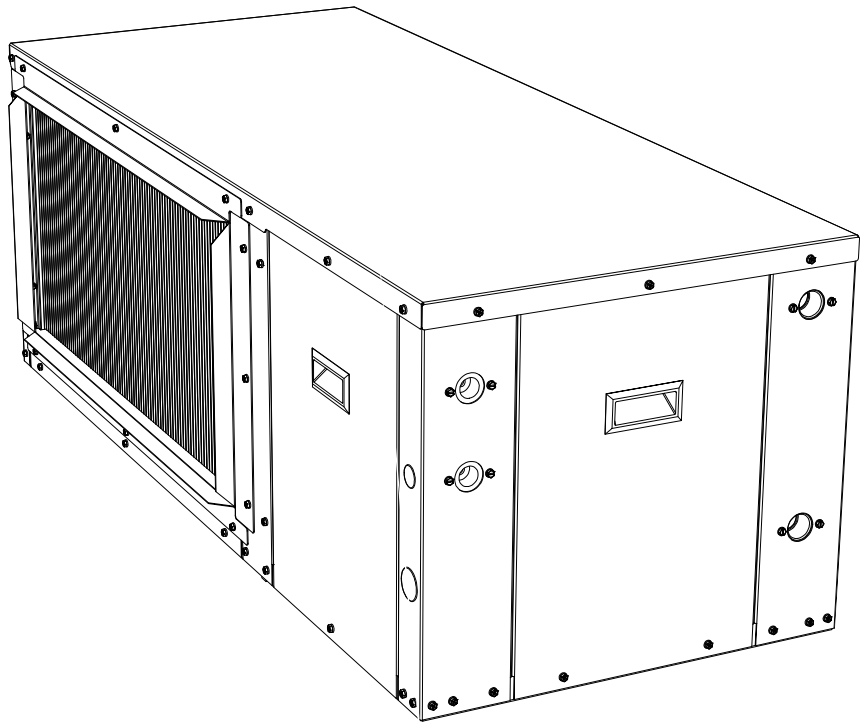
ENERTECH
ENERGY + TECHNOLOGY

Installation & Operations Manual

ZS/ZT MODELS HORIZONTAL PACKAGED SYSTEM WATER-TO-AIR HEAT PUMPS



20D218-16NN

Table of Contents

Section 9A: Wiring Diagrams (ECM Fans Only)

Section 9B: Wiring Diagrams (PSC Fan Only)

Section 10: Accessories

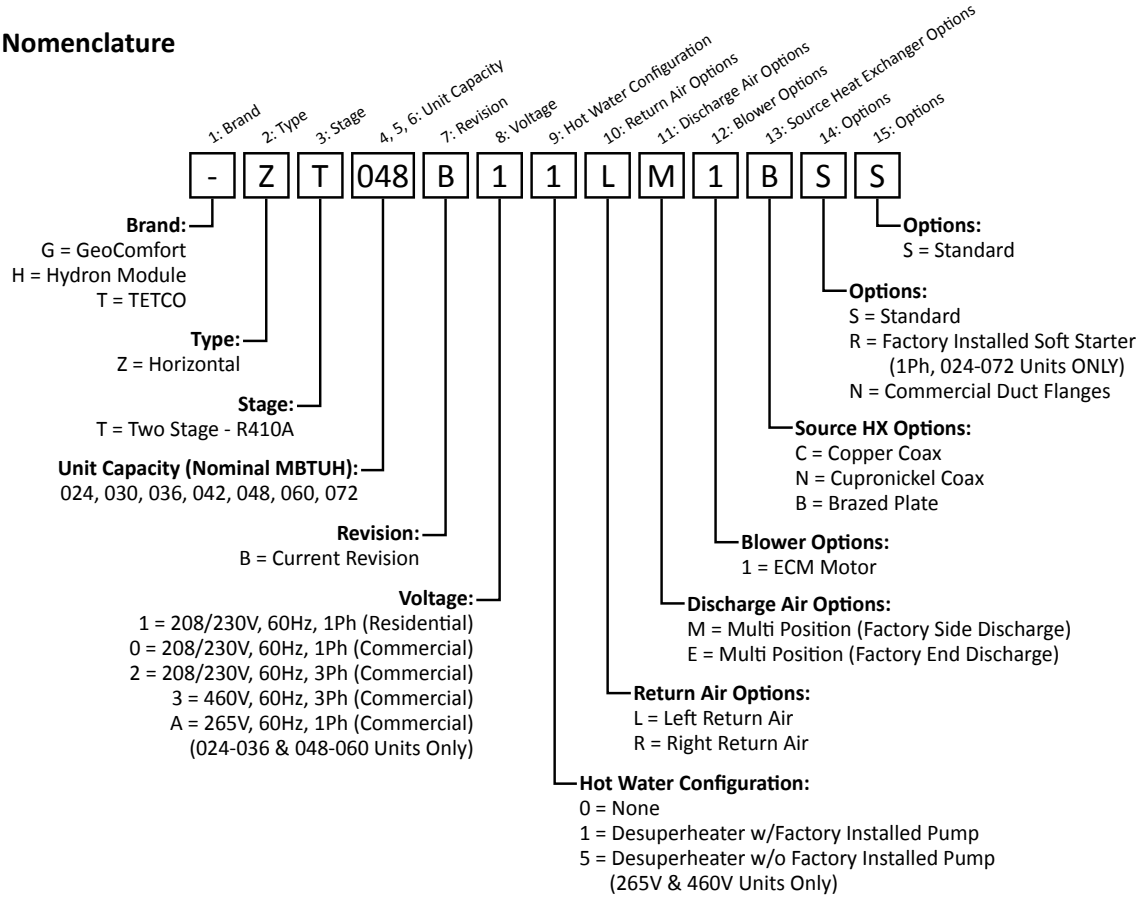
Section 11: Equipment Start-Up Procedures

Section 12: Troubleshooting

Section 13: Warranty Forms and Revision Table

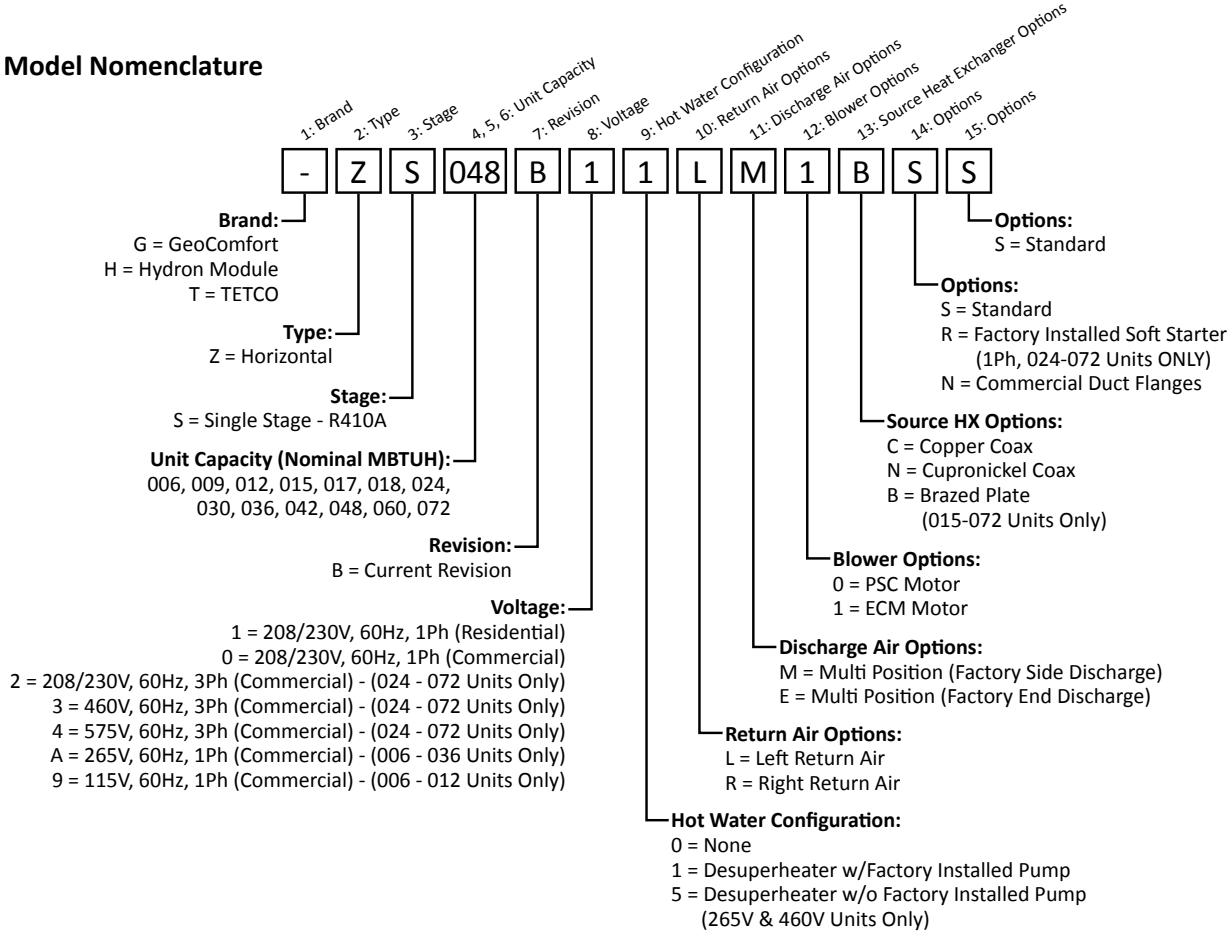
Section 1: Model Nomenclature

ZT Model Nomenclature



Model Nomenclature - ZS Series

ZS Model Nomenclature



Section 2: Installation 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.

Safety Labeling and Signal Words
The signal words **NOTICE, DANGER, WARNING, CAUTION,** and **Note** are used on product labels and throughout this manual to identify levels of hazard seriousness.

"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, product or property damage.

"WARNING" Indicates a 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.

"Note" Used to highlight suggestions which will result in enhanced installation, reliability, or operation.

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 5 days. If not filed within 5 days the freight company can deny all claims.

Note: Notify Enertech Global, LLC shipping department of all damages within 5 days. It is the responsibility of the purchaser to file all necessary claims with the freight company.

Un-packaging
Enertech units are mounted to wooden pallets for easy handling during shipment and installation. Units are protected during shipment with durable cardboard corner posts, top and air coil panels. Shrink wrap is applied covering the entire unit and attachment to the pallet.

Upon receipt of the unit carefully remove the shrink wrap. Using a box cutter slit the shrink wrap on the cardboard top and corner posts. Use caution to not damaged the finished surface of the unit.

Keep all cardboard or other packaging material for safe storage and transport to the job site prior to installation.

Remove the front compressor section service panel to locate technical documents; manuals, bulletins or instructions and accessory items; HWG piping kits, supply/return duct flange kits or condensate tubing kits prior to installation.

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.

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.

Removal and Disposal
All Geothermal units removed from service should have all components, oils, antifreeze and refrigerants properly disposed of according to all local and national environmental recycling codes, regulations, standards and rules.

Pre-Installation
Special care should be taken in locating the geothermal unit. Installation location chosen should include adequate service clearance around the unit. If not suspended, horizontal 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.

Section 2: Installation Introduction

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 or hold the 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.

⚠ CAUTION ⚠

UNITS WITH BRAZED PLATE HEAT EXCHANGERS REQUIRE ANTIFREEZE IN THE GROUND LOOP IF UNITS WILL BE OPERATING IN THE HEATING MODE. COAXIAL HEAT EXCHANGERS ARE RECOMMENDED FOR SYSTEMS WITHOUT ANTIFREEZE.

Components

Master Contactor: Energizes Compressor and optional Hydronic Pump and/or Hot Water Generator (HWG) 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.

Reversing Valve: Controls the cycle of the refrigerant system (heating or cooling). Energized in cooling 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. A flow switch is included on BPHE units as a secondary freeze protection device. It is not available on units that utilize a coax as the water heat exchanger.

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

Blower Motor: ECM (Electronically Commutated Motor) for variable fan speeds or PSC (permanent split capacitor) Motors are available.

Compressor: 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, thermostat and indicator lights. Also provide the consumer with the manufacturer's Owner's Manual for the equipment being installed.

Enertech Global D-I-Y Policy: Enertech Global's geothermal heat pumps and system installations may include electrical, refrigerant and/or water connections. Federal, state and local codes and regulations apply to various aspects of the installation. Improperly installed equipment can lead to equipment failure and health/safety concerns. For these reasons, only qualified technicians should install an Enertech Global built geothermal system. Because of the importance of proper installation, Enertech Global does not sell equipment direct to homeowners. Internet websites and HVAC outlets may allow for purchases directly by homeowners and do-it-yourselfers, but Enertech Global offers no warranty on equipment that is purchased via the internet or installed by persons without proper training.

