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Installation, Operation & Maintenance: Packaged Horizontal, Vertical & Combination Series Units

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Guide Revision Table:

Date	By	Page	Note
19 Feb, 2009	DS	All	Minor Formatting Fixes
02 Jan, 09	DS	41	Updated Wiring Diagram
17 Dec, 08	DS	All	First published

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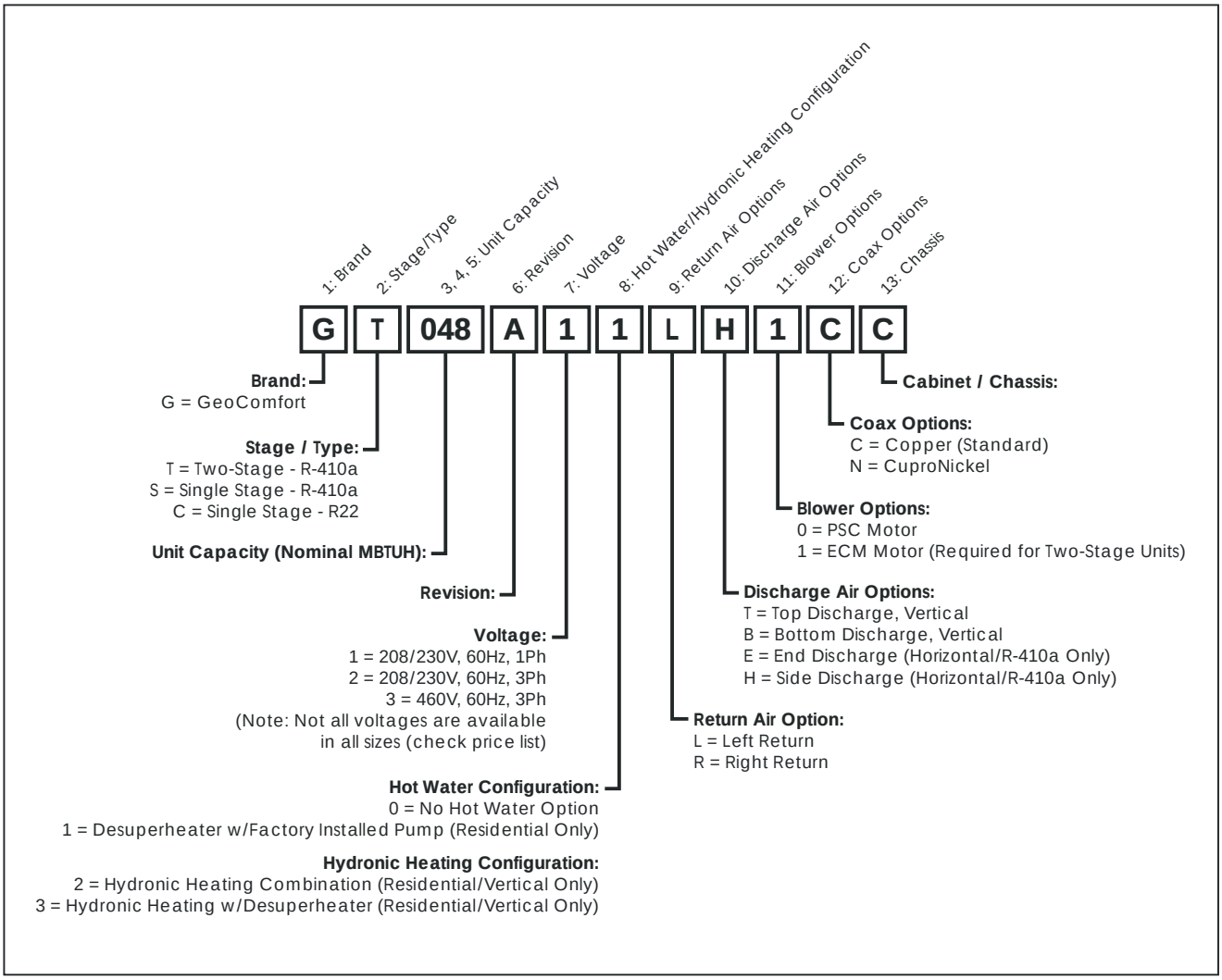
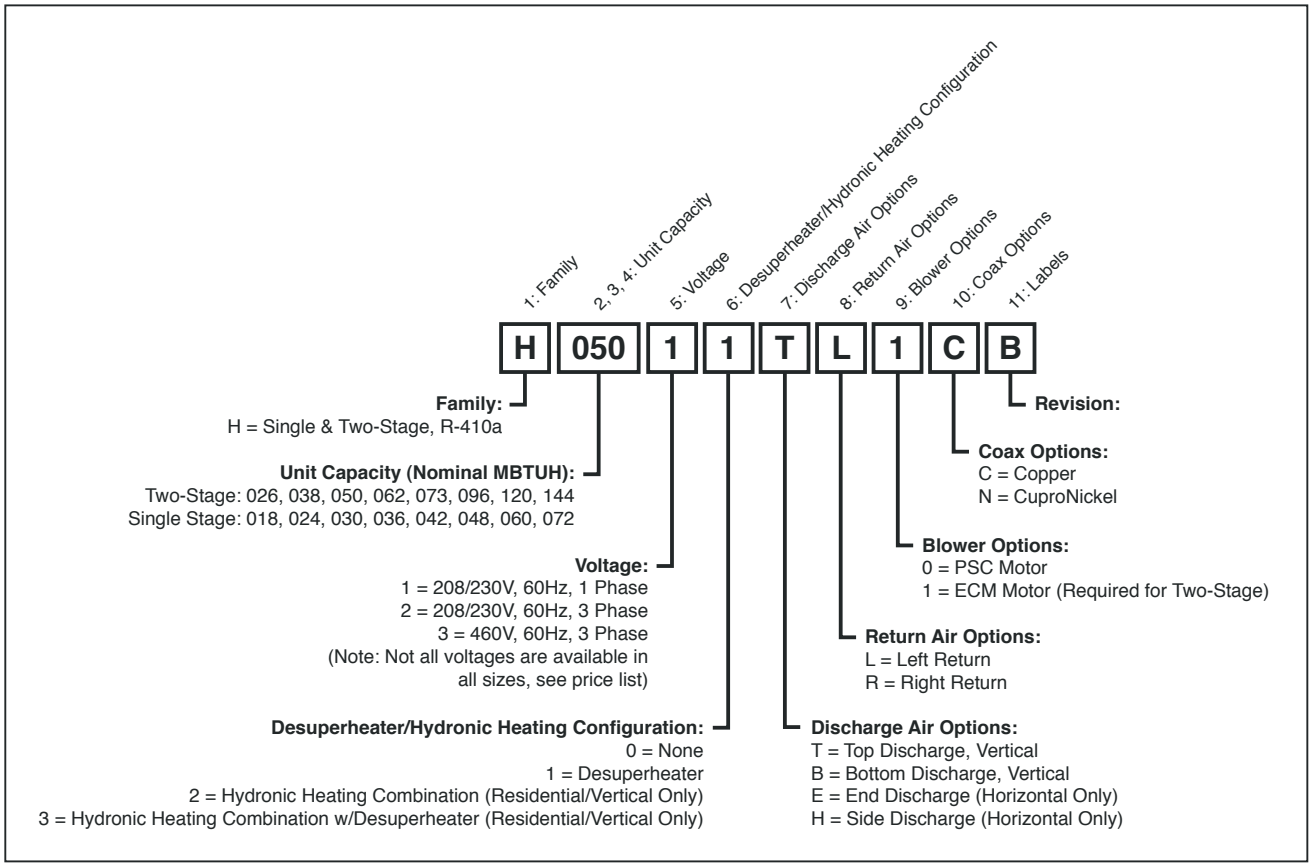
Section 1a: GeoComfort® Series Model Nomenclature

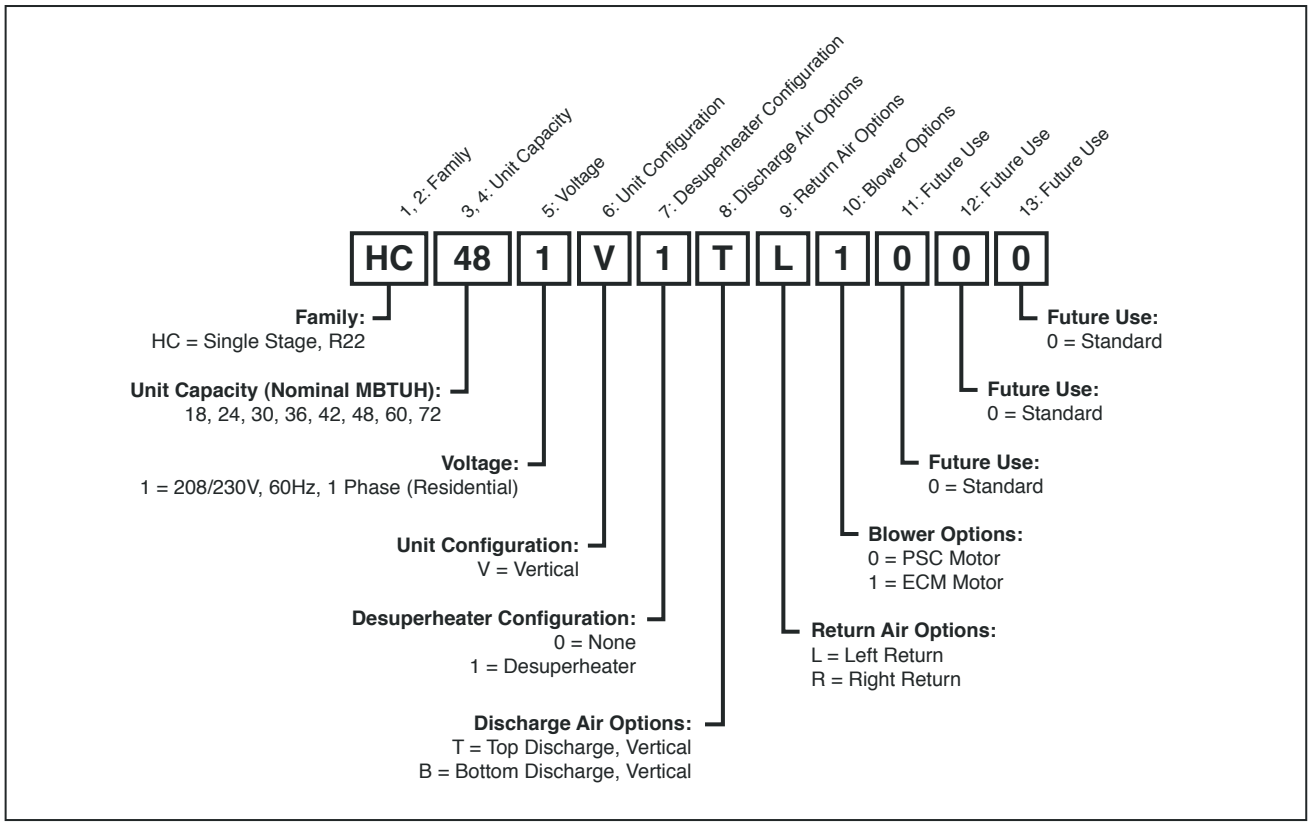


Rev.: 11 November, 2008D

Section 1b: Hydron Module® Series Model Nomenclature



Rev.: 11 November, 2008D



Rev.: 08 August, 2008D

Section 2: Introduction

INTRODUCTION:
This geothermal heat pump provides heating and cooling as well as optional domestic water heating capability. Engineering and quality control is built into every geothermal unit. Good performance depends on proper application and correct installation.

Notices, Cautions, Warnings, & Dangers

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

"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.

"WARNING" Indicates potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

"DANGER" Indicates an immediate hazardous situation which, if not avoided, WILL result in death or serious injury.

Inspection:
Upon receipt of any geothermal equipment, carefully check the shipment against the packing slip and the freight company bill of lading. Verify that all units and packages have been received. Inspect the packaging of each package and each unit for damages. Insure that the carrier makes proper notation of all damages or shortage on all bill of lading papers. Concealed damage should be reported to the freight company within 15 days. If not filed within 15 days the freight company can deny all claims.

Note: Notify Enertech Manufacturing, LLC shipping department of all damages within 15 days. It is the responsibility of the purchaser to file all necessary claims with the freight company.

Unit Protection:
Protect units from damage and contamination due to plastering (spraying), painting and all other foreign materials that may be used at the job site. Keep all units covered on the job site with either the original packaging or equivalent protective covering. Cap or recap unit connections and all piping until unit is installed. Precautions must be taken to avoid physical damage and contamination which may prevent proper start-up and may result in costly equipment repair.

⚠ CAUTION ⚠

DO NOT OPERATE THE GEOTHERMAL HEAT PUMP UNIT DURING BUILDING CONSTRUCTION PHASE.

Storage:
All geothermal units should be stored inside in the original packaging in a clean, dry location. Units should be stored in an upright position at all times. Units should not be stacked unless specially noted on the packaging.

Pre-Installation:
Special care should be taken in locating the geothermal unit. Installation location chosen should include adequate service clearance around the unit. All vertical units should be placed on a vibration-absorbing pad (air pad) slightly larger than the base of the unit. Flex connectors should also be installed in between the ductwork and the unit. All units should be located in an indoor area where the ambient temperature will remain above 55°F and should be located in a way that piping and ductwork or other permanently installed fixtures do not have to be removed for servicing and filter replacement.

Pre-Installation Steps:

1. Compare the electrical data on the unit nameplate with packing slip and ordering information to verify that the correct unit has been shipped.
2. Remove any packaging used to support blower during shipping.
3. Inspect all electrical connections and wires. Connections must be clean and tight at the terminals, and wires should not touch any sharp edges or copper pipe.

4. Verify that all refrigerant tubing is free of dents and kinks. Refrigerant tubing should not be touching other unit components.
5. Before unit start-up, read all manuals and become familiar with unit components and operation. Thoroughly check the unit before operating.

⚠ CAUTION ⚠

ALL GEOTHERMAL EQUIPMENT IS DESIGNED FOR INDOOR INSTALLATION ONLY. DO NOT INSTALL OR STORE UNIT IN A CORROSIVE ENVIRONMENT OR IN A LOCATION WHERE TEMPERATURE AND HUMIDITY ARE SUBJECT TO EXTREMES. EQUIPMENT IS NOT CERTIFIED FOR OUTDOOR APPLICATIONS. SUCH INSTALLATION WILL VOID ALL WARRANTIES.

⚠ WARNING ⚠

FAILURE TO FOLLOW THIS CAUTION MAY RESULT IN PERSONAL INJURY. USE CARE AND WEAR APPROPRIATE PROTECTIVE CLOTHING, SAFETY GLASSES AND PROTECTIVE GLOVES WHEN SERVICING UNIT AND HANDLING PARTS.

⚠ CAUTION ⚠

BEFORE DRILLING OR DRIVING ANY SCREWS INTO CABINET, CHECK TO BE SURE THE SCREW WILL NOT HIT ANY INTERNAL PARTS OR REFRIGERANT LINES.

Components:

Master Contactor: Energizes Compressor and optional Hydronic Pump and/or Desuperheater package.

Logic Board: Logic Board operates the compressor and protects unit by locking out when safety switches are engaged. It also provides fault indicator(s).

Terminal Strip: Provides connection to the thermostat or other accessories to the low voltage circuit.

Transformer: Converts incoming (source) voltage to 24V AC.

Low Voltage Breaker: Attached directly to transformer, protects the transformer and low voltage circuit.

Blower Motor Relay: Energizes the blower motor (PSC motors only).

Reversing Valve: Controls the cycle of the refrigerant system (heating or cooling). Energized in cooling mode.

Three Way Valve: Is used with radiant water heating combination units. Energized in water heating mode.

High Pressure Switch: Protects the refrigerant system from high refrigerant pressure, by locking unit out if pressure exceeds setting.

Low Pressure Switch: Protects the refrigerant system from low suction pressure, if suction pressure falls below setting.

Flow Switch (Freeze Protection Device): Protects the water heat exchanger from freezing, by shutting down compressor if water flow decreases.

Electric Heater: Provides auxiliary heat during cold temperatures and provides electric backup if unit malfunctions.

Blower Motor (ECM & PSC): ECM (Electrically Communicated Motor) for variable fan speeds. PSC (Permanent Split Capacitor) motor is available on single stage units.

Compressor (Copeland Scroll): Pumps refrigerant through the heat exchangers and pressurizes the refrigerant, which increases the temperature of the refrigerant.

Section 3: Installation Considerations

Consumer Instructions: Dealer should instruct the consumer in proper operation, maintenance, filter replacements, thermostat and indicator lights. Also provide the consumer with the manufacturer's Owner's Manual for the equipment being installed.

Equipment Installation: Special care should be taken in locating the unit. All vertical units should be placed on a vibration absorbing pad (air pad) slightly larger than the base of the unit. Downflow units should be placed on a non-combustible base. Flex connectors should also be installed in between the ductwork and the unit. All units should be located in an indoor area were the ambient temperature will remain above 55°F and should be located in a way that piping and ductwork or other permanently installed fixtures do not have to be removed for servicing and filter replacement.

Electrical: All wiring, line and low voltage, should comply with the manufacturer's recommendations, The National Electrical Code, and all local codes and ordinances.

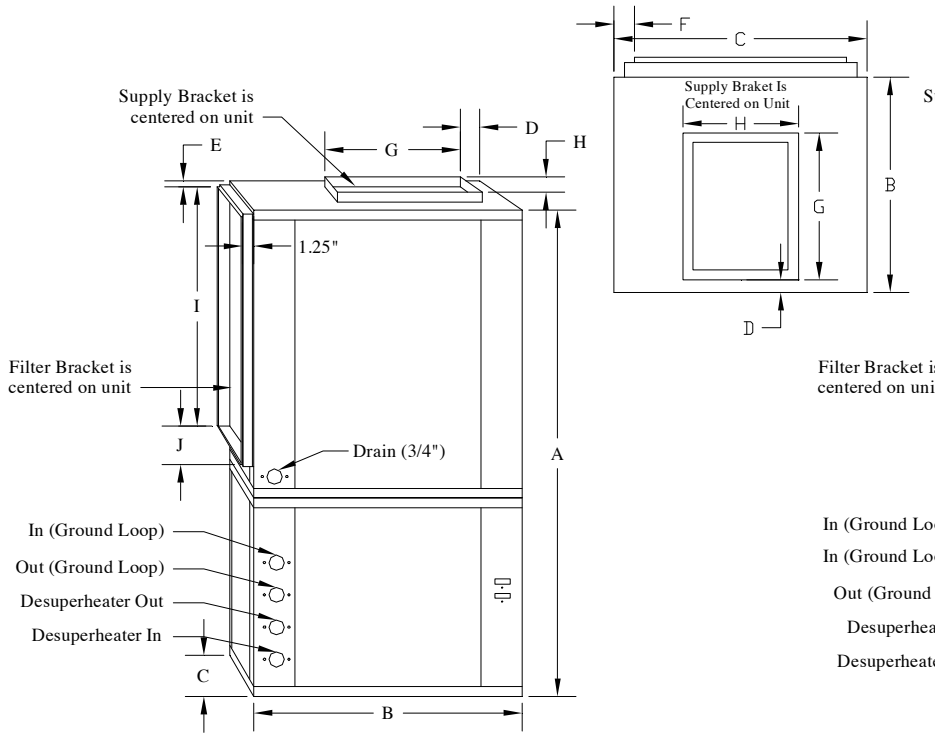
Thermostat: Thermostats should be installed approximately 54 inches off the floor on an inside wall in the return air pattern and where they are not in direct sunlight at anytime.

Loop Pumping Modules: Must be wired to the heat pump's electric control box. A special entrance knockout is provided below the thermostat entrance knockout. A pump module connection block, connected to the master contactor, is provided to connect the Pump Module wiring.

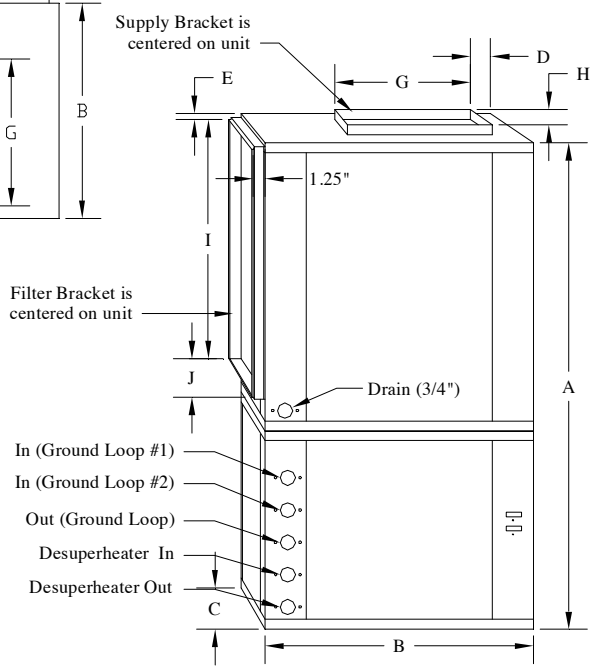
Desuperheater Package: Water heating is standard on all residential units (units may be ordered without). It uses excess heat during both heating and cooling cycles, to provide hot water for domestic needs. A desuperheater exchanger (coil) located between the compressor and the reversing valve, extracts superheated vapor to heat domestic water; still satisfying its heating and cooling needs. The water circulation pump comes pre-mounted in all residential units, but must be electrically connected to the master contactor. Leaving it unconnected ensures that the pump is not run without a water supply.
The Desuperheater package can make up to 60% (depending on heat pump usage) of most domestic water needs, but a water heater is still recommended.

Desuperheater Piping: All copper tubes & fittings should be 5/8" O.D (1/2" nom) minimum with a maximum of 50ft separation. Piping should be insulated with 3/8" wall closed cell insulation.

Section 4a: Two-Stage R-410a Vertical Equipment Physical Dimensions



024 thru 073

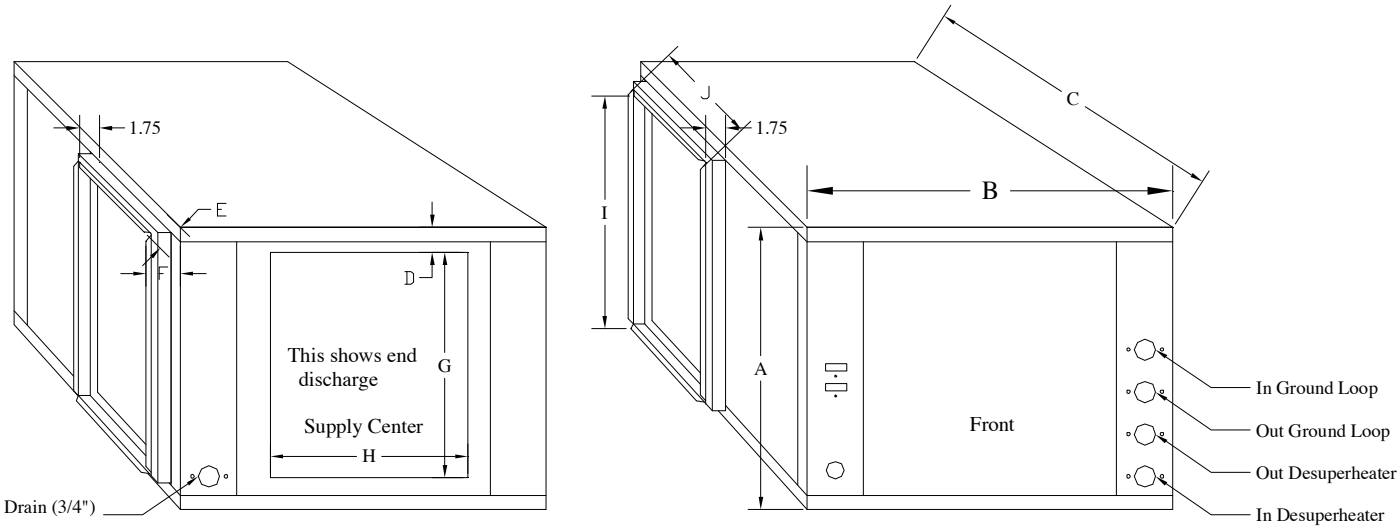


096 thru 144

Model	Dimensional Data						Supply Air		Return Air		Water Loop	
	A	B	C	D	E	F	G	H	I	J	IN	OUT
024/ 026	50.25	22.0	25.5	0.75	1.7	2.4	14.0	12.0	28.2	20.7	3/4”	3/4”
036/ 038	54.25	26.0	30.5	0.75	1.7	2.4	14.0	16.0	30.2	25.7	3.4”	3/4”
048/ 050	60.25	26.0	30.5	0.75	1.8	2.4	16.0	16.0	34.2	25.7	1.0”	1.0”
060/ 062	60.25	28.0	30.5	0.75	1.7	2.4	16.0	18.0	34.2	25.7	1.0”	1.0”
072	60.25	28.0	30.5	0.75	1.7	2.4	16.0	18.0	34.2	25.7	1.0”	1.0”
096	59.25	32.0	39.5	0.25	1.7	2.4	20.0	24.0	34.00	34.75	1.0”	1-1/4”
120	59.25	32.0	39.5	0.25	1.7	2.4	20.0	24.0	34.00	34.75	1.0”	1-1/2”
144	59.25	32.0	39.5	0.25	1.7	2.4	20.0	24.0	34.00	34.75	1.0”	1-1/2”

Notes
Down Flow equipment has the same dimensional data in an inverted configuration.
All Desuperheater connections are 3/4” FPT.
All measurements are in inches.

Section 4b: Two-Stage R-410a Horizontal Equipment Physical Dimensions

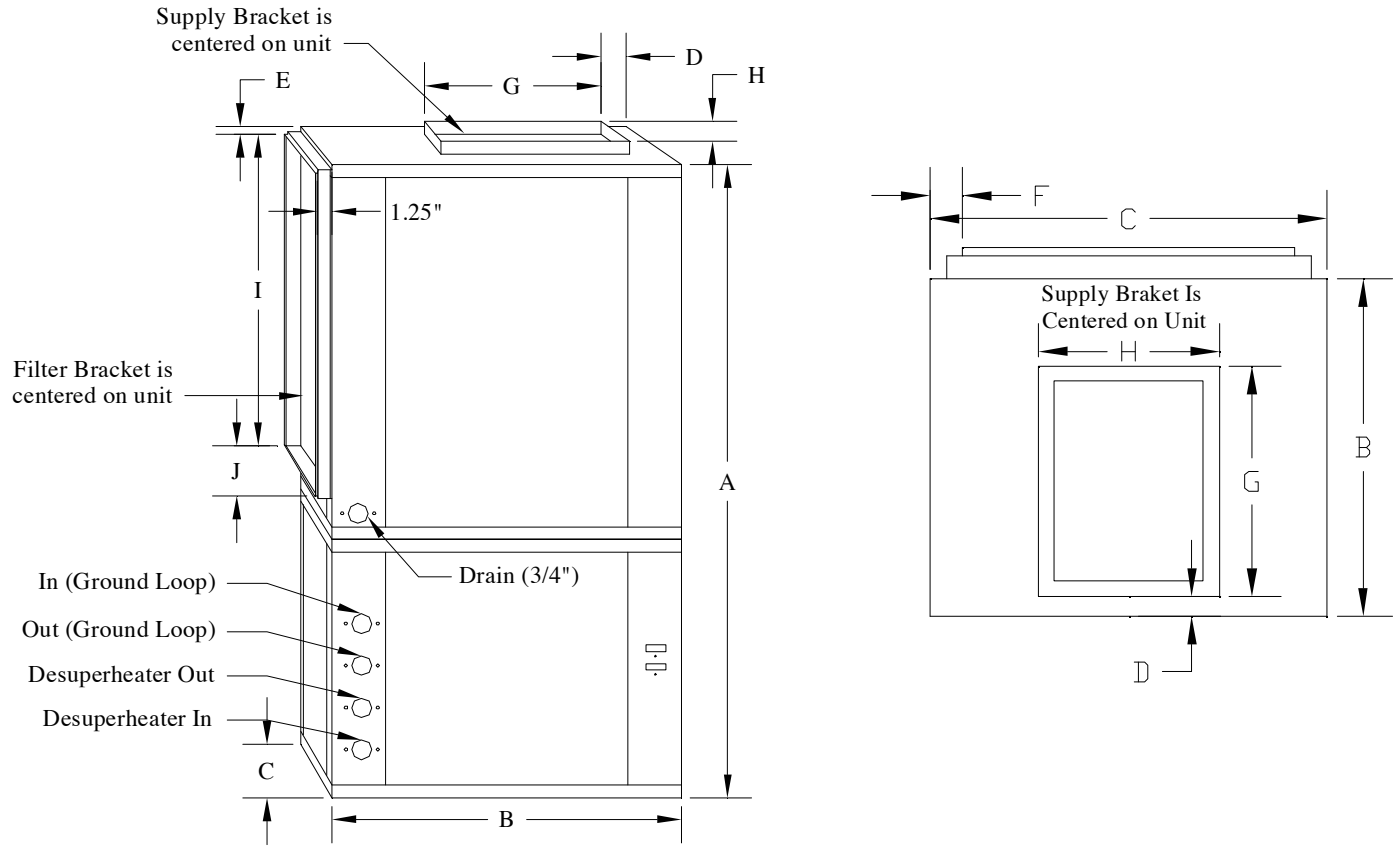


Note: If aux heater is needed, an external duct heater is required.

Model	Dimensional Data						Supply Air		Return Air		Water Loop	
	A	B	C	D	E	F	G	H	I	J	IN	OUT
024/ 026	22.0	26.0	54.0	2.0	1.75	2.0	14.0	12.0	16.75	33.25	3/4”	3/4”
036/ 038	22.0	28.0	66.0	2.0	1.75	2.0	16.0	14.0	16.75	45.25	3/4”	3/4”
048/ 050	24.0	30.0	68.0	2.0	1.72	2.0	16.0	16.0	18.75	47.25	1.0”	1.0”
060/ 062 072/ 073	24.0	30.0	68.0	2.0	1.75	2.0	16.0	16.0	18.75	47.25	1.0”	1.0”

Notes
All Desuperheater connections are 3/4” FPT.
All measurements are in inches.

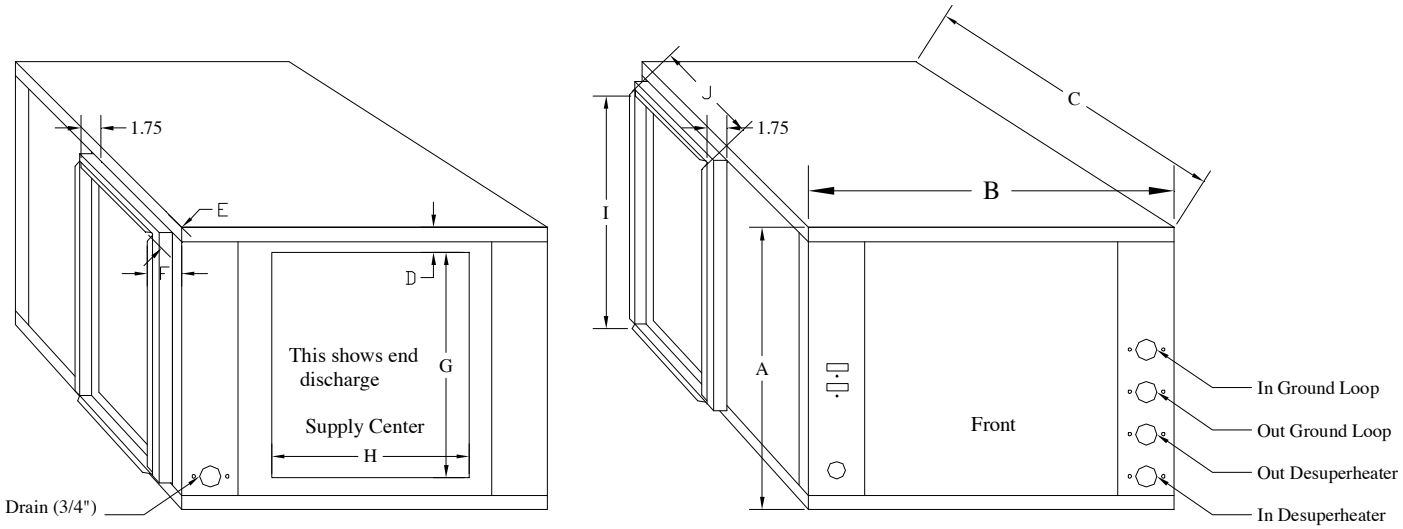
Section 4c: Single Stage R-410a Vertical Equipment Physical Dimensions



Model	Dimensional Data						Supply Air		Return Air		Water Loop	
	A	B	C	D	E	F	G	H	I	J	IN	OUT
018	50	22	25.5	0.75	1.6	2.5	12	14	28.2	20.7	3/4”	3/4”
024	50	22	25.5	0.75	1.6	2.5	12	14	28.2	20.7	3/4”	3/4”
030	54	26	30.5	0.75	1.6	2.5	14	16	30.2	25.7	3/4”	3/4”
036	54	26	30.5	0.75	1.6	2.5	14	16	30.2	25.7	3/4”	3/4”
042	60	26	30.5	0.75	1.6	2.5	16	16	34.2	25.7	1.0”	1.0”
048	60	26	30.5	0.75	1.6	2.5	16	16	34.2	25.7	1.0”	1.0”
060	60	28	30.5	0.75	1.6	2.5	16	16	34.2	25.7	1.0”	1.0”
072	60	28	30.5	0.75	1.6	2.5	16	16	34.2	25.7	1.0”	1.0”

Notes
Down Flow equipment has the same dimensional data in an inverted configuration.
All Desuperheater connections are 3/4” FPT.
All measurements are in inches.

