call for compressor

Performance Troubleshooting

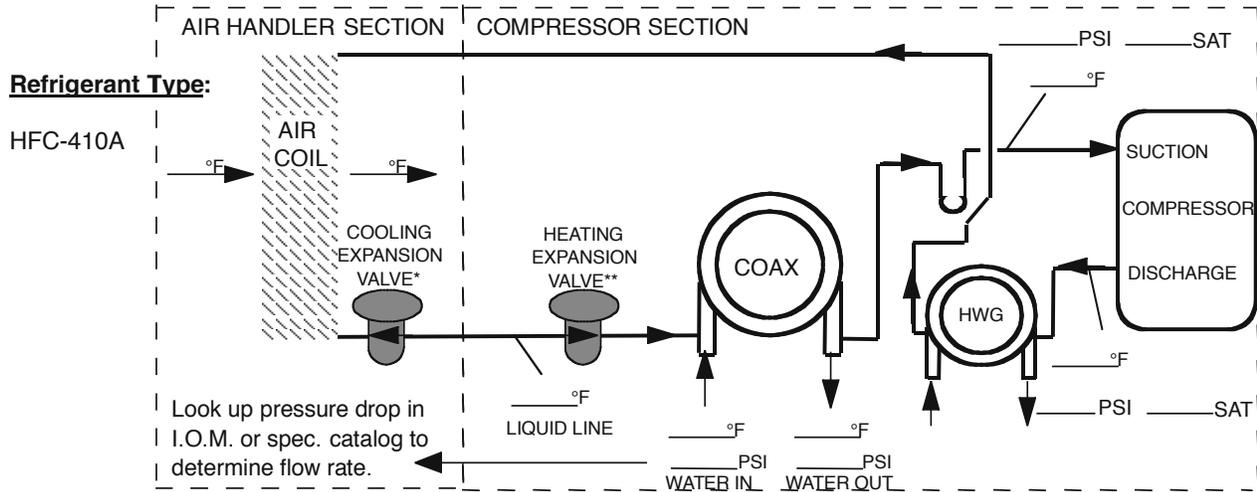
Symptom	Htg	Clg	Possible Cause	Solution
Insufficient Capacity/ Not Cooling or Heating Properly	X	X	Dirty filter	Replace or clean
	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace Check fan motor operation and airflow restrictions Too high of external static - check static vs blower table
		X	Reduced or no air flow in cooling	Check for dirty air filter and clean or replace Check fan motor operation and airflow restrictions Too high of external static - check static vs blower table
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present
	X	X	Low refrigerant charge	Check superheat and subcooling per chart
	X	X	Restricted metering device	Check superheat and subcooling per chart - replace
		X	Defective reversing valve	Perform RV touch test
	X	X	Thermostat improperly located	Check location and for air drafts behind stat
	X	X	Unit undersized	Recheck loads & sizing check sensible clg load and heat pump capacity
	X	X	Scaling in water heat exchanger	Perform Scaling check and clean if necessary
High Head Pressure	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace Check fan motor operation and airflow restrictions Too high of external static - check static vs blower table
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting Check water flow adjust to proper flow rate
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture
	X		Air temperature out of range in heating	Bring return air temp within design parameters
		X	Scaling in water heat exchanger	Perform Scaling check and clean if necessary
	X	X	Unit over charged	Check superheat and subcooling - reweigh in charge
	X	X	Non-condensables in system	Vacuum system and reweigh in charge
	X	X	Restricted metering device	Check superheat and subcooling per chart - replace
Low Suction Pressure	X		Reduced water flow in heating	Check pump operation or water valve operation/setting Plugged strainer or filter - clean or replace Check water flow adjust to proper flow rate
	X		Water temperature out of range	Bring water temp within design parameters
		X	Reduced air flow in cooling	Check for dirty air filter and clean or replace Check fan motor operation and airflow restrictions Too high of external static - check static vs blower table
		X	Air temperature out of range	Too much cold vent air - bring entering air temp within design parameters
	X	X	Insufficient charge	Check for refrigerant leaks
Low Discharge Air Temperature in Heating	X		Too high of air flow	Check fan motor speed selection and airflow chart
	X		Poor performance	See "Insufficient Capacity"
High Humidity		X	Too high of air flow	Check fan motor speed selection and airflow chart
		X	Unit oversized	Recheck loads and sizing check sensible clg load and heat pump capacity
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for Line voltage across blower relay contacts. Check fan power enable relay operation (if present)
	X	X	Fan motor	Check for line voltage at motor. Check capacitor
	X	X	Thermostat wiring	Check thermostat wiring at or DXM2. Put in Test Mode and then jumper Y1 and W1 to R to give call for fan, compressor and electric heat.
Unit Doesn't Operate in Cooling		X	Reversing Valve	Set for cooling demand and check 24VAC on RV coil. If RV is stuck, run high pressure up by reducing water flow and while operating engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	For DXM2 check for "O" RV setup not "B".
		X	Thermostat wiring	Check O wiring at heat pump. DXM2 requires call for compressor to get RV coil "Click."
Modulating Valve Troubleshooting	X	X	Improper output setting	Verify the AO-2 jumper is in the 0-10V position
			No valve output signal	Check DC voltage between AO2 and GND. Should be 0 when valve is off and between 3.3v and 10v when valve is on.
			No valve operation	Check voltage to the valve Replace valve if voltage and control signals are present at the valve and it does not operate