Enertech Global has set forth this policy to ensure installations of Enertech Global geothermal systems are done safely and properly. The use of well-trained, qualified technicians helps ensure that your system provides many years of comfort and savings.

Equipment Installation: Special care should be taken in locating the unit. If not suspended, horizontal 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 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.

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

Electrical (Power Supply): When any compressor bearing equipment is connected to a weak power supply, starting current will generate a significant "sag" in voltage which reduces the starting torque of the compressor motor and increases start time. This will influence the rest of the electrical system in the building by lowering the voltage to the lights. This momentary low voltage causes "light dimming". The total electrical system should be evaluated with an electrician and HVAC technician.

The evaluation should include all connections, sizes of wires and size of the distribution panel between the unit and the utility's connection. The transformer connections and sizing should be evaluated by the local electric utility provider.

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.

Hot Water Generator (HWG) Package: Water heating is standard on all residential units (units may be ordered without this feature). It uses excess heat during both heating and cooling cycles, to provide hot water for domestic needs. A double wall Hot Water Generator (HWG) 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 Hot Water Generator (HWG) package can make up to 60% (depending on heat pump usage) of most domestic water needs, but a water heater is still recommended.

Hot Water Generator (HWG) 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.

Note: Copper is the only approved material for Hot Water Generator (HWG) piping.

UV Light Usage: The use of a UV light in the unit return air plenum should be such that the light does not have a direct line of sight to the inside of the unit. UV lights will cause the insulation and other coatings to deteriorate. It would be better to place the UV light in the supply air plenum, or ductwork. This also helps keep the light cleaner. Additionally, if a humidifier is installed and in line of the sight of the UV light, consult the humidifier install manual for indication of whether the light will deteriorate any parts of the humidifier (like the water evaporator pad).

Section 3: Installation Considerations

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.*** If not suspended, horizontal geothermal units should be placed on a formed plastic or high density, closed cell polyethylene pad to provide **6 inches of vertical clearence** for all plumbing and electrical connections. 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 remove any packaging material or documentation included in the unit.

☐ Locate the Unit Start-Up form from this manual and have it available as the unit installation proceeds.

☐ Clean the air coil with soap and water solution to remove any oil or dirt.

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 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. Wild or Free returns may be used in open ceiling or other applications when proper ventilation is available. When running a cooling or heating load on a building, size ductwork accordingly to the building design load and heat pump CFM.

Industry Standard: 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.

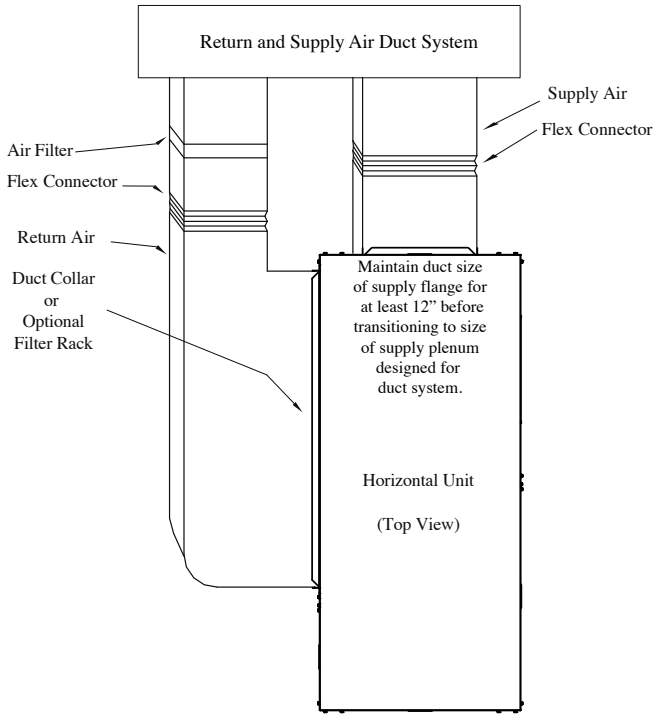
In buildings where ceilings are 8 feet or more, at least 50 percent of the return air should be taken back to the heat pump from the ceiling or high sidewall location and not more than 50 percent from the floor or low sidewall location.

Section 3: Installation Considerations

MAXIMUM AIR VELOCITIES TABLE

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

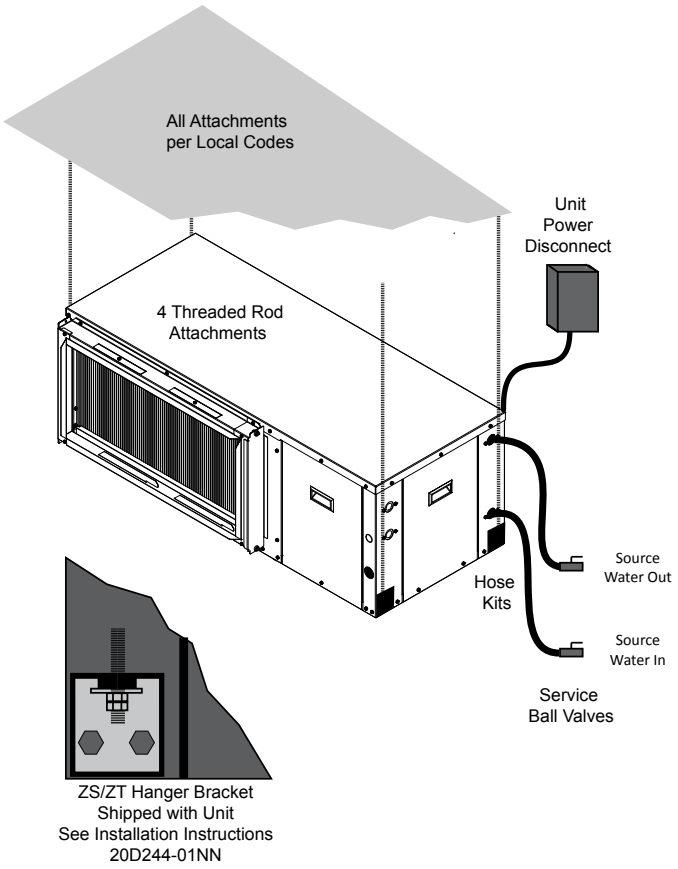
Typical Ductwork Connection Setup



Optional Filter Rack Kit Installation

Installation of the optional and sold separately accessory filter rack is described in the installation instructions provided with that item. Maintenance and filter change instructions are included in the owners manual shipped with every packaged unit.

Horizontal Unit Suspension

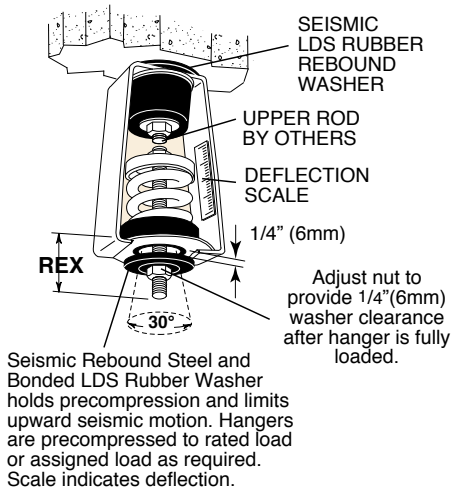


Seismic Hanger Bracket

PC30N (Mason Industries) -- Available from mason-industries.com

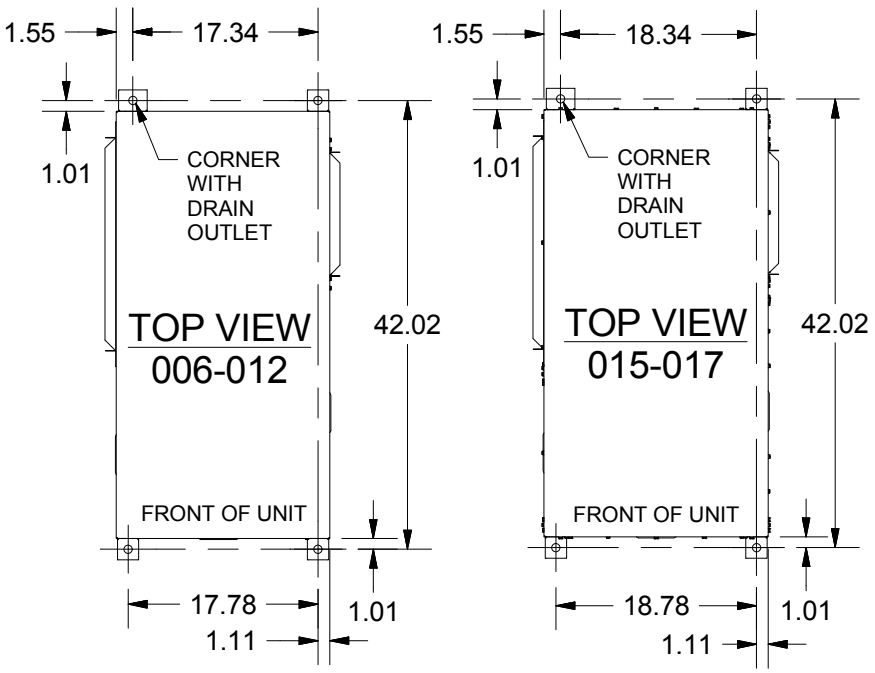
TYPE 30N PRECOMPRESSED & SEISMIC RESTRAINT

Install with hanger box snug to 1/4" (6mm) Seismic LDS Rubber Washer, so washer is tight to overhead surface. Upper hanger element deflects under load, leaving space on top. Washer cushions upward seismic travel.