Section 4d: Single Stage R-410a Horizontal Equipment Physical Dimensions

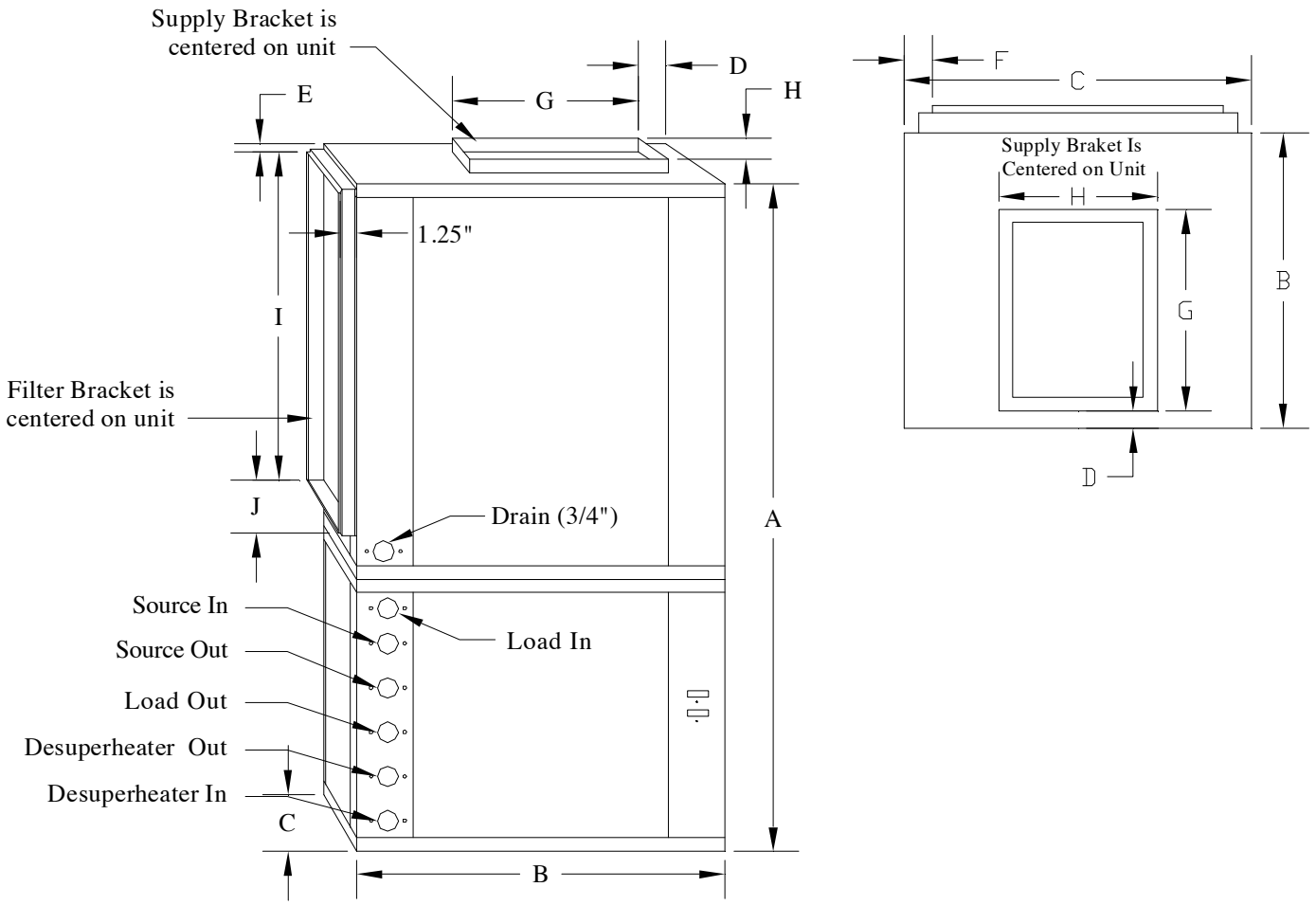


Note: If aux heater is needed, an external duct heater is required.

Model	Dimensional Data						Supply Air		Return Air		Water Loop	
	A	B	C	D	E	F	G	H	I	J	IN	OUT
018	22	26	54	2	1.75	2	14	12	16.75	33.25	3/4”	3/4”
024	22	26	54	2	1.75	2	14	12	16.75	33.25	3/4”	3/4”
030	22	28	66	2	1.75	2	16	14	16.75	45.25	3/4”	3/4”
036	22	28	66	2	1.75	2	16	14	16.75	45.25	3/4”	3/4”
042	24	30	68	2	1.75	2	16	16	18.75	47.25	1.0”	1.0”
048	24	30	68	2	1.75	2	16	16	18.75	47.25	1.0”	1.0”
060	24	30	68	2	1.75	2	16	16	18.75	47.25	1.0”	1.0”
072	24	30	68	2	1.75	2	16	16	18.75	47.25	1.0”	1.0”

Notes
All Desuperheater connections are 3/4” FPT.
All measurements are in inches.

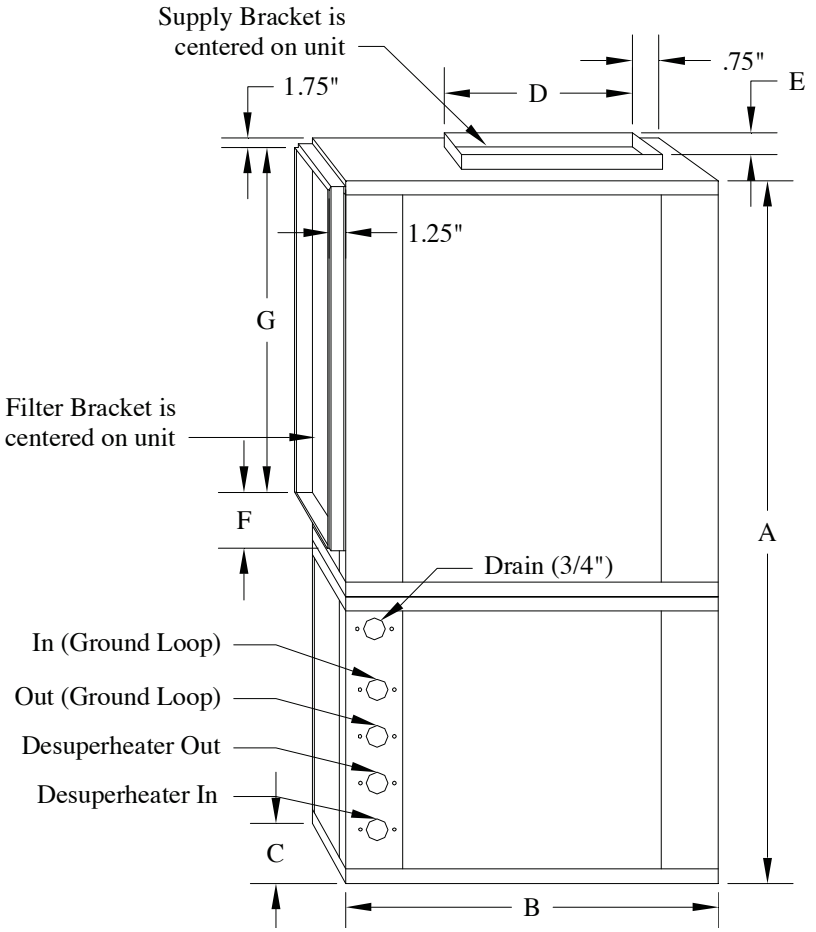
Section 4e: Combination Series Vertical Equipment Physical Dimensions



Model	Dimensional Data						Supply Air		Return Air		Water Loop	
	A	B	C	D	E	F	G	H	I	J	IN	OUT
024/ 026	50	22	25.5	0.75	1.6	2.5	12	14	28.2	20.7	3/4”	3/4”
036/ 038	54	26	30.5	0.75	1.6	2.5	14	16	30.2	25.7	3.4”	3/4”
048/ 050	60	26	30.5	0.75	1.6	2.5	16	16	34.2	25.7	1.0”	1.0”
060/ 062 & 072	60	28	30.5	0.75	1.6	2.5	16	16	34.2	25.7	1.0”	1.0”

Notes
All Desuperheater connections are 3/4” FPT.
All measurements are in inches.

Section 4f: Single Stage R-22 Vertical Equipment Physical Dimensions



Model	Dimensional Data			Supply Air		Return Air		Water Loop	
	A	B	C	D	E	F	G	IN	OUT
018	43	23	31	12	14	26.25	20.63	3/4”	3/4”
024	43	23	31	12	14	26.25	20.63	3/4”	3/4”
030	49	26	31	14	16	26.25	24.63	3/4”	3/4”
036	49	26	31	14	16	26.25	24.63	3/4”	3/4”
042	52	26	32	14	16	27.25	26.63	1.0”	1.0”
048	52	26	32	14	16	27.25	26.63	1.0”	1.0”
060	55	28	34.5	16	16	29.75	28.63	1.0”	1.0”
072	55	28	34.5	16	16	29.75	28.63	1.0”	1.0”

Notes
All Desuperheater connections are 3/4” FPT.
All measurements are in inches.

Section 5a: Two-Stage R-410a Unit Physical Data

Dual Capacity (024 - 073) and Dual Compressor (096 - 144)								
Model Number	**024 / 026**	**036 / 038**	**048 / 050**	**060 / 062**	**072/073**	**096**	**120**	**144**
Fan Wheel (in.)	9 x 7	9 x 9	11x10	11x10	11x10	12 x 12	15 x 15	15 x 15
Fan Motor ECM (HP)	1/2	1/2	1.0	1.0	1.0	2 - 1.0	2 - 1.0	2 - 1.0
PSC (HP)	-	-	-	-	-	2 - 0.5 or 1 - 1.5*	2 - 1.0 or 1 - 2.0*	2 - 1.0 or 1 - 2.0*
Refrigerant Charge (oz.)	48.0	64.0	64.0	80.0	112.0	64.0 Each	72.0 Each	80.0 Each
Air Coil								
Face Area (Sq.Ft.)	4.2	5.6	6.3	6.3	6.3	8.9	8.9	8.9
Dimensions (in.)	20x30	25x32	25x36	25x36	25x36	34x36	34x36	34x36
Number Of Rows	3	3	3	4	4	3	4	5
Filter 1" Thick	30x24	32x28	36x28	36x28	36x28	36x38	36x38	36x38
Unit Weight (nominal) - lbs	320	380	430	470	520	700	780	800
Horizontal – Single Compressor Dual Capacity								
Fan Wheel (in.)	9 x 7	9 x 9	11x10	11x10				
Fan Motor (HP) ECM	1/2	1/2	1.0	1.0				
Refrigerant Charge (oz.)	48.0	64.0	64.0	80.0				
Air Coil								
Face Area (Sq.Ft.)	4.0	5.5	6.4	6.4				
Dimensions (in.)	18x32	18x44	20x46	20x46				
Number Of Rows	3	3	3	4				
Filter 1" Thick	18x36	18x48	20x50	20x50				
Unit Weight (nominal) - lbs	320	380	430	470				

Section 5b: Single Stage R-410a Unit Physical Data

Vertical - Single Compressor								
Model Number	**018**	**024**	**030**	**036**	**042**	**048**	**060**	**072**
Fan Motor (in.) ECM	9 x 7	9 x 7	9 x 9	9 x 9	11x10	11x10	11x10	12x12
PSC	9 x 7	9 x 7	9 x 9	9 x 9	11x10	11x10	11x10	12x12
Fan Motor ECM (HP)	1/2	1/2	1/2	1/2	1	1	1	1
PSC (HP)	1/4	1/4	1/2	1/2	1/2	1/2	1	1
Refrigerant Charge (oz.)	48	48	64	64	64	64	80	80
Air Coil								
Face Area (Sq.Ft.)	4.2	4.2	5.6	5.6	6.3	6.3	6.3	6.3
Dimensions (in.)	20x30	20x30	25x32	25x32	25x36	25x36	25x36	25x36
Number Of Rows	3	3	3	3	3	3	4	4
Filter 1" Thick	30x24		32x28		36x28		36x28	
Unit Weight (nominal) - lbs	290	300	350	370	400	430	460	470
Horizontal - Single Compressor								
Fan Motor (in.) ECM	9 x 7	9 x 7	9 x 9	9 x 9	11x10	11x10	11x10	12x12
PSC	9 x 7	9 x 7	9 x 9	9 x 9	11x10	11x10	11x10	12x12
Fan Motor ECM (HP)	1/2	1/2	1/2	1/2	1	1	1	1
PSC (HP)	1/4	1/4	1/2	1/2	1/2	1/2	1	1
Refrigerant Charge (oz.)	48	48	64	64	64	64	80	80
Air Coil								
Face Area (Sq.Ft.)	4	4	5.5	5.5	6.4	6.4	6.4	6.4
Dimensions (in.)	18x32	18x32	18x44	18x44	20x46	20x46	20x46	20x46
Number Of Rows	3	3	3	3	3	3	4	4
Filter 1" Thick	18x36		18x48		20x50		20x50	
Unit Weight (nominal) - lbs	290	300	350	370	400	430	460	470

Section 5c: Combination Unit Physical Data

Dual Capacity					
Model Number	**024 / 026**	**036 / 038**	**048 / 050**	**060 / 062**	**072**
Fan Wheel (in.)	9 x 7	9 x 9	11x10	11x10	12x12
Fan Motor ECM (HP)	1/2	1/2	1.0	1.0	1.0
PSC (HP)	-	-	-	-	-
Refrigerant Charge (oz.)	40.0	58.0	56.0	80.0	80.0
Air Coil					
Face Area (Sq.Ft.)	4.2	5.6	6.3	6.3	6.3
Dimensions (in.)	20x30	25x32	25x36	25x36	25x36
Number Of Rows	3	3	3	4	4
Filter 1" Thick	30x24	32x28	36x28	36x28	36x28
Unit Weight (nominal) - lbs	370	430	480	520	550

Section 5d: Single Stage R22 Unit Physical Data

Vertical - Single Compressor								
Model Number	**018**	**024**	**030**	**036**	**042**	**048**	**060**	**072**
Fan Motor (in.) ECM	9 x 7	9 x 7	9 x 9	9 x 9	10x10	10x10	10x10	12x12
PSC	9 x 7	9 x 7	9 x 9	9 x 9	10x10	10x10	10x10	12x12
Fan Motor ECM (HP)	1/2	1/2	1/2	1/2	1/2	1	1	1
PSC (HP)	1/6	1/6	1/4	1/4	1/2	1/2	3/4	1
Refrigerant Charge (oz.)	58	58	76	76	80	80	104	104
Air Coil								
Face Area (Sq.Ft.)	3.5	3.5	4.3	4.3	4.8	4.8	5.7	5.7
Dimensions (in.)								
Number Of Rows	3	3	3	3	3	3	4	4
Filter 1" Thick	22x30		26x30		28x30		32x30	
Unit Weight (nominal) - lbs	290	300	350	370	400	430	460	470

Section 6a: Two-Stage R-410a & Combination Unit Electrical Data

Model	60Hz Power		Compressor		Fan Motor		Total Unit FLA	Minimum Circuit Ampacity	Maximum Circuit Size
	Volts	Phase	RLA	LRA	FLA	LRA			
024/026	208-230	1	6.2	52.0	1.1	2.5	7.3	10.0	15.0
036/038	208-230	1	13.3	82.0	1.7	4.5	15.0	20.0	30.0
	208-230	3	8.1	58.0	1.7	4.5	9.8	15.0	20.0
048/050	208-230	1	17.3	96.0	3.1	8.0	20.4	30.0	45.0
	208-230	3	11.5	88.0	3.4	8.0	14.6	20.0	30.0
060/062	208-230	1	22.2	118.0	4.3	10.4	26.5	35.0	55.0
	208-230	3	14.9	135.0	4.3	10.4	19.2	25.0	40.0
072/073	208-230	1	25.0	125.0	4.3	10.4	29.3	40	60
	208-230	3	15.5	110	4.3	10.4	19.8	30	45
096*	208-230	1	21.8 Each	134.0 Each	2-1.7*	2-4.5*	47	30.0 Each	45.0 Each
	208-230	3	14.4 Each	123.0 Each	2-1.7*	2-4.5*	32.2	25.0 Each	30.0 Each
120*	208-230	1	24.7 Each	158.0 Each	2-5.0*	2-38.3*	58	40.0 Each	55.0 Each
	208-230	3	16.3 Each	155.0 Each	2-5.0*	2-38.3*	41.2	30.0 Each	45.0 Each
144*	208-230	1	25.7 Each	148.0 Each	2-5.4*	2-40.0*	62.2	45.0 Each	50.0 Each
	208-230	3	18.2 Each	149.0 Each	2-5.4*	2-40.0*	47.2	35.0 Each	40.0 Each
Shown Below Are the Specifications For Belt Driven Blowers (Optional).									
096	208-230	1	21.8 Each	134.0 Each	8.9	50.3	52.5	40.0 Each	45.0 Each
	208-230	3	14.4 Each	123.0 Each	4.4	26.4	33.2	25.0 Each	30.0 Each
	460	3	6.2 Each	46.0 Each	2	12.1	14.4	10.0 Each	10.0 Each
	575	3	5.0 Each	37.0 Each	1.4	8.4	14	10.0 Each	10.0 Each
120	208-230	1	24.7 Each	158.0 Each	10	66	59.4	80.0 Each	100.0 Each
	208-230	3	16.3 Each	155.0 Each	5.8	34.8	38.4	50.0 Each	60.0 Each
	460	3	8.0 Each	75.0 Each	2.6	15.6	18.6	10.0 Each	15.0 Each
	575	3	6.5 Each	54.0 Each	1.9	13.8	14.9	10.0 Each	15.0 Each
144	208-230	1	25.7 Each	148.0 Each	11	66	62.4	45.0 Each	55.0 Each
	208-230	3	18.2 Each	149.0 Each	5.8	34.8	42.2	30.0 Each	40.0 Each
	460	3	9.1 Each	75.0 Each	3	15.6	21.2	15.0 Each	20.0 Each
	575	3	7.3 Each	54.0 Each	2.3	13.8	16.9	10.0 Each	15.0 Each

Notes:

* These models come standard with direct drive twin blowers. Fan motor FLA & RLA are shown for each motor.

1. 096, 120 & 144 models come with two compressors; separate refrigerant systems.
   These models may be operated as two-stage equipment.
   PSC = Blower capacity remains constant.
   ECM = Blower Capacity variable speed.
2. Make sure compressors and blower motors do not run backwards on three-phase equipment.
3. Always refer to unit nameplate data prior to installation
   Installing Wires (High Voltage): Main Electric Supply for the unit (compressor compartment) should enter the unit at the heat pump high voltage wiring entrance. Wire should be run through a conduit up to the cabinet and wired to the heat pump main contactor.

Section 6b: Single Stage R-410a Unit Electrical Data

Model	60 HZ Power		Compressor		Fan Motor		Total Unit FLA	Minimum Circuit Ampacity	Maximum Fuse Size
	Volts	Phase	RLA	LRA	FLA	LRA			
018	208-230	1	7.2	48.0	1.7	2.5	8.9	15	15
024	208-230	1	10.6	64.0	1.7	4.5	12.3	20	25
	208-230	3	7.4	63.0	1.7	4.5	9.1	15	20
	460	3	3.6	28.0	0.75	2.3	4.4	5.5	8.8
030	208-230	1	13.5	79.0	3.1	8.0	16.6	25	35
	208-230	3	9.4	77.0	3.1	8.0	12.5	15	25
	460	3	4.6	38.0	1.4	4.2	6.0	10	10
036	208-230	1	16.3	112.0	3.1	8.0	19.4	25	40
	208-230	3	10.9	88.0	3.1	8.0	14.0	20	30
	460	3	5.4	44.0	1.4	4.2	6.8	10	10
	575	3	4.1	34.0	0.7	3.9	4.8	10	10
042	208-230	1	18.6	117.0	1.7	4.5	20.3	25	40
	208-230	3	12.0	91.0	1.7	4.5	13.7	20	25
	460	3	5.6	41.0	1.4	4.2	7.0	10	10
	575	3	4.6	33.0	0.8	3.9	5.4	10	10
048	208-230	1	21.8	134.0	1.7	4.5	26.1	30	50
	208-230	3	14.4	123.0	1.7	4.5	18.7	20	30
	460	3	6.2	46.0	1.4	4.2	7.6	10	15
	575	3	5.0	37.0	0.9	3.9	5.9	10	10
060	208-230	1	24.7	158.0	5.0	38.3	29.7	40	60
	208-230	3	16.3	155.0	5.0	38.3	21.3	30	40
	460	3	8.0	75.0	1.5	4.8	9.5	15	15
	575	3	6.5	54.0	1.4	3.9	7.9	10	15
072	208-230	1	25.7	148.0	5.4	40.0	31.1	40	60
	208-230	3	18.2	149.0	5.4	40.0	23.6	30	45
	460	3	9.1	75.0	1.6	4.8	10.7	15	20
	575	3	7.3	54.0	1.5	4.0	8.8	15	15

Notes:

1. PSC = Permanent Split Capacitor motor (CFM varies with ESP)
   ECM = Electronically Commutated Motor (constant CFM up to max. allowable ESP)
2. Make sure compressors and blower motors do not run backwards on three-phase equipment.
3. Always refer to unit nameplate data prior to installation
   Installing Wires (High Voltage): Main Electric Supply for unit (compressor compartment) should enter the unit at the heat pump high voltage wiring entrance. Wire should be run through a conduit up to the cabinet and wired to the heat pump main contactor.

Section 6c: Single Stage R22 Unit Electrical Data

Model	60 HZ Power		Compressor		Fan Motor		Total Unit FLA	Minimum Circuit Ampacity	Maximum Fuse Size
	Volts	Phase	RLA	LRA	FLA	LRA			
018	208-230	1	7.5	45.0	1.1	2.5	8.6	12.0	15.0
024	208-230	1	9.9	63.0	1.1	2.5	11.0	15.0	20.0
	208-230	3	6.9	55.0	1.1	2.5	8.0	10.0	15.0
030	208-230	1	12.3	73.0	1.7	4.5	14.0	20.0	25.0
	208-230	3	8.3	63.0	1.7	4.5	10.0	15.0	20.0
036	208-230	1	14.9	95.0	1.7	4.5	16.6	20.0	35.0
	208-230	3	9.7	77.0	1.7	4.5	11.4	15.0	20.0
042	208-230	1	17.2	109.0	3.1	8.0	20.3	25.0	40.0
	208-230	3	11.1	88.0	3.1	8.0	14.2	20.0	25.0
048	208-230	1	20.7	137.0	3.1	8.0	23.8	30.0	45.0
	208-230	3	12.7	91.0	3.1	8.0	15.8	20.0	30.0
060	208-230	1	25.3	148.0	4.3	10.4	29.6	40.0	60.0
	208-230	3	15.4	137.0	4.3	10.4	19.7	25.0	35.0
072	208-230	1	27.9	176.0	5.0	38.3	32.9	40.0	65.0
	208-230	3	18.2	156.0	5.0	38.3	23.2	30.0	45.0

Notes:

1. PSC = Permanent Split Capacitor motor (CFM varies with ESP)
   ECM = Electronically Commutated Motor (constant CFM up to max. allowable ESP)
2. Make sure compressors and blower motors do not run backwards on three-phase equipment.
3. Always refer to unit nameplate data prior to installation
   Installing Wires (High Voltage): Main Electric Supply for unit (compressor compartment) should enter the unit at the heat pump high voltage wiring entrance. Wire should be run through a conduit up to the cabinet and wired to the heat pump main contactor.

Section 7: Unit Placement

UNIT PLACEMENT:
When installing a geothermal heating and cooling unit, there are several items the installer should consider before placing the equipment.

1. ***Service Access.*** Is there enough space for service access? A general rule of thumb is at least 2 feet in the front and 2 feet on at least one side.
2. ***Unit Air Pad.*** All vertical geothermal heating and cooling equipment should be placed on either a formed plastic air pad, or a high density, closed cell polystyrene pad. Downflow units should be placed on a non-combustible base. This helps eliminate vibration noise that could be transmitted through the floor.
3. The installer has verified that all applicable wiring, ductwork, piping, and accessories are correct and on the job site.

PRE-INSTALLATION:
Before you fully install the geothermal equipment, it is recommended you go through this quick checklist before placing the equipment.

- ☐ Fully inspect the unit after unpacking.
- ☐ Open both the air handler section and compressor section and removed any packaging material or documentation included in the unit.
- ☐ Remove all packaging materials and ties from the rear of the blower.
- ☐ Locate the Unit Start-Up form from this manual and have it available as the unit installation proceeds.

⚠ WARNING ⚠

DOWNFLOW UNITS REQUIRE THAT THE FLOOR OPENING (BETWEEN THE UNIT AND THE SUPPLY DUCT PLENUM) BE SLEEVED THROUGH THE FLOOR WITH METAL DUCT. THIS IS ESPECIALLY IMPORTANT IF THE UNIT IS SITTING ON AN AIR PAD.

Section 7a: Ductwork Installation

DUCT WORK:
All new ductwork shall be designed as outlined in Sheet Metal and Air Conditioning Contractors National Association (SMACNA) or Air Conditioning Contractors of America (ACCA) or American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) handbooks.

All supply/return plenums should be isolated from the unit by a flexible connector (canvas) or equivalent to prevent transfer of vibration noise to the ductwork. The flex connector should be designed so as not to restrict airflow. Turning vanes should be used on any run over 500 CFM. If the unit is installed in a noninsulated space the metal ductwork should be insulated on the inside with fiberglass insulation or similar insulation to prevent heat loss/gain and to absorb air noise. If the unit is being installed with existing ductwork, the ductwork must be designed to handle the air volume required by the unit being installed. When running a cooling or heating load on a building, size ductwork accordingly to the building design load and heat pump CFM.

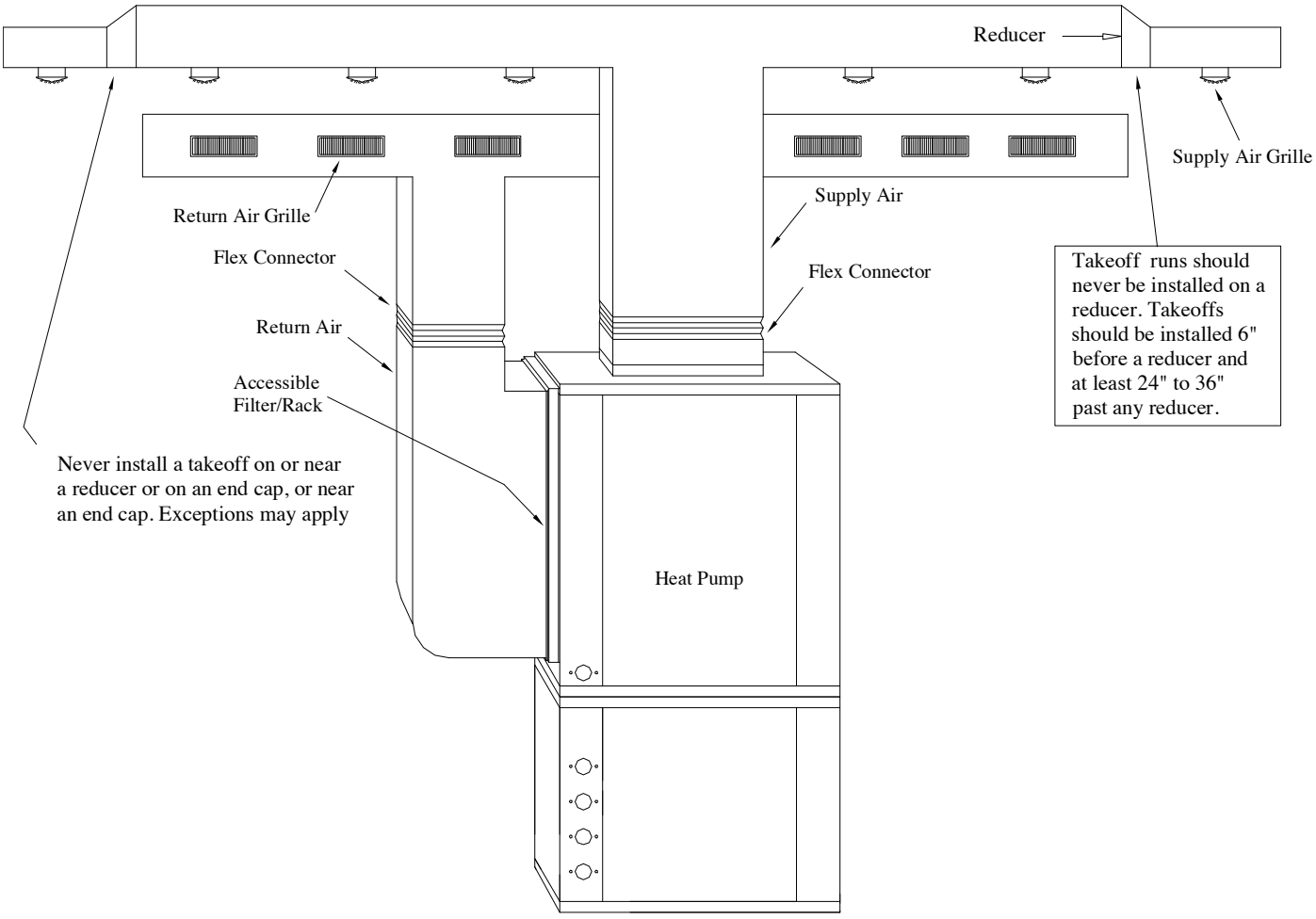
Rule of Thumb: When sizing ductwork use 400 CFM per Ton.

As a general rule, maximum recommended face velocity for a supply outlet used in a residential application is 800 FPM. Maximum recommended return grille velocity is 400 FPM. Systems with higher velocity, are likely to have noise problems.

In buildings where ceilings are 8 feet or more, at least 50 percent of the return air should be taken back to the heat pump from the ceiling or high sidewall location and not more than 50 percent from the floor or low sidewall location.