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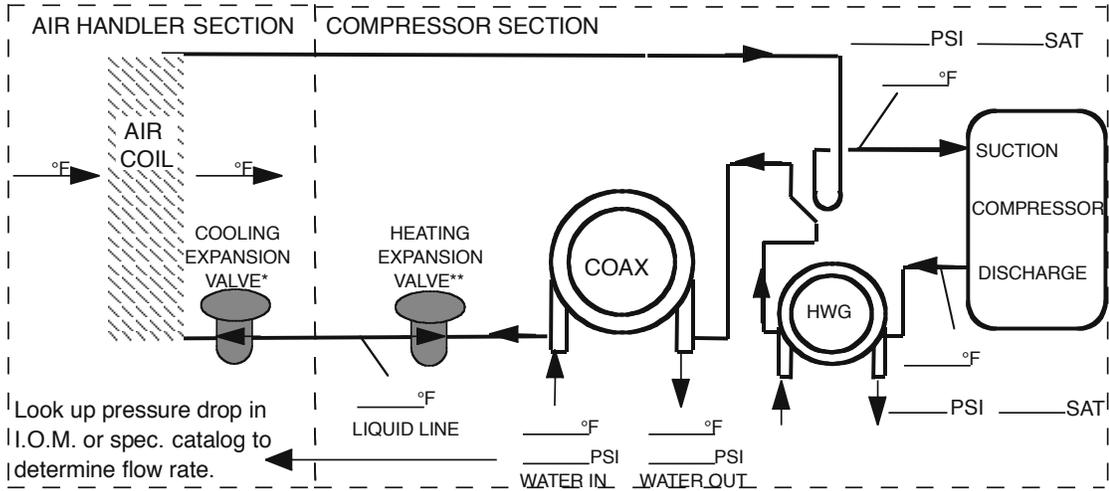
Troubleshooting Form

Customer: _____ Antifreeze: _____
 Model#: _____ Serial#: _____ Loop type: _____
 Complaint: _____

HEATING CYCLE ANALYSIS -



COOLING CYCLE ANALYSIS -



*Cooling expansion valve meters in the cooling mode, and bypasses in the heating mode.
 **Heating expansion valve meters in the heating mode, and bypasses in the cooling mode.

Heat of Extraction (Absorbion) or Heat of Rejection =

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

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

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

†Use 500 for water, 485 for antifreeze.

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

Notes:



Design, specifications and materials subject to change without notice.

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