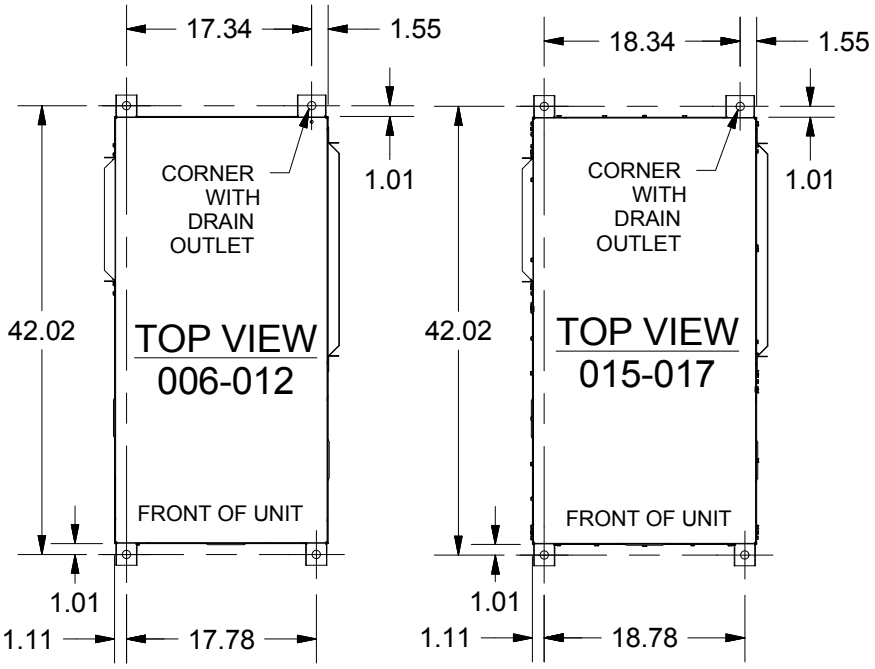


Horizontal Unit Suspension Hanger Locations and Dimensions

LEFT HAND RETURN CABINET

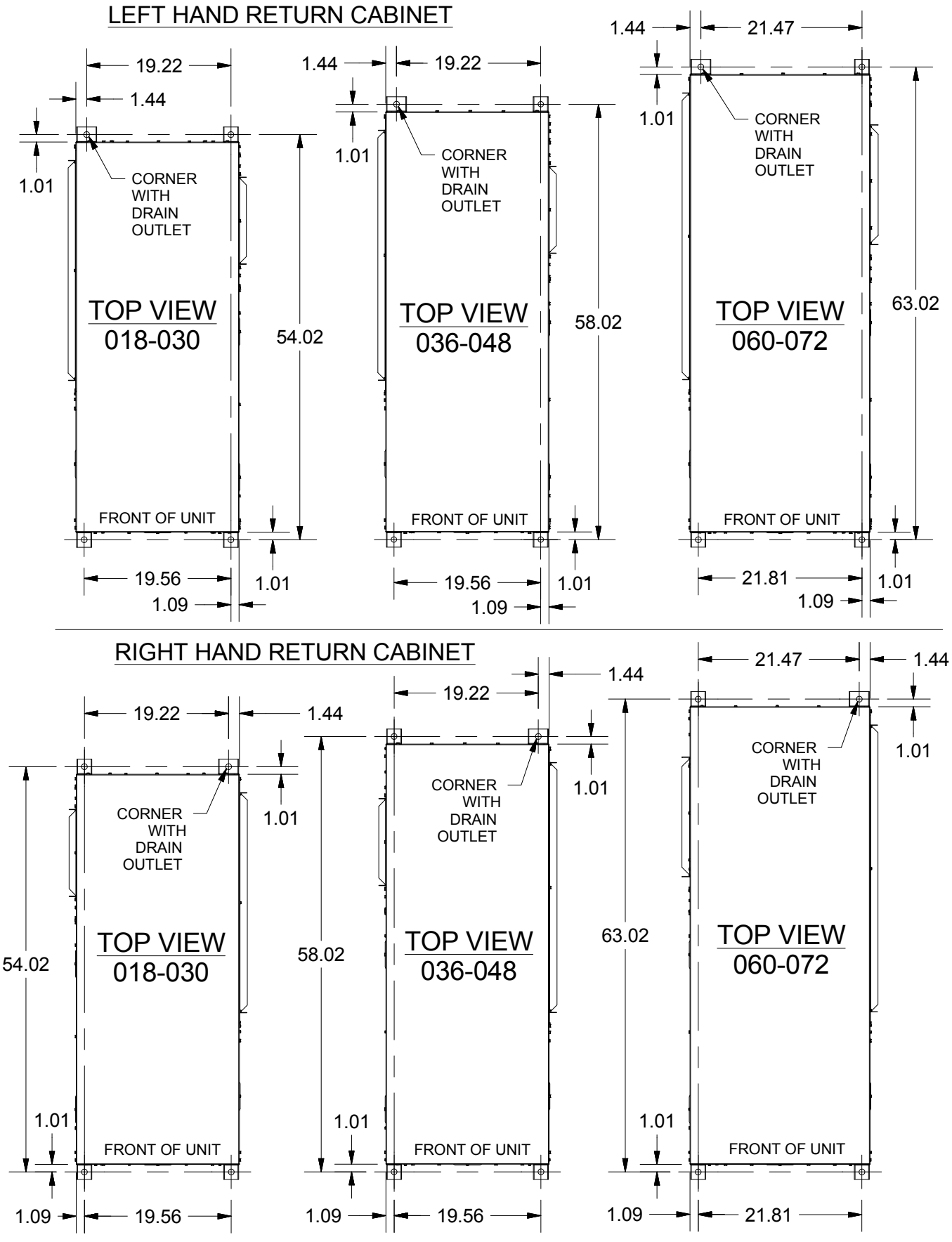


RIGHT HAND RETURN CABINET



Section 3: Installation Considerations

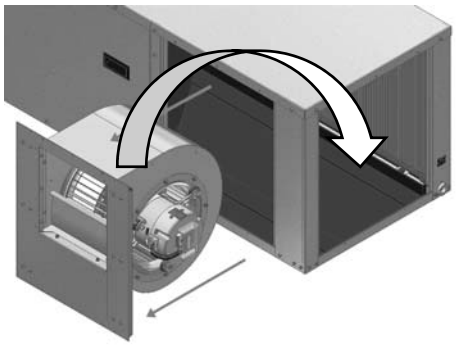
Horizontal Unit Suspension Hanger Locations and Dimensions

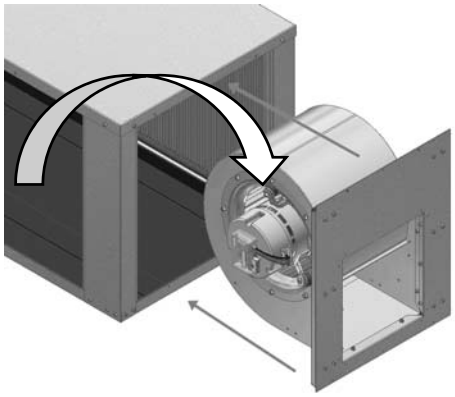


Retrofitting Unit Discharge from Side to End Discharge

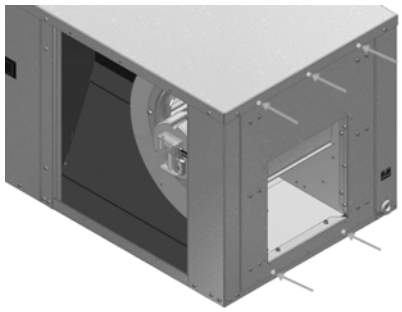
You will need a 5/16 hex driver to complete what is described below. To insure that you do not strip out screws use a manual driver.

1. Remove the end door from unit by removing (3) screws.
2. Disconnect the unit wiring harness from the motor.
3. On the discharge door asm. remove (5) screws (3 near the top, 2 near the bottom) then remove discharge door asm. from the unit.
4. Carefully rotate the discharge door asm 180 deg. and place the door into the opening on the end. This will insure that when configured as end discharge that the motor is not on the air coil side and can be serviced via the side door.

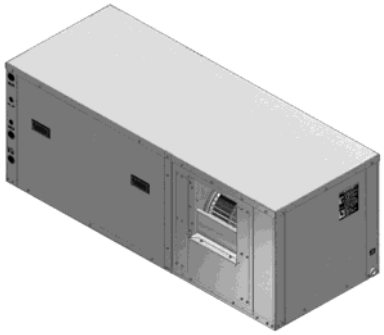




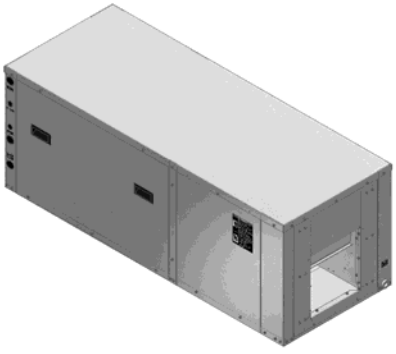
5. Reassemble the discharge door asm using the (5) screws from before, (3 near the top, 2 near the bottom).



6. Be sure to securely re-connect the motor wiring to the motor through the side door opening. Once this has been completed reassemble the side door using the (3) screws from before, (1 near the top, 2 near the bottom).



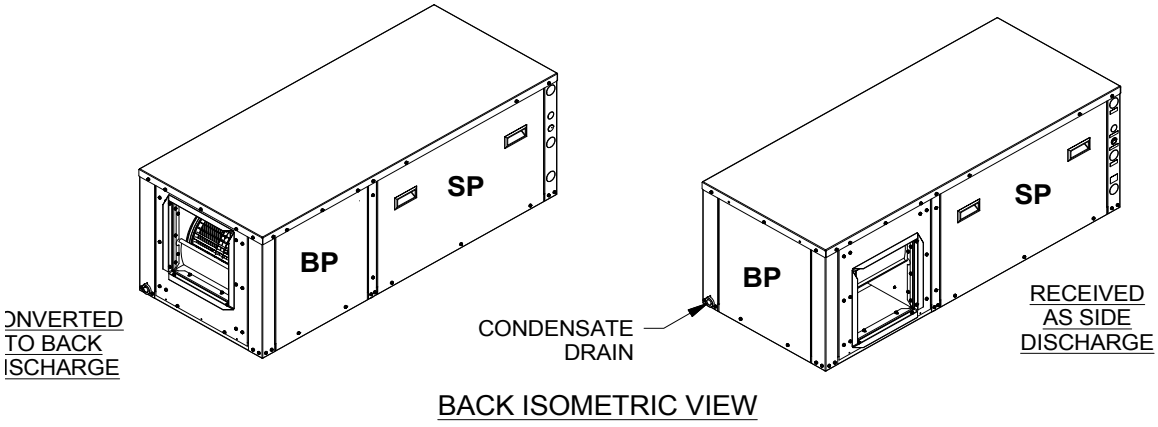
Side discharge as provided



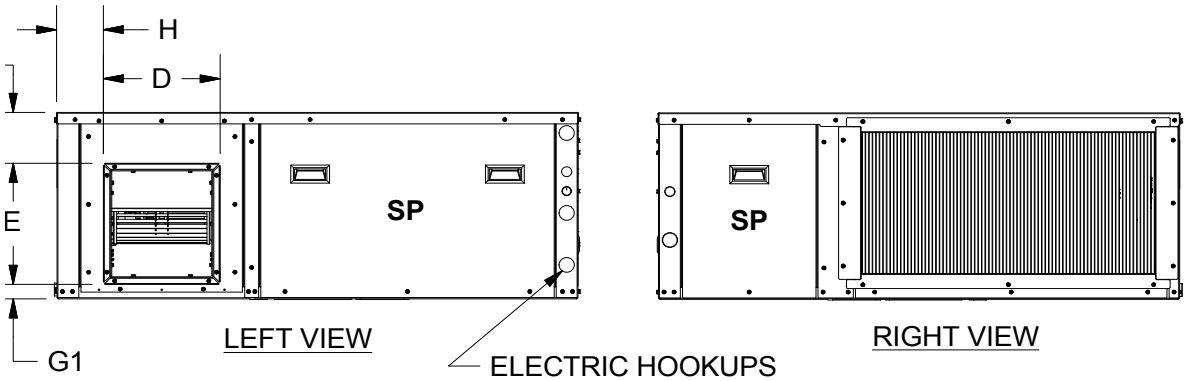
End Discharge as retrofitted

Section 4: Unit Data Information

Unit Dimensional Data



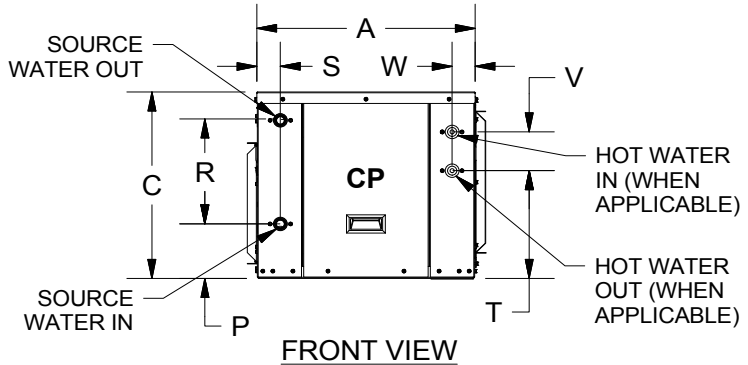
BACK ISOMETRIC VIEW



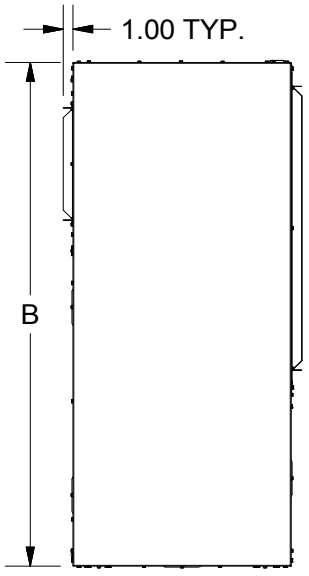
LEFT VIEW

RIGHT VIEW

ELECTRIC HOOKUPS ALONG THIS CORNER



FRONT VIEW



TOP VIEW

LEGEND
SP = Service Panel
BP = Blower Service Panel
CP = Control Access Panel

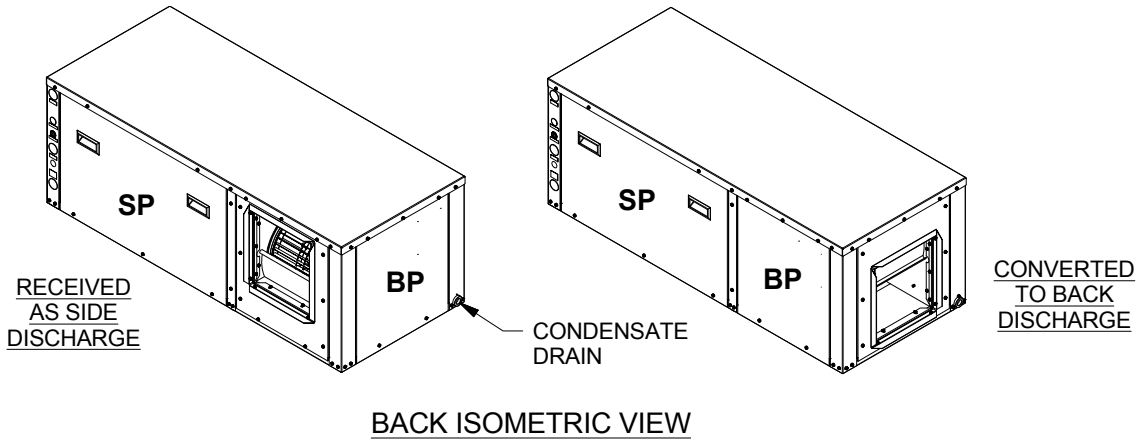
SHOWN IN RIGHT HAND RETURN CONFIGURATION

Reference dimensional data enclosed.
Units utilize FPT source water connections.
Units with Desuperheater utilize FPT connections.
Electrical knockouts are sized to 1/2" or 3/4" conduit.
All views are shown with flanges for reference.
Return duct flanges or 1" commercial filter rack are factory installed. See separate dimensional data sheet for further detail.