Section 7a: Ductwork Installation

Figure 1: Standard Ductwork Connection Setup

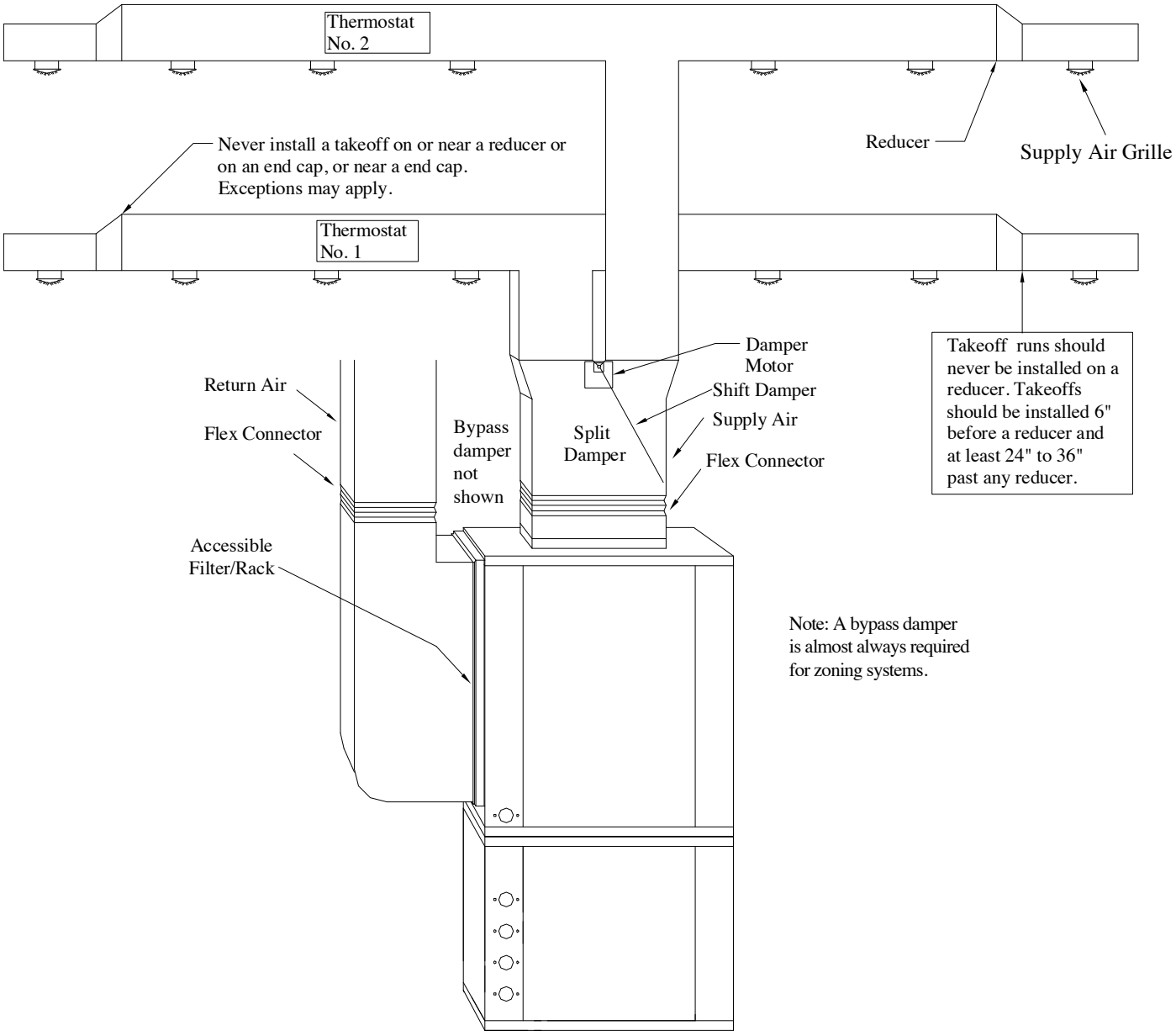


The geothermal unit comes with an ECM Motor or PSC 3-speed blower motor. For maximum performance, the blower speed should be set to maintain between 350 and 450 CFM/ton. Changing the wires (for PSC) at the blower will change the blower speed.

Table 1: Maximum Air Velocities

Location	Supply	Return
Main Ducts	900 FPM	600 FPM
Branch Ducts	700 FPM	600 FPM
Grills, Registers, Diffusers	750 FPM	600 FPM

Figure 2: Ductwork with Split Damper Connection Setup



Open Loop Piping

Placement of the components for an open loop system are important when considering water quality and long term maintenance. The water solenoid valve should always be placed on the outlet of the heat pump, which will keep the heat exchanger under pressure when the unit is not operating. If the heat exchanger is under pressure, minerals will stay in suspension. Water solenoid valves are also designed to close against the pressure, not with the pressure. Otherwise, they tend to be noisy when closing.

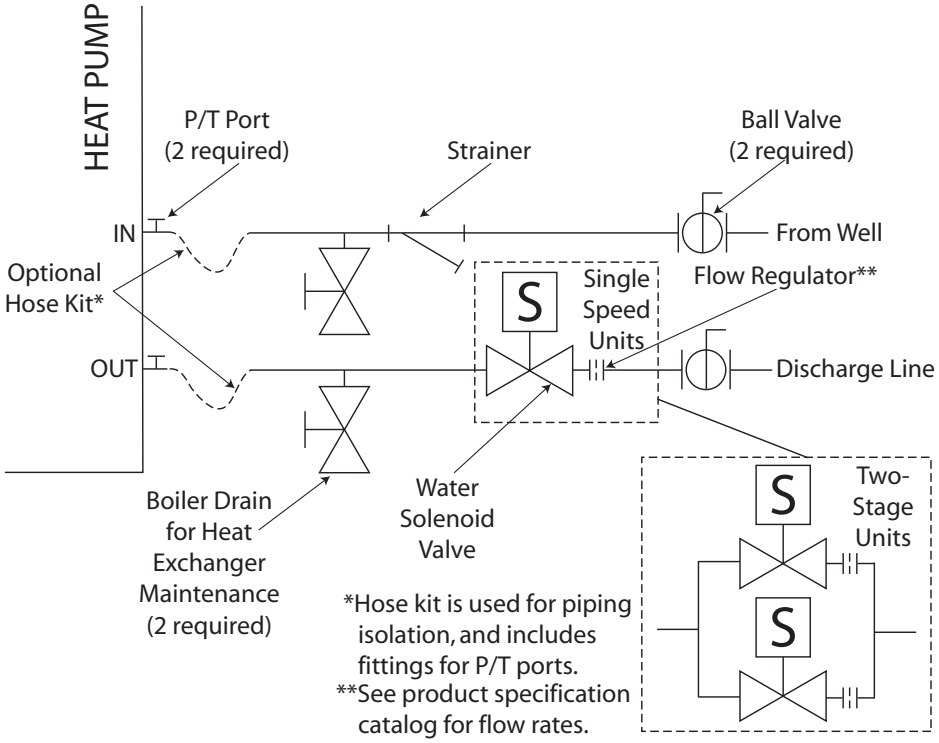
A flow regulator should be placed after the water solenoid valve. Always check the product specification catalog for proper flow rate. A calculation must be made to determine the flow rate, so that the leaving water temperature does not have the possibility of freezing.

Other necessary components include a strainer, boiler drains for heat exchanger flushing, P/T ports and ball valves. Ball valves allow the water to be shut off for service, and also help when velocity noise is noticeable through the flow regulator. Spreading some of the pressure drop across the ball valves will lessen the velocity noise. Always double check flow rate at the P/T ports to make sure the ball valve adjustments have not lowered water flow too much, and essentially taken the flow regulator out of the equation. It's a good idea to remove the ball valve handles once the system is completed to avoid nuisance service calls.

Hose kits are optional, but make for an easier installation, since the P/T ports and connections are included. The hose also helps to isolate the heat pump from the piping system.

Two-stage units typically include two water solenoid valves, since the heat pump can operate at lower water flow on first stage, saving water. The flow regulators should be sized so that when one valve is open the unit operates at first stage flow rate, and when both valves are open, the unit operates at full load flow rate. For example, a 4 ton unit needs approximately 4 GPM on first stage, and approximately 7 GPM at full load. The flow regulator after the first valve should be 4 GPM, and the flow regulator after the second valve should be 3 GPM. When both valves are open, the unit will operate at 7 GPM.

Figure 3: Open Loop Piping Example



Water Quality

The quality of the water used in geothermal systems is very important. In closed loop systems the dilution water (water mixed with antifreeze) must be of high quality to ensure adequate corrosion protection. Water of poor quality contains ions that make the fluid "hard" and corrosive. Calcium and magnesium hardness ions build up as scale on the walls of the system and reduce heat transfer. These ions may also react with the corrosion inhibitors in glycol based heat transfer fluids, causing them to precipitate out of solution and rendering the inhibitors ineffective in protecting against corrosion. In addition, high concentrations of corrosive ions, such as chloride and sulfate, will eat through any protective layer that the corrosion inhibitors form on the walls of the system.

Ideally, de-ionized water should be used for dilution with antifreeze solutions since de-ionizing removes both corrosive and hardness ions. Distilled water and zeolite softened water are also acceptable. Softened water, although free of hardness ions, may actually have increased concentrations of corrosive ions and, therefore, its quality must be monitored. It is recommended that dilution water contain less than 100 PPM calcium carbonate or less than 25 PPM calcium plus magnesium ions; and less than 25 PPM chloride or sulfate ions.

In an open loop system the water quality is of no less importance. Due to the inherent variation of the supply water, it should be tested prior to making the decision to use an open loop system. Scaling of the heat exchanger and corrosion of the internal parts are two of the potential problems. The Department of Natural Resources or your local municipality can direct you to the proper testing agency. Please see Table 2 for guidelines.

Table 2: Water Quality

Potential Problem	Chemical(s) or Condition	Range for Copper Heat Exchangers	Range for Cupro-Nickel Heat Exchangers
Scaling	Calcium & Magnesium Cabonate	Less than 350 ppm	Less than 350 ppm
Corrosion	pH Range	7 - 9	5 - 9
	Total Disolved Solids	Less than 1000 ppm	Less than 1500 ppm
	Ammonia, Ammonium Hydroxide	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonium Chloride, Ammonium Nitrate	Less than 0.5 ppm	Less than 0.5 ppm
	Calcium Chloride / Sodium Chloride	Less than 125 ppm	Less than 125 ppm - Note 4
	Chlorine	Less than 0.5 ppm	Less than 0.5 ppm
	Hydrogen Sulfide	None Allowed	None Allowed
Biological Growth	Iron Bacteria	None Allowed	None Allowed
	Iron Oxide	Less than 1 ppm	Less than 1 ppm
Erosion	Suspended Solids	Less than 10 ppm	Less than 10 ppm
	Water Velocity	Less than 8 ft/s	Less than 12 ft/s

Notes:
1. Harness in ppm is equivalent to hardness in mg/l
2. Grains/gallon = ppm divided by 17.1
3. Copper and cupro-nickel heat exchangers are not recommended for pool applications for water outside the range of the table. Secondary heat exchangers are required for applications not meeting the requirements shown above.
4. Saltwater applications (approx. 25,000 ppm) require secondary heat exchangers due to copper piping between the heat exchanger and the unit fittings.

Section 8: Unit Piping Installation

Interior Piping

All interior piping must be sized for proper flow rates and pressure loss. Insulation should be used on all inside piping when minimum loop temperatures are expected to be less than 50°F. Use the table below for insulation sizes with different pipe sizes. All pipe insulation should be a closed cell and have a minimum wall thickness of 3/8". All piping insulation should be glued and sealed to prevent condensation and dripping. Interior piping may consist of the following materials: HDPE, copper, brass, or rubber hose (hose kit only). **PVC is not allowed on pressurized systems.**

Table 3: Pipe Insulation

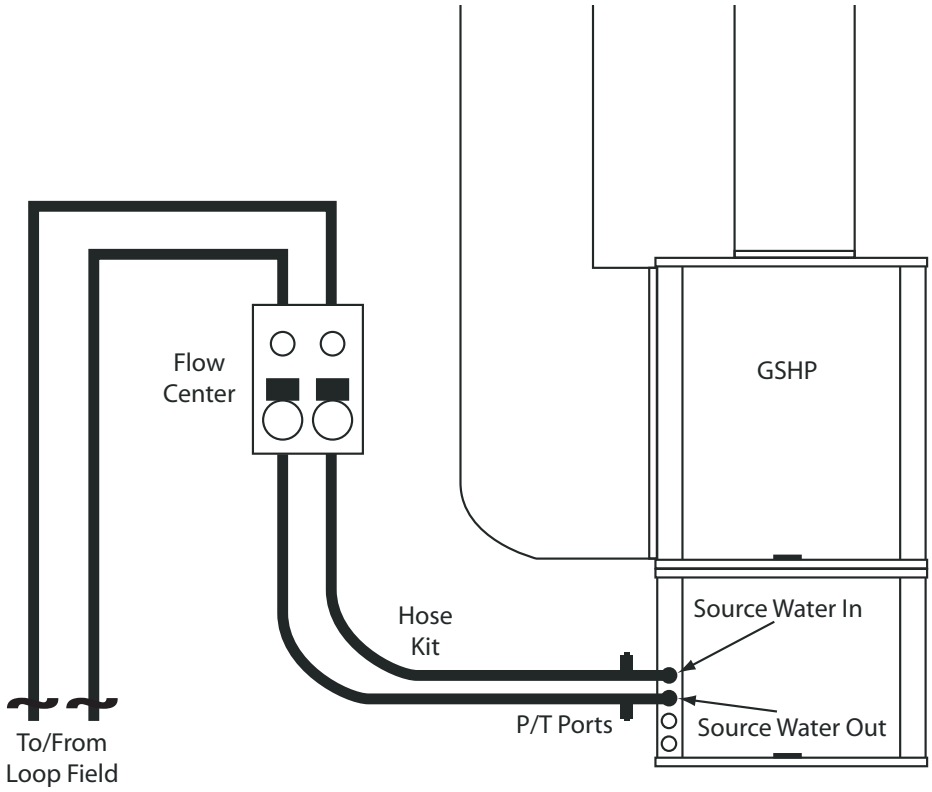
Piping Material	Insulation Description
1" IPS Hose	1-3/8" ID - 3/8" Wall
1" IPS PE	1-1/4" ID - 3/8" Wall
1-1/4" IPS PE	1-5/8" ID - 3/8" Wall
2" IPS PD	2-1/8" ID - 3/8" Wall

Typical Pressurized Flow Center Installation

The flow centers are insulated and contain all flushing and circulation connections for residential and light commercial earth loops that require a flow rate of no more than 20 gpm. 1-1/4" fusion x 1" double o-ring fittings (AGA6PES) are furnished with the AGFC_A flow centers for HDPE loop connections. Various fittings are available for the AGFC_A flow centers for different connections. A typical installation will require the use of a hose kit. Hose kits AGHK_A come with the AGA5INS adapter to transition from the AGFC_A double o-ring connection to 1" hose connection.

Note: AGFC_B flow centers all have 1" FPT connections. AGHK_B hose kits come with the AGBA55 adapter needed to transition from 1" FPT to 1" hose.

Figure 4: Typical Single Unit Piping Connection (Pressurized Flow Center)



Typical Non-Pressurized Flow Center Installation
Standing column flow centers are designed to operate with no static pressure on the earth loop. The design is such that the column of water in the flow center is enough pressure to prime the pumps for proper system operation and pump reliability. The flow center does have a cap/seal, so it is still a closed system, where the fluid will not evaporate. If the earth loop header is external, the loop system will still need to be flushed with a purge cart. The non-pressurized flow center needs to be isolated from the flush cart during flushing because the flow center is not designed to handle pressure. Since this is a non-pressurized system, the interior piping can incorporate all the above-mentioned pipe material options (see interior piping), including PVC. The flow center can be mounted to the wall with the included bracket or mounted on the floor as long as it is properly supported.

Figure 5: Typical Single Unit Piping Connection (Non-Pressurized Flow Center)

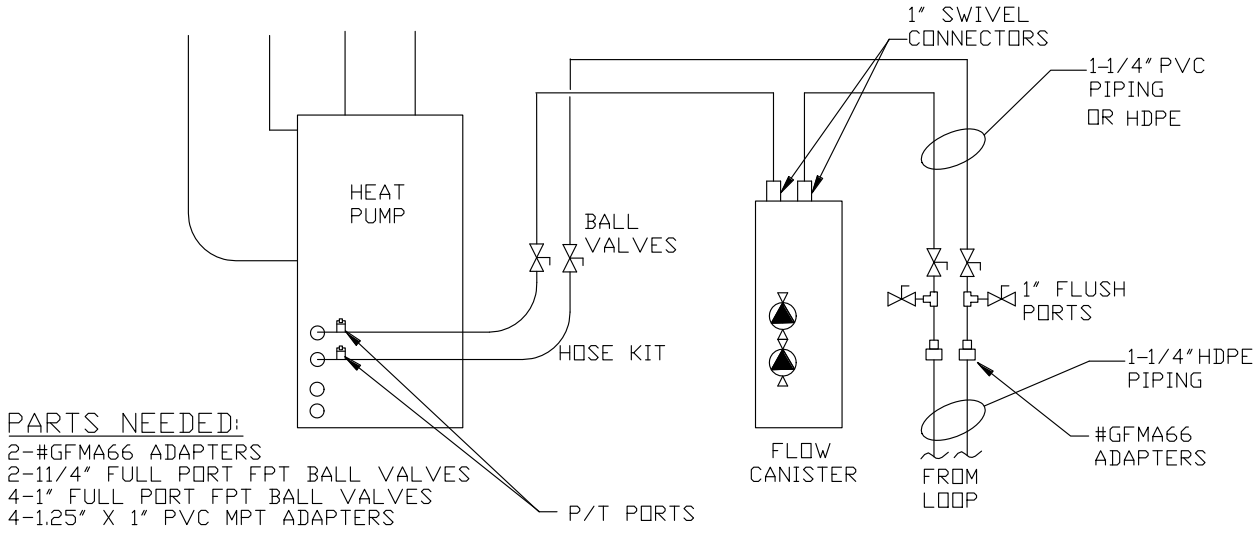
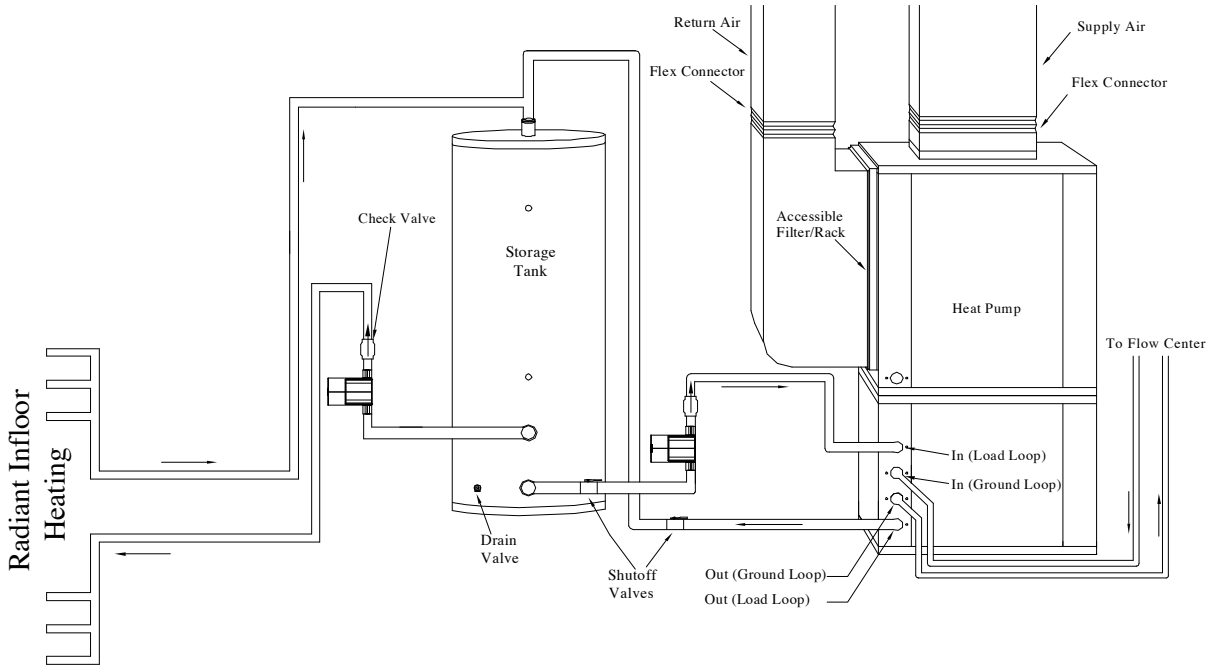


Figure 6: Typical Single Combination Unit Piping Connection



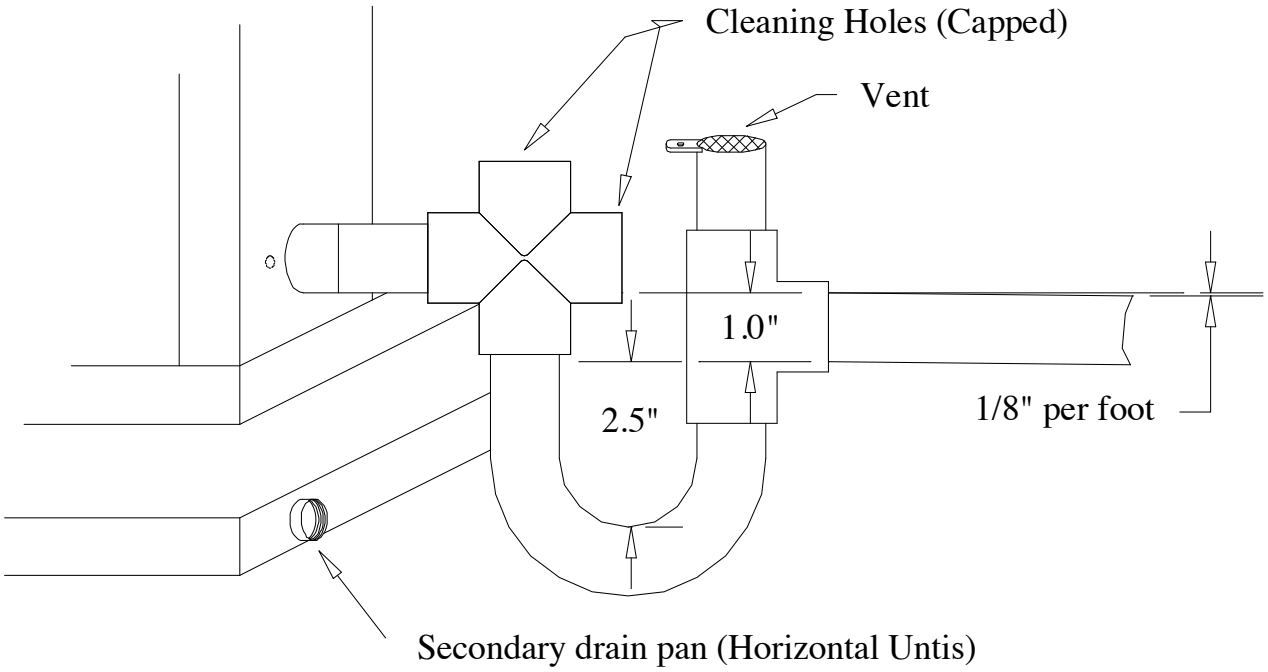
Condensation Drain Connection

Connect the EZ-Trap to the condensate drain on the equipment drain connection. The condensation line must be trapped a minimum of 1.0" as shown on diagram. The condensation line should be pitched away from the unit a minimum of 1/8" per foot. The top of trap must be below the drain connection. For more information on installing EZ-Trap, see installation sheet that comes with the EZ-Trap Kit.

Note: Connect the drain through the trap to the condensation drain system in conformance to local plumbing codes.

Part Number	Description
ACDT1A	EZ-Trap ¾" Kit
ACDT2A	EZ-Trap 1" Kit

Figure 7: Condensation Drain Connection



Section 9: Antifreeze

Antifreeze Overview

In areas where minimum entering loop temperatures drop below 40°F, or where piping will be routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze. However, local and state/provincial codes supersede any instructions in this document. The system needs antifreeze to protect the coaxial heat exchanger from freezing and rupturing. Freeze protection should be maintained to 15°F below the lowest expected entering loop temperature. For example, if 30°F is the minimum expected entering loop temperature, the leaving loop temperature could be 22 to 25°F. Freeze protection should be set at 15°F (30-15 = 15°F). To determine antifreeze requirements, calculate how much volume the system holds. Then, calculate how much antifreeze will be needed by determining the percentage of antifreeze required for proper freeze protection. See Tables 3 and 4 for volumes and percentages. The freeze protection should be checked during installation using the proper hydrometer to measure the specific gravity and freeze protection level of the solution.

Antifreeze Characteristics

Selection of the antifreeze solution for closed loop systems require the consideration of many important factors, which have long-term implications on the performance and life of the equipment. Each area of concern leads to a different "best choice" of antifreeze. *There is no "perfect" antifreeze.* Some of the factors to consider are as follows (Brine = antifreeze solution including water):

Safety: The toxicity and flammability of the brine (especially in a pure form).

Cost: Prices vary widely.

Thermal Performance: The heat transfer and viscosity effect of the brine.

Corrosiveness: The brine must be compatible with the system materials.

Stability: Will the brine require periodic change out or maintenance?

Convenience: Is the antifreeze available and easy to transport and install?

Codes: Will the brine meet local and state/ provincial codes?

The following are some general observations about the types of brines presently being used:

Methanol: Wood grain alcohol that is considered toxic in pure form. It has good heat transfer, low viscosity, is non-corrosive, and is mid to low price. The biggest down side is that it is flammable in concentrations greater than 25%.

Ethanol: Grain alcohol, which by the ATF (Alcohol, Tobacco, Firearms) department of the U.S. government, is required to be denatured and rendered unfit to drink. It has good heat transfer, mid to high price, is non-corrosive, non-toxic even in its pure form, and has medium viscosity. It also is flammable with concentrations greater than 25%. Note that the brand of ethanol is very important. Make sure it has been formulated for the geothermal industry. Some of the denaturants are not compatible with HDPE pipe (for example, solutions denatured with gasoline).

Propylene Glycol: Non-toxic, non-corrosive, mid to high price, poor heat transfer, high viscosity when cold, and can introduce micro air bubbles when adding to the system. It has also been known to form a "slime-type" coating inside the pipe. Food grade glycol is recommended because some of the other types have certain inhibitors that react poorly with geothermal systems. A 25% brine solution is a minimum required by glycol manufacturers, so that bacteria does not start to form.

Ethylene Glycol: Considered toxic and is not recommended for use in earth loop applications.

GS4 (POTASSIUM ACETATE): Considered highly corrosive (especially if air is present in the system) and has a very low surface tension, which causes leaks through most mechanical fittings. This brine is not recommended for use in earth loop applications.

Section 9: Antifreeze

Notes:

1. Consult with your representative or distributor if you have any questions regarding antifreeze selection or use.
2. All antifreeze suppliers and manufacturers recommend the use of either de-ionized or distilled water with their products.

Antifreeze Charging

Calculate the total amount of pipe in the system and use Table 3 to calculate the amount of volume for each specific section of the system. Add the entire volume together, and multiply that volume by the proper antifreeze percentage needed (Table 4) for the freeze protection required in your area. Then, double check calculations during installation with the proper hydrometer and specific gravity chart (Figure 8) to determine if the correct amount of antifreeze was added.

⚠ CAUTION ⚠

Use extreme care when opening, pouring, and mixing flammable antifreeze solutions. Remote flames or electrical sparks can ignite undiluted antifreezes and vapors. Use only in a well ventilated area. Do not smoke when handling flammable solutions. Failure to observe safety precautions may result in fire, injury, or death. Never work with 100% alcohol solutions.

Table 4: Pipe Fluid Volume

Type	Size	Volume Per 100ft US Gallons
Copper	1" CTS	4.1
Copper	1.25" CTS	6.4
Copper	1.5" CTS	9.2
HDPE	.75 SDR11	3.0
HDPE	1" SDR11	4.7
HDPE	1.25" SDR11	7.5
HDPE	1.5: SDR11	9.8
HDPE	2" SDR11	15.4

Additional component volumes:
Unit coaxial heat exchanger = 1 Gallon
Flush Cart = 8-10 Gallons
10' of 1" Rubber Hose = 0.4 Gallons

Section 9: Antifreeze

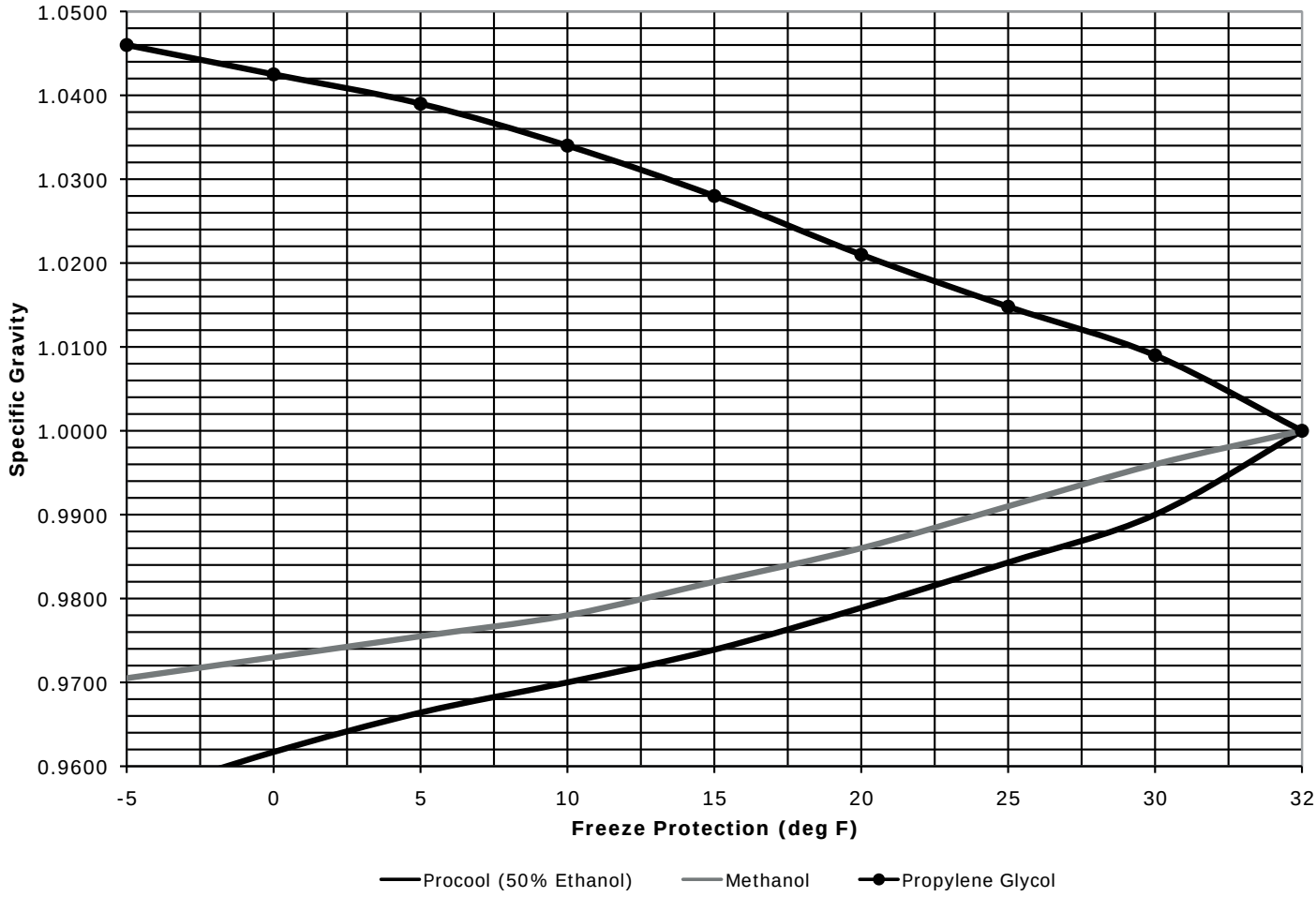
Table 5: Antifreeze Percentages by Volume

Type of Antifreeze	Minimum Temperature for Freeze Protection			
	10°F (-12.2°C)	15°F (-9.4°C)	20°F (-6.7°C)	25°F (-3.9°C)
ProCool (Ethanol)	25%	22%	17%	12%
Methanol	25%	21%	16%	10%
Propylene Glycol	38%	30%	22%	15%

All antifreeze solutions are shown in pure form - not premixed

NOTE: Most manufacturers of antifreeze solutions recommend the use of de-ionized water. Tap water may include chemicals that could react with the antifreeze solution.

Figure 8: Antifreeze Specific Gravity



Section 10: Desuperheater Installation

Desuperheater Installation
Units that ship with the desuperheater function also ship with a connection kit.

Note: Desuperheater capacity is based on 0.4 GPM Flow per nominal ton at 90°F entering hot water temperature.

Note: Units that are shipped with a desuperheater do not have the desuperheater pump wires connected to the electrical circuit, to preclude accidentally running the pump while dry. Pump has to be connected to the electric circuit (master contactor) when the lines from the water heater are installed & air is removed.

CONTENTS OF THE DESUPERHEATER FITTING KIT:

- (1) p/n 23-23-0024-001, Installation Instructions
- (1) p/n 11-08-0004-001, 3/4"x 3/4"x 3/4" FPT Brass Tee
- (1) p/n 11-08-0003-001, ¾" Boiler Drain Valve
- (1) p/n 11-08-0005-001, ¾" MPT x 3-1/2" Brass Nipple
- (3) p/n 11-08-0006-001, ½" SWT x ¾" MPT Copper Adaptor
- (1) p/n 11-08-0007-001, ¾" x ¾" x ½" SWT Copper Tee

Plumbing Installation

NOTE: All plumbing and piping connections must comply with local plumbing codes.

TIP: Measure the distance above the floor or shelf that the water heater is setting on, to where the drain valve is located. This distance must be greater than one-half the width of the tee you're about to install, or you won't be able to thread the tee on to the water heater.

1. Disconnect electricity to water heater.
2. Turn off water supply to water heater.
3. Drain water heater. Open pressure relief valve.
4. Remove drain valve and fitting from water heater.
5. Thread the ¾" MPT x 3-1/2" nipple into the water heater drain port. Use Teflon tape, or pipe dope on threads.
6. Thread the center port of the ¾" brass tee to the other end of the nipple.
7. Thread one of the copper adaptors into the end of the tee closest to the heat pump.
8. Thread the drain valve into the other end of the nipple. See Figure 9.
9. Above the water heater, cut the incoming cold water line. Remove a section of that line to enable the placement of the copper tee.
10. Insert the copper tee in the cold water line. See Figure 10.
11. Thread the remaining two ½"SWT x ¾"MPT copper adaptors into the ¾" FPT fittings on the heat pump, marked HOT WATER IN and HOT WATER OUT.
12. Run interconnecting ½" copper pipe from the HOT WATER OUT on the heat pump, to the copper adaptor located on the tee at the bottom of the water heater (Step 7).
13. Run interconnecting ½" copper pipe from the HOT WATER IN on the heat pump, to the copper tee in the cold water line (Step 10).
14. Install an air vent fitting at the highest point of the line from step 13 (assuming it's the higher of the two lines from the heat pump to the water heater). See Figure 10.
15. Turn the water supply to the water heater on. Fill water heater.

Section 10: Desuperheater Installation

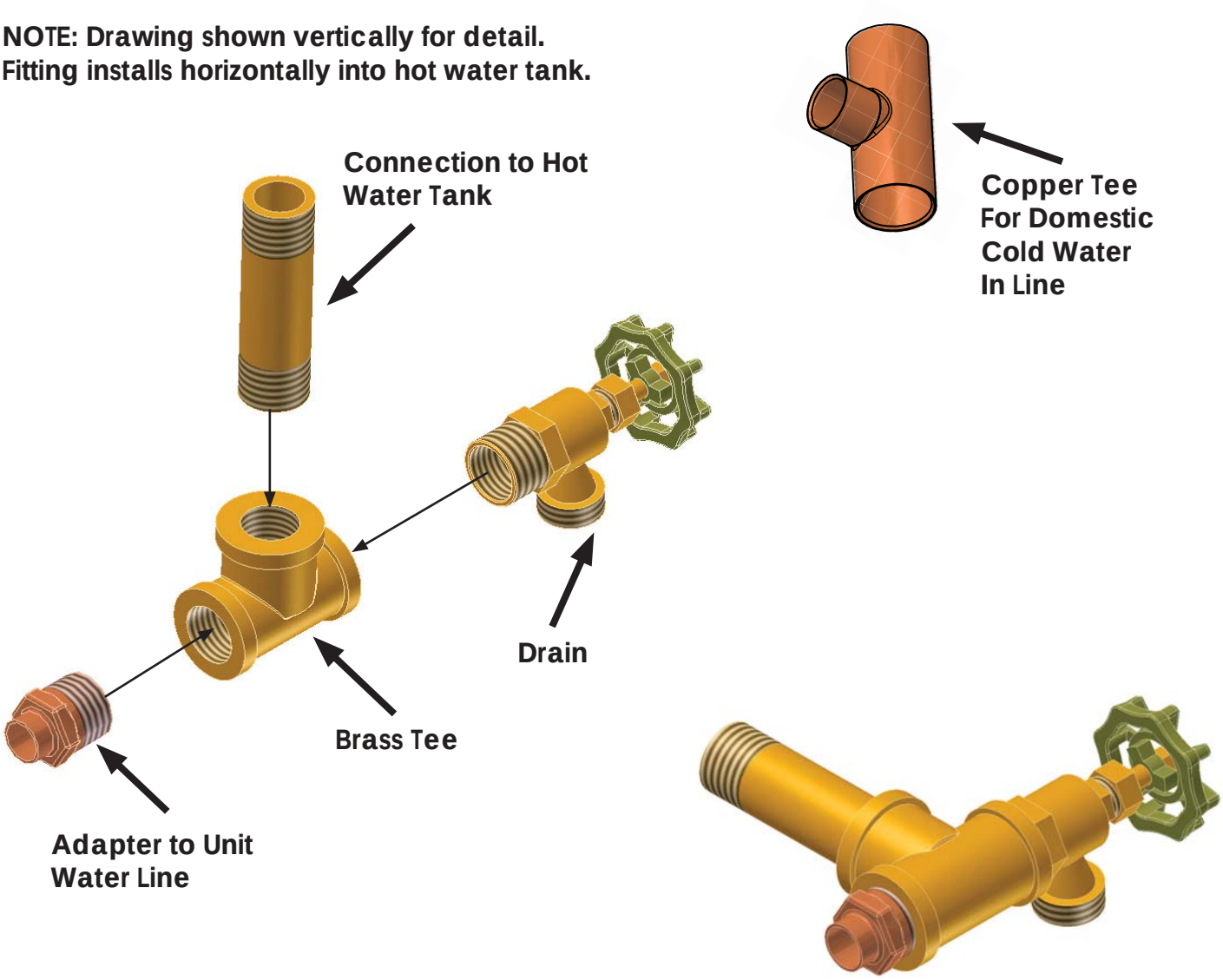
16. Flush the interconnecting lines, and check for leaks.

17. Install 3/8" closed cell insulation on the lines connecting the heat pump to the water heater.

18. Reconnect electricity to water heater.

Figure 9: Water Heater Connection Kit Assembly for Bottom of Water Heater

NOTE: Drawing shown vertically for detail. Fitting installs horizontally into hot water tank.



Section 10: Desuperheater Installation

Figure 10: Typical Desuperheater Installation

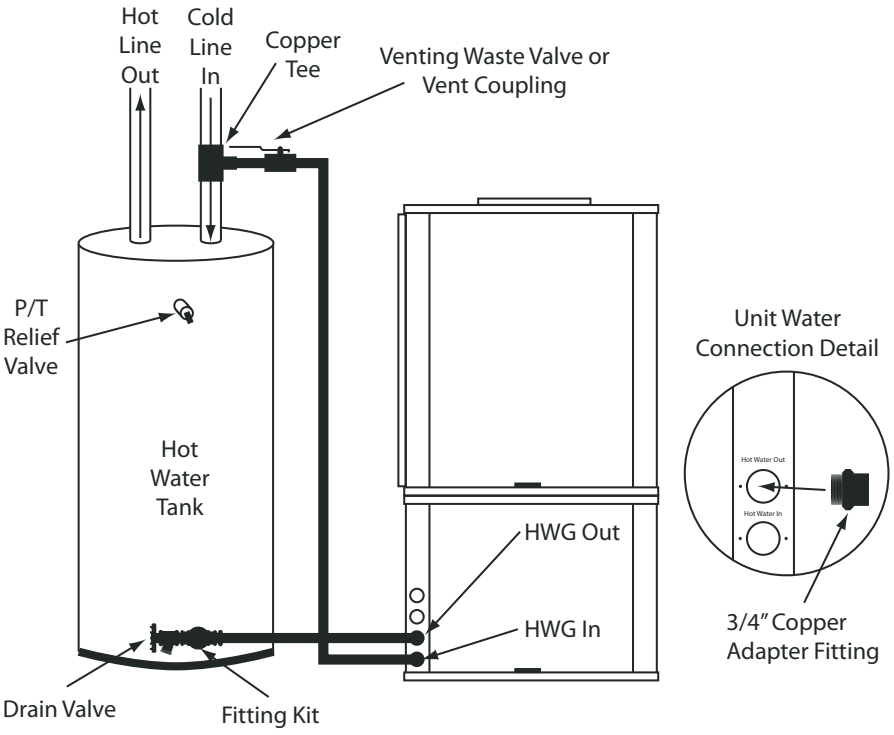
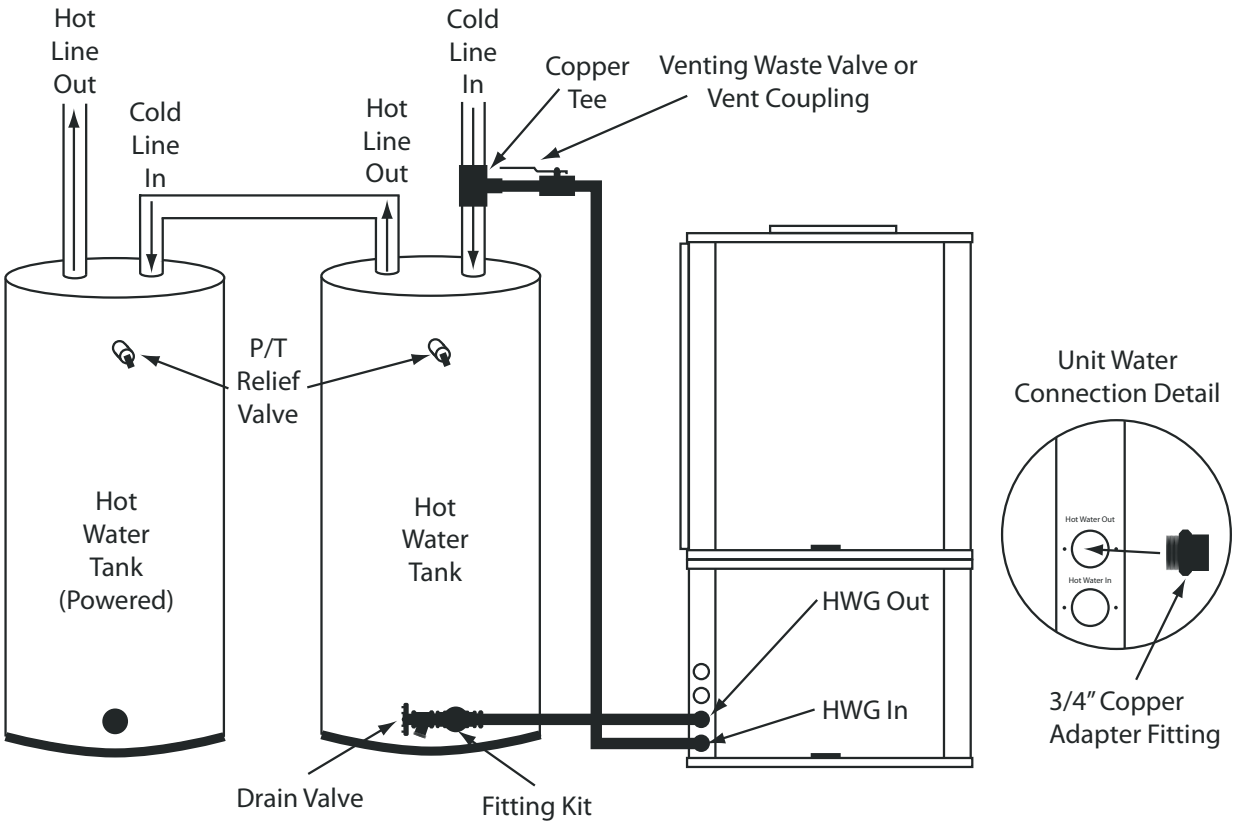


Figure 11: Desuperheater Installation in Preheat Tank



Section 10: Desuperheater Installation

Figure 12: Typical Desuperheater Installation using Marathon Hot Water Tanks

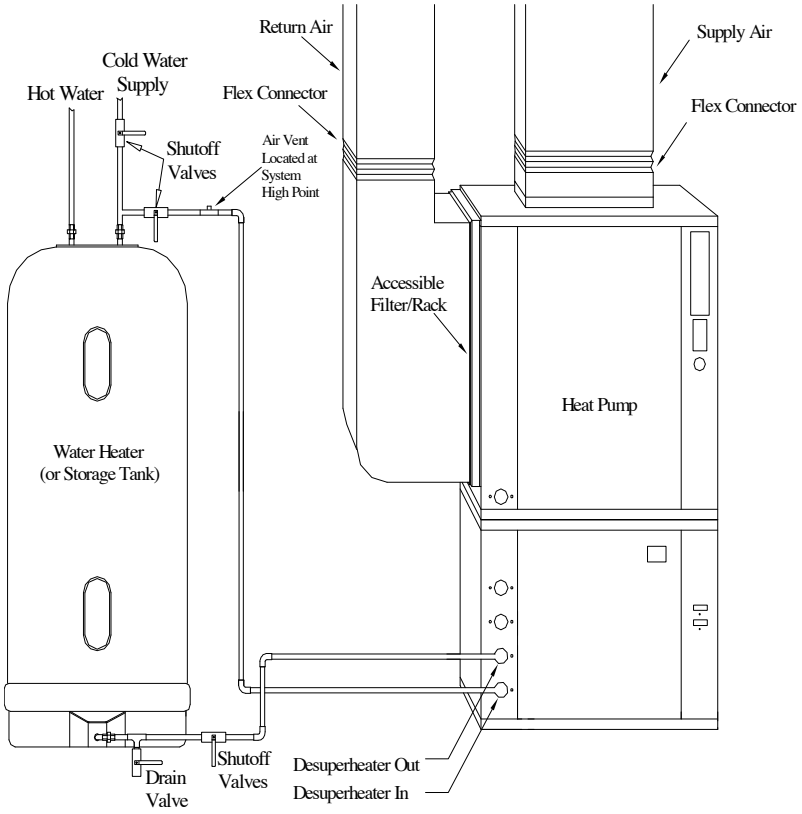
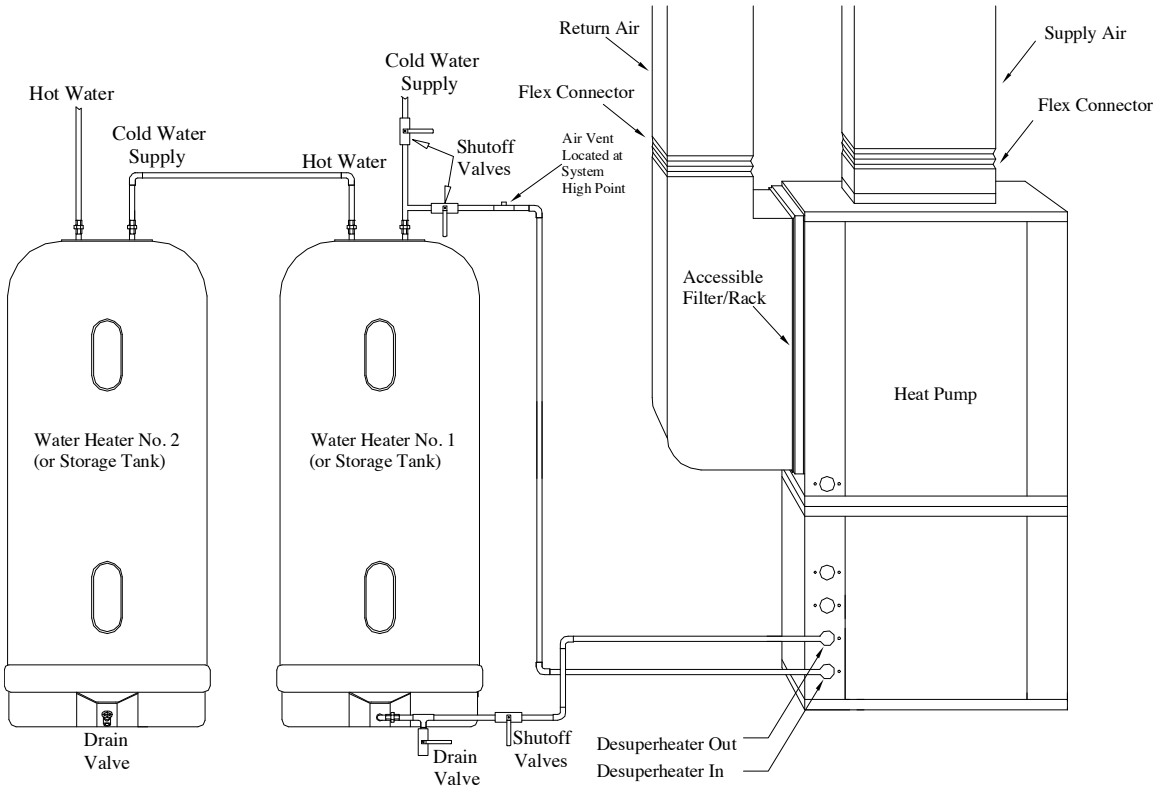


Figure 13: Desuperheater Installation in Preheat Tank using Marathon Hot Water Tanks



Section 11a: Revision B Controls

Note: The following are ***Revision B*** controls. Please see page 42 for Revision A controls. The model number of the heat pump will indicate the control revision. For example, models GT048A11LT1CC and H05011TL1NS are revision "A" models. GT048B11LT1CC and H05011TL1CB are revision "B" models. "S" indicates revision "A" for Hydron Module units.

MICROPROCESSOR FEATURES AND OPERATION
Enertech Manufacturing geothermal heat pump controls provide a unique modular approach for controlling heat pump operation. The control system uses one, two, or three printed circuit boards, depending upon the features of a particular unit. This approach simplifies installation and troubleshooting, and also eliminates features that are not applicable for some units.

A microprocessor-based printed circuit board controls the inputs to the unit as well as outputs for status mode, faults, and diagnostics. A status LED and an LED for each fault is provided for diagnostics. An ECM control module provides field selectable options for airflow and dehumidification mode, plus an LED to indicate CFM (100 CFM per flash). If the combination unit is desired (combination water-to-air and water-to-water heat pump), a third board controls the hydronic portion of the unit, allowing field selectable hot water/forced air priority and other options.

Removable low voltage terminal strips provide all necessary terminals for field connections. Not only are the thermostat inputs included, but there are also two additional removable terminal strips for all of the accessory and electric heat wiring for ease of installation and troubleshooting.

Startup/Random Start
The unit will not operate until all the inputs and safety controls are checked for normal conditions. At first power-up, the compressor is energized after a five minute delay. In addition, a zero to sixty second random start delay is added at first power-up to avoid multiple units from being energized at the same time.

Short Cycle Protection
A built-in five minute anti-short cycle timer provides short cycle protection of the compressor.

Component Sequencing Delays
Components are sequenced and delayed for optimum space conditioning performance and to make any startup noise less noticeable.

Test Mode
The microprocessor control allows the technician to shorten most timing delays for faster diagnostics by changing the position of a jumper located on the lockout board.

Water Solenoid Valve Connections
Two accessory relay outputs at the terminal strip provide a field connection for two types of water solenoid valves, a standard 24VAC solenoid valve, or a 24VAC solenoid valve with an end switch. Additional field wiring is no longer required for operation of the end switch.

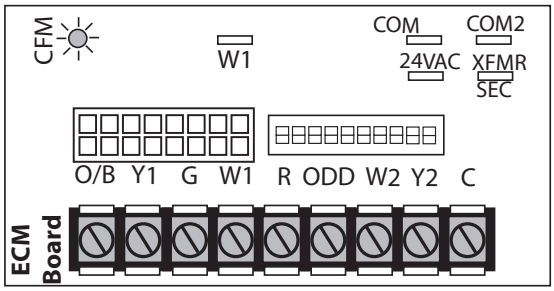
Humidifier/Dehumidification Connections
Connections for a humidistat are provided, which automatically engages the fan when the humidistat contact closes. In addition, a field connection is provided at the terminal strip for external control of the On Demand Dehumidification (ODD) feature for the variable speed ECM motor (when equipped), which automatically lowers the fan speed when the space humidity is higher than set point. Either connection may be used with a thermostat that includes humidifier/dehumidification outputs. Not applicable for splits/water-to-water.

Airflow Monitor (Units with ECM Motor)
An LED on the ECM control module flashes one time per 100 CFM when the unit's fan is operating to indicate airflow.

Resistance Heat Control
The electric heat control module contains the appropriate high-voltage control relays. Low voltage control signals from the compressor section energize the relays in the electric heat module to engage backup electric heat when necessary.

Electronic Condensate Overflow Protection
The control board utilizes an impedance sensing liquid sensor at the top of the drain pan.

Figure 14: ECM Board Layout



Since the drain pan is grounded, when water touches the sensor for 30 continuous seconds, the sensor sends a ground signal to the lockout board, indicating that a condensate overflow fault has occurred.

Loop Pump Circuit Breakers (Single Compressor Units)

The loop pump(s) and desuperheater pump are protected by control box mounted circuit breakers for easy wiring of pumps during installation. Circuit breakers eliminate the need to replace fuses.

Safety Controls

The control receives separate signals for high pressure, low pressure, low water flow, and condensate overflow faults. Upon a continuous 30-second measurement of the fault (immediate for high pressure), compressor operation is suspended (see Fault Retry below), and the appropriate LED flashes. Once the unit is locked out (see Fault Retry below), an output (terminal "L") is made available to a fault LED at the thermostat (water-to-water unit has fault LED on the corner post).

Low Pressure: If the low pressure switch is open for 30 continuous seconds, the compressor operation will be interrupted, and the control will go into fault retry mode. At startup, the low pressure switch is not monitored for 90 seconds to avoid nuisance faults.

High Pressure: If the high pressure switch opens, the compressor operation will be interrupted, and the control will go into fault retry mode. There is no delay from the time the switch opens and the board goes into fault retry mode. There is also no delay of switch monitoring at startup.

Flow Switch: If the flow switch is open for 30 continuous seconds, the compressor operation will be interrupted, and the control will go into fault retry mode. At startup, the flow switch is not monitored for 30 seconds to avoid nuisance faults.

Condensate Overflow: If water touches the condensate overflow sensor for 30 continuous seconds, the compressor operation will be interrupted, and the control will go into fault retry mode. There is no delay of switch monitoring at startup.

FAULT RETRY

All faults are retried twice before finally locking the unit out. The fault retry feature is designed to prevent nuisance service calls. There is an anti-short cycle period between fault retries. On the third fault, the board will go into lockout mode.

Over/Under Voltage Shutdown

The lockout board protects the compressor from operating when an over/under voltage condition exists. The control monitors secondary voltage (24VAC) to determine if an over/under voltage condition is occurring on the primary side of the transformer. For example, if the secondary voltage is 19 VAC, the primary voltage for a 240V unit would be approximately 190V, which is below the minimum voltage (197V) recommended by the compressor manufacturer. This feature is self-resetting. If the voltage comes back within range, normal operation is restored. Therefore, over/under voltage is not a lockout.

Under voltage (18 VAC) causes the compressor to disengage and restart when the voltage returns to 20 VAC. Over voltage (31 VAC) causes the compressor to disengage and restart when the voltage returns to 29 VAC. During an over or under voltage condition, all five fault LEDs will blink (HP + LP + FS + CO + Status). When voltage returns to normal operation, the four fault LED's will stop blinking, but the status LED will continue to flash. While the board LEDs are flashing, the thermostat fault light will be illuminated.

Section 11a: Revision B Controls

Intelligent Reset
If the thermostat is powered off and back on (soft reset), the board will reset, but the last fault will be stored in memory for ease of troubleshooting. If power is interrupted to the board, the fault memory will be cleared.

Lockout with Emergency Heat
While in lockout mode, if the thermostat is calling for backup heat, emergency heat mode will occur.

Diagnostics
The lockout board includes five LEDs (status, high pressure, low pressure, low water flow, condensate overflow) for fast and simple control board diagnosis. Below is a table showing LED function.

Table 6: LED Identification

LED Color	Location[1]	Function	Normal Operation	Fault Retry[2]	Lockout[2]
Green	Top	High Pressure	OFF	Flashing[3]	ON[3]
Orange	2nd	Low Pressure	OFF	Flashing[3]	ON[3]
Red	3rd	Water Flow	OFF	Flashing[3]	ON[3]
Yellow	4th	Condensate Overflow	OFF	Flashing[3]	ON[3]
Green	Bottom	Status	Flashing[4]	Flashing[5]	Flashing[4]

Notes:
1. Looking at the board when the LEDs are on the right hand side
2. If all five lights are flashing, the fault is over/under voltage
3. Only the light associated with the particular fault/lockout will be on or flashing.
   For example, if a high pressure lockout has occurred, the top green light will be on.
   The orange, red, and yellow lights will be off
4. Status lights will be off when tin test mode
5. Flashes alternately with the fault LED

Hot Water Pump Control
Controls for high water temperature and low compressor discharge line temperature prevent the hot water (desuperheater) pump from operating when the leaving water temperature is above 130°F, or when the compressor discharge line is too cool to provide adequate water heating.

Lockout Board Jumper Selection
The lockout board includes three jumpers for field selection of various board features.

Water Solenoid Valve Delay (WSD): When the WSD jumper is installed, the "A" terminal is energized when the compressor is energized. When the jumper is removed, the "A" terminal is energized 10 seconds after the compressor. If using the Taco water solenoid valve (or a valve with an end switch), the unit terminal strip includes a means for connecting a valve of this type. The WSD jumper should be installed. If using a slow opening valve that does not have an end switch, the jumper should be removed.

Test Mode (TEST): When the TEST jumper is installed, the board operates in the normal mode. When the jumper is removed, the board operates in test mode, which speeds up all delays for easier troubleshooting. When service is complete, the jumper must be re-installed in order to make sure that the unit operates with normal sequencing delays.

Over/Under Voltage Disable (O/V): When the O/V jumper is installed, the over/under voltage feature is active. When the jumper is removed, the over/under voltage feature is disabled. On rare occasions, variations in voltage will be outside the range of the over/under voltage feature, which may require removal of the jumper. However, removal of the jumper could cause the unit to run under adverse conditions, and therefore should not be removed without

contacting technical services. An over/under voltage condition could cause premature component failure or damage to the unit controls. Any condition that would cause this fault must be thoroughly investigated before taking any action regarding the jumper removal. Likely causes of an over/under voltage condition include power company transformer selection, insufficient entrance wire sizing, defective breaker panel, incorrect transformer tap (unit control box), or other power-related issues.

SEQUENCE OF OPERATION:
Water-to-Air Units, Single Compressor, ECM Fan

Heating, 1st Stage (Y1,G) Single Speed Units
The fan motor is started immediately at 75% CFM level, the compressor and loop/ desuperheater pump(s) are energized 10 seconds after the "Y1" input is received, and the ECM fan adjusts to 100% CFM level 30 seconds after the "Y1" input.

Heating, 2nd Stage (Y1,W,G) Single Speed Units
The ECM fan remains at 100% of 1st stage CFM level, and the electric backup heat is energized.

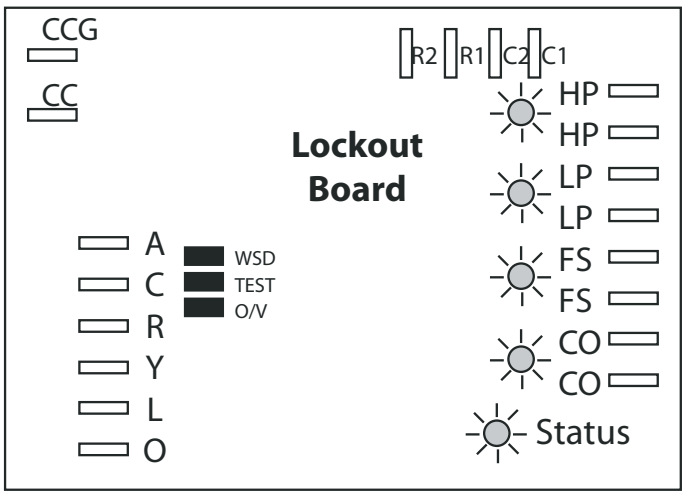
Heating, 1st Stage (Y1,G) Two-Stage Units
The ECM fan is started immediately at 75% (of 1st stage operation) CFM level, first stage compressor and the loop/desuperheater pump(s) are energized 10 seconds after the "Y1" input is received, and the ECM fan adjusts to 100% (of 1st stage operation) CFM level 30 seconds after the "Y1" input.

Heating, 2nd Stage (Y1,Y2,G) Two-Stage Units
The ECM fan adjusts to 2nd stage CFM level, and the compressor full load solenoid valve is energized.

Heat, 3rd Stage (Y1,Y2,W,G) Two-Stage Units
The ECM fan remains at 100% of 2nd stage CFM level, and the electric backup heat is energized.

Emergency Heat (W,G)
The fan is started immediately at 110% of 2nd stage CFM level, and the electric backup heat is energized.

Figure 15: Lockout Board Layout



Cooling Operation
The reversing valve is energized for cooling operation. Terminal "O" from the thermostat is connected to the reversing valve solenoid.

Cooling (Y1,0,G) Single Speed Units
The fan motor is started immediately at 75% CFM level, the compressor and loop/ desuperheater pump(s) are energized 10 seconds after the "Y1" input is received, and the ECM fan adjusts to 100% CFM level 30 seconds after the "Y1" input.

Cooling, 1st stage (Y1,0,G) Two-Stage Units
The ECM fan is started immediately at 75% (of 1st stage operation) CFM level, first stage compressor and the loop/desuperheater pump(s) are energized 10 seconds after the "Y1" input is received, and the ECM fan adjusts to 100% (of 1st stage operation) CFM level 30 seconds after the "Y1" input.

Cooling, 2nd Stage (Y1,Y2,O,G) Two-Stage Units
The ECM fan adjusts to 2nd stage CFM level, and the compressor full load solenoid valve is energized.

Cooling, Dehumidification Mode
The ECM control module includes two types of dehumidification modes, Forced Dehumidification mode, and On Demand Dehumidification (ODD). If the ECM control module is set to Forced Dehumidification mode, the ECM fan runs at normal CFM in all heating

stages, but all cooling operation will be 85% of the current stage CFM level, which lowers the CFM through the evaporator coil, improving latent capacity. In ODD mode, a humidistat or a thermostat with a dehumidification output (output must be reverse logic -- i.e. it must operate like a humidistat) is connected to the ODD terminal. When the module receives a call for dehumidification, the fan runs at 85% of the current stage CFM in the cooling mode. Otherwise, the airflow is at the normal CFM level. The signal is ignored in the heating mode.

Fan Only
When the ECM control module receives a "G" call without a call for heating or cooling, the fan operates at 50% of the full load CFM level.

SEQUENCE OF OPERATION:
Water-to-Air Units, Single Compressor, PSC Fan

Heating, 1st Stage (Y1,G)
The fan motor is started immediately, the compressor and loop/desuperheater pump(s) are energized 10 seconds after the "Y1" input is received.

Heating, 2nd Stage (Y1,W,G)
The compressor continues to operate, and the electric backup heat is energized when a "W" input is received.

Emergency Heat (W,G)
The fan and electric backup heat are energized immediately when a "W" input is received.

Cooling Operation
The reversing valve is energized for cooling operation. Terminal "O" from the thermostat is connected to the reversing valve solenoid.

Cooling (Y1,0,G)
The fan motor is started immediately, the compressor and loop/desuperheater pump(s) are energized 10 seconds after the "Y1" input is received.

Fan Only
When the control receives a "G" call without a call for heating or cooling, the fan operates at the heating/cooling CFM level.

SEQUENCE OF OPERATION:
Water-to-Water Units, Single Compressor

Heating (Y1)
The compressor and loop/desuperheater pump(s) are energized 10 seconds after the "Y1" input is received.

Cooling Operation
The reversing valve is energized for cooling operation. Terminal "O" is connected to the reversing valve solenoid.

Cooling (Y1,0)
The compressor and loop/desuperheater pump(s) are energized 10 seconds after the "Y1" input is received.

SEQUENCE OF OPERATION:
Water-to-Water Units, Dual Compressors

Heating, 1st Stage (Y1)
The first compressor and desuperheater pump are energized 10 seconds after the "Y1" input is received.

Heating, 2nd Stage (Y1,Y2)
The second compressor is energized immediately upon receiving a "Y2" input.

Cooling Operation
The reversing valve is energized for cooling operation. Terminal "O" is connected to the reversing valve solenoid.

Cooling, 1st Stage (Y1,O)
The first compressor and desuperheater pump are energized 10 seconds after the "Y1" input is received.