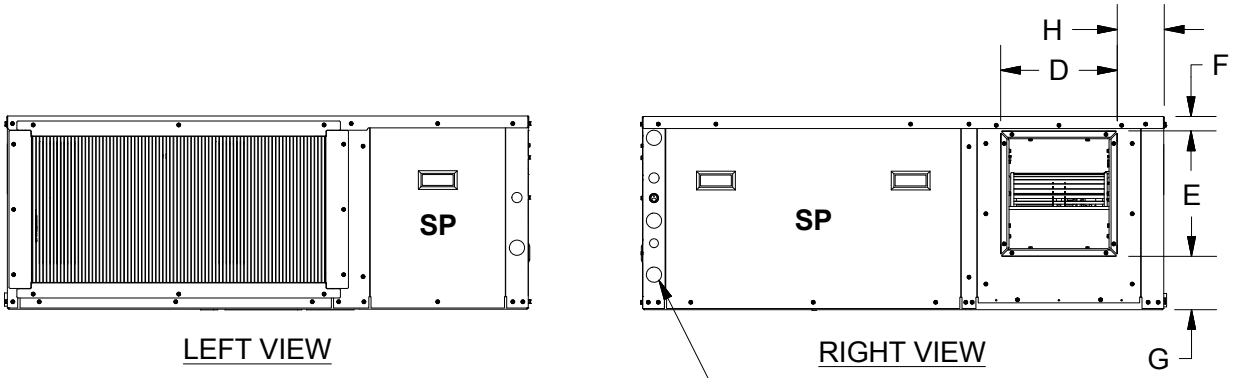
All measurements are in inches.
Drawings are typical, individual models may vary.
Optional filter rack kits are available as needed. See separate dinmensional data sheet for details.
Discharge flanges are field installed and are shipped inside of the unit.

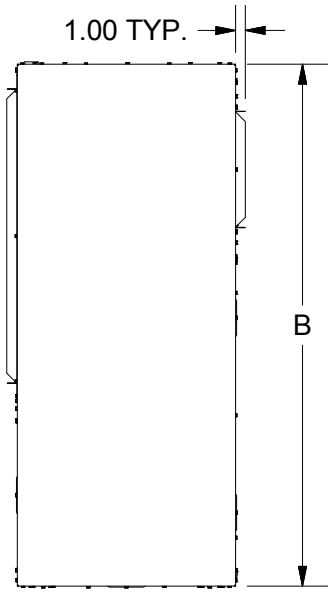
Section 4: Unit Data Information

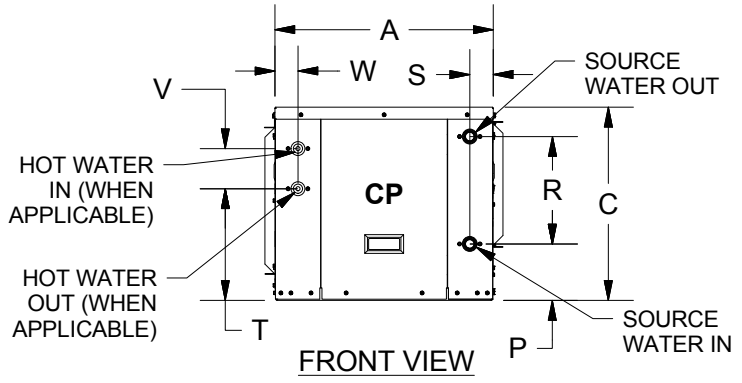
Unit Dimensional Data



BACK ISOMETRIC VIEW







SHOWN IN LEFT HAND RETURN CONFIGURATION

LEGEND
SP = Service Panel
BP = Blower Service Panel
CP = Control Access Panel

Reference dimensional data enclosed.
Units utilize FPT source water connections.
Units with Desuperheater utilize FPT connections.
Electrical knockouts are sized to 1/2" or 3/4" conduit.
All views are shown with flanges for reference.
Return duct flanges or 1" commercial filter rack are factory installed. See separate dimensional data sheet for further detail.

All measurements are in inches.
Drawings are typical, individual models may vary.
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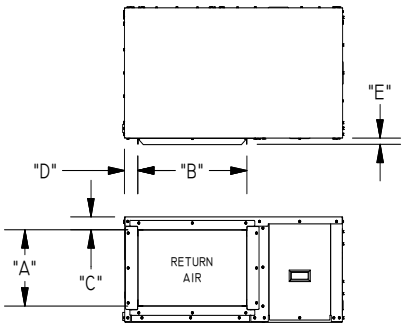
Discharge flanges are field installed and are shipped inside of the unit.

Section 4: Unit Data Information

Return Flanges/Filter Rack Dimensional Data

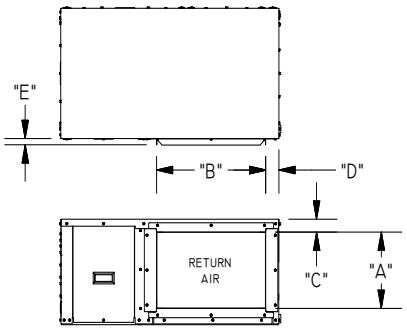
LEFT HAND RETURN MODELS

WITH RETURN FLANGES

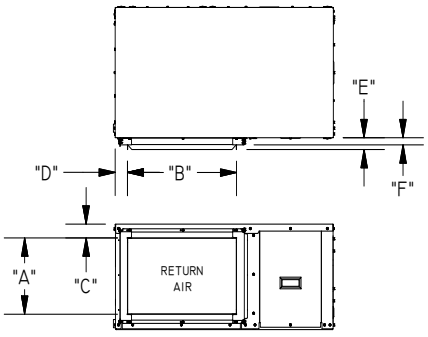


RIGHT HAND RETURN MODELS

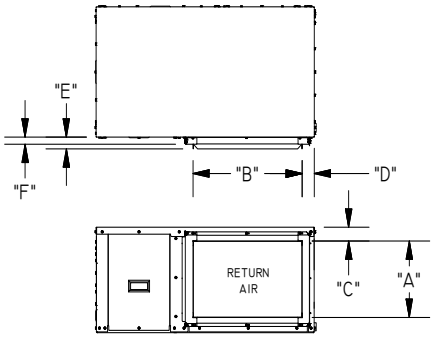
WITH RETURN FLANGES



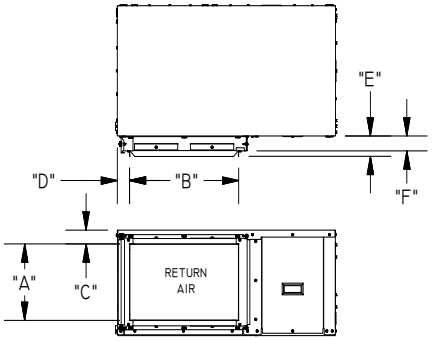
WITH 1" COMMERCIAL FILTER RACK



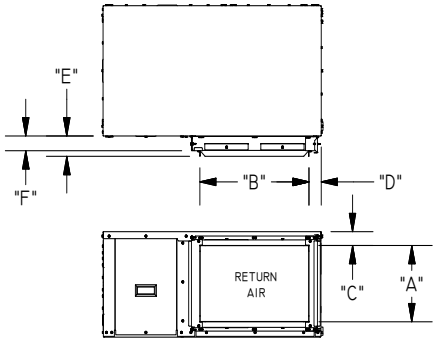
WITH 1" COMMERCIAL FILTER RACK



WITH 1"-2" DELUXE FILTER RACK



WITH 1"-2" DELUXE FILTER RACK



UNIT	DESCRIPTION	"A" HEIGHT	"B" WIDTH	"C"	"D'	"E"	"F"
006-009-012	RETURN DUCT FLANGES	7.31	20.00	2.06	2.44	1.00	N/A
	1" COMMERCIAL RACK	7.31	20.00	2.22	2.24	1.89	1.14
	1"-2" DELUXE RACK	7.31	20.00	2.22	2.24	3.30	2.39
015-017	RETURN DUCT FLANGES	12.31	20.00	2.06	2.44	1.00	N/A
	1" COMMERCIAL RACK	12.31	20.00	2.22	2.24	1.89	1.14
	1"-2" DELUXE RACK	12.31	20.00	2.22	2.24	3.30	2.39
018-024-030	RETURN DUCT FLANGES	14.64	29.35	1.99	2.44	1.00	N/A
	1" COMMERCIAL RACK	14.64	29.35	1.99	2.15	1.89	1.14
	1"-2" DELUXE RACK	14.64	29.35	1.99	2.44	3.30	2.39
036-048	RETURN DUCT FLANGES	16.64	33.35	1.99	2.44	1.00	N/A
	1" COMMERCIAL RACK	16.64	33.35	1.99	2.15	1.89	1.14
	1"-2" DELUXE RACK	16.64	33.35	1.99	2.44	3.30	2.39
060-072	RETURN DUCT FLANGES	16.64	38.25	1.99	2.44	1.00	N/A
	1" COMMERCIAL RACK	16.64	38.25	1.99	2.15	1.89	1.14
	1"-2" DELUXE RACK	16.64	38.25	1.99	2.44	3.30	2.39

Section 4: Unit Data Information

Unit Dimensional Data

MODEL	Overall Cabinet Size			Supply Air (Side Blower Discharge)						
	A (Width)	B (Depth)	C (Height)	D (Width)	E (Height)	F (LHR)	G (LHR)	F1 (RHR)	G1 (RHR)	H
006	20.0	40.0	12.0	11.6	7.5	1.6	2.9	2.9	1.6	3.8
009	20.0	40.0	12.0	11.6	7.5	1.6	2.9	2.9	1.6	3.8
012	20.0	40.0	12.0	11.6	7.5	1.6	2.9	2.9	1.6	3.8
015	21.0	40.0	17.0	11.6	12.5	1.4	3.1	3.1	1.4	3.8
017	21.0	40.0	17.0	11.6	12.5	1.4	3.1	3.1	1.4	3.8
018	21.7	52.0	19.2	11.6	12.5	1.4	5.3	5.3	1.4	4.7
024	21.7	52.0	19.2	11.6	12.5	1.4	5.3	5.3	1.4	4.7
030	21.7	52.0	19.2	11.6	12.5	1.4	5.3	5.3	1.4	4.7
036	21.7	56.0	21.2	11.6	12.5	1.4	7.3	7.3	1.4	7.2
042	21.7	56.0	21.2	11.6	12.5	1.4	7.3	7.3	1.4	7.2
048	21.7	56.0	21.2	11.6	12.5	1.4	7.3	7.3	1.4	7.2
060	24.0	61.0	21.2	16.0	16.0	1.4	3.8	3.8	1.4	6.7
072	24.0	61.0	21.2	16.0	16.0	1.4	3.8	3.8	1.4	6.7

MODEL	Source Water			Hot Water (If Applicable)		
	P	R	S	T	V	W
006	3.6	6.0	2.1	N/A	N/A	N/A
009	3.6	6.0	2.1	N/A	N/A	N/A
012	3.6	6.0	2.1	N/A	N/A	N/A
015	5.6	8.0	2.1	8.6	4.0	2.1
017	5.6	8.0	2.1	8.6	4.0	2.1
018	5.6	10.7	2.3	11.1	4.0	2.3
024	5.6	10.7	2.3	11.1	4.0	2.3
030	5.6	10.7	2.3	11.1	4.0	2.3
036	5.6	12.0	2.5	11.1	4.0	2.3
042	5.6	12.0	2.5	11.1	4.0	2.3
048	5.6	12.0	2.5	11.1	4.0	2.3
060	5.6	12.0	2.5	11.1	4.0	2.3
072	5.6	12.0	2.5	11.1	4.0	2.3