Heating, 2nd Stage (Y1,Y2,O)
The second compressor is energized immediately upon receiving a "Y2" input

Section 11a: Revision B Controls

Table 7: ECM Fan Performance - Two-Stage Compressor Units

Model[1]	Program[2]	Heating/Cooling Modes			Dehumidification Mode[3]			DIP Switch Settings[4]							
		1st Stage	2nd Stage	Fan	1st Stage	2nd Stage	Fan	S1	S2	S3	S4	S5	S6	S7	S8
024/ 026	C	425	765	383				ON	ON	ON	OFF	ON	ON	OFF	OFF
	A	500	900	450	425	765	450	ON	ON	OFF	OFF	ON	ON	OFF	OFF
	B	550	990	495	468	842	495	ON	ON	OFF	ON	ON	ON	OFF	OFF
036/ 038	C	765	1105	553				ON	ON	ON	OFF	ON	ON	OFF	OFF
	A	900	1300	650	765	1105	650	ON	ON	OFF	OFF	ON	ON	OFF	OFF
	B	990	1430	715	842	1216	715	ON	ON	OFF	ON	ON	ON	OFF	OFF
048/ 050	C	935	1445	723				ON	ON	ON	OFF	ON	ON	OFF	OFF
	A	1100	1700	850	935	1445	850	ON	ON	OFF	OFF	ON	ON	OFF	OFF
	B	1210	1870	935	1029	1590	935	ON	ON	OFF	ON	ON	ON	OFF	OFF
060/ 062	C	1105	1785	893				OFF	ON	ON	OFF	OFF	ON	OFF	OFF
	A	1300	2100	1050	1105	1785	1050	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
	B	1430	2310	1155	1216	1964	1155	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
072/ 073	C	1360	1785	893				ON	OFF	ON	OFF	ON	OFF	OFF	OFF
	A	1600	2100	1050	1360	1785	1050	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
	B	1760	2310	1155	1496	1964	1155	ON	OFF	OFF	ON	ON	OFF	OFF	OFF

Notes:

1. Models 024 to 038 can maintain above CFM up to 0.5" ESP; Models 048 - 073 can maintain above CFM up to 0.75" ESP.
2. Program A (Bold type) is factory settings and rated CFM. CFM is controlled within 5% up to the max. ESP. Max. ESP includes allowance for wet coil and standard filter.
3. Heating CFM and fan only is not affected. Cooling CFM is listed in this section. See Dehumidification Mode Options table for settings. Program C is not recommended if using dehumidification mode (black shaded areas).
4. Gray shaded columns are factory settings, and are shown for reference only. Use S3 & S4 for field adjustments.

Section 11a: Revision B Controls

Table 8: ECM Fan Performance - Single Stage Compressor Units

Model[1]	Program[2]	Heating/Cooling Modes			Dehumidification Mode[3]			DIP Switch Settings[4]							
		Heating	Cooling	Fan	Heating	Cooling	Fan	S1	S2	S3	S4	S5	S6	S7	S8
018	C	510	510	255				OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
	A	600	600	300	600	510	300	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	B	660	660	330	660	561	330	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
024	C	680	680	340				OFF	ON	ON	OFF	OFF	ON	OFF	OFF
	A	800	800	400	800	680	400	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
	B	880	880	440	880	748	440	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
030	C	850	850	425				OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
	A	1000	1000	500	1000	850	500	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	B	1100	1100	550	1100	935	550	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
036	C	1020	1020	510				OFF	ON	ON	OFF	OFF	ON	OFF	OFF
	A	1200	1200	600	1200	1020	600	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
	B	1320	1320	660	1320	1122	660	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
042	C	1190	1190	595				OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
	A	1400	1400	700	1400	1190	700	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	B	1540	1540	770	1540	1309	770	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
048	C	1445	1445	723				ON	ON	ON	OFF	ON	ON	OFF	OFF
	A	1700	1700	850	1700	1445	850	ON	ON	OFF	OFF	ON	ON	OFF	OFF
	B	1870	1870	935	1870	1590	935	ON	ON	OFF	ON	ON	ON	OFF	OFF
060	C	1700	1700	850				ON	OFF	ON	OFF	ON	OFF	OFF	OFF
	A	2000	2000	1000	2000	1700	1000	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
	B	2200	2200	1100	2200	1870	1100	ON	OFF	OFF	ON	ON	OFF	OFF	OFF
072	C	2040	2040	1020				ON	ON	ON	OFF	ON	ON	OFF	OFF
	A	2400	2400	1200	2400	2040	1200	ON	ON	OFF	OFF	ON	ON	OFF	OFF
	B	2640	2640	1320	2640	2244	1320	ON	ON	OFF	ON	ON	ON	OFF	OFF

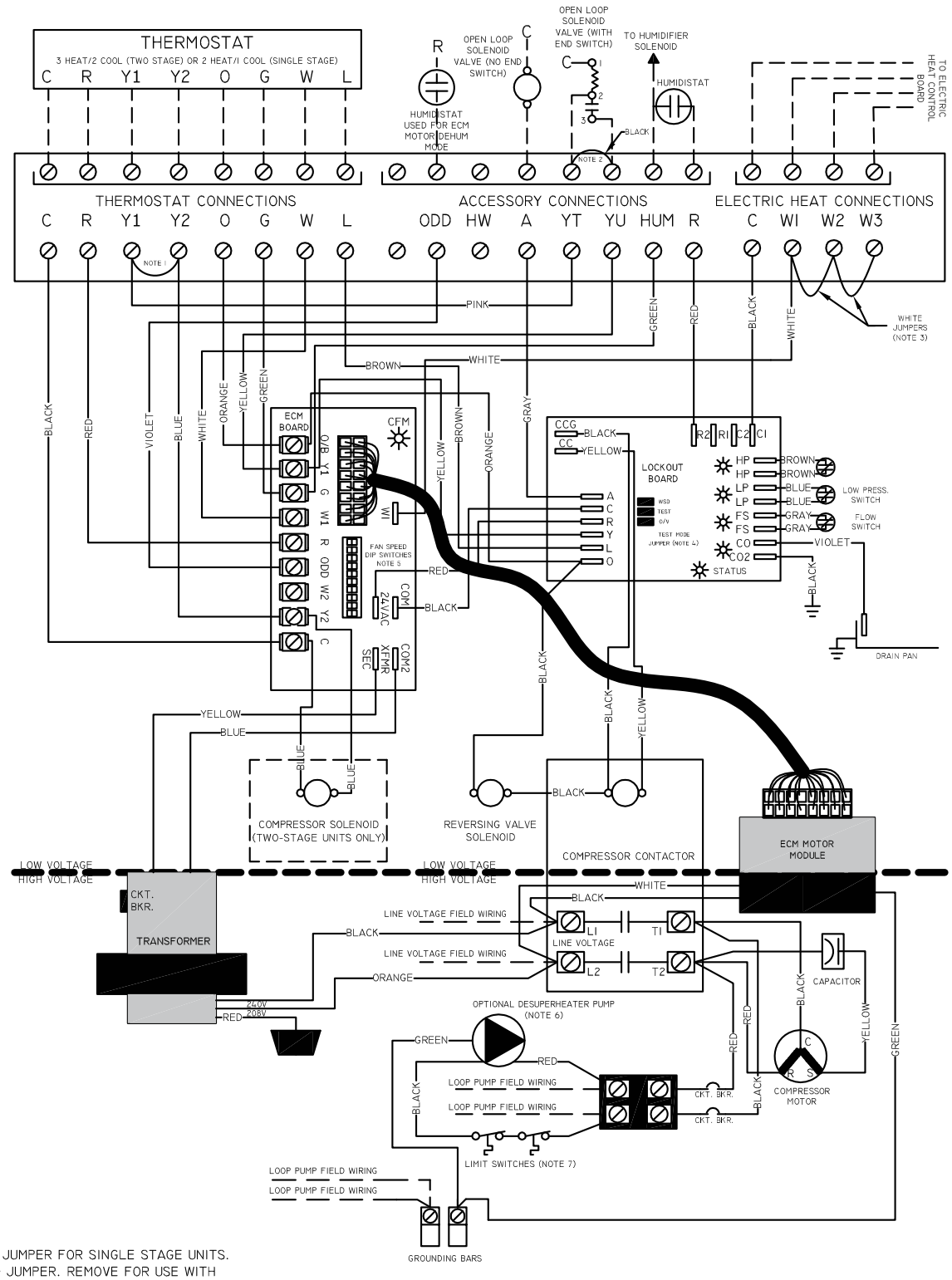
Notes:
1. Models 018 - 042 can maintain above CFM up to 0.5" ESP; 042 - 072 can maintain above CFM up to 0.75" ESP.
2. Program A (Bold type) is factory settings and rated CFM. CFM is controlled within 5% up to the max. ESP. Max. ESP includes allowance for wet coil and standard filter.
3. Heating CFM and fan only is not affected. Cooling CFM is listed in this section. See Dehumidification Mode Options table for settings. Program C is not recommended if using dehumidification mode (black shaded areas).
4. Gray shaded columns are factory settings, and are shown for reference only. Use S3 & S4 for field adjustments.

Table 9: Dehumidification Mode Options

DIP Switch		Mode	Operation
S9	S10		
ON	OFF	Normal	Dehumidification mode disabled (normal Htg/Clg CFM) - factory setting
OFF	ON	ODD	On Demand dehumidification mode (humidistat input at terminal ODD) - Humidistat required
OFF	OFF	Constant Dehum	Constant dehumidification mode (always uses dehum CFM for cooling and normal CFM for heating) - No humidistat required
ON	ON	Not Used	Not an applicable selection

Notes:
1. ODD uses reverse logic, which allows a humidistat to be used for this feature instead of a dehumidistat. To enter dehumidification mode, ODD input should be 0 VAC; for normal cooling CFM, ODD input should be 24VAC.
2. Heating CFM is not affected by dehumidification mode. When in dehumidification mode, cooling CFM is 85% of normal cooling CFM (when not in dehumidification mode).

Section 11a: Revision B Controls



NOTES:

1. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.
2. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
3. OPTIONAL FIELD INSTALLED STAGING KIT INSTALLED HERE.
4. JUMPER INSTALLED=NORMAL; JUMPER REMOVED=TEST.
5. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
6. DESUPERHEAT PUMP POWER WIRES ARE NOT CONNECTED AT THE FACTORY. DO NOT CONNECT WIRES UNTIL THE PIPING IS COMPLETED AND PURGED OF AIR. RUNNING THE PUMP WITHOUT WATER WILL DAMAGE THE PUMP.
7. DESUPERHEATER LEAVING WATER TEMPERATURE SWITCH OR HOT GAS LINE TEMPERATURE SWITCH WILL DISENGAGE THE PUMP WHEN CONDITIONS ARE INAPPROPRIATE FOR WATER HEATING.

Section 11b: Revision A Controls

Note: The following are ***Revision A*** controls. The model number of the heat pump will indicate the control revision. For example, models GT048A11LT1CC and H05011TL1NS are revision "A" models. GT048B11LT1CC and H05011TL1CB are revision "B" models. "S" indicates revision "A" for Hydron Module units.

01CB30 LOGIC CONTROLLED SYSTEM (TWO-STAGE AND COMBO UNITS)
(01CB30) is a microprocessor-based printed circuit board. It is located in the unit control box for convenient accessibility. This control board is specially design for the geothermal units which integrate the ECM blower motor. The microprocessor provides control of the entire unit as well as outputs for status modes, faults and diagnostics. A LED is located on front corner of the unit for quick inspection without removing any access panels.

Low voltage strip provide all necessary terminal for field installations. The board accepts standard 24VAC Thermostat inputs.

Startup
The unit will not operate until all inputs and safety controls are checked for normal conditions.

Fault Retry & Diagnostics
All faults are retried three times, with 5 minute delay between each attempt, before finally locking the unit out. An output signal (L) is made available for a fault LED at the thermostat. The "fault retry" feature is designed to prevent nuisance service calls.

Safety Controls
The control receives separate signals for a high pressure switch for safety, a low pressure switch to prevent loss/low refrigerant charge damage and a flow switch for freeze protection.

Fan Speed Control
The BK terminal on the board allows field speed reduction of 15% blower speed for cooling in the dehumidification mode.

Flow Switch (Freeze Protection) Operation
When 24vac is applied to the Y/Y2 or Y terminal, the control is monitoring the flow switch input. If the flow switch opens (no water flow), the control board will energize the compressor contactor, and start the compressor after the random start is over. If the flow switch is still open after 30 seconds, the control will de-energize the compressor contactor. The control board won't start the sequence unless the flow switch closes. If the flow switch opens while the compressor is energized, the control board will energize the compressor contactor for a minimum time period of 30 seconds, after 30 seconds. The control board will de-energize the compressor contactor and go into a soft lockout. The control board will not energize the compressor contactor unless the flow switch closes and the anti-short cycle time has expired. If the flow switch opens three times within 1 hour, the control board will go into manual lockout and the fault indicator will energize. When the flow switch is open, or if in lockout mode, the status led on the control board will blink, three times.

Condensation Overflow Protection
Units with R-410a refrigerant come standard with a condensate sensor. If sensor is sensing condensation liquid, the compressor will shut down and the status light will blink, three times.

Anti-Short Cycle Operation
If all safety controls are satisfactory, the compressor contactor will energize when the control board receives 24VAC on the thermostat input "Y/Y2 or Y1" terminal. If 24VAC on the "Y/Y2 or Y1" terminal is removed, the control board will de-energize the compressor contactor and go into a 300 second anti-short cycle. If 24VAC is reapplied to the "Y/Y2 or Y1" terminal again, the control board will not energize the compressor contactor until after the 300 second anti-short cycle is over.

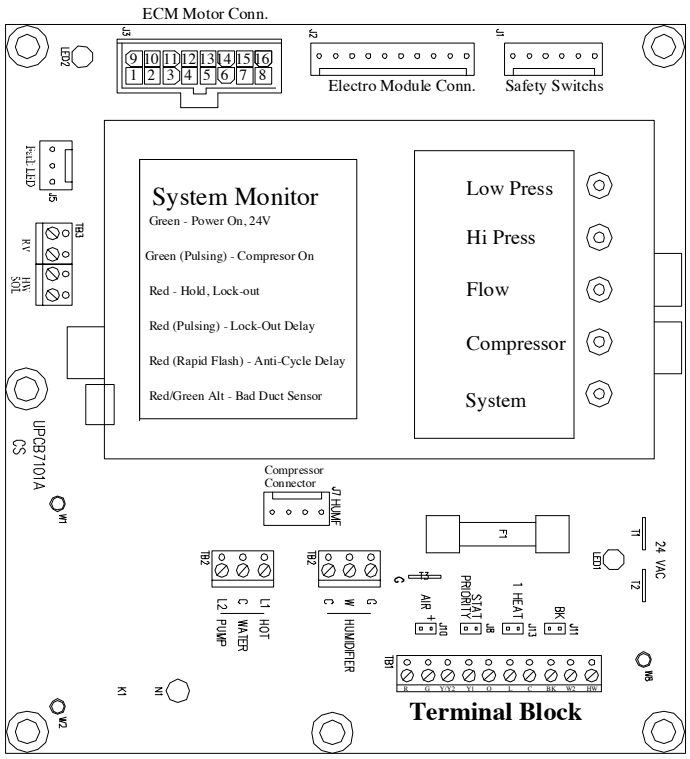
High & Low Pressure Safety Operation
When the 24vac is applied to the "Y/Y2 or Y1" terminal, the control board monitors the high and low pressure switch input to make sure that they are closed. The control board won't start the sequence unless the high and Low pressure switch are closed. If the high and low pressure switches opens while the compressor contactor is energized, the control will de-energize the compressor contactor and go into a soft lockout. The control board will not energize the

compressor contactor unless the high or low pressure switch closes and the anti-short cycle time has expired. If the high or low pressure switch opens three times within 1 hour, the control board will go into manual lockout and the fault contact will energize.

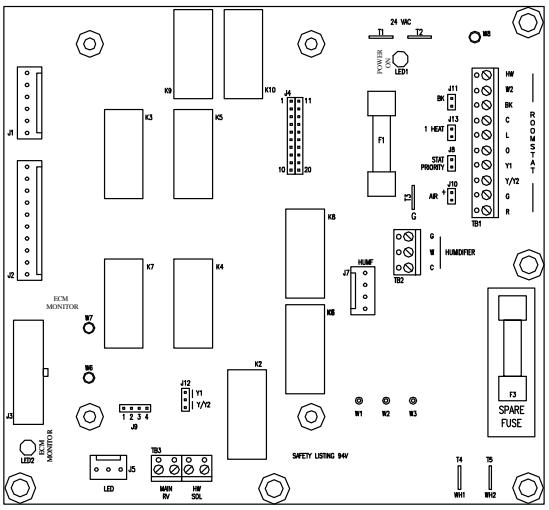
Plenum Temperature Sensor

Plenum temperature sensor should be installed 18" to 24" above (or from) the auxiliary heat elements. Stage 1 is a direct function of W2 stat input only. The controller has the ability to interrupt or deactivate stage 2 and stage 3. Sensor must be enabled to function.

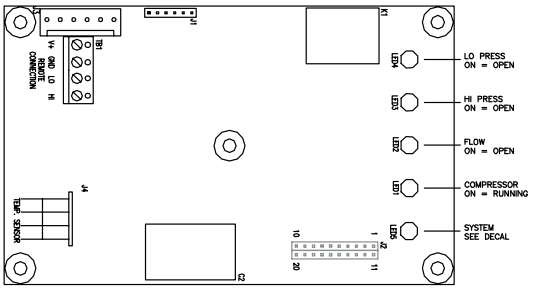
Figure 16: 01CB30 Microprocessor Control Board



Bottom Board



Top Board



CONTROL BOARD LOCKOUT FUNCTIONS

Jumper Setup

J8 = stat priority – "Y" is priority over HW terminal if jumper is installed.

J9 = ECM jumpers - Relates to specific models. Can also be used to lower motor speed.

J10 = Air+ - Change the continuous fan speed "G" call (50%) to 65 % continuous air, if jumper is installed.

J11 = BK - Cooling only. If jumper is installed, fan runs at normal speed. When a humidistat is connected to BK terminal remove jumper. When humidistat calls, (0 volts at BK terminal) fan will reduce speed by 15%.

J12, Selects single speed or dual speed compressor (three posts, two positions) - jumper installed at Y/Y2 sets up standard single stage stat.

Y/Y2 screw. Jumper installed at Y1 sets up Y1 input as first stage stat where "basic Y or Y1 on thermostat" is connected on Y1 screw. Jumper set at Y1 requires a 2 Heat/2 Cool thermostat and if Backup installed a 3 Heat/2 Cool Thermostat.

J13, 1 HEAT – Heating mode only. With pin jumper installed, Y1 activates both compressor speed 1 and speed 2. Stat Y/Y2 basically has no function (heat only). Note: Not all boards have jumper J13.

HEATING OPERATION

Heat, 1st stage (Y/Y1)

The fan motor is started on low speed immediately, the loop pump is also started at the Y/Y1 call, and the compressor is energized on low capacity. The fan motor speed is changed to 70% in 30 seconds, after Y call.

Heat, 2nd stage (Y & W2) Single Capacity Units

The second stage heat is energized. The fan motor speed is changed to 100% after W2 calls. After ten minutes of continuous W2 Call, and plenum temperature is not at max, the fan motor will change to 110%.

Heat, 2nd stage (Y1 & Y2) Dual Capacity Units

The second stage heat is energized. The fan motor speed is changed to 85% after Y2 calls.

Heat, 3rd stage (Y1, Y2 & W2) Dual Capacity Units

The third stage heat is energized. The fan motor speed is changed to 100% after W2 calls. After ten minutes of continuous W2 Call, and plenum temperature is not at max, the fan motor will change to 110%.

Emergency Heat (W2 Only)

The fan motor is started on high speed, and the first stage heat is energized. Ten seconds after continuous demand, additional stages of resistance heat will sequence to desired temperature (if temperature sensor is installed).

COOLING OPERATION

In cooling mode, the O terminal (reversing valve) is always energized.

Cool, 1st stage (Y, O or Y1, O)

The fan motor is started on low speed immediately, the loop pump is also started at the Y1 call, and the compressor is energized on low capacity (dual capacity units). For single stage units, the compressor is energized. The fan motor speed is changed to 70% in 30 seconds (100% for single stage units), after Y1 call.

Cool, 2nd stage (Y1 & Y2) Dual Capacity Units

The second stage cool is energized. The fan motor speed is changed to 85% and after 15 seconds to 100% (85% if Humidistat calls), after Y2 calls.

OTHER OPERATION

Humidifier Terminal Strip

The G Terminal allows a direct 24 volt signal (from the thermostat G terminal) if the O is not energized. The W terminal allows a direct 24 volt signal (from the thermostat Y terminal) if the O is not energized. Both G & W are de-energized when the O terminal is active.

Fan (G Only)

The "G" terminal starts the fan at low speed. Regardless of the fan input "G" from thermostat, the fan will remain on low speed for

30 seconds at the end of each heating, cooling or emergency heat cycle.

Indicator LEDs
Top Board, Controller & External (outside) Corner System - red and green color with various combinations.

Green = on solid - power-on, ready or no t-stat call. Pulsing - compressor relay on.

Red = pulsing - in lockout mode.
On solid - in lockout hold mode.
Fast pulsing - in anti-cycle delay (ACD).

Green/red = alternating - detected bad temperature sensor or not plugged in.

Top Board, Controller
Compressor: Yellow = On indicates voltage to compressor contactor coil.

Flow: Red = on indicates no flow. If there's no t-stat call, LED is on representing no flow.

High Pressure: Red = on indicates open. Momentary open declares lockout hold (set at 600 PSI).

Low Pressure: Red = on indicates open. Momentary open declares lockout hold (Set at 40 PSI).

L Fault LED (Thermostat)
Pulsing = in lockout mode or bad temperature sensor.

01CB28 CONTROL BOARD (SINGLE STAGE UNITS AND TWO COMPRESSOR UNITS)
(01CB28) is a microprocessor-based printed circuit board. It is located in the unit control box for convenient accessibility. This control board is specially design for the geothermal unit. The Board provides control of the unit as well as outputs for status modes, faults and diagnostics.

Startup
The unit will not operate until all inputs and safety controls are checked for normal conditions.

Fault Retry & Diagnostics
All faults are retried three times, with 5 minute delay between each attempt, before finally locking the unit out.
1 Blink for high pressure switch
2 Blinks for low pressure switch
3 Blinks for flow switch

Safety Controls
The control receives separate signals for a high pressure switch for safety, a low pressure switch to prevent loss/lo refrigerant charge damage & a flow switch for freeze protection.

Testing
The control allows service personal to shorten timing delays for fast diagnostics. If jumper is set to "No" positions, timing is set to standard, If jumper is set to "Yes" position; timing is reduced for service and startup.

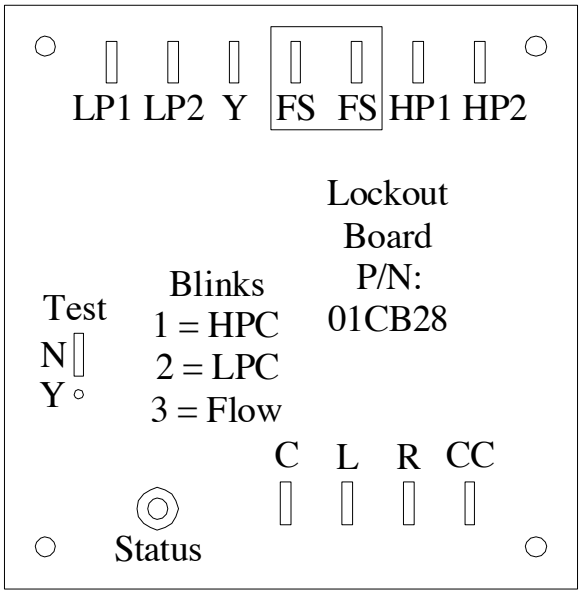
Flow Switch (Freeze Protection) Operation
When 24vac is applied to the Y terminal, the control monitors the flow switch input. If the flow switch opens (no water flow), the control board will energize the compressor contactor, and start the compressor, after the random start is over. If the flow switch is still open after the 30 seconds, the control will de-energize the compressor contactor. The control board won't start the sequence unless the flow switch closes. If the flow switch opens while the compressor is energized, the control board will energize the compressor contactor for a minimum time period of 30 seconds. After 30 seconds, the control board will de-energize the compressor contactor and go into a soft lockout. The control board will not energize the compressor

contactor unless the flow switch closes and the anti-short cycle time has expired. If the flow switch opens three times with-in 1 hour, the control board will go into manual lockout and the fault indicator will energize. When the flow switch is open, or if in lockout mode, the status led on the control board will blink, three times.

Condensation Overflow Protection
Units with R-410a refrigerant come standard with a condensate sensor. If sensor is sensing condensation liquid, the compressor will shut down and the flow status light will blink, three times.

Anti-Short Cycle Operation
If all safety controls are satisfactory, the compressor contactor will energize when the control board receives 24VAC on the thermostat input "Y" terminal. If 24VAC on the "Y" terminal is removed, the control board will de-energize the compressor contactor and go into a 300 second anti-short cycle. If 24VAC is reapplied to the "Y" terminal again, the control board will not energize the compressor contactor until after the 300 second anti-short cycle is over.

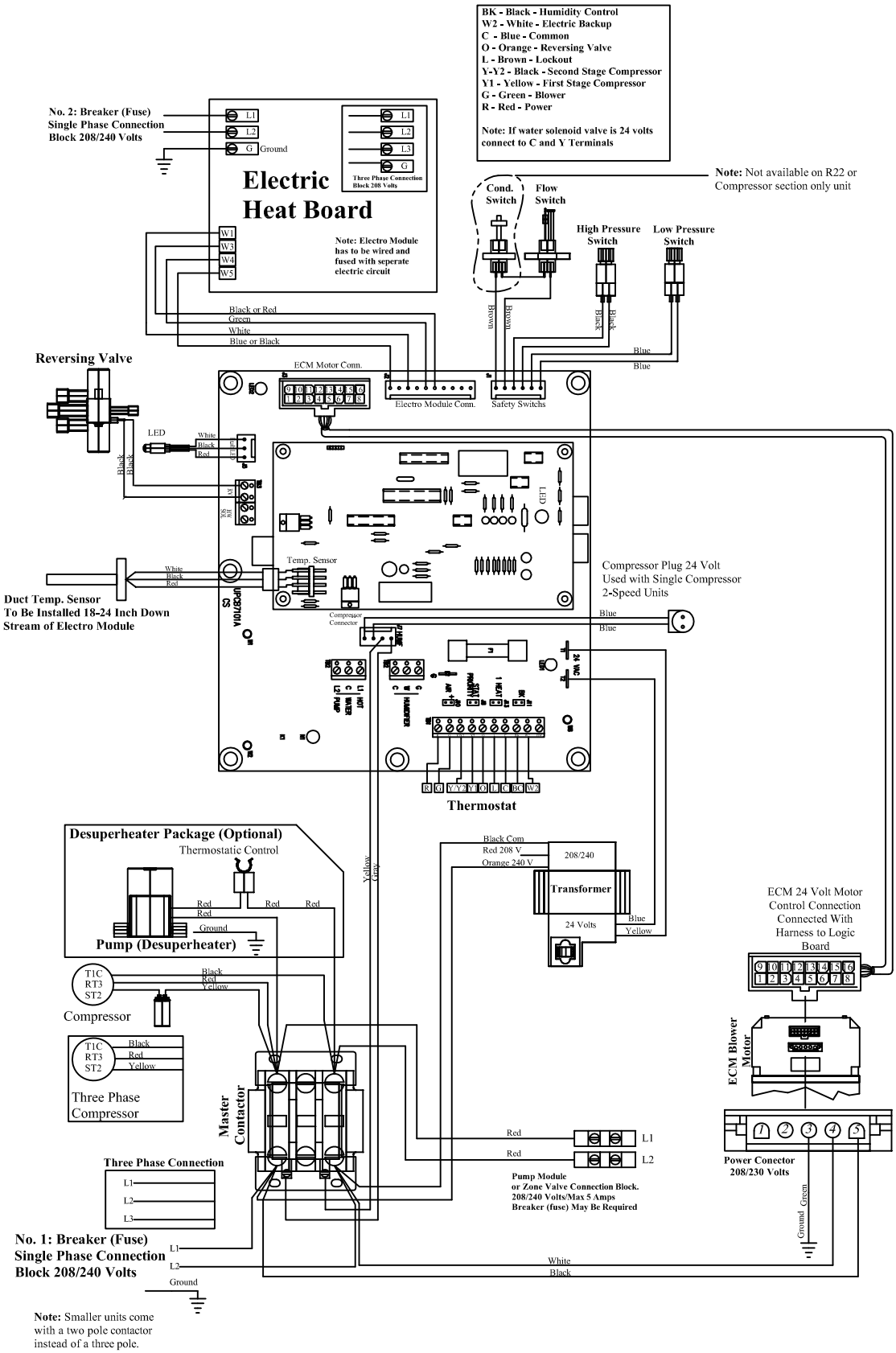
Figure 17: Single Stage Lockout Board



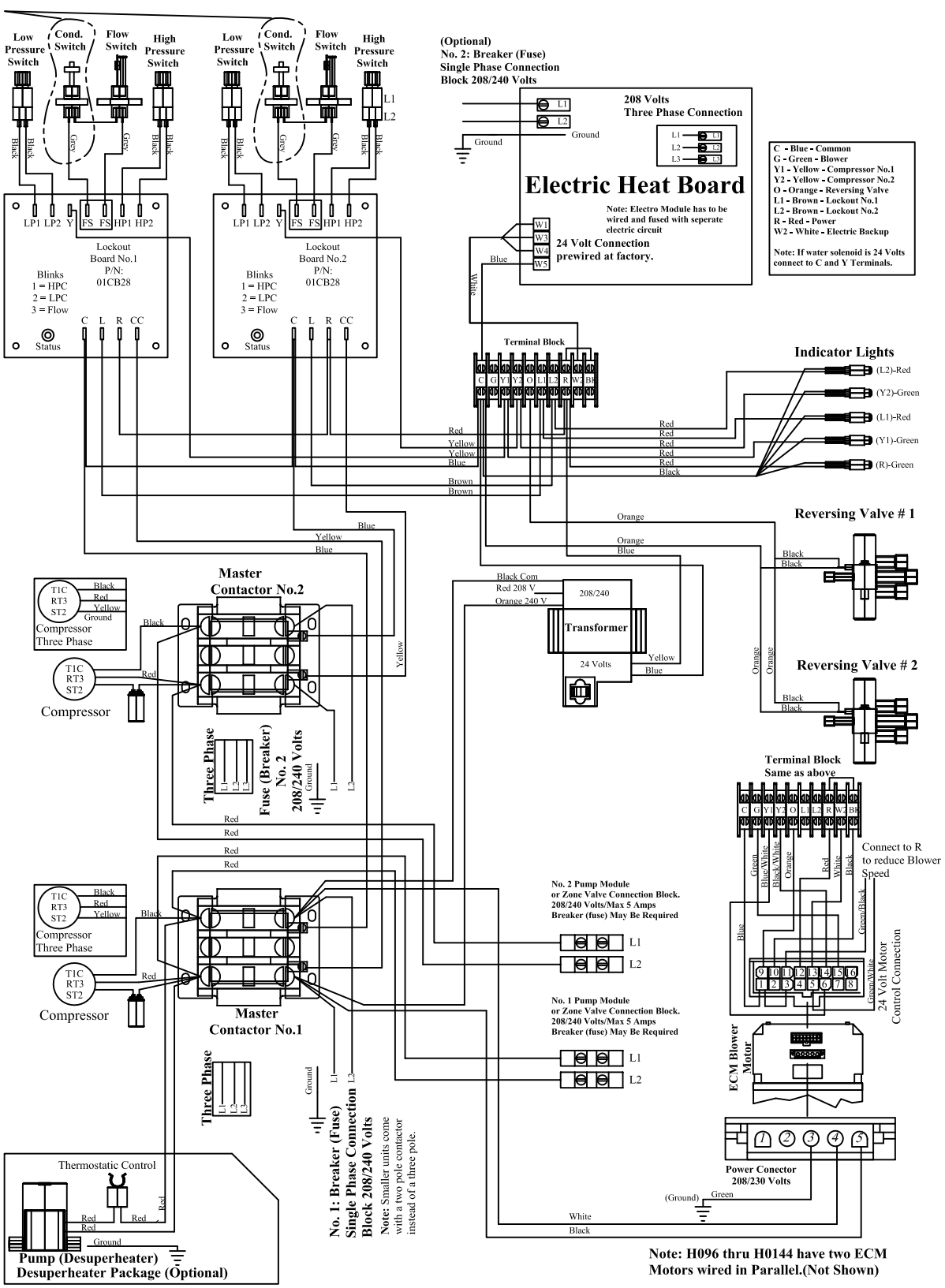
LP1 - Low Pressure
LP2 - Low Pressure
Y - H/C Call
FS - Flow Switch
FS - Flow Switch
SS - Contactor
HP1 - High Pressure
HP2 - High Pressure
C - Common
L - Fault
R - Power

High & Low Pressure Safety Operation
When 24vac is applied to the "Y" terminal, the control board monitors the high and low pressure switch input to make sure that they are closed. The control board won't start the sequence unless the high & Low pressure switch are closed. If the high or low pressure switch opens while the compressor contactor is energized, the control will de-energize the compressor contactor and go into a soft lockout. The control board will not energize the compressor contactor unless the high or low pressure switch closes and the anti-short cycle time has expired. If the high or low pressure switch opens three times with in 1 hour, the control board will go into manual lockout and the fault contact will energize. When the high or low pressure switch opens or if in lockout mode, the status led on the control board will board will blink, one for high, and two for low pressure switch.

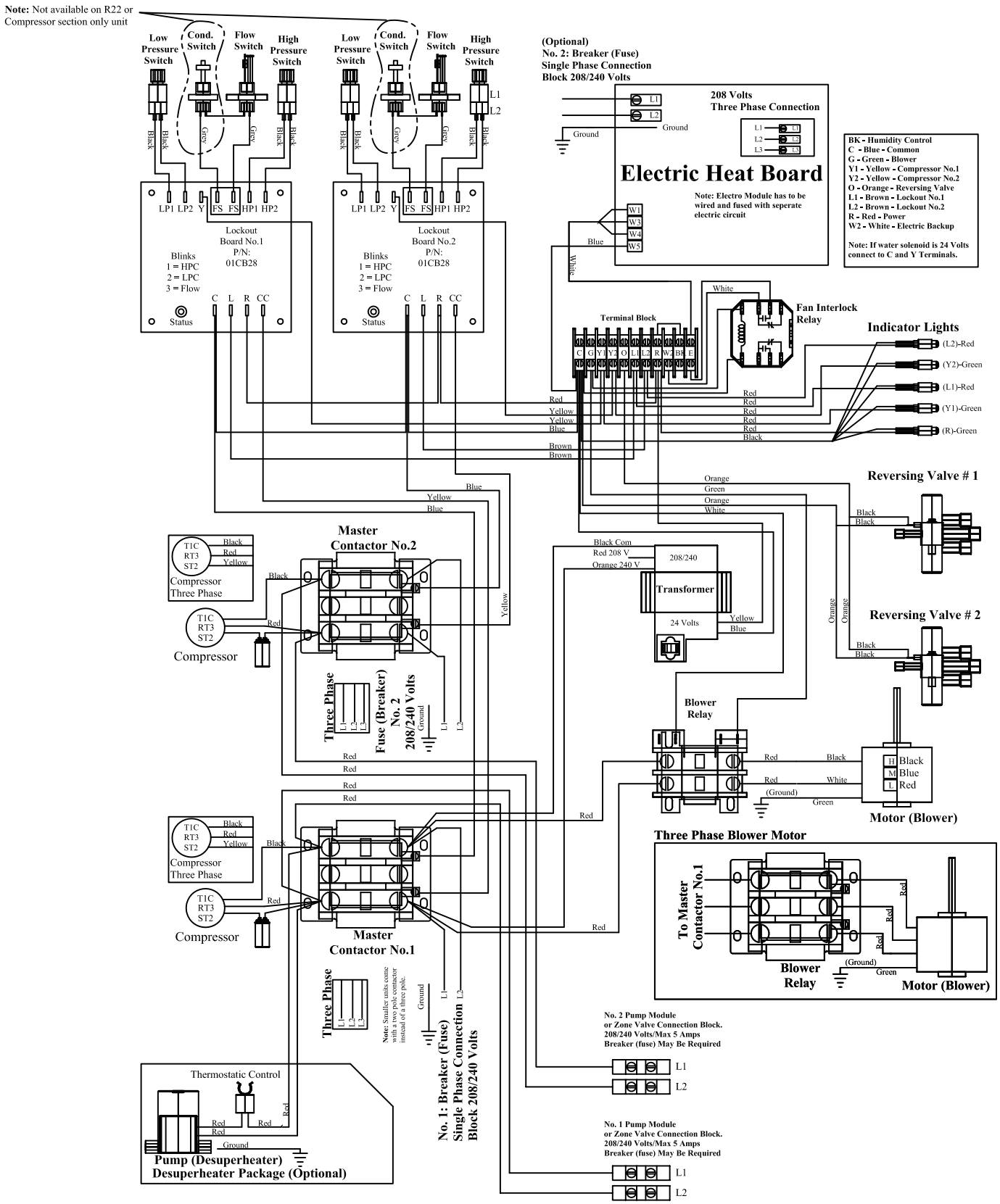
Single Compressor, Two-Stage Unit with ECM Motor Wiring Diagram



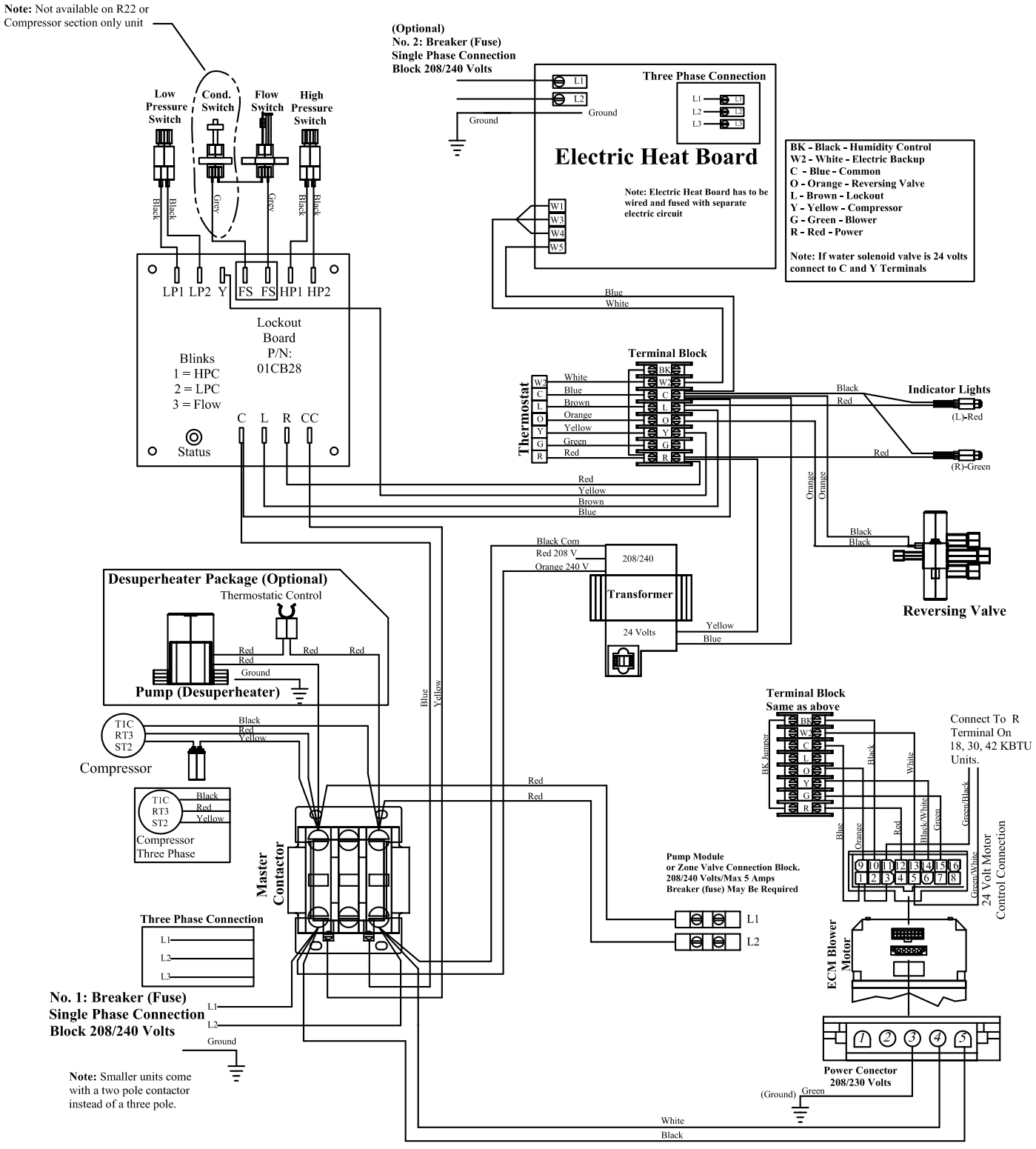
Dual Compressor with ECM Motor Wiring Diagram



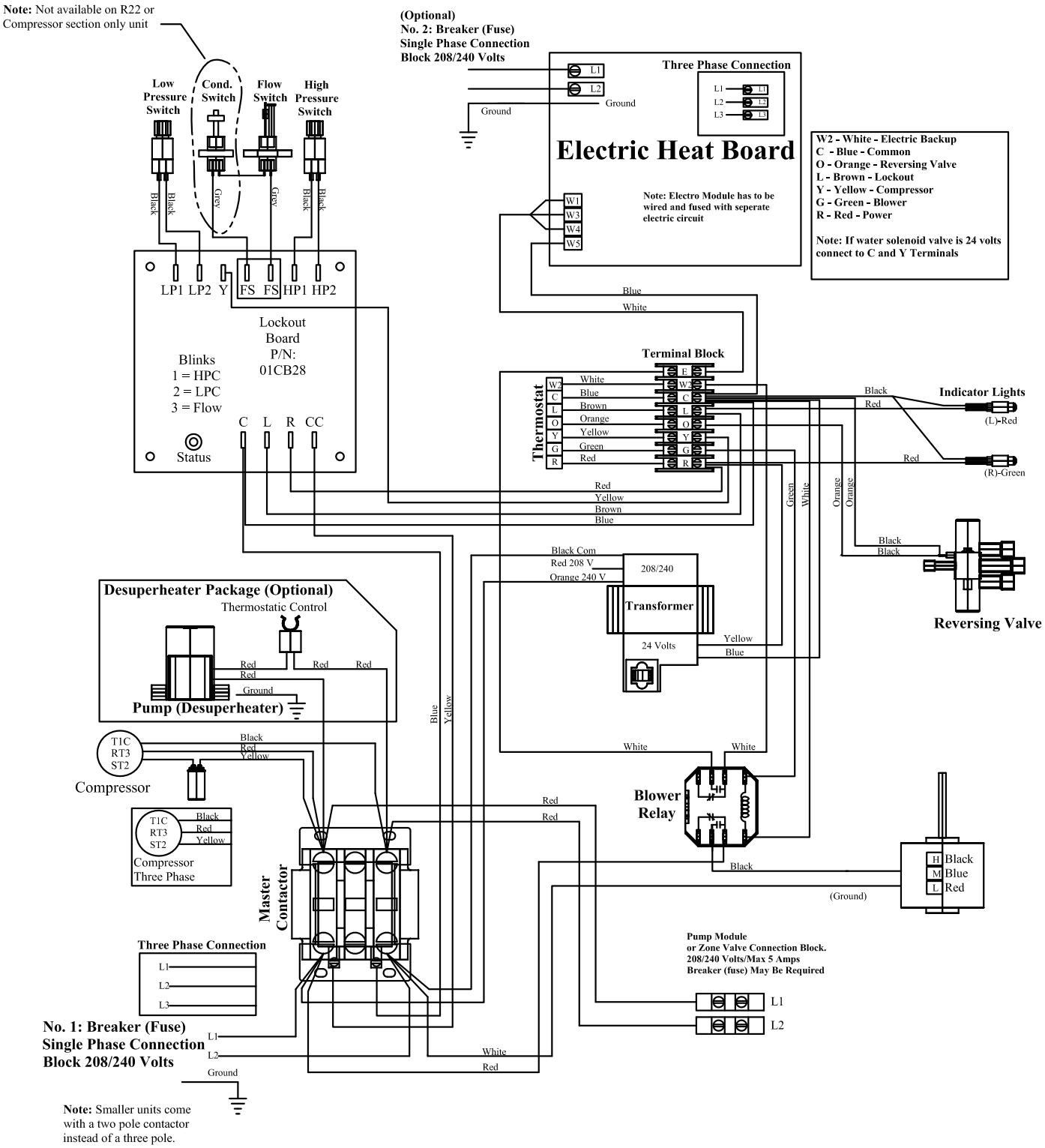
Dual Compressor with PSC Motor Wiring Diagram



Single Compressor, Single Stage Unit with ECM Motor Wiring Diagram



Single Compressor, Single Stage Unit with PSC Motor Wiring Diagram



Single Compressor Combination Unit with ECM Motor Wiring Diagram

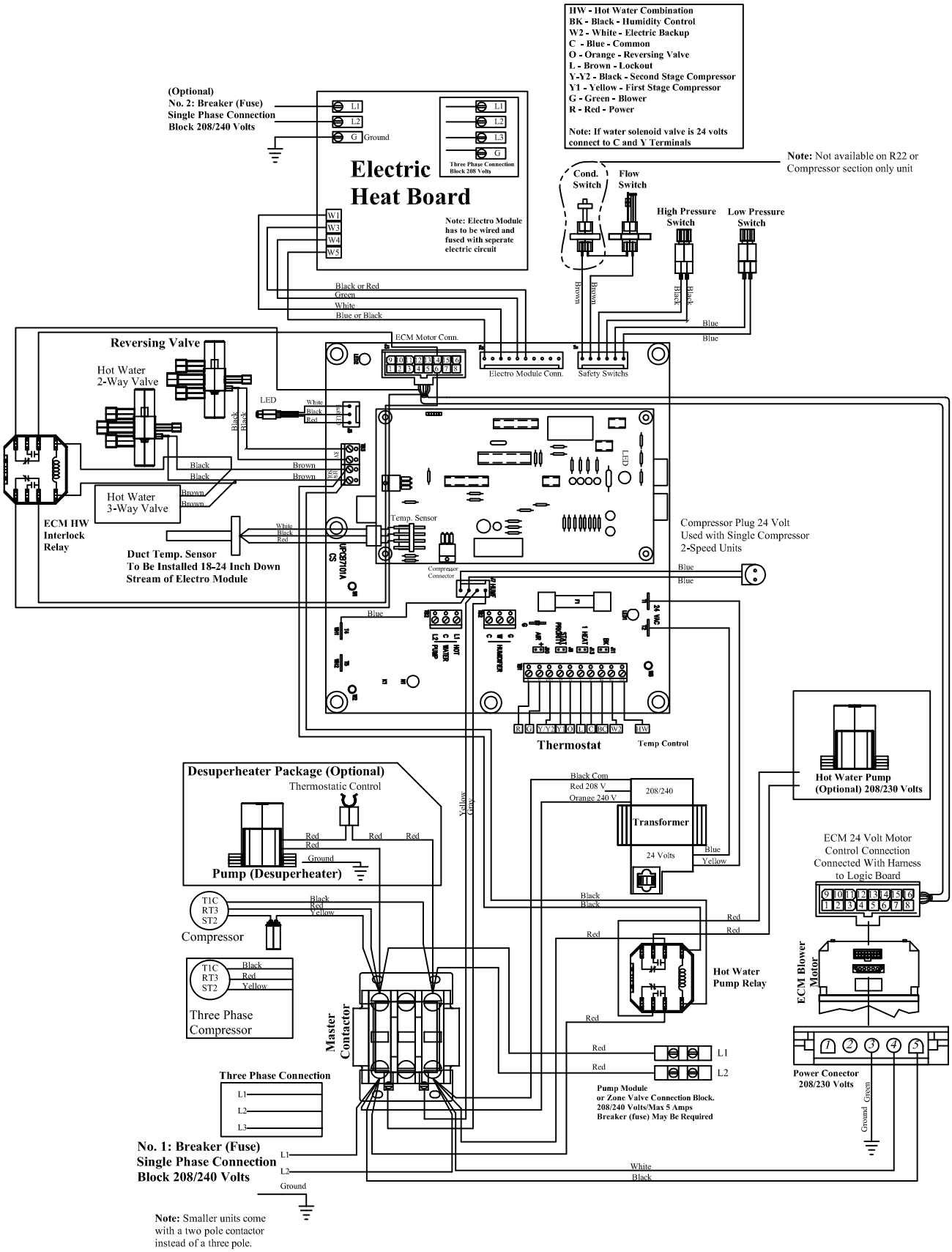
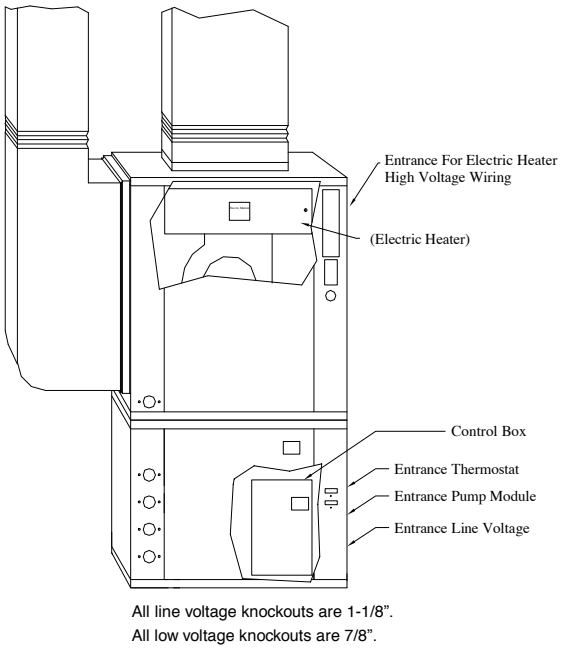


Table 10: Auxiliary Heater Electrical Data

Model Number	Unit Model	kW	Volts	Amps	Minimum Circuit Size	Maximum Circuit Size	Fuse Size Amps (Inside Heater)	Minimum CFM
AHTR101A	024 - 073	10	240	40.0	50.0	90.0	None	600
AHTR151A	036 - 073	15	240	60.0	75.0	135.0	2 - 30 & 2 - 50	900
AHTR201A	048 - 073	20	240	80.0	100.0	180.0	4 - 50	1200

Note: 20kW heater not recommended for 036/038

Figure 18: Auxiliary Heater Placement



APSMA PUMP SHARING MODULE

The pump sharing module, part number APS-MA, is designed to allow two units to share one flow center. With the APSMA module, either unit can energize the pump(s). Connect the units and flow center as shown in figure 1, below. Figure 2 includes a schematic of the board. The module must be mounted in a NEMA enclosure or inside the unit control box. Local code supersedes any recommendations in this document.

Installing Electric Heater High Voltage Wires:

Wires should enter the unit at the entrance of Electric Heater wiring entrance. Wire should be run through a conduit up to the cabinet and wired to the Electric Heater terminal strip (See wiring diagram located inside units electric box cover).

A separate circuit/breaker must be installed for the Electric Heater. It is not recommended to operate the Electric Heater on the same Line or Fuse (breaker) that the compressor is powered.

All wiring MUST be done in strict compliance with local, state, national or any other applicable codes.

Note: If Electric Auxiliary is used, never disconnect power to the heat unit as it may be required to properly heat the home. Major damage may result.

Figure 19: APSMA Module Layout

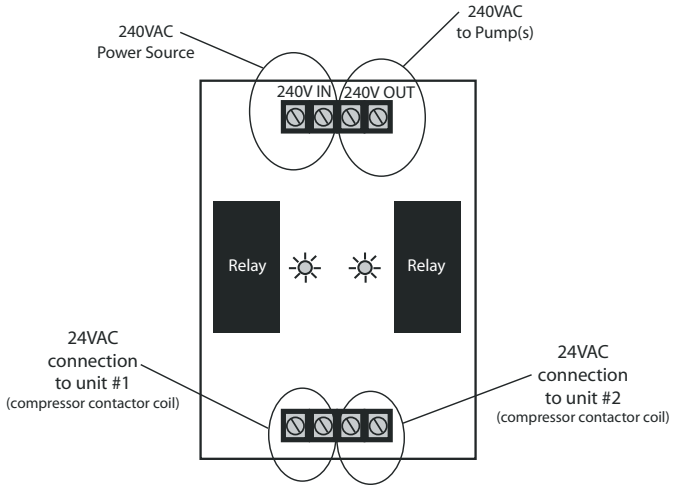


Figure 20: APSMA Module Wiring Schematic

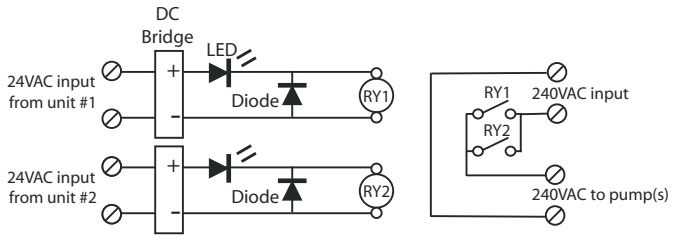


Table 11: Two-Stage Unit Heat of Extraction/Rejection Data (Full Load)

Two-Stage Water-to-Air Packaged Units (70°F EAT Heating; 75/63°F EAT Cooling)											
Heat of Extraction/Rejection-Full Load Operation (Mbtuh) -- DSP Disconnected											
EWT	Flow Rate	024/26		036/38		048/050		060/062		072/073	
°F	GPM/Ton	HE	HR	HE	HR	HE	HR	HE	HR	HE	HR
30	1.5	14.6		20.3		29.5		33.7		38.6	
	2.25	15.2		21.1		30.7		35.1		40.2	
	3	15.6		21.6		31.4		36.0		41.1	
50	1.5	20.4	33.0	28.4	45.8	41.2	66.5	47.1	76.1	53.9	83.7
	2.25	21.5	33.1	29.8	45.9	43.3	66.7	49.5	76.3	56.6	84.0
	3	22.0	33.3	30.5	46.2	44.4	67.1	50.8	76.7	58.0	84.4
70	1.5	25.8	32.1	35.8	44.6	52.0	64.7	59.5	74.1	68.1	81.5
	2.25	27.2	32.2	37.8	44.7	54.8	65.0	62.8	74.3	71.7	81.8
	3	28.1	32.4	38.9	45.0	56.5	65.3	64.7	74.7	74.0	82.2
90	1.5	30.4	30.9	42.2	42.9	61.3	62.3	70.1	71.3	80.2	78.4
	2.25	32.3	31.1	44.8	43.1	65.1	62.6	74.5	71.7	85.1	78.8
	3	33.4	31.1	46.4	43.2	67.4	62.7	77.1	71.8	88.1	79.0
110	1.5		29.4		40.8		59.3		67.8		74.6
	2.25		29.5		41.0		59.5		68.1		74.9
	3		29.5		41.0		59.5		68.1		74.9

Table 12: Two-Stage Unit Heat of Extraction/Rejection Data (Part Load)

Two-Stage Water-to-Air Packaged Units (70°F EAT Heating; 75/63°F EAT Cooling)											
Heat of Extraction/Rejection-Part Load Operation (Mbtuh) -- DSP Disconnected											
EWT	Flow Rate	024/26		036/38		048/050		060/062		072/073	
°F	GPM/Ton	HE	HR	HE	HR	HE	HR	HE	HR	HE	HR
30	1.5	10.1		13.6		19.6		23.6		30.1	
	2.25	10.5		14.1		20.4		24.6		31.4	
	3	10.8		14.5		20.9		25.2		32.1	
50	1.5	14.1	22.8	18.9	30.6	27.3	44.1	33.0	53.2	42.1	66.8
	2.25	14.8	22.8	19.9	30.7	28.7	44.3	34.6	53.4	44.2	67.1
	3	15.2	23.0	20.4	30.8	29.4	44.5	35.5	53.6	45.3	67.4
70	1.5	17.8	22.2	23.9	29.7	34.5	42.9	41.6	51.8	53.1	65.1
	2.25	18.8	22.2	25.2	29.9	36.4	43.1	43.9	52.0	56.0	65.3
	3	19.4	22.4	26.0	30.0	37.5	43.3	45.2	52.2	57.7	65.6
90	1.5	21.0	21.3	28.2	28.6	40.7	41.3	49.0	49.8	62.6	62.6
	2.25	22.3	21.4	29.9	28.8	43.2	41.6	52.1	50.1	66.4	63.0
	3	23.1	21.5	31.0	28.8	44.7	41.6	53.9	50.2	68.8	63.1
110	1.5		20.3		27.2		39.3		47.4		59.6
	2.25		20.4		27.3		39.5		47.6		59.8
	3		20.4		27.3		39.5		47.6		59.8

Table 14: Two-Stage Unit Heat Exchanger Pressure Drop (Full Load)

Two-Stage Water-to-Air Packaged Units						
Heat Exchanger Pressure Drop						
Full Load Operation		Pressure Drop at Entering Water Temp. Listed Below				
Model	Flow Rate GPM	30°F PSI	50°F PSI	70°F PSI	90°F PSI	110°F PSI
024/026	3.9	1.4	1.3	1.3	1.2	1.2
	5.4	2.6	2.4	2.3	2.1	2.1
	7.0	4.1	3.9	3.7	3.4	3.4
036/38	5.0	1.8	1.7	1.7	1.6	1.5
	7.0	3.4	3.1	3.0	2.8	2.8
	9.0	5.4	5.0	4.8	4.4	4.4
048/050	6.7	2.2	2.0	2.0	1.9	1.9
	9.3	4.0	3.7	3.6	3.3	3.3
	12.0	6.5	6.0	5.8	5.3	5.3
060/062	8.3	2.2	2.1	2.1	1.9	1.9
	11.7	4.1	3.8	3.7	3.4	3.4
	15.0	6.7	6.2	5.9	5.5	5.4
072/073	10.0	3.2	3.0	3.0	2.8	2.8
	14.0	6.0	5.6	5.4	5.0	5.0
	18.0	9.7	9.1	8.6	8.0	8.0

Table 15: Two-Stage Unit Heat Exchanger Pressure Drop (Part Load)

Two-Stage Water-to-Air Packaged Units						
Heat Exchanger Pressure Drop						
Part Load Operation		Pressure Drop at Entering Water Temp. Listed Below				
Model	Flow Rate GPM	30°F PSI	50°F PSI	70°F PSI	90°F PSI	110°F PSI
024/026	2.2	0.9	0.8	0.8	0.8	0.8
	3.1.	1.7	1.6	1.5	1.4	1.4
	4.0	2.7	2.5	2.4	2.2	2.2
036/38	2.8	1.2	1.1	1.1	1.0	1.0
	3.9	2.2	2.0	2.0	1.8	1.8
	5.0	3.5	3.3	3.1	2.9	2.8
048/050	3.9	1.4	1.3	1.3	1.2	1.2
	5.4	2.6	2.4	2.3	2.1	2.1
	7.0	4.1	3.9	3.7	3.4	3.4
060/062	5.6	1.4	1.3	1.3	1.2	1.2
	7.8	2.7	2.5	2.4	2.2	2.2
	10.0	4.3	4.0	3.8	3.6	3.5
072/073	8.3	2.6	2.4	2.4	2.2	2.2
	11.7	4.8	4.5	4.3	4.0	4.0
	15.0	7.8	7.2	6.9	6.4	6.4

Table 16: Single Stage Unit Heat of Extraction/Rejection Data

Single-Stage Water-to-Air Packaged Units (70°F EAT Heating; 75/63°F EAT Cooling)																	
Heat of Extraction/Rejection-Full Load Operation (Mbtuh) -- DSP Disconnected																	
EWT	Flow Rate GPM/ Ton	018		024		030		036		042		048		060		072	
°F		HE	HR	HE	HR	HE	HR	HE	HR	HE	HR	HE	HR	HE	HR	HE	HR
30	1.5	9.1		13.6		17.6		20.4		23.8		28.9		32.3		39.7	
	2.25	9.4		14.2		18.3		21.3		24.8		30.1		33.7		41.3	
	3	9.7		14.5		18.7		21.8		25.4		30.8		34.5		42.3	
50	1.5	12.7	20.5	19.0	30.7	24.6	39.6	28.5	46.0	33.3	53.7	40.4	65.2	45.2	72.9	55.4	89.5
	2.25	13.3	20.5	20.0	30.6	25.8	39.8	30.0	46.2	34.9	53.9	42.4	65.4	47.4	73.1	58.2	89.8
	3	13.6	20.6	20.5	30.9	26.4	40.0	30.7	46.4	35.8	54.2	43.5	65.8	48.6	73.5	59.7	90.3
70	1.5	16.0	19.9	24.0	29.9	31.0	38.6	36.0	44.8	42.0	52.3	51.0	63.5	57.0	70.9	70.1	87.1
	2.25	16.9	20.0	25.3	30.0	32.7	38.7	38.0	45.0	44.3	52.5	53.8	63.7	60.1	71.2	73.4	87.4
	3	17.4	20.1	26.1	30.1	33.7	38.9	39.1	45.2	45.7	52.7	55.5	64.1	62.0	71.6	76.1	87.9
90	1.5	18.9	19.2	28.3	28.7	36.5	37.1	42.4	43.1	49.5	50.3	60.1	31.1	67.2	68.3	82.5	83.8
	2.25	20.0	19.3	30.0	28.9	38.8	37.3	45.1	43.4	52.6	50.6	63.8	61.4	71.3	68.7	87.6	84.3
	3	20.7	19.3	31.1	29.0	40.2	37.4	46.7	43.4	54.4	50.7	66.1	61.5	73.9	68.8	90.7	84.5
110	1.5		18.2		27.3		35.3		41.0		47.9		58.1		65.0		79.8
	2.25		18.3		27.5		35.5		41.2		48.0		58.3		65.2		80.1
	3		18.3		27.5		35.5		41.2		48.0		58.3		65.2		80.1

Table 17: Single Stage Unit Heat Exchanger Pressure Drop

Single-Stage Water-to-Air Packaged Units						
Heat Exchanger Pressure Drop						
Model	Flow Rate GPM	Pressure Drop at Entering Water Temp Listed Below				
		30°F PSI	50°F PSI	70°F PSI	90°F PSI	110°F PSI
018	2.8	1.2	1.1	1.1	1.0	1.0
	3.9	2.2	2.1	2.0	1.8	1.8
	5.0	3.6	3.4	3.2	3.0	3.0
024	3.3	1.4	1.3	1.3	1.2	1.2
	4.7	2.5	2.3	2.3	2.1	2.1
	6.0	4.1	3.8	3.6	3.3	3.3
030	3.9	1.4	1.3	1.3	1.2	1.2
	5.4	2.5	2.3	2.3	2.1	2.1
	7.0	4.1	3.8	3.6	3.3	3.3
036	5.0	1.8	1.7	1.7	1.6	1.6
	7.0	3.4	3.1	3.0	2.8	2.8
	9.0	5.4	5.0	4.8	4.4	4.4
042	6.1	1.5	1.4	1.4	1.3	1.3
	8.5	2.8	2.6	2.5	2.3	2.3
	11.0	4.5	4.2	4.0	3.7	3.7
048	7.2	2.2	2.0	2.0	1.9	1.9
	10.1	4.0	3.7	3.6	3.3	3.3
	13.0	6.5	6.0	5.8	5.3	5.3
060	8.3	2.2	2.1	2.1	1.9	1.9
	11.7	4.1	3.8	3.7	3.4	3.4
	15.0	6.7	6.2	5.9	5.5	5.5
072	10.0	2.3	2.2	2.2	2.0	2.0
	14.0	4.4	4.1	3.9	3.6	3.6
	18.0	7.0	6.6	6.2	5.8	5.8

Table 14: Unit Operating Pressures (R-410a)

Heating - Without Desuperheater							
EWT (°F)	GPM Per Ton	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Sub Cooling (°F)	Super Heat (°F)	Air Temperature Rise (°F-DB)	Water Temperature Drop (°F)
30	1.5	285-310	68-76	4-10	8-12	14-20	5-8
	3	290-315	70-80	4-10	8-12	16-22	3-6
50	1.5	315-345	100-110	6-12	9-14	22-28	7-10
	3	320-350	105-115	6-12	9-14	24-30	5-8
70	1.5	355-395	135-145	7-12	10-15	30-36	9-12
	3	360-390	140-150	7-12	10-15	32-38	7-10
Cooling - Without Desuperheater							
EWT (°F)	GPM Per Ton	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Sub Cooling (°F)	Super Heat (°F)	Air Temperature Drop (°F-DB)	Water Temperature Rise (°F)
50	1.5	220-235	120-130	10-16	12-20	20-26	19-23
	3	190-210	120-130	10-16	12-20	20-26	9-12
70	1.5	280-300	125-135	8-14	10-16	19-24	18-22
	3	250-270	125-135	8-14	10-16	19-24	9-12
90	1.5	360-380	130-145	8-14	10-14	18-22	17-21
	3	330-350	130-140	8-14	10-14	18-22	8-11

PERFORMANCE CHECK
Heat of Extraction(HE)/Rejection(HR)
Record information on the Unit Start-up Form

Equipment should be in operation for a minimum of 10 minutes in either mode – ***WITH THE HOT WATER GENERATOR TURNED OFF.***

1. Determine flow rate in gallons per minute
a. Check entering water temperature
b. Check entering water pressure
c. Check leaving water pressure

Once this information is recorded, find corresponding entering water temperature column in Specification Manual for unit. Find pressure differential in PSI column in Spec Manual. Then read the GPM column in Spec Manual to determine flow in GPM.