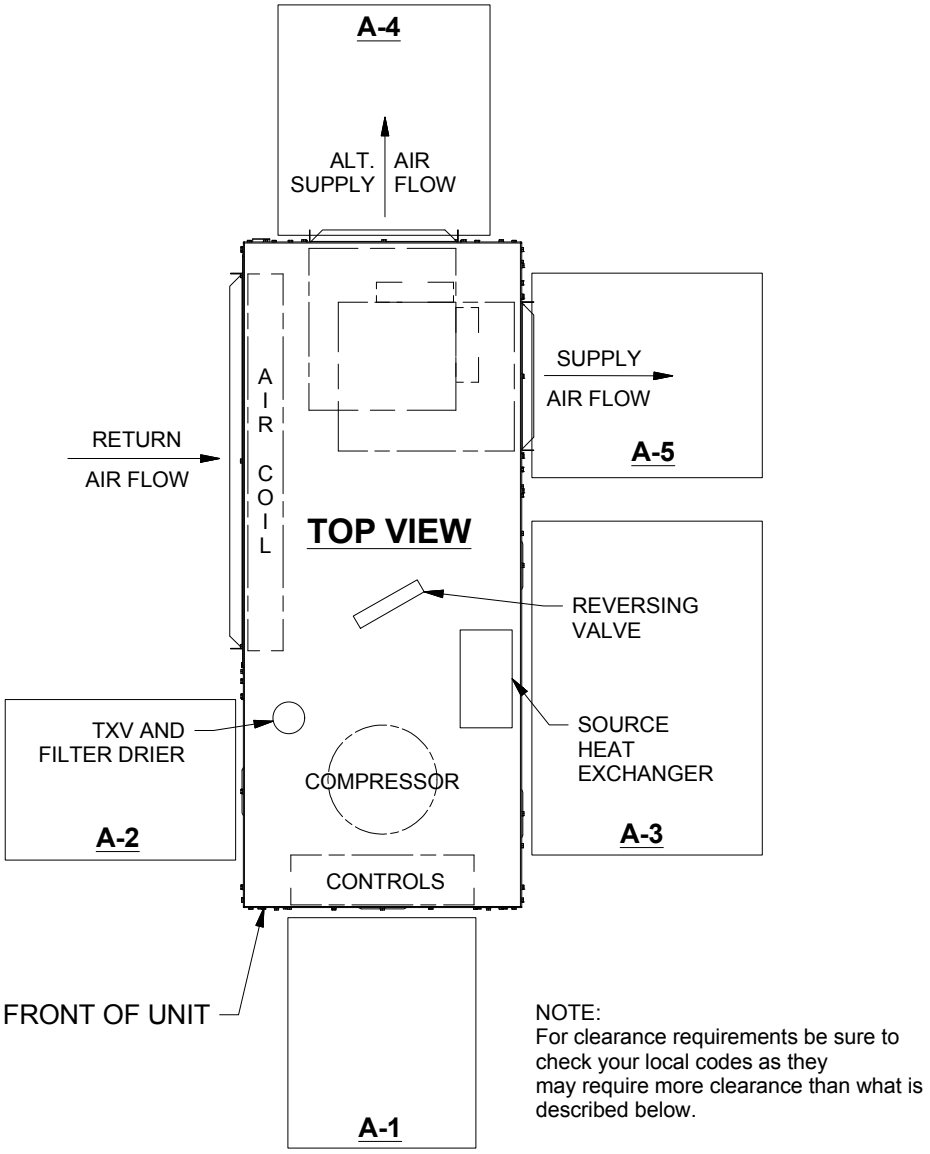
MODEL	1"-2" Optional Deluxe Filter Rack
	Order Item Number
006	AFR0923A
009	AFR0923A
012	AFR0923A
015	AFR1423A
017	AFR1423A
018	AFR1632A
024	AFR1632A
030	AFR1632A
036	AFR1836A
042	AFR1836A
048	AFR1836A
060	AFR1841A
072	AFR1841A

Note:

1. For Return Flange / Filter Rack Dimensional Data see additional sheet.
2. Residential Models are shipped with factory applied Return Duct Flanges.
3. Commercial Models are shipped with either a factory applied 1" Commercial Filter Rack or Return Duct Flanges.

Service Access Clearances

SERVICE ACCESS CLEARANCE
(Shown below as Left Hand Return)



NOTE:
For clearance requirements be sure to check your local codes as they may require more clearance than what is described below.

LEGEND:

A-1: This is the main controls and compressor access panel. Requires 2 feet of clearance.

A-2: This is the txv-filter drier access area. Be sure to leave adequate clearance for any future maintenance if needed.

A-3: This is the source heat exchanger reversing valve access area. Be sure to leave adequate clearance for any future maintenance if needed.

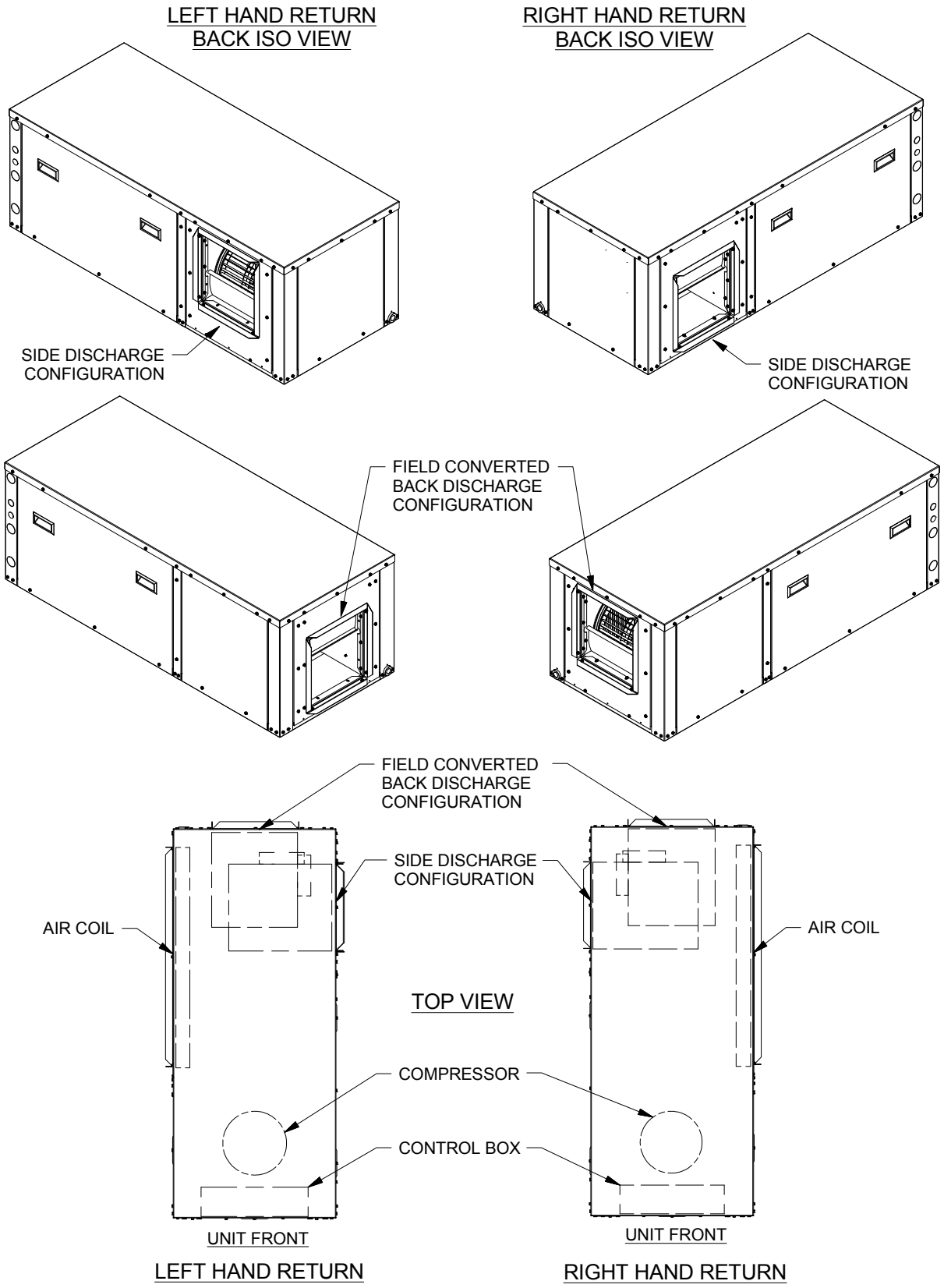
A-4: This is the blower motor access when the unit is configured as side discharge. This is the configutation that the unit is shipped in. When side discharge then this access area requires 2 feet of clearance.

ONLY FOR ALT. SUPPLY AIR

A-5: This is the blower motor access when the unit is configured as back discharge. When back discharge then this access area requires 2 feet of clearance.

Section 4: Unit Data Information

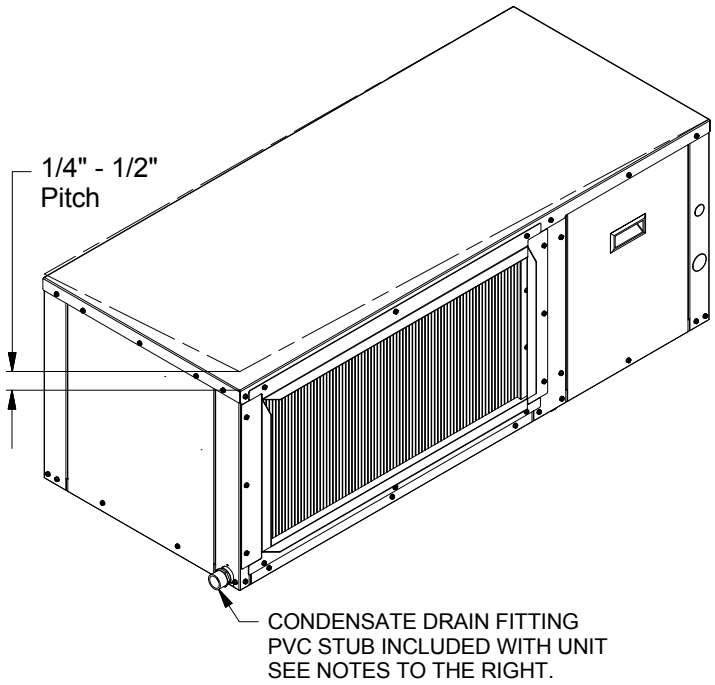
Isometric Views



Section 4: Unit Data Information

Unit Dimensional Data

UNIT PITCH FOR CONDENSATE DRAIN



Condensate Drain Notes:

1. Unit must pitch from level towards the condensate drain for proper drainage.
2. Confirm that condensate drains properly from unit and that the amount of pitch does not cause condensate leaks inside of the unit.
3. Units are equipped with overflow protection.
4. Be sure to leave adequate height for the P-Trap in applications where clearance could be an issue.
5. In some high humidity applications you may need to apply insulative tape around condensate drain fitting.