2. Check leaving water temperature of unit. FORMULA: [GPM x water temp diff, x 485 (antifreeze)] /500 (fresh water) = HE or HR in BTU/HR

A 10% variance from Spec Manual is allowed. Always use the same pressure gauge & temperature measuring device.
Water flow must be in range of Specification Manual. If system has too much water flow, performance problems should be expected

Section 13: Troubleshooting

A: UNIT WILL NOT START IN EITHER CYCLE

Thermostat	Set thermostat on heating and highest temperature setting. Unit should run. Set thermostat on cooling and lowest temperature setting. Unit should run. Set fan to On position. Fan should run. If unit does not run in any position, disconnect wires at heat pump terminal block and jump R, G, Y. Unit should run in heating. If unit runs, replace thermostat with correct thermostat only.
Loose or broken wires	Tighten or replace wires.
Blown Fuse/ Tripped Circuit Breakers	Check fuse size, replace fuse or reset circuit breaker. Check low voltage circuit breaker.
Low Voltage Circuit	Check 24 volt transformer. If burned out or less than 24 volt, replace. Before replacing, verify tap setting and correct if necessary.
Water Flow	If water flow is low (less than 1 GPM), unit will not start. Make sure Pump Module or solenoid valve is connected (see wiring diagram). Water has to flow through the heat exchanger in the right direction (see labels at water fitting connections) before the compressor can start. If water flow is at normal flow, use an ohmmeter to check if you get continuity at the flow switch. If no switch is open and flow is a normal flow, remove switch and check for stuck particles or bad switch.

B: BLOWER RUNS BUT COMPRESSOR WILL NOT START

Logic Board	Check if logic board is working properly. Check status light for fault. See board imprint for blink faults.
Flow Switch	Temporarily bypass flow switch until compressor starts. If compressor runs properly, check switch. If defective, replace. If switch is not defective, check for air in loop system. Make sure loop system is properly purged. Verify flow rate before changing switch.

C: BLOWER RUNS BUT COMPRESSOR SHORT CYCLES OR DOES NOT RUN

Wiring	Loose or broken wires. Tighten or replace wires. See A: Unit will not start in either cycle.
Blown Fuse	Check fuse size. Check unit nameplate for correct sizing. Replace fuse or reset circuit breaker. Check low voltage circuit breaker.
Flow Switch	Temporarily bypass flow switch for a couple seconds. If compressor runs properly, check switch. If defective, replace. If switch is not defective, check for air in loop system. Make sure loop system is properly purged. Verify flow rate before changing switch. .
No Water flow	See A: Unit will not start in either cycle.
High or low pressure switches	If heat pump is out on high or low-pressure cutout (lockout), check for faulty switches by jumping the high and low-pressure switches individually. If defective replace. Check airflow, filters, water flow, loss of refrigerant and ambient temperature. WARNING: Only allow compressor to run for a couple of seconds with the high pressure switch jumpered
Defective logic board relay	Jump or bypass relay. If defective, replace.
Defective capacitor	Check capacitor. If defective, replace.
Frozen Compressor	See charts O and P for compressor diagnostic. If compressor still doesn't run, replace it.
Low refrigerant charge	Check for leaks and fix leaks.

D: BLOWER FAILS TO START BUT COMPRESSOR ATTEMPTS TO START

Defective blower motor capacitor	Check capacitor. If defective, replace.
Defective blower motor relay	Check relay. If defective, replace.

E: NOISY BLOWER AND LOW AIR FLOW

Noisy Blower	Blower wheel contacting housing—Readjust. Foreign material inside housing—Clean housing. Loose duct work—Secure properly.
Broken belt	If defective, replace belt. Check pulleys. If bad, replace. Check bearings. If frozen, replace bearing.
Low air flow	Check speed setting, check nameplate or data manual for proper speed, and correct speed setting. Check for dirty air filter—Clean or replace; obstruction in system—Visually check. Balancing dampers closed, registers closed, leaks in ductwork. Repair. Ductwork too small. Resize ductwork.

F: UNIT RUNNING NORMAL, BUT SPACE TEMPERATURE IS UNSTABLE

Thermostat	Thermostat is getting a draft of cold or warm air. Make sure that the wall or hole used to run thermostat wire from the ceiling or basement is sealed, so no draft can come to the thermostat. Faulty Thermostat (Replace).

G: NO WATER FLOW

Pump Module	Make sure Pump Module is connected to the control box relay (check all electrical connections). For non-pressurized systems, check water level in Pump Module. If full of water, check pump. Close valve on the pump flanges and loosen pump. Take off pump and see if there is an obstruction in the pump. If pump is defective, replace. For pressurized systems, check loop pressure. Repressurize if necessary. May require re-flushing if there is air in the loop.
Solenoid valve	Make sure solenoid valve is connected. Check solenoid. If defective, replace.

H: IN HEATING OR COOLING MODE, UNIT OUTPUT IS LOW

Water	Water flow & temperature insufficient.
Airflow	Check speed setting, check nameplate or data manual for proper speed, and correct speed setting. Check for dirty air filter—Clean or replace. Restricted or leaky ductwork. Repair.
Refrigerant charge	Refrigerant charge low, causing inefficient operation. Make adjustments only after airflow and water flow are checked.
Reversing valve	Defective reversing valve can create bypass of refrigerant to suction side of compressor. Switch reversing valve to heating and cooling mode rapidly. If problem is not resolved, replace valve. Wrap the valve with a wet cloth and direct the heat away from the valve. Excessive heat can damage the valve. Always use dry nitrogen when brazing. Replace filter/drier any time the circuit is opened.

I: IN HEATING OR COOLING MODE, UNIT OUTPUT IS LOW

Heat pump will not cool but will heat. Heat pump will not heat but will cool.	Reversing valve does not shift. Check reversing valve wiring. If wired wrong, correct wiring. If reversing valve is stuck, replace valve. Wrap the valve with a wet cloth and direct the heat away from the valve. Excessive heat can damage the valve. Always use dry nitrogen when brazing. Replace filter/drier any time the circuit is opened.
Water heat exchanger	Check for high-pressure drop, or low temperature drop across the coil. It could be scaled. If scaled, clean with condenser coil cleaner.
System undersized	Recalculate conditioning load.

J: WATER HEAT EXCHANGER FREEZES IN HEATING MODE

Water flow	Low water flow. Increase flow. See F. No water flow.
Flow Switch	Check switch. If defective, replace.

K: EXCESSIVE HEAD PRESSURE IN COOLING MODE

Inadequate water flow	Low water flow, increase flow.

L: EXCESSIVE HEAD PRESSURE IN HEATING MODE

Low air flow	See E: Noisy blower and low air flow.

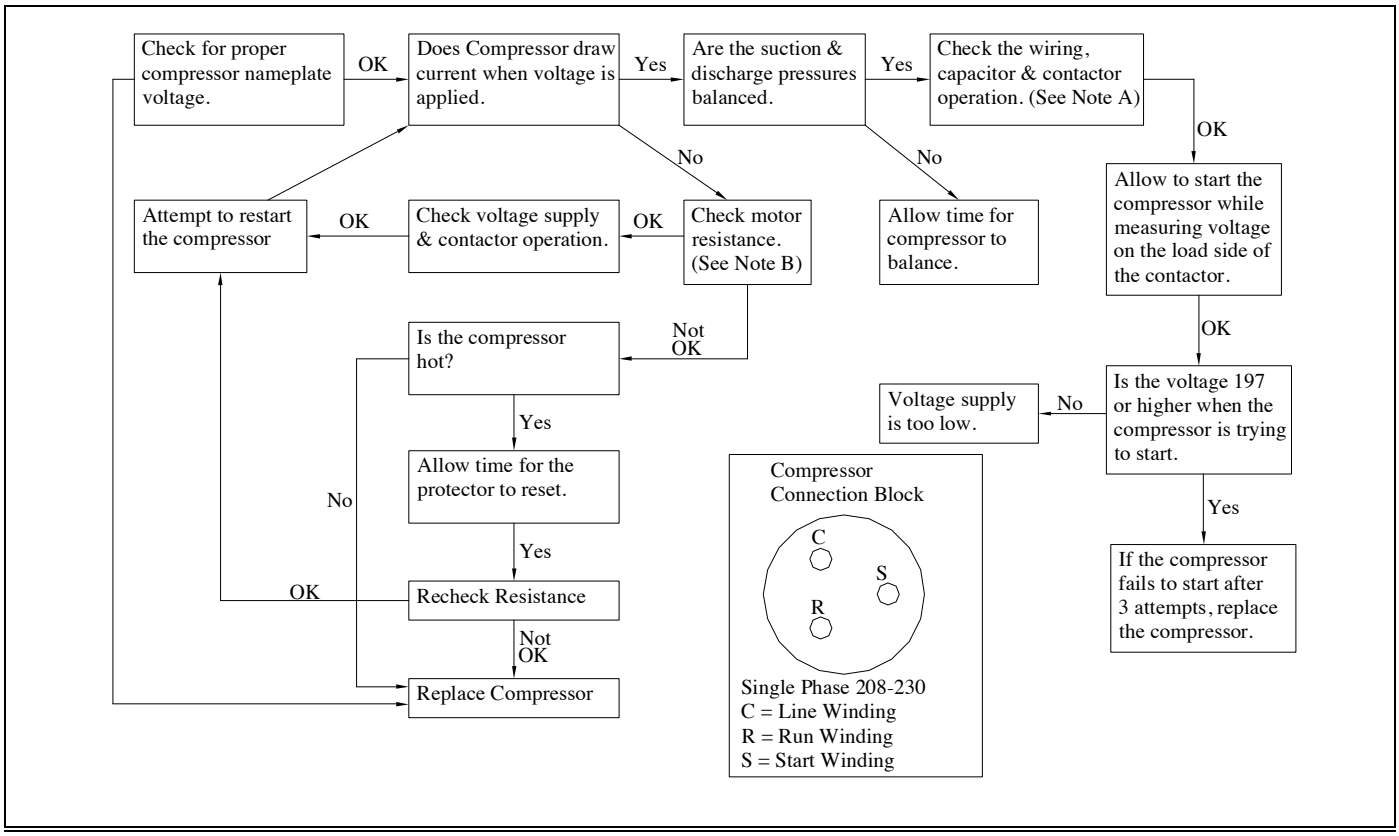
M: AIR COIL FREEZES OVER IN COOLING MODE

Air flow	See E: Noisy blower and low air flow.
Blower motor	Motor not running or running too slow. Motor tripping off on overload. Check for overheated blower motor and tripped overload. Replace motor if defective.
Panels	Panels not in place.
Low air flow	See E: Noisy blower and low air flow.

N: WATER DRIPPING FROM UNIT

Unit not level	Level unit.
Condensation drain line plugged	Unplug condensation line.
Water sucking off the air coil in cooling mode	Too much airflow. Duct work not completely installed. If duct work is not completely installed, finish duct work. Check static pressure and compare with air flow chart in spec manual under specific models section. If ductwork is completely installed it may be necessary to reduce CFM.
Water sucking out of the drain pan	Install an EZ-Trap or P-Trap on the drain outlet so blower cannot suck air back through the drain outlet.

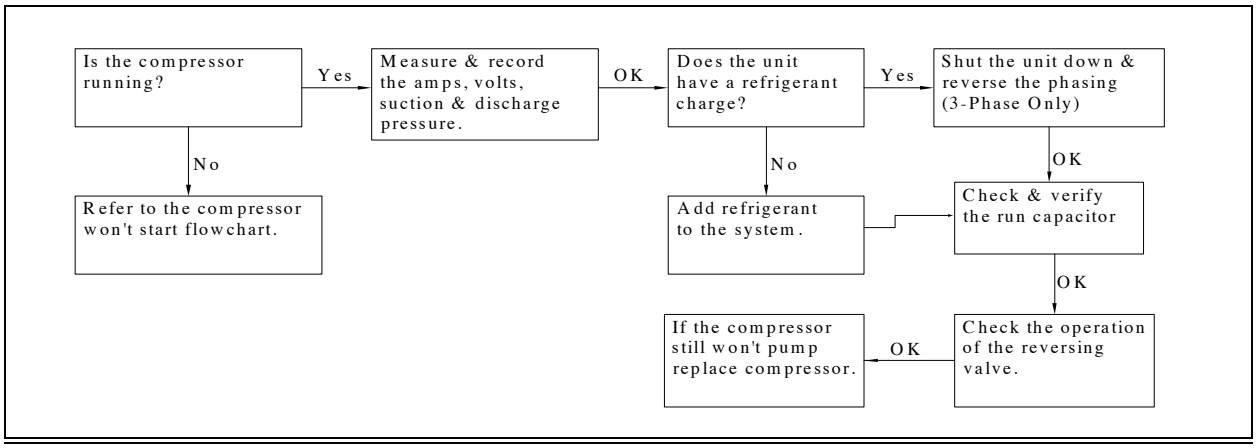
O: COMPRESSOR WON'T START



A: Check all terminals, wires & connections for loose or burned wires and connections. Check contactor and 24 Volt coil. Check capacitor connections & check capacitor with capacitor tester.

B: If ohm meter reads 0 (short) resistance from C to S, S to R, R to C or from anyone of one of these terminals to ground (shorted to ground), compressor is bad.

P: COMPRESSOR WON'T PUMP CHART



Section 13: Troubleshooting

Table 15: Refrigeration Troubleshooting

System Faults		Air Flow	Water Flow	Under Charge	Over Charge	Super Heat	Subcooling
Head Pressure Too High	Heat	P - Too Low			P		
	Cool		P - Too Low		P		
Head Pressure Too Low	Heat		P - Too Low	P		High	Low
	Cool	P - Too Low	S - Too High	P		High	Low
Suction Pressure Too High	Heat	P - Too Low					High
	Cool				P		High
Suction Pressure Too Low	Heat		P - Too Low	P		High	Low
	Cool	P - Too Low		P		High	Low
Liquid Refrigerant Flood Back	Heat				P		High
	Cool				P		High
Air Coil Frosting	Heat						
	Cool	P - Too Low		P		High	Low
Compressor Runs Inadequate. Or No Cooling/Heating	Heat	S - Too High	P - Too Low	P		High	Low
	Cool	S - Too High	P - Too Low	P		High	Low

P - Primary causes (most common problems) S - Secondary causes (problems that occur, but are not common)

Section 14: Forms - Troubleshooting

Customer/Job Name:_____ Date:_____

Model #:_____ Serial #:_____

Antifreeze Type:_____

HE or HR = GPM x TD x Fluid Factor
(Use 500 for water; 485 for antifreeze)

SH = Suction Temp. - Suction Sat.
SC = Disch. Sat. - Disch. Temp.

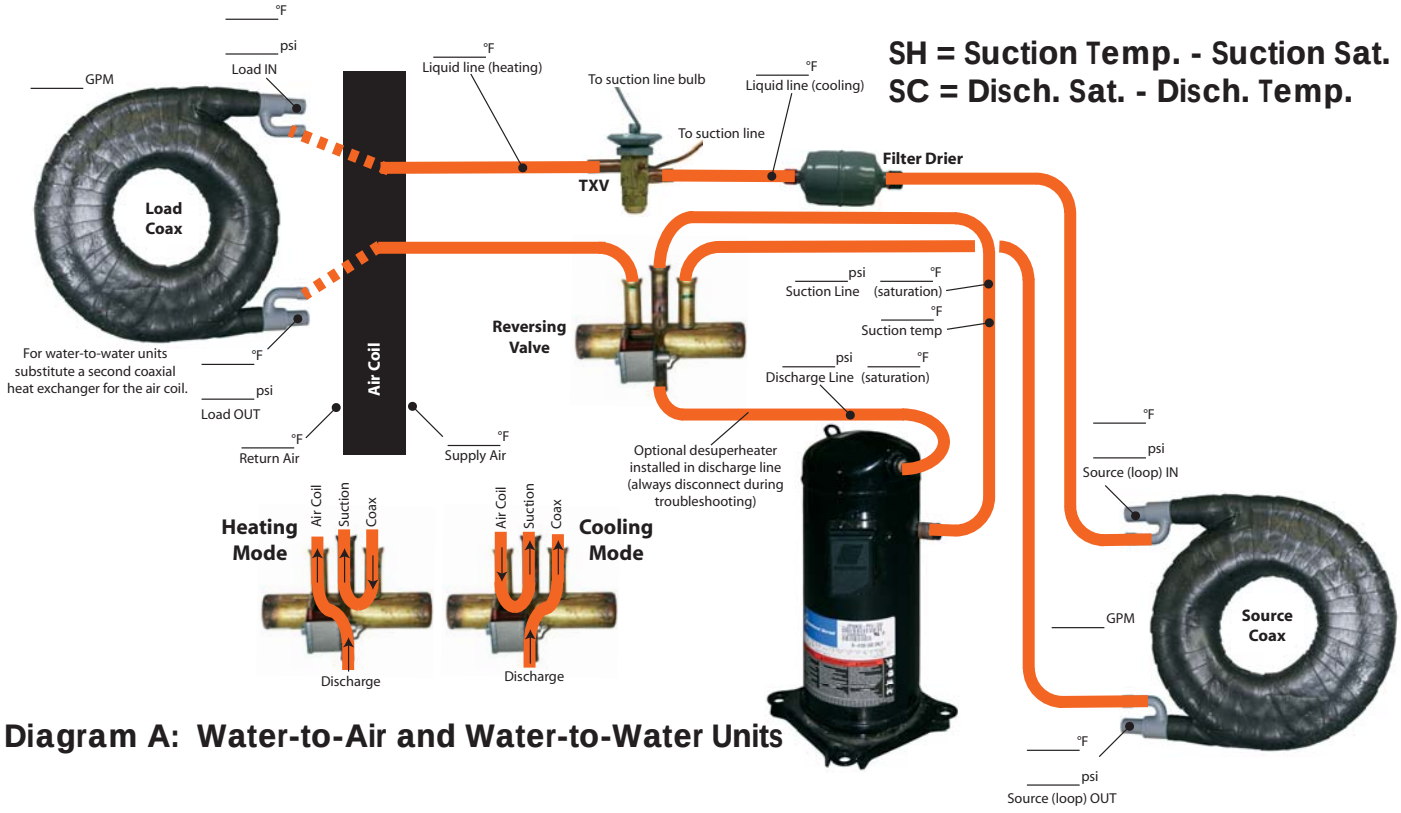


Diagram A: Water-to-Air and Water-to-Water Units

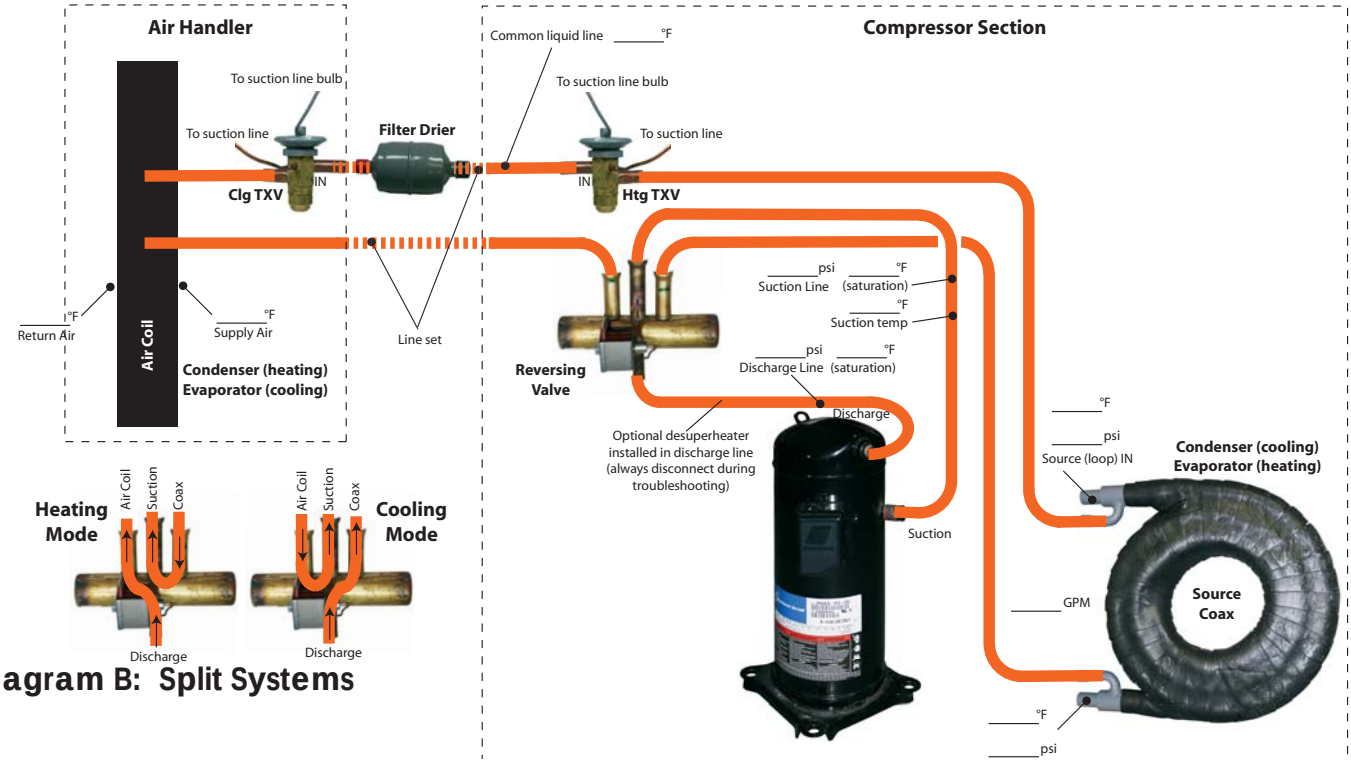


Diagram B: Split Systems

Section 14: Forms - Troubleshooting

Customer/Job Name:_____ Date:_____

Model #:_____ Serial #:_____

Antifreeze Type:_____

HE or HR = GPM x TD x Fluid Factor
(Use 500 for water; 485 for antifreeze)

SH = Suction Temp. - Suction Sat.
SC = Disch. Sat. - Disch. Temp.

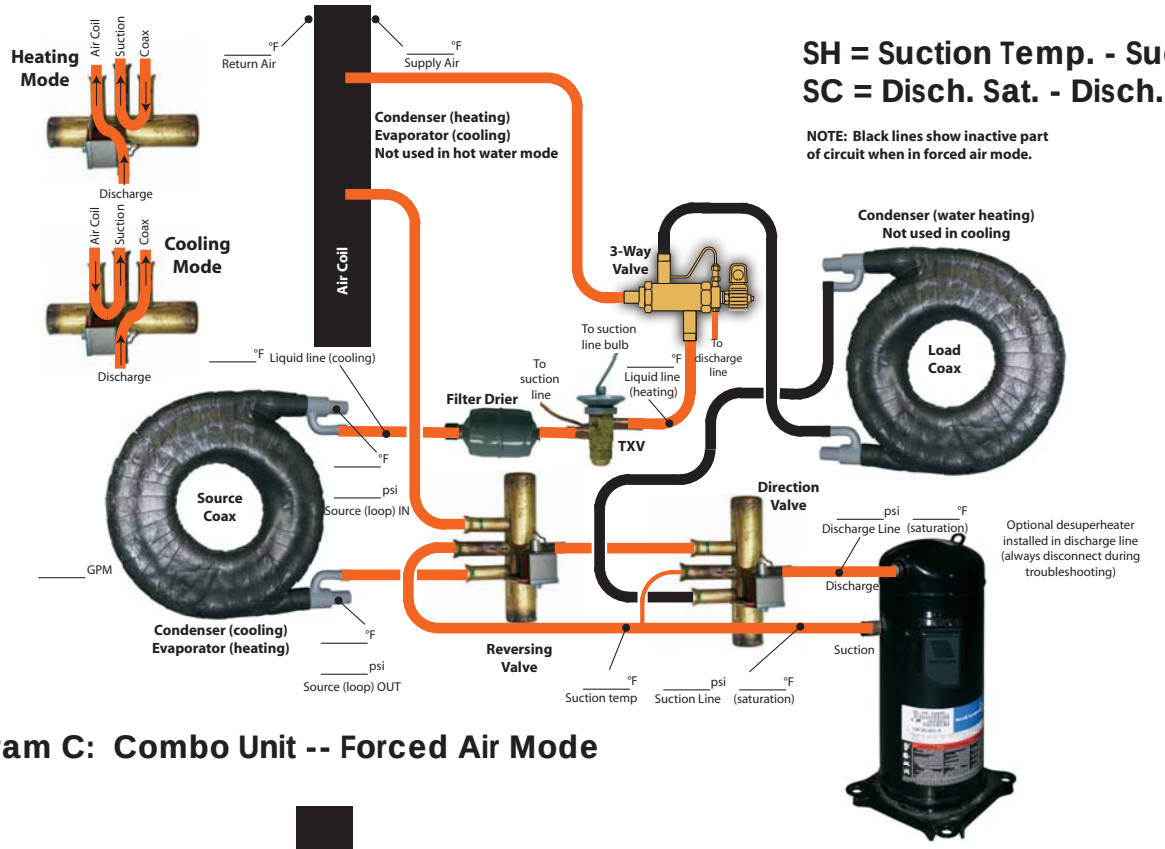


Diagram C: Combo Unit -- Forced Air Mode

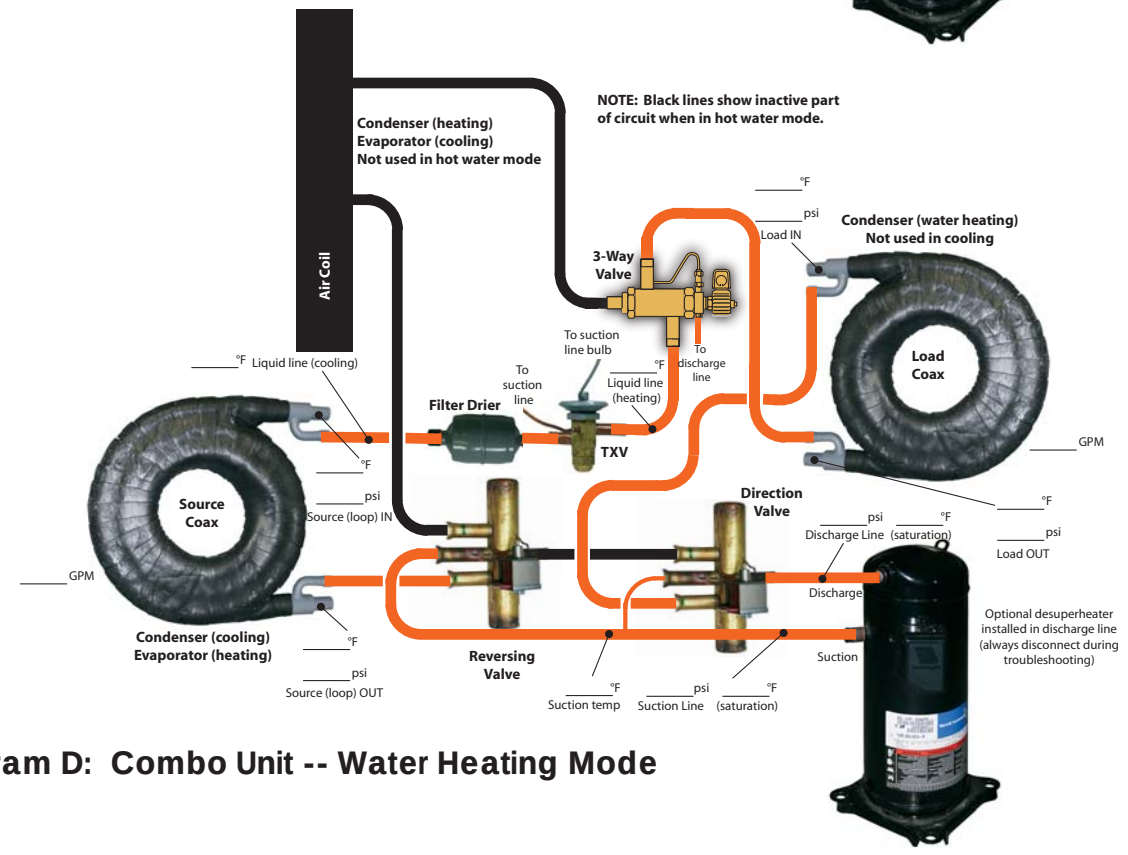


Diagram D: Combo Unit -- Water Heating Mode

EQUIPMENT START-UP FORM

Customer/Job Name:_____ Date:_____

Model #:_____ Serial #:_____

Dealer Name:_____

Check the following before power is applied to the equipment

Note: Start-Up should not occur until the structure is ready to be occupied

ELECTRICAL:

- ☐ High voltage wiring is installed correctly
- ☐ High voltage wiring & breaker are the correct size
- ☐ Auxiliary electric heaters are wired and installed correctly
- ☐ Circulating pumps are wired and fused (if necessary) correctly
- ☐ Desuperheater pump (if applicable) is NOT wired, unless piping is complete and all air is purged
- ☐ Low voltage wiring is correct and completely installed

PLUMBING:

- ☐ Pipe and pump sizes are correct
- ☐ Air is purged from all lines
- ☐ Antifreeze is installed
- ☐ All valves are open, including those on the pump kit
- ☐ Condensate is trapped and piped to the drain

DUCTWORK:

- ☐ Filter is installed and clean
- ☐ Packaging is removed from the blower assembly
- ☐ Blower turns freely

Cut along this line

Equipment Start-Up

Note: Steps should be followed in order
Note: Equipment operation will vary with thermostat brand and model. Refer to thermostat instructions

1. Energize equipment with high voltage.
2. Be sure all pumps and valves are open.
3. Set thermostat settings to correspond with application, and set thermostat to "Heat". Place set point above room temperature. Compressor will start after thermostat time delay expires.
4. Check water flow via one or a combination of these 3 methods:
   A: ΔT (temp difference):
   1. Source (5°-10° F) _____
   B: Flowmeter:
   1. 3 gpm (gallons per minute) per nominal ton of equipment. (Open Loop 1.5 to 2 GPM).
   C: Pressure Drop:
   1. Refer to Table 13.
5. Check ΔT of return and discharge air.
   1. (18°-30°F) _____
6. If system is two stage or dual capacity, increase set point and verify that second stage engages (increasing air flow). ΔT will remain the same.
7. If system has auxiliary heat, increase set point and verify that auxiliary heat engages ΔT will increase.
8. Switch thermostat to off, Compressor will shutoff.
9. Place thermostat in "Cooling" and decrease set point below room temperature. Compressor will start after thermostat time delay expires.
10. Check water flow via and one or combination of these 3 methods:
    A. ΔT(temp difference).
    1. Source (6°-12° F) _____.
    B. Flowmeter.
    1. 3 GPM (gallons per minute) per nominal ton of equipment. (Open Loop 1.5 to 2 GPM).
    C. Pressure Drop.
    1. Refer to Table 13.
11. Check ΔT of return and discharge air.
    1. 16°-25° F
12. If system is two stage or dual capacity, increase set point and verify that second stage engages (increasing air flow). ΔT will remain the same.
13. If, at anytime, there is excessive noise or vibration, the problem should be fixed and testing resumed.