Section 4: Unit Data Information

Unit Physical Data

UNIT WEIGHTS ZS-ZT MODELS	BTU SIZES - BPHE UNITS ONLY									
	015	017	018	024	030	036	042	048	060	072
Unit Weight (lbs)	173	173	236	236	236	263	263	263	303	303
Tare Weight (lbs)	32	32	37	37	37	37	37	37	37	37
Shipped Unit Weight (lbs)	205	205	273	273	273	300	300	300	340	340
Left Return Corner A (Unit Wt.)	35	35	47	47	47	53	53	53	61	61
Left Return Corner B (Unit Wt.)	61	61	83	83	83	92	92	92	106	106
Left Return Corner C (Unit Wt.)	26	26	35	35	35	39	39	39	45	45
Left Return Corner D (Unit Wt.)	52	52	71	71	71	79	79	79	91	91
Right Return Corner A (Unit Wt.)	26	26	35	35	35	39	39	39	45	45
Right Return Corner B (Unit Wt.)	52	52	71	71	71	79	79	79	91	91
Right Return Corner C (Unit Wt.)	35	35	47	47	47	53	53	53	61	61
Right Return Corner D (Unit Wt.)	61	61	83	83	83	92	92	92	106	106

SINGLE CAPACITY ZS MODELS	BTU SIZES - BPHE UNITS ONLY									
	015	017	018	024	030	036	042	048	060	072
Compressor Type	Rotary		Single Capacity Scroll							
Blower/Fan Wheel (in)	9 x 7T	9 x 7T	10 x 8T	10 x 8T	10 x 8T	10 x 8	10 x 8	10 x 8	11 x 10T	11 x 10T
Fan Motor ECM (HP)	1/2 hp	1/2 hp	1/2 hp	1/2 hp	1/2 hp	1/2 hp	1/2 hp	3/4 hp	1 hp	1 hp
Fan Motor PSC (HP)	1/4 hp	1/4 hp	1/4 hp	1/3 hp	1/3 hp	1/3 hp	1/2 hp	3/4 hp	1 hp	1 hp
Source Water Connection Size	3/4" FPT		1" FPT							
HWG Water (when available)	3/4" FPT									
Refrigerant Charge (oz)*	37	36	41	41	40	46	52	48	56	60
Air Coil Face Area (sq.ft.)	1.79 sq.ft.		3.26 sq.ft.			4.17 sq.ft.			4.76 sq.ft.	
Air Coil Dimesions (in)	20.5 x 12.6 x 1.26		30.3 x 15.5 x 1			34.5 x 17.4 x 1			39.4 x 17.4 x 1	
Air Coil Type	All Aluminum Microchannel Coil									

* Always check the unit data plate for specific refrigerant charge volume

DUAL CAPACITY ZT MODELS	BTU SIZES - BPHE UNITS ONLY						
	024	030	036	042	048	060	072
Compressor Type	Dual Capacity Scroll						
Blower/Fan Wheel (in)	10 x 8T	10 x 8T	10 x 8	10 x 8	10 x 8	11 x 10T	11 x 10T
Fan Motor ECM (HP)	1/2 hp	1/2 hp	1/2 hp	1/2 hp	3/4 hp	1 hp	1 hp
Fan Motor PSC (HP)	1/3 hp	1/3 hp	1/3 hp	1/2 hp	3/4 hp	1 hp	1 hp
Source Water Connection Size	1" FPT						
HWG Water (when available)	3/4" FPT						
Refrigerant Charge (oz)*	41	39	46	49	51	56	62
Air Coil Face Area (sq.ft.)	3.26 sq.ft.		4.17 sq.ft.			4.76 sq.ft.	
Air Coil Dimesions (in)	30.3 x 15.5 x 1		34.5 x 17.4 x 1			39.4 x 17.4 x 1	
Air Coil Type	All Aluminum Microchannel Coil						

* Always check the unit data plate for specific refrigerant charge volume

Unit Physical Data (COAX Units Only)

UNIT WEIGHTS ZS-ZT MODELS	BTU SIZES - COAX UNITS ONLY												
	006	009	012	015	017	018	024	030	036	042	048	060	072
Unit Weight (lbs)	140	140	140	175	175	246	246	255	278	292	306	342	344
Tare Weight (lbs)	32	32	32	32	32	37	37	37	37	37	37	37	37
Shipped Unit Weight (lbs)	172	172	172	207	207	283	283	292	315	329	343	379	381
Left Return Corner A (Unit Wt.)	28	28	28	35	35	49	49	51	55	58	61	67	67
Left Return Corner B (Unit Wt.)	49	49	49	62	62	90	90	92	102	106	110	130	130
Left Return Corner C (Unit Wt.)	21	21	21	26	26	35	35	37	39	42	44	46	46
Left Return Corner D (Unit Wt.)	42	42	42	52	52	72	72	75	82	86	91	99	101
Right Return Corner A (Unit Wt.)	21	21	21	26	26	35	35	37	39	42	44	46	46
Right Return Corner B (Unit Wt.)	42	42	42	52	52	72	72	75	82	86	91	99	101
Right Return Corner C (Unit Wt.)	28	28	28	35	35	49	49	51	55	58	61	67	67
Right Return Corner D (Unit Wt.)	49	49	49	62	62	90	90	92	102	106	110	130	130

SINGLE CAPACITY ZS MODELS	BTU SIZES - COAX UNITS ONLY												
	006	009	012	015	017	018	024	030	036	042	048	060	072
Compressor Type	Rotary					Single Capacity Scroll							
Blower/Fan Wheel (in)	6 X 9	6 X 9	6 X 9	9 x 7T	9 x 7T	10 x 8T	10 x 8T	10 x 8T	10 x 8	10 x 8	10 x 8	11 x 10T	11 x 10T
Fan Motor ECM (HP)	N/A	N/A	N/A	1/2 hp	1/2 hp	1/2 hp	1/2 hp	1/2 hp	1/2 hp	1/2 hp	3/4 hp	1 hp	1 hp
Fan Motor PSC (HP)	1/16 hp	1/16 hp	1/16 hp	1/4 hp	1/4 hp	1/4 hp	1/3 hp	1/3 hp	1/3 hp	1/2 hp	3/4 hp	1 hp	1 hp
Source Water Connection Size	3/4" FPT					1" FPT							
HWG Water (when available)	N/A	N/A	N/A	3/4" FPT									
Refrigerant Charge (oz)*	32	31	31	39	39	54	52	45	60	63	61	74	77
Air Coil Face Area (sq.ft.)	1.08 sq.ft.			1.79 sq.ft.		3.26 sq.ft.			4.17 sq.ft.			4.76 sq.ft.	
Air Coil Dimesions (in)	20.5 x 7.6 x 1.26			20.5 x 12.6 x 1.26		30.3 x 15.5 x 1			34.5 x 17.4 x 1			39.4 x 17.4 x 1	
Air Coil Type	All Aluminum Microchannel Coil												

* Always check the unit data plate for specific refrigerant charge volume

DUAL CAPACITY ZT MODELS	BTU SIZES - COAX UNITS ONLY						
	024	030	036	042	048	060	072
Compressor Type	Dual Capacity Scroll						
Blower/Fan Wheel (in)	10 x 8T	10 x 8T	10 x 8	10 x 8	10 x 8	11 x 10T	11 x 10T
Fan Motor ECM (HP)	1/2 hp	1/2 hp	1/2 hp	1/2 hp	3/4 hp	1 hp	1 hp
Fan Motor PSC (HP)	1/3 hp	1/3 hp	1/3 hp	1/2 hp	3/4 hp	1 hp	1 hp
Source Water Connection Size	1" FPT						
HWG Water (when available)	3/4" FPT						
Refrigerant Charge (oz)*	51	45	60	65	65	76	75
Air Coil Face Area (sq.ft.)	3.26 sq.ft.		4.17 sq.ft.			4.76 sq.ft.	
Air Coil Dimesions (in)	30.3 x 15.5 x 1		34.5 x 17.4 x 1			39.4 x 17.4 x 1	
Air Coil Type	All Aluminum Microchannel Coil						

* Always check the unit data plate for specific refrigerant charge volume

Section 4: Unit Data Information

ECM Fan Performance/Dip Switch Settings- One and Two-Stage Compressor Units

***ZS/*ZT Series ECM Fan Performance Data: One & Two-Stage Compressor Units**

Model	Max ESP in. w.c.[2]	Program[3]	Heating Mode		Cooling Mode		Dehumidification Mode		Fan Only	AUX/ EMG Heat[4]	DIP Switch Settings							
			1st	2nd	1st	2nd	1st	2nd			S1	S2	S3	S4	S5	S6	S7	S8
015	1.0	A	-	620	-	620	-	490	295	N/A	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		B	**-**	**500**	**-**	**500**	**-**	**430**	**260**		**ON**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	**OFF**
		C	-	430	-	430	-		230		OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
		D	-	360	-	370	-		200		ON	ON	OFF	OFF	ON	ON	OFF	OFF
017	1.0	A	-	670	-	690	-	600	355	N/A	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
		B	**-**	**620**	**-**	**620**	**-**	**490**	**295**		**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
		C	-	500	-	500	-		260		ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
		D	-	430	-	430	-		230		OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
018	1.0	A	-	680	-	680	-	580	370	990	OFF	ON	ON	OFF	OFF	ON	OFF	OFF
		B	**-**	**630**	**-**	**630**	**-**	**520**	**340**	**900**	**OFF**	**ON**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**OFF**
		C	-	560	-	570	-	480	290	800	ON	ON	ON	OFF	ON	ON	OFF	OFF
		D	-	500	-	510	-	430	260	720	ON	ON	OFF	OFF	ON	ON	OFF	OFF
024	1.1	A	700	930	740	930	610	800	500	1210	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
		B	**650**	**850**	**650**	**860**	**570**	**740**	**460**	**1100**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
		C	600	780	620	780	520	690	400	990	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
		D	560	730	570	730	480	640	390	920	ON	OFF	ON	OFF	ON	OFF	OFF	OFF
030	1.1	A	920	1240	820	1060	730	960	610	1230	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		B	**840**	**1070**	**750**	**960**	**660**	**870**	**570**	**1130**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**
		C	770	1050	680	830	610	780	480	1050	ON	OFF	ON	OFF	ON	OFF	OFF	OFF
		D	720	960	630	740			430	950	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
036	0.9	A	1080	1380	990	1390	880	1190	850	1490	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		B	**980**	**1230**	**910**	**1260**	**870**	**1090**	**760**	**1450**	**ON**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	**OFF**
		C	870	1090	840	1100	830	960	670	1420	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
		D	840	1020	820	960			550	1380	ON	ON	OFF	OFF	ON	ON	OFF	OFF
042	1.1	A	1120	1430	1330	1570	970	1290	740	1580	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
		B	**1010**	**1270**	**1200**	**1410**	**870**	**1150**	**660**	**1430**	**ON**	**OFF**	**OFF**	**ON**	**ON**	**OFF**	**OFF**	**OFF**
		C	910	1140	1090	1270	810	1050	560	1250	ON	ON	OFF	OFF	ON	ON	OFF	OFF
		D	820	1030	1000	1130			470	1130	ON	ON	OFF	ON	ON	ON	OFF	OFF
048	1.1	A	1490	1900	1660	1880	1150	1550	890	1950	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		B	**1230**	**1580**	**1510**	**1710**	**1050**	**1420**	**810**	**1760**	**ON**	**OFF**	**ON**	**OFF**	**ON**	**OFF**	**OFF**	**OFF**
		C	1120	1420	1390	1580	950	1280	730	1600	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
		D	1000	1260	1270	1420			650	1400	ON	ON	ON	OFF	ON	ON	OFF	OFF
060	1.1	A	1810	2290	1660	2090	1390	1750	1010	2410	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
		B	**1560**	**2000**	**1500**	**1900**	**1260**	**1590**	**910**	**2220**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
		C	1470	1870	1390	1730			810	2000	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
		D	1420	1790	1310	1650			770	1990	ON	OFF	ON	OFF	ON	OFF	OFF	OFF
072	1.1	A	N/A															
		B	**1900**	**2200**	**1820**	**2230**	**1530**	**1870**	**1110**	**2430**	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
		C	1760	2030	1650	2000			1020	2180	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
		D	1590	1840	1480	1810			910	1960	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF

Notes:

1. Program **B (Bold Type)** is factory settings and rated CFM. CFM is controlled within 5% up to the Max ESP.
2. Max ESP includes allowance for wet coil and NO FILTER
3. Power must be off to the unit for at least 3 seconds before the ECM motor will recognize a program change.
4. Max ESP for ZS018 through ZS/ZT036 models with external electric heat is 0.8 in. w.c.; for ZS/ZT048 models it is 0.9 in. w.c.; and for ZS/ZT060 and ZS/ZT072 it is 1.1 in. w.c. Exceeding the Max ESP may result in nuisance trips of the electric heat. Thermal limits are rated at 100,000 cycles.

***ZS/*ZT Series 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. To enter dehumidification mode, ODD input should be 0 VAC; for normal cooling CFM, ODD input should be 24 VAC.
2. Heating CFM is not affected by dehumidification mode. When in dehumidification mode, cooling CFM is 85% of normal CFM.

Section 4: Unit Data Information

PSC Fan Performance - Single-Stage Compressor Units

*ZS Series PSC Fan Performance Data															
Model	Motor Speed[1]	Blower Size	Motor HP	CFM Nominal	Static Pressure (inches w.c.)										
					0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.60	0.70	0.80
006/009/012	H	6 x 9	1/16	350 (009/012[2])	410	400	395	380	370	360	340	320	290			
	M/H				375	370	360	355	340	325	310	295	275			
	M/L			275 (006)	330	320	310	300	290	280	260	240	210			
	L				285	275	265	250	240	230	210	195	180			
015/017	H	9 x 7T	1/4	650 (017)	995	935	910	865	840	800	775	745	710	630	575	
	M			525 (015)	730	710	685	685	675	650	625	610	585	520	460	285
	L				615	605	600	580	575	555	535	510	495	450	340	230
018	H	10 x 8T	1/4		1050	1045	1040	1040	1035	1030	1025	1015	1000	965	925	875
	M			600 (018)	690	685	675	665	650	645	635	620	600	575	525	460
	L				600	590	580	570	555	535	515	510	500	445	410	380
024/030	H	10 x 8T	1/3	1000 (030)	1110	1125	1135	1140	1140	1140	1140	1135	1130	1110	1090	1055
	M			750 (024)	780	780	780	785	785	785	780	775	770	750	700	660
	L				660	655	650	650	645	640	635	620	600	585	570	510
036	H	10 x 8	1/3	1100	1210	1215	1220	1215	1210	1205	1195	1195	1190	1165	1135	1100
	M				865	870	870	875	875	875	870	865	860	845	825	790
	L				685	700	710	710	710	705	700	700	695	670	630	595
042	H	10 x 8	1/2	1400	1620	1620	1615	1610	1605	1600	1595	1580	1565	1520	1465	1405
	M				1000	1100	1015	1018	1020	1023	1025	1028	1030	1040	1025	990
	L				850	860	865	870	875	875	875	873	870	860	850	820
048	H	10 x 8	3/4		2090	2070	2050	2035	2015	1990	1965	1940	1910	1855	1790	1710
	M			1500	1740	1745	1750	1740	1730	1720	1710	1695	1675	1645	1600	1535
	L				1400	1410	1420	1430	1435	1440	1440	1440	1440	1420	1390	1330
060/072	H	11 x 10	1	2200 (072)	2560	2540	2515	2505	2495	2470	2445	2420	2390	2350	2290	2210
	M			1900 (060)	2000	2000	1995	1998	2000	2005	2010	2005	1995	1940	1935	1885
	L				1590	1605	1620	1630	1640	1645	1645	1645	1645	1640	1625	1600

Notes:

1. PSC Blower motors come with 3 or 4 speed taps. To change the speed of the motor to a higher or lower speed, remove the electric box cover that is mounted on the blower. Locate the label on the motor to identify the wire color for each speed. Remove the wire nut on the existing speed and replace with the wire of selected speed.
2. Running the ZS012 at the static/SCFM points highlighted in gray, is not recommended.

3. Max ESP and speed settings for ZS models with external electric heat is shown below. Exceeding the Max ESP may result in nuisance trips of the electric heat. Thermal limits are rated at 100,000 cycles.

*ZS Series-Electric Heat Limitations					
Model	Electric Heater	Speed			Max Static
		High	Med	Low	
018	AXCH051MB		X		0.7
		X			0.8
024/030	AXCH051MB		X		0.7
		X			0.8
	AXCH101MB	X			0.8
036	AXCH051MB		X		0.8
		X			0.9
	AXCH101MB	X			0.8
042	AXCH051MB	X	X	X	0.9
	AXCH101MB			X	0.7
			X		0.8
		X			0.9
048	AXCH101MB	X	X	X	0.9
	AXCH151MB	X	X		0.9
060/072	AXCH101LB	X	X	X	1.0
	AXCH151LB		X	X	0.9
		X			1.1

Section 4: Unit Data Information

Unit Electrical Data, ZT 024 - 048, ECM Models

Model	Voltage Code/ HWG Option	60 Hz Power		Compressor		Fan Motor FLA	HWG Pump FLA	Ext. Loop Pump FLA	Total Unit FLA	Min Circuit AMPS	Max Brkr HACR
		Volts	Phase	LRA	RLA						
ZT024	00	208/230	1	58.3	11.7	3.9	0.0	0.0	15.6	18.5	30
	01	208/230	1	58.3	11.7	3.9	0.5	0.0	16.1	19.0	30
	10	208/230	1	58.3	11.7	3.9	0.0	4.0	19.6	22.5	30
	11	208/230	1	58.3	11.7	3.9	0.5	4.0	20.1	23.0	35
	20	208/230	3	55.4	6.5	3.9	0.0	0.0	10.4	12.0	15
	21	208/230	3	55.4	6.5	3.9	0.5	0.0	10.9	12.5	15
	30/35	460	3	28.0	3.5	3.3	0.0	0.0	6.8	7.7	15
	A	265	1	54.0	9.1	3.3	0.0	0.0	12.4	14.7	20
ZT030	00	208/230	1	73.0	13.1	3.9	0.0	0.0	17.0	20.3	30
	01	208/230	1	73.0	13.1	3.9	0.5	0.0	17.5	20.8	30
	10	208/230	1	73.0	13.1	3.9	0.0	4.0	21.0	24.3	35
	11	208/230	1	73.0	13.1	3.9	0.5	4.0	21.5	24.8	35
	20	208/230	3	58.0	8.7	3.9	0.0	0.0	12.6	14.8	20
	21	208/230	3	58.0	8.7	3.9	0.5	0.0	13.1	15.3	20
	30/35	460	3	28.0	4.3	3.3	0.0	0.0	7.6	8.7	15
	A	265	1	60.0	10.2	3.3	0.0	0.0	13.5	16.1	25
ZT036	00	208/230	1	83.0	15.6	3.9	0.0	0.0	19.5	23.4	35
	01	208/230	1	83.0	15.6	3.9	0.5	0.0	20.0	23.9	40
	10	208/230	1	83.0	15.6	3.9	0.0	4.0	23.5	27.4	40
	11	208/230	1	83.0	15.6	3.9	0.5	4.0	24.0	27.9	40
	20	208/230	3	73.0	11.6	3.9	0.0	0.0	15.5	18.4	30
	21	208/230	3	73.0	11.6	3.9	0.5	0.0	16.0	18.9	30
	30/35	460	3	38.0	5.7	3.3	0.0	0.0	9.0	10.4	15
	A	265	1	72.0	13.0	3.3	0.0	0.0	16.3	19.6	30
ZT042	00	208/230	1	96.0	17.9	5.9	0.0	0.0	23.8	28.3	45
	01	208/230	1	96.0	17.9	5.9	0.5	0.0	24.3	28.8	45
	10	208/230	1	96.0	17.9	5.9	0.0	5.5	29.3	33.8	50
	11	208/230	1	96.0	17.9	5.9	0.5	5.5	29.8	34.3	50
	20	208/230	3	88.0	14.2	5.9	0.0	0.0	20.1	23.7	35
	21	208/230	3	88.0	14.2	5.9	0.5	0.0	20.6	24.2	35
	30/35	460	3	44.0	6.2	4.8	0.0	0.0	11.0	12.6	15
ZT048	00	208/230	1	104.0	21.2	5.9	0.0	0.0	27.1	32.4	50
	01	208/230	1	104.0	21.2	5.9	0.5	0.0	27.6	32.9	50
	10	208/230	1	104.0	21.2	5.9	0.0	5.5	32.6	37.9	50
	11	208/230	1	104.0	21.2	5.9	0.5	5.5	33.1	38.4	60
	20	208/230	3	83.1	14.0	5.9	0.0	0.0	19.9	23.4	35
	21	208/230	3	83.1	14.0	5.9	0.5	0.0	20.4	23.9	35
	30/35	460	3	41.0	6.4	4.8	0.0	0.0	11.2	12.8	15
	A	265	1	109.7	16.0	4.8	0.0	0.0	20.8	24.8	40

Notes:
1. All line and low voltage wiring must adhere to the National Electrical Code and local codes, whichever is the most stringent.
2. In determining the correct supply wire size and maximum length, reference NFPA 70, Section 310. If the calculation is close to the maximum allowable ampacity of a particular wire size, use the next size up. This will ensure that no adverse effects occur, such as light dimming and/or shortened compressor life.
3. Min/Max Voltage: 208/230/60 = 187-252, 460/60 = 432-504, 265/60 = 249-291
4. See Wiring Diagrams for proper 460V power.
*The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 042-072 and two pumps for 024-036.

Section 4: Unit Data Information

Unit Electrical Data, ZT 060 - 072, ECM Models

Model	Voltage Code/ HWG Option	60 Hz Power		Compressor		Fan Motor FLA	HWG Pump FLA	Ext. Loop Pump FLA	Total Unit FLA	Min Circuit AMPS	Max Brkr HACR
		Volts	Phase	LRA	RLA						
ZT060	00	208/230	1	152.9	27.1	7.4	0.0	0.0	34.5	41.3	60
	01	208/230	1	152.9	27.1	7.4	0.5	0.0	35.0	41.8	60
	10	208/230	1	152.9	27.1	7.4	0.0	5.5	40.0	46.8	70
	11	208/230	1	152.9	27.1	7.4	0.5	5.5	40.5	47.3	70
	20	208/230	3	110.0	16.5	7.4	0.0	0.0	23.9	28.0	45
	21	208/230	3	110.0	16.5	7.4	0.5	0.0	24.4	28.5	45
	30/35	460	3	52.0	7.2	6.0	0.0	0.0	13.2	15.0	20
	A	265	1	130.0	22.4	6.0	0.0	0.0	28.4	34.0	50
ZT072	00	208/230	1	179.2	29.7	7.4	0.0	0.0	37.1	44.5	70
	01	208/230	1	179.2	29.7	7.4	0.5	0.0	37.6	45.0	70
	10	208/230	1	179.2	29.7	7.4	0.0	5.5	42.6	50.0	80
	11	208/230	1	179.2	29.7	7.4	0.5	5.5	43.1	50.5	80
	20	208/230	3	136.0	17.6	7.4	0.0	0.0	25.0	29.4	45
	21	208/230	3	136.0	17.6	7.4	0.5	0.0	25.5	29.9	45
	30/35	460	3	66.1	8.5	6.0	0.0	0.0	14.5	16.6	25

Notes:

1. All line and low voltage wiring must adhere to the National Electrical Code and local codes, whichever is the most stringent.
2. In determining the correct supply wire size and maximum length, reference NFPA 70, Section 310. If the calculation is close to the maximum allowable ampacity of a particular wire size, use the next size up. This will ensure that no adverse effects occur, such as light dimming and/or shortened compressor life.
3. Min/Max Voltage: 208/230/60 = 187-252, 460/60 = 432-504, 265/60 = 249-291
4. See Wiring Diagrams for proper 460V power.

*The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 042-072 and two pumps for 024-036.

Section 4: Unit Data Information

Unit Electrical Data, ZS 015 - 036, ECM Models

Model	Voltage Code/ HWG Option	60 Hz Power		Compressor		Fan Motor FLA	HWG Pump FLA	Ext. Loop Pump FLA	Total Unit FLA	Min Circuit AMPS	Max Brkr HACR
		Volts	Phase	LRA	RLA						
ZS015	00	208/230	1	26.0	5.5	3.9	0.0	0.0	9.4	10.8	15
	01	208/230	1	26.0	5.5	3.9	0.5	0.0	9.9	11.3	15
	10	208/230	1	26.0	5.5	3.9	0.0	4.0	13.4	14.8	20
	11	208/230	1	26.0	5.5	3.9	0.5	4.0	13.9	15.3	20
	A	265	1	28.0	5.0	3.3	0.0	0.0	8.3	9.6	15
ZS017	00	208/230	1	33.0	6.6	3.9	0.0	0.0	10.5	12.2	15
	01	208/230	1	33.0	6.6	3.9	0.5	0.0	11.0	12.7	15
	10	208/230	1	33.0	6.6	3.9	0.0	4.0	14.5	16.2	20
	11	208/230	1	33.0	6.6	3.9	0.5	4.0	15.0	16.7	20
	A	265	1	28.0	5.6	3.3	0.0	0.0	8.9	10.3	15
ZS018	00	208/230	1	48.0	9.0	3.9	0.0	0.0	12.9	15.2	20
	01	208/230	1	48.0	9.0	3.9	0.5	0.0	13.4	15.7	25
	10	208/230	1	48.0	9.0	3.9	0.0	4.0	16.9	19.2	25
	11	208/230	1	48.0	9.0	3.9	0.5	4.0	17.4	19.7	25
	A	265	1	43.0	7.1	3.3	0.0	0.0	10.4	12.2	15
ZS024	00	208/230	1	58.3	13.5	3.9	0.0	0.0	17.4	20.8	30
	01	208/230	1	58.3	13.5	3.9	0.5	0.0	17.9	21.3	35
	10	208/230	1	58.3	13.5	3.9	0.0	4.0	21.4	24.8	35
	11	208/230	1	58.3	13.5	3.9	0.5	4.0	21.9	25.3	35
	20	208/230	3	55.4	7.1	3.9	0.0	0.0	11.0	12.8	20
	21	208/230	3	55.4	7.1	3.9	0.5	0.0	11.5	13.3	20
	30/35	460	3	28.0	3.5	3.3	0.0	0.0	6.8	7.7	15
	A	265	1	54.0	9.0	3.3	0.0	0.0	12.3	14.6	20
ZS030	00	208/230	1	64.0	12.8	3.9	0.0	0.0	16.7	19.9	30
	01	208/230	1	64.0	12.8	3.9	0.5	0.0	17.2	20.4	30
	10	208/230	1	64.0	12.8	3.9	0.0	4.0	20.7	23.9	35
	11	208/230	1	64.0	12.8	3.9	0.5	4.0	21.2	24.4	35
	20	208/230	3	58.0	8.3	3.9	0.0	0.0	12.2	14.3	20
	21	208/230	3	58.0	8.3	3.9	0.5	0.0	12.7	14.8	20
	30/35	460	3	28.0	5.1	3.3	0.0	0.0	8.4	9.7	15
	A	265	1	60.0	10.9	3.3	0.0	0.0	14.2	16.9	25
ZS036	00	208/230	1	79.0	16.7	3.9	0.0	0.0	20.6	24.8	40
	01	208/230	1	79.0	16.7	3.9	0.5	0.0	21.1	25.3	40
	10	208/230	1	79.0	16.7	3.9	0.0	4.0	24.6	28.8	45
	11	208/230	1	79.0	16.7	3.9	0.5	4.0	25.1	29.3	45
	20	208/230	3	73.0	10.4	3.9	0.0	0.0	14.3	16.9	25
	21	208/230	3	73.0	10.4	3.9	0.5	0.0	14.8	17.4	25
	30/35	460	3	38.0	5.8	3.3	0.0	0.0	9.1	10.6	15
	A	265	1	72.0	13.5	3.3	0.0	0.0	16.8	20.2	30

Notes:
1. All line and low voltage wiring must adhere to the National Electrical Code and local codes, whichever is the most stringent.
2. In determining the correct supply wire size and maximum length, reference NFPA 70, Section 310. If the calculation is close to the maximum allowable ampacity of a particular wire size, use the next size up. This will ensure that no adverse effects occur, such as light dimming and/or shortened compressor life.
3. Min/Max Voltage: 208/230/60 = 187-252, 460/60 = 432-504, 265/60 = 249-291
4. See Wiring Diagrams for proper 460V power.
*The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 042-072 and two pumps for 015-036.