Note: If a problem occurs during start-up, please do the following:
1. Refer to the troubleshooting sections contained within the unit Installation, Operation, and Maintenance Manual
2. Contact Technical Support at your distributor.

Installer/Technician:_____ Date:_____

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Manufacturing, LLC

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(618)-664-9010

Owner's Manual: Packaged Horizontal, Vertical & Combination Series Units

Rev.: 17 Dec, 2008D
P/N: 23-23-0030-001

Table of Contents:

Guide Revision Table:

Date	By	Page	Note
17 Dec, 08	DS	All	First published

Enertech Manufacturing is continually working to improve its products. As a result, the design and specifications of each product may change without notice and may not be as described herein. For the most up-to-date information, please visit our website, or contact our Customer Service department at (618)-664-9010. Statements and other information contained herein are not express warranties and do not form the basis of any bargain between the parties, but are merely Enertech Manufacturing's opinion or commendation of its products.

Section 1: Introduction

WELCOME!
You're made the smart investment in a geothermal system. We understand the number of available options you could of chose from, and we thank you for choosing us. Not only are you going to enjoy better comfort, but noticeable energy savings as well. On top of it all, you're the proud owner of one of the most environmentally friendly technologies around.

The purpose of this manual is to acquaint you with some of the features of your new geothermal system, as well as cover a few basic maintenance items that will ensure you'll be enjoying your system for years to come.

If at anytime you have a question regarding your system, contact your installer listed below.

Dealer/Installer	
Address	
Phone:	
Email:	
Date of Installation:	

Section 2: Maintenance

MAINTENANCE
Each unit contains a high pressure and low-pressure limit sensor to shut the unit down in case an unusual or abnormal condition exists. Should a sensor need to be reset more than once in a 24-hour period or if resetting becomes regular (repeatedly once a week or more) contact your Dealer/Installer.

For Belt Drive Blower Units only, inspect at least twice yearly and replace belt, if broken or worn. Adjust blower belt drive if necessary. It is recommended a spare belt be kept on premises.

For units with Hot Water Exchangers, follow suppliers' service and maintenance recommendations for all external pumps, circulators, valves and accessories.

OWNER REMINDERS:

1. Check air filter(s) every 2 weeks. Replace at least once a month. Poor heating during heating season indicates a dirty filter. Poor cooling during air conditioning season indicates a dirty filter. Low air circulation during any season indicates a dirty filter. Operation without a filter clogs the heat exchanger and may necessitate extra service. Always shut down the unit before removing a filter.

2. Know which switch/fuse or circuit breakers feed the unit. Shut the unit off and contact your Installer Service Tech anytime you suspect malfunction. Check the disconnect switch/fuse or circuit breaker whenever the unit stops and its thermostat or control signal is on. Report any repeated outages to your Installer-Service Tech. Shut the unit off during any power outage. Switch it on only after you are assured electrical service is continuous and voltage is proper.

3. The following may save unnecessary service calls. The high and low limit sensors usually operate because of a correctable condition.
   A. Dirty filter(s).
   B. Closed air diffusers or return registers.
   C. Blocked return air grilles

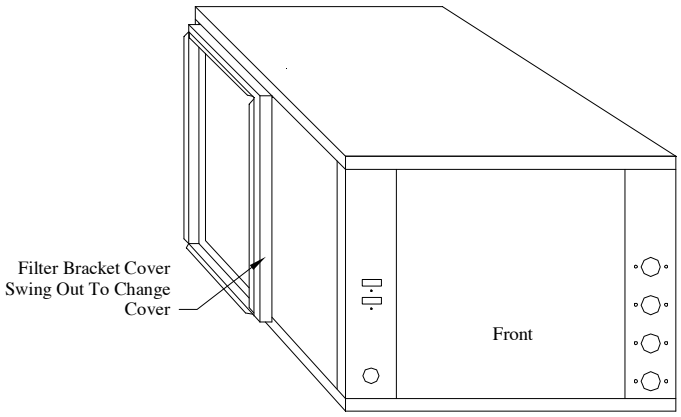
4. For systems on open wells, it is recommended to have your local dealer examine your heat exchanger at least once a year to insure there is no sediment buildup in the system.

⚠ WARNING ⚠

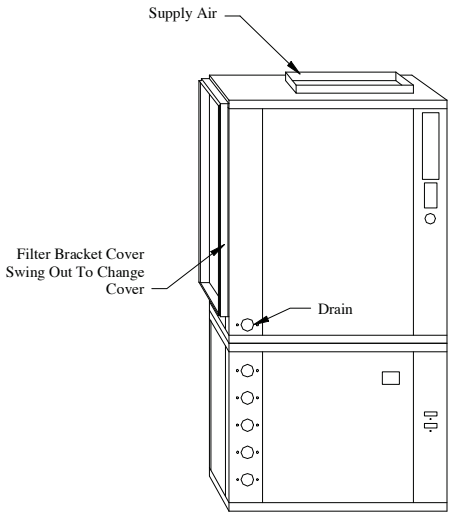
Warning: There are no user serviceable components in or on any of the equipment. Do not attempt to service or repair this equipment. Only skilled and certified technical technicians should attempt such service and/or repair. Your attempt to service or repair this equipment could result in serious injury or even death.

Section 3: Air Filters

Horizontal Units



Vertical Units



Vertical Units

Model	Filter Size	Model	Filter Size	Model	Filter Size	Model	Filter Size
GT024	30 x 24	H026	30 x 24	GS018	30 x 24	H018	30 x 24
GT036	32 x 28	H038	32 x 28	GS024	30 x 24	H024	30 x 24
GT048	36 x 28	H050	36 x 28	GS030	32 x 28	H030	32 x 28
GT060	36 x 28	H062	36 x 28	GS036	32 x 28	H036	32 x 28
GT072	36 x 28	H073	36 x 28	GS042	36 x 28	H042	36 x 28
GT096	36 x 38	H096	36 x 38	GS048	36 x 28	H048	36 x 28
GT120	36 x 38	H120	36 x 38	GS060	36 x 28	H060	36 x 28
GT144	36 x 38	H144	36 x 38	GS072	36 x 28	H072	36 x 28

Model	Filter Size	Model	Filter Size
GC018	30 x 22	HC018	30 x 22
GC024	30 x 22	HC024	30 x 22
GC030	30 x 26	HC030	30 x 26
GC036	30 x 26	HC036	30 x 26
GC042	30 x 28	HC042	30 x 28
GC048	30 x 28	HC048	30 x 28
GC060	30 x 32	HC060	30 x 32
GC072	30 x 32	HC072	30 x 32

1" Electrostatic Filter (Washable) Is Also Available As An Option

[Note: Washable filter should be washed at least every four weeks. Spray the filter on the side with the cross bar (light electrostatic filter degreaser such as 409 recommended). Never install filter wet. We recommend you have two filters, one in the unit and one to be washed and set aside to dry.]

Horizontal Units

Model	Filter Size	Model	Filter Size	Model	Filter Size	Model	Filter Size
GT024	18 x 36	H026	18 x 36	GS018	18 x 36	H018	18 x 36
GT036	18 x 48	H038	18 x 48	GS024	18 x 36	H024	18 x 36
GT048	20 x 50	H050	20 x 50	GS030	18 x 48	H030	18 x 48
GT060	20 x 50	H062	20 x 50	GS036	18 x 48	H036	18 x 48
GT072	20 x 50	H073	20 x 50	GS042	20 x 50	H042	20 x 50
				GS048	20 x 50	H048	20 x 50
				GS060	20 x 50	H060	20 x 50
				GS072	20 x 50	H072	20 x 50

Section 4: Thermostats

THERMOSTAT
Thermostats shall be located and installed according to the manufacturer's instructions and recommendations. Thermostats most generally are installed 54 inches off the floor on an inside wall in the return air pattern and where they are not in the sun at anytime.

STANDARD MANUAL/AUTO CHANGEOVER THERMOSTAT
Fan Switch
On – Fan runs continuously
Auto – Fan cycles on a call for heat or cool

System Switch
Off - Heating and Cooling functions are inoperative.
Heat - Compressor and/or auxiliary heater is cycling on a call for heat from the thermostat. First stage heat is cycling the compressor to satisfy a call for heat. Auxiliary heat may be required in cold temperatures. Auxiliary operation is normally indicated by the auxiliary light.
Cool - Reversing valve is energized. On a call for cooling, the thermostat is cycling the compressor to maintain a thermostat cooling set point.
Auto – On a call for heat, the thermostat cycles the compressor to maintain the thermostat's heating set point. On a call for cooling, the thermostat cycles the compressor to maintain the thermostat cooling set point.

Emergency Heat
Emergency heat is available (if equipped) for heating when the unit is locked out due to a malfunction. The compressor is disabled and the auxiliary duct heater is cycling in 2nd stage to satisfy a call for heat by the thermostat. The auxiliary light will indicate duct heater operation. In the emergency mode the emergency light is lit at all times. The emergency light will be illuminated and will thus function as a fault indicator if the compressor lockout relay has been engaged due to low or high pressure safety switch activation in either the heat pump or normal mode

Note: On a trip of the high or low pressure safety switch, the compressor's locked out to prevent short cycling. To reset the unit, turn the system switch to the Off position, then back to the desired heat or cool function.

Section 5: Warranty Registration

IMPORTANT WARRANTY INFORMATION FOR END-USER:
In order to validate your warranty, your installer must fill out the warranty registration form, included with this information package, or via our online form at www.enertechmfg.com.

You, as the end-user, must endorse the registration form via the online form, or mail the form to the address below, or fax to 618-664-4597.

Enertech Manufacturing, LLC
Attn: Warranty & Claims Dept.
P.O. Box 573
Greenville, IL 62246

We have a fine warranty and want you to be able to take full advantage of its benefits; however, we ask that you do your part to help us serve you better.

A Warranty Registration Form must be filed within 10 days of equipment start-Up. Exceptions may be made under certain circumstances and at the sole discretion of Enertech Manufacturing, LLC.

WARRANTY REGISTRATION FORM

IMPORTANT: This form (one for each unit) or our online form, must be completed by the Dealer (Installer), endorsed by the original purchaser and mailed to Enertech Manufacturing, LLC. within ten days after installation, to put the warranty into effect.

Model No._____ Serial No._____ Brand._____

Date of Sale: _____ Delivery Date: _____ Installation Date: _____

1. APPLICATION: ☐ Office Building ☐ School/College ☐ Industrial Bldg ☐ Town House ☐ Store or Mall
☐ Hospital ☐ Gov. Bldg. ☐ Apartment ☐ Restaurant ☐ Church ☐ Condominium ☐ House ☐ Comm. Laundry
☐ Auditorium ☐ Swimming Pools ☐ Other:_____

2. USE: ☐ Comfort Conditioning ☐ Computer Room ☐ Ice Rink ☐ Water Heating ☐ Swimming Pool
☐ Humidity Control ☐ Radiant Heating ☐ Other:_____

3. SOURCE: ☐ Well Water ☐ Geothermal Earth Loop ☐ Lake/Pond ☐ Other:_____

4. BACKUP: ☐ None ☐ Electric ☐ Gas ☐ Oil ☐ Wood ☐ Other:_____

PURCHASER-USER: _____ Phone: (_____)_____

Address: _____ City: _____ State_____ Zip: _____

Dealer (Installer): _____Phone: (_____)_____

Address: _____ City: _____State: _____Zip: _____

I have supervised the installation and start-up in accordance with Enertech Manufacturing, LLC. installation instructions.

This unit is performing? Satisfactorily Not Satisfactorily, if not explain: _____

_____ _____

To the best of my knowledge the above information is accurate and I request the Warranty be put into effect.

Dealer (Installer): _____ Date: _____

Customer / End User: _____ Date: _____

For Enertech Manufacturing, LLC use only:

Date Received: _____ By: _____

Invoice #: _____Dated: _____

Optional Extended Warranty p/n: _____

Electrical / Parts & Labor Warranty effective through: Month:_____ Date: _____ Year:_____

Refrigerant / Compressor Warranty effective through: Month:_____ Date: _____ Year: _____

Mail This Form to:
Enertech Manufacturing LLC
P.O. Box 573
Greenville, IL 62246

Fax This Form to:
Enertech Manufacturing LLC
(618)-664-4597

Register online at www.enertechmfg.com

Cut along this line

Notes:

Enertech Manufacturing, LLC., for brand: "Hydron Module" Residential Single Family
10-YEAR LIMITED WARRANTY (10/10/10)

Enertech Manufacturing, LLC. warrants the refrigerant system components, to include the compressor, air coil, expansion valve and reversing valve, to be free from defects in material and workmanship for a period of ten (10) years from the date of delivery to the original purchaser-user, transferable to new owner.

Enertech Manufacturing, LLC. warrants its geothermal unit against defect in materials and workmanship for ten (10) years from the date of delivery to the original purchaser-user, transferable to new owner. However, accessories (thermostat, flow center, electric heater, (EWC) zoning), if purchased from Enertech Manufacturing, LLC. are not transferable.

Enertech Manufacturing, LLC. warrants its Hydron Module brand cabinets (stainless steel) and heat exchanger coax for life, to the original purchaser-user, against defect in materials and workmanship, excluding damage due to rough handling, abuse, accident or casualty loss; exposure to outdoor elements/outdoor installment, including but not limited to, salt air exposure, damage caused by exposure to the following (whether indoors or outdoors): chlorine, airborne contaminants, other corrosive elements in the atmosphere, swimming pools, or hot tubs.

Enertech Manufacturing, LLC. warrants the service labor allowances for nine (9) years (second through tenth years, with dealer/installer warranting the first year) from the date of delivery to the original purchaser-user, transferable to new owner, for the servicing, removing or reinstalling parts for the refrigerant system, or for any defect in materials and workmanship inside the unit as set forth above. Labor allowances may not cover the full amount of labor charged, depending upon the servicing contractor.

CONDITIONS AND EXCLUSIONS:

The Limited Warranty only applies if the following conditions are met:

A. This Limited Warranty will not apply and shall be null and void if the Enertech Manufacturing, LLC. serial number has been altered, defaced or removed.
B. This Limited Warranty shall be null and void if the Enertech Manufacturing, LLC. unit has been disconnected or removed from the location of original installation, or if dealer/seller has not been paid in full for the unit.
C. This Limited Warranty shall not apply to unit failure or defect caused by improper installation, field modification, improper voltage, improper maintenance or misuse including operation during building construction, corrosion caused by airborne contaminants, chlorine or salt air exposure, corrosive liquids or water, abuse, neglect, Act of God, outdoor installation, damage from abuse, accident, fire, flood and the like, or to defects or damage caused by the use of any attachment, accessory or component not authorized by Enertech Manufacturing, LLC.
D. Replacement or repaired parts and components are warranted only for the remainder of the original warranty period, as stated above.
E. This Limited Warranty applies only to Enertech Manufacturing, LLC. units sold and installed by a factory trained, independent, Dealer of Enertech Manufacturing, LLC., in the United States or Canada, and subjected to normal usage as described and rated on the applicable descriptive sheet for such unit. This warranty shall not be valid if equipment is not installed in accordance with methods prescribed in our data and technical manuals and in compliance with local codes. Dealer must complete the warranty registration card supplied with the Enertech Manufacturing, LLC. unit, which must then be endorsed by original purchaser-user and mailed within ten (10) days after initial installation. If warranty card is not returned, warranty shall commence at date unit was shipped from Enertech Manufacturing, LLC.
F. The obligation for Enertech Manufacturing, LLC. under this Limited Warranty is expressly limited to replacement of any parts or components as specified and found within the cabinet. Enertech Manufacturing, LLC. reserves the right to replace defective components under warranty with new or reconditioned parts. Except as set forth above, this warranty does not cover any labor expenses for service, nor for removing or reinstalling parts. Accessory, peripheral and ancillary parts and equipment or not covered by this warranty.
G. Enertech Manufacturing, LLC. does not warrant equipment which has been custom built or modified to purchaser-user specifications. Likewise, any field modification of any equipment shall also void this, and any and all warranties.

Notice: Outdoor or unconditioned space installation of any equipment shall cause this and all warranties to be deemed void.

SHIPPING COSTS: The purchaser-user will be responsible for the cost of shipping warranty replacement parts from the Enertech Manufacturing, LLC. factory to the distributor of the parts. Purchaser-user is also responsible for any shipping cost of returning the failed part to the distributor.

THE FOREGOING LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES (AND IMPLIED CONDITIONS IN CANADA), EXPRESSED, IMPLIED AND STATUTORY, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANT-ABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL SUCH WARRANTIES, EXPRESSED OR IMPLIED, ARE EXCLUDED AND SHALL NOT APPLY TO THE GOODS SOLD. IN NO EVENT SHALL WARRANTOR BE LIABLE FOR DIRECT, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECT IN THE GOODS EXCEPT TO THE EXTENT SET FORTH HEREIN.

(Some states do not allow exclusion or limitation of implied warranties or liability for incidental or consequential damage). For additional information or assistance, contact the WARRANTOR, which is: Enertech Manufacturing, LLC., P.O. Box 573, 2506 South Elm Street, Greenville, IL 62246.

Form: 23-23-0018-002
Page 1 of 2

Enertech Manufacturing, LLC., for brand: "Hydron Module" Residential Single Family
OPTIONAL RESIDENTIAL EXTENDED WARRANTIES
See form 23-23-0018-002 page 1 of 2, for standard Residential Warranty details. The following optional extended warranties, if purchased, modify the standard Residential Warranty.

Part # WHDEDUCT Hydron Module Residential geothermal units. (3/5/10)
Enertech Manufacturing, LLC. warrants the refrigerant system components, to include the compressor, air coil, expansion valve and reversing valve, to be free from defects in material and workmanship for a period of ten (10) years from the date of delivery to the original purchaser-user, transferable to new owner. Part # WHDEDUCT does not change this section of the warranty.

Enertech Manufacturing, LLC. warrants its geothermal unit against defect in materials and workmanship for ten (10) years from the date of delivery to the original purchaser-user, transferable to new owner. However, accessories (thermostat, flow center, electric heater, (EWC) zoning), if purchased from Enertech Manufacturing, LLC. are not transferable. Part # WHDEDUCT changes this section of the warranty to be for five (5) years in lieu of ten (10).

Enertech Manufacturing, LLC. warrants its Hydron Module brand cabinets (stainless steel) and heat exchanger coax for life, to the original purchaser-user, against defect in materials and workmanship, excluding damage due to rough handling, abuse, accident or casualty loss; exposure to outdoor elements/outdoor installment, including but not limited to, salt air exposure, damage caused by exposure to the following (whether indoors or outdoors): chlorine, airborne contaminants, other corrosive elements in the atmosphere, swimming pools, or hot tubs. Part # WHDEDUCT does not change this section of the warranty.

Enertech Manufacturing, LLC. warrants the service labor allowances for nine (9) years (second through tenth years, with dealer/installer warranting the first year) from the date of delivery to the original purchaser-user, transferable to new owner, for the servicing, removing or reinstalling parts for the refrigerant system, or for any defect in materials and workmanship inside the unit as set forth above. Labor allowances may not cover the full amount of labor charged, depending upon the servicing contractor. Part # WHDEDUCT changes this section of the warranty to be for three (3) years in lieu of ten (10), by changing the wording to: "...two (2) years (second and third years, with dealer/installer warranting the first year)…"

Form: 23-23-0018-002
Page 2 of 2

Enertech Manufacturing, LLC., for brand: "GeoComfort" Residential Single Family
10-YEAR LIMITED WARRANTY (3/5/10)

Enertech Manufacturing, LLC. warrants the refrigerant system components, to include the compressor, coaxial exchanger, air coil, expansion valve and reversing valve, to be free from defects in material and workmanship for a period of ten (10) years from the date of delivery to the original purchaser-user, transferable to new owner.

Enertech Manufacturing, LLC. warrants its geothermal unit against defect in materials and workmanship for five (5) years from the date of delivery to the original purchaser-user, transferable to new owner. However, accessories (thermostat, flow center, electric heater, (EWC) zoning), if purchased from Enertech Manufacturing, LLC. are not transferable.

Enertech Manufacturing, LLC. warrants service labor allowances for two (2) years (second & third years, with dealer/installer warranting the first year) from the date of delivery to the original purchaser-user, transferable to new owner, for the servicing, removing or reinstalling parts for the refrigerant system, or for any defect in materials and workmanship inside the unit as set forth above. Labor allowances may not cover the full amount of labor charged, depending upon the servicing contractor.

CONDITIONS AND EXCLUSIONS:

The Limited Warranty only applies if the following conditions are met:

A. This Limited Warranty will not apply and shall be null and void if the Enertech Manufacturing, LLC. serial number has been altered, defaced or removed.
B. This Limited Warranty shall be null and void if the Enertech Manufacturing, LLC. unit has been disconnected or removed from the location of original installation, or if dealer-seller has not been paid in full for the unit.
C. This Limited Warranty shall not apply to unit failure or defect caused by improper installation, field modification, improper voltage, improper maintenance or misuse including operation during building construction, corrosion caused by airborne contaminants, chlorine or salt air exposure, corrosive liquids or water, abuse, neglect, Act of God, outdoor installation, damage from abuse, accident, fire, flood and the like, or to defects or damage caused by the use of any attachment, accessory or component not authorized by Enertech Manufacturing, LLC.
D. Replacement or repaired parts and components are warranted only for the remainder of the original warranty period, as stated above.
E. This Limited Warranty applies only to Enertech Manufacturing, LLC. units sold and installed by a factory trained, independent, Dealer of Enertech Manufacturing, LLC., in the United States or Canada, and subjected to normal usage as described and rated on the applicable descriptive sheet for such unit. This warranty shall not be valid if equipment is not installed in accordance with methods prescribed in our data and technical manuals and in compliance with local codes. Improper installation may endanger the occupants of the dwelling. Dealer must complete the warranty registration card supplied with the Enertech Manufacturing, LLC. unit, which must then be endorsed by original purchaser-user and mailed within ten (10) days after initial installation. If warranty card is not returned, warranty shall commence at date unit was shipped from Enertech Manufacturing, LLC.
F. The obligation for Enertech Manufacturing, LLC. under this Limited Warranty is expressly limited to replacement of any parts or components as specified and found within the cabinet. Enertech Manufacturing, LLC. reserves the right to replace defective components under warranty with new or reconditioned parts. Except as set forth above, this warranty does not cover any labor expenses for service, nor for removing or reinstalling parts. Accessory, peripheral and ancillary parts and equipment or not covered by this warranty.
G. Enertech Manufacturing, LLC. does not warrant equipment which has been custom built or modified to purchaser-user specifications. Likewise, any field modification of any equipment shall also void this, and any and all warranties.

Notice: Outdoor or unconditioned space installation of any equipment shall cause this and all warranties to be deemed void.

SHIPPING COSTS: The purchaser-user will be responsible for the cost of shipping warranty replacement parts from the Enertech Manufacturing, LLC. factory to the distributor of the parts. Purchaser-user is also responsible for any shipping cost of returning the failed part to the distributor.

THE FOREGOING LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES (AND IMPLIED CONDITIONS IN CANADA), EXPRESSED, IMPLIED AND STATUTORY, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANT-ABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL SUCH WARRANTIES, EXPRESSED OR IMPLIED, ARE EXCLUDED AND SHALL NOT APPLY TO THE GOODS SOLD. IN NO EVENT SHALL WARRANTOR BE LIABLE FOR DIRECT, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECT IN THE GOODS EXCEPT TO THE EXTENT SET FORTH HEREIN.

(Some states do not allow exclusion or limitation of implied warranties or liability for incidental or consequential damage). For additional information or assistance, contact the WARRANTOR, which is: Enertech Manufacturing, LLC., P.O. Box 573, 2506 South Elm Street, Greenville, IL 62246.

Form: 23-23-0017-002
Page 1 of 2

Enertech Manufacturing, LLC., for brand: "GeoComfort" Residential Single Family
OPTIONAL RESIDENTIAL EXTENDED WARRANTIES

See form 23-23-0017-02 page 1 of 2, for standard Residential Warranty details. The following optional extended warranties, if purchased, are additive to the standard Residential Warranty.

Part # WGT-SC-1010B Serenity GT Series Residential Extended Warranty - 10 Year Parts and Labor Allowance
Extends five (5) year geothermal unit, including accessories, and 3 year service labor allowances, to ten (10) years.

Part # WGT2-SC-1010B Serenity GT Series Combination Residential Extended Warranty - 10 Year Parts and Labor Allowance
Extends five (5) year geothermal unit, including accessories, and 3 year service labor allowances, to ten (10) years.

Part # WGS-SC-1010B Serenity GS Series Residential Extended Warranty - 10 Year Parts and Labor Allowance
Extends five (5) year geothermal unit, including accessories, and 3 year service labor allowances, to ten (10) years.

Part # WGTC-SC-1010B Serenity GT Split Series Residential Extended Warranty - 10 Year Parts and Labor Allowance
Extends five (5) year geothermal unit, including accessories, and 3 year service labor allowances, to ten (10) years.

Part # WGSC-SC-1010B Serenity GS Split Series Residential Extended Warranty - 10 Year Parts and Labor Allowance
Extends five (5) year geothermal unit, including accessories, and 3 year service labor allowances, to ten (10) years.

Part # WGSE-SC-1010B GSE Series Residential Extended Warranty - 10 Year Parts and Labor Allowance
Extends five (5) year geothermal unit, including accessories, and 3 year service labor allowances, to ten (10) years.

Part # WGWS-SC-1010B GWS Series Residential Extended Warranty - 10 Year Parts and Labor Allowance
Extends five (5) year geothermal unit, including accessories, and 3 year service labor allowances, to ten (10) years.

Part # WGWT-DC-1010B GWT Series Residential Extended Warranty - 10 Year Parts and Labor Allowance
Extends five (5) year geothermal unit, including accessories, and 3 year service labor allowances, to ten (10) years.

Part # WGHFC-DC-1010B GHFC Series Residential Extended Warranty - 10 Year Parts and Labor Allowance
Extends five (5) year geothermal unit, including accessories, and 3 year service labor allowances, to ten (10) years.

Form: 23-23-0017-002
Page 2 of 2

Enertech Manufacturing, LLC., for brands: "GeoComfort" and "Hydron Module" Commercial or Non-Single Family
1-YEAR LIMITED WARRANTY

Enertech Manufacturing, LLC. warrants the refrigerant system components, to include the compressor, coaxial exchanger, air coil, expansion valve and reversing valve, to be free from defects in material and workmanship for a period of one (1) year from the date of delivery to the original purchaser-user.
Enertech Manufacturing, LLC. warrants its geothermal unit against defect in materials and workmanship for one (1) year from the date of delivery to the original purchaser-user.

CONDITIONS AND EXCLUSIONS:

The Limited Warranty only applies if the following conditions are met:

A. This Limited Warranty will not apply and shall be null and void if the Enertech Manufacturing, LLC. serial number has been altered, defaced or removed.
B. This Limited Warranty shall be null and void if the Enertech Manufacturing, LLC. unit has been disconnected or removed from the location of original installation, or if dealer-seller has not been paid in full for the unit.
C. This Limited Warranty shall not apply to unit failure or defect caused by improper installation, field modification, improper voltage, improper maintenance or misuse including operation during building construction, corrosion caused by airborne contaminants, chlorine or salt air exposure, corrosive liquids or water, abuse, neglect, Act of God, outdoor installation, damage from abuse, accident, fire, flood and the like, or to defects or damage caused by the use of any attachment, accessory or component not authorized by Enertech Manufacturing, LLC.
D. Replacement or repaired parts and components are warranted only for the remainder of the original warranty period, as stated above.
E. This Limited Warranty applies only to Enertech Manufacturing, LLC. commercial and/or muti-family use (i.e. non-residential-single-family) units sold and installed by a trained, independent, contractor-customer of Enertech Manufacturing, LLC., or an authorized representative and/or distributor, in the United States or Canada, and subjected to normal usage as described and rated on the applicable descriptive sheet for such unit. This warranty shall not be valid if equipment is not installed in accordance with methods prescribed in our data and technical manuals and in compliance with local codes. Improper installation may endanger the occupants of the dwelling. Contractor-customer must complete the warranty registration card supplied with the Enertech Manufacturing, LLC. unit, which must then be endorsed by original purchaser-user and mailed within ten (10) days after initial installation. If warranty card is not returned, warranty shall commence at date unit was shipped from Enertech Manufacturing, LLC.
F. The obligation for Enertech Manufacturing, LLC. under this Limited Warranty is expressly limited to replacement of any parts or components as specified and found within the cabinet. Enertech Manufacturing, LLC. reserves the right to replace defective components under warranty with new or reconditioned parts. This warranty does not cover any labor expenses for service, nor for removing or reinstalling parts. Accessory, peripheral and ancillary parts and equipment or not covered by this warranty.
G. Enertech Manufacturing, LLC. does not warrant equipment which has been custom built or modified to purchaser-user specifications. Likewise, any field modification of any equipment shall also void this, and any and all warranties.

Notice: Outdoor or unconditioned space installation of any equipment shall cause this and all warranties to be deemed void.

SHIPPING COSTS: The purchaser-user will be responsible for the cost of shipping warranty replacement parts from the Enertech Manufacturing, LLC. factory to the distributor of the parts. Purchaser-user is also responsible for any shipping cost of returning the failed part to the distributor.

THE FOREGOING LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES (AND IMPLIED CONDITIONS IN CANADA), EXPRESSED, IMPLIED AND STATUTORY, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANT-ABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL SUCH WARRANTIES, EXPRESSED OR IMPLIED, ARE EXCLUDED AND SHALL NOT APPLY TO THE GOODS SOLD. IN NO EVENT SHALL WARRANTOR BE LIABLE FOR DIRECT, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECT IN THE GOODS EXCEPT TO THE EXTENT SET FORTH HEREIN.

(Some states do not allow exclusion or limitation of implied warranties or liability for incidental or consequential damage). For additional information or assistance, contact the WARRANTOR, which is: Enertech Manufacturing, LLC., P.O. Box 573, 2506 South Elm Street, Greenville, IL 62246

Form: 23-23-0003-003
Page 1 of 2

Enertech Manufacturing, LLC., for brands: "GeoComfort" and "Hydron Module" Commercial or Non-Single Family

OPTIONAL COMMERCIAL EXTENDED WARRANTIES

See part number 23-23-0003-03 page 1 of 2, for standard Commercial Warranty details. The following optional extended warranties, if purchased, are additive to the standard Commercial Warranty.

Part# CPW COMMERCIAL EXTENDED WARRANTY - FIVE YEAR INTERNAL COMPONENTS LIMITED WARRANTY

Enertech Manufacturing, LLC. warrants the refrigerant system components, to include the compressor, coaxial exchanger, air coil, expansion valve and reversing valve, to be free from defects in material and workmanship for a period of one (1) year from the date of delivery to the original purchaser-user. Enertech Manufacturing, LLC. warrants its geothermal unit against defect in materials and workmanship for one (1) year from the date of delivery to the original purchaser-user. **Extended warranty part number CPW extends the refrigerant system components and geothermal warranty by four (4) years, or five (5) years total from date of delivery to the original purchaser-user.**

Part # CRW COMMERCIAL EXTENDED WARRANTY - FIVE YEAR REFRIGERANT CIRCUIT LIMITED WARRANTY

Enertech Manufacturing, LLC. warrants the refrigerant system components, to include the compressor, coaxial exchanger, air coil, expansion valve and reversing valve, to be free from defects in material and workmanship for a period of one (1) year from the date of delivery to the original purchaser-user. Enertech Manufacturing, LLC. warrants its geothermal unit against defect in materials and workmanship for one (1) year from the date of delivery to the original purchaser-user. **Extended warranty part number CRW extends the refrigerant system components warranty by four (4) years, or five (5) years total from date of delivery to the original purchaser-user.**

Part # CCW COMMERCIAL EXTENDED WARRANTY - FIVE YEAR COMPRESSOR LIMITED WARRANTY

Enertech Manufacturing, LLC. warrants the refrigerant system components, to include the compressor, coaxial exchanger, air coil, expansion valve and reversing valve, to be free from defects in material and workmanship for a period of one (1) year from the date of delivery to the original purchaser-user. Enertech Manufacturing, LLC. warrants its geothermal unit against defect in materials and workmanship for one (1) year from the date of delivery to the original purchaser-user. Extended warranty part number CCW extends the compressor warranty by fours (4) years, or five (5) years total from date of delivery to the original purchaser-user.

Form: 23-23-0003-003
Page 2 of 2