Section 4: Unit Data Information

Unit Electrical Data, ZS 042 - 072, ECM Models

Model	Voltage Code/ HWG Option	60 Hz Power		Compressor		Fan Motor FLA	HWG Pump FLA	Ext. Loop Pump FLA	Total Unit FLA	Min Circuit AMPS	Max Brkr HACR
		Volts	Phase	LRA	RLA						
ZS042	00	208/230	1	109.0	16.7	5.9	0.0	0.0	22.6	26.8	40
	01	208/230	1	109.0	16.7	5.9	0.5	0.0	23.1	27.3	40
	10	208/230	1	109.0	16.7	5.9	0.0	5.5	28.1	32.3	45
	11	208/230	1	109.0	16.7	5.9	0.5	5.5	28.6	32.8	45
	20	208/230	3	88.0	11.2	5.9	0.0	0.0	17.1	19.9	30
	21	208/230	3	88.0	11.2	5.9	0.5	0.0	17.6	20.4	30
	30/35	460	3	44.0	5.6	4.8	0.0	0.0	10.4	11.8	15
ZS048	00	208/230	1	130.0	19.6	5.9	0.0	0.0	25.5	30.4	50
	01	208/230	1	130.0	19.6	5.9	0.5	0.0	26.0	30.9	50
	10	208/230	1	130.0	19.6	5.9	0.0	5.5	31.0	35.9	50
	11	208/230	1	130.0	19.6	5.9	0.5	5.5	31.5	36.4	50
	20	208/230	3	83.1	13.7	5.9	0.0	0.0	19.6	23.0	35
	21	208/230	3	83.1	13.7	5.9	0.5	0.0	20.1	23.5	35
	30/35	460	3	41.0	6.2	4.8	0.0	0.0	11.0	12.6	15
ZS060	00	208/230	1	144.2	24.4	7.4	0.0	0.0	31.8	37.9	60
	01	208/230	1	144.2	24.4	7.4	0.5	0.0	32.3	38.4	60
	10	208/230	1	144.2	24.4	7.4	0.0	5.5	37.3	43.4	60
	11	208/230	1	144.2	24.4	7.4	0.5	5.5	37.8	43.9	60
	20	208/230	3	110.0	16.0	7.4	0.0	0.0	23.4	27.4	40
	21	208/230	3	110.0	16.0	7.4	0.5	0.0	23.9	27.9	40
	30/35	460	3	52.0	7.8	6.0	0.0	0.0	13.8	15.8	20
ZS072	00	208/230	1	178.0	30.8	7.4	0.0	0.0	38.2	45.9	70
	01	208/230	1	178.0	30.8	7.4	0.5	0.0	38.7	46.4	70
	10	208/230	1	178.0	30.8	7.4	0.0	5.5	43.7	51.4	80
	11	208/230	1	178.0	30.8	7.4	0.5	5.5	44.2	51.9	80
	20	208/230	3	136.0	19.6	7.4	0.0	0.0	27.0	31.9	50
	21	208/230	3	136.0	19.6	7.4	0.5	0.0	27.5	32.4	50
	30/35	460	3	66.1	8.2	6.0	0.0	0.0	14.2	16.3	20

Notes:
1. All line and low voltage wiring must adhere to the National Electrical Code and local codes, whichever is the most stringent.
2. In determining the correct supply wire size and maximum length, reference NFPA 70, Section 310. If the calculation is close to the maximum allowable ampacity of a particular wire size, use the next size up. This will ensure that no adverse effects occur, such as light dimming and/or shortened compressor life.
3. Min/Max Voltage: 208/230/60 = 187-252, 460/60 = 432-504, 265/60 = 249-291
4. See Wiring Diagrams for proper 460V power.
*The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 042-072 and two pumps for 015-036.

Section 4: Unit Data Information

Unit Electrical Data, ZS 006 - 030, PSC Models

Model	Voltage Code/ HWG Option	60 Hz Power		Compressor		Fan Motor FLA	HWG Pump FLA	Ext. Loop Pump FLA	Total Unit FLA	Min Circuit AMPS	Max Brkr HACR
		Volts	Phase	LRA	RLA						
ZS006	00	208/230	1	17.7	2.5	0.8	0.0	0.0	3.3	3.9	15
	10	208/230	1	17.7	2.5	0.8	0.0	4.0	7.3	7.9	15
	A0	265	1	13.5	2.1	0.7	0.0	0.0	2.8	3.3	15
	90	115	1	36.2	5.0	1.5	0.0	0.0	6.5	7.8	15
ZS009	00	208/230	1	22.2	3.6	0.8	0.0	0.0	4.4	5.3	15
	10	208/230	1	22.2	3.6	0.8	0.0	4.0	8.4	9.3	15
	A0	265	1	17.5	3.4	0.7	0.0	0.0	4.1	5.0	15
	90	115	1	45.6	7.7	1.5	0.0	0.0	9.2	11.1	15
ZS012	00	208/230	1	32.5	5.6	0.8	0.0	0.0	6.4	7.8	15
	10	208/230	1	32.5	5.6	0.8	0.0	4.0	10.4	11.8	15
	A0	265	1	22.2	3.8	0.7	0.0	0.0	4.5	5.5	15
	90	115	1	63.0	11.8	1.5	0.0	0.0	13.3	16.3	25
ZS015	00	208/230	1	26.0	5.5	1.5	0.0	0.0	7.0	8.4	15
	01	208/230	1	26.0	5.5	1.5	0.5	0.0	7.5	8.9	15
	10	208/230	1	26.0	5.5	1.5	0.0	4.0	11.0	12.4	15
	11	208/230	1	26.0	5.5	1.5	0.5	4.0	11.5	12.9	15
	A	265	1	28.0	5.0	2.0	0.0	0.0	7.0	8.3	15
ZS017	00	208/230	1	33.0	6.6	1.5	0.0	0.0	8.1	9.8	15
	01	208/230	1	33.0	6.6	1.5	0.5	0.0	8.6	10.3	15
	10	208/230	1	33.0	6.6	1.5	0.0	4.0	12.1	13.8	20
	11	208/230	1	33.0	6.6	1.5	0.5	4.0	12.6	14.3	20
	A	265	1	28.0	5.6	2.0	0.0	0.0	7.6	9.0	15
ZS018	00	208/230	1	48.0	9.0	1.5	0.0	0.0	10.5	12.8	20
	01	208/230	1	48.0	9.0	1.5	0.5	0.0	11.0	13.3	20
	10	208/230	1	48.0	9.0	1.5	0.0	4.0	14.5	16.8	25
	11	208/230	1	48.0	9.0	1.5	0.5	4.0	15.0	17.3	25
	A	265	1	43.0	7.1	2.0	0.0	0.0	9.1	10.9	15
ZS024	00	208/230	1	58.3	13.5	1.9	0.0	0.0	15.4	18.8	30
	01	208/230	1	58.3	13.5	1.9	0.5	0.0	15.9	19.3	30
	10	208/230	1	58.3	13.5	1.9	0.0	4.0	19.4	22.8	35
	11	208/230	1	58.3	13.5	1.9	0.5	4.0	19.9	23.3	35
	20	208/230	3	55.4	7.1	1.9	0.0	0.0	9.0	10.8	15
	21	208/230	3	55.4	7.1	1.9	0.5	0.0	9.5	11.3	15
	30/35	460	3	28.0	3.5	0.9	0.0	0.0	4.4	5.3	15
	40/45	575	3	24.5	2.9	1.1	0.0	0.0	4.0	4.7	15
	A	265	1	54.0	9.0	2.2	0.0	0.0	11.2	13.5	20
ZS030	00	208/230	1	64.0	12.8	1.9	0.0	0.0	14.7	17.9	30
	01	208/230	1	64.0	12.8	1.9	0.5	0.0	15.2	18.4	30
	10	208/230	1	64.0	12.8	1.9	0.0	4.0	18.7	21.9	35
	11	208/230	1	64.0	12.8	1.9	0.5	4.0	19.2	22.4	35
	20	208/230	3	58.0	8.3	1.9	0.0	0.0	10.2	12.3	20
	21	208/230	3	58.0	8.3	1.9	0.5	0.0	10.7	12.8	20
	30/35	460	3	28.0	5.1	0.9	0.0	0.0	6.0	7.3	15
	40/45	575	3	23.7	3.3	1.1	0.0	0.0	4.4	5.2	15
	A	265	1	60.0	10.9	2.2	0.0	0.0	13.1	15.8	25

Notes:
1. All line and low voltage wiring must adhere to the National Electrical Code and local codes, whichever is the most stringent.
2. In determining the correct supply wire size and maximum length, reference NFPA 70, Section 310. If the calculation is close to the maximum allowable ampacity of a particular wire size, use the next size up. This will ensure that no adverse effects occur, such as light dimming and/or shortened compressor life.
3. Min/Max Voltage: 208/230/60 = 187-252, 460/60 = 432-504, 265/60 = 249-291, 115/60 = 108/126
4. See Wiring Diagrams for proper 460V power.
*The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 048-072 and two pumps for 006-030.

Section 4: Unit Data Information

Unit Electrical Data, ZS 036 - 072, PSC Models

Model	Voltage Code/ HWG Option	60 Hz Power		Compressor		Fan Motor FLA	HWG Pump FLA	Ext. Loop Pump FLA	Total Unit FLA	Min Circuit AMPS	Max Brkr HACR
		Volts	Phase	LRA	RLA						
ZS036	00	208/230	1	79.0	16.7	1.9	0.0	0.0	18.6	22.8	35
	01	208/230	1	79.0	16.7	1.9	0.5	0.0	19.1	23.3	40
	10	208/230	1	79.0	16.7	1.9	0.0	4.0	22.6	26.8	40
	11	208/230	1	79.0	16.7	1.9	0.5	4.0	23.1	27.3	40
	20	208/230	3	73.0	10.4	1.9	0.0	0.0	12.3	14.9	25
	21	208/230	3	73.0	10.4	1.9	0.5	0.0	12.8	15.4	25
	30/35	460	3	38.0	5.8	0.9	0.0	0.0	6.7	8.2	15
	40/45	575	3	36.5	3.8	1.1	0.0	0.0	4.9	5.9	15
	A	265	1	72.0	13.5	2.2	0.0	0.0	15.7	19.1	30
ZS042	00	208/230	1	109.0	16.7	2.9	0.0	0.0	19.6	23.8	40
	01	208/230	1	109.0	16.7	2.9	0.5	0.0	20.1	24.3	40
	10	208/230	1	109.0	16.7	2.9	0.0	5.5	25.1	29.3	45
	11	208/230	1	109.0	16.7	2.9	0.5	5.5	25.6	29.8	45
	20	208/230	3	88.0	11.2	2.9	0.0	0.0	14.1	16.9	25
	21	208/230	3	88.0	11.2	2.9	0.5	0.0	14.6	17.4	25
	30/35	460	3	44.0	5.6	1.2	0.0	0.0	6.8	8.2	15
	40/45	575	3	34.0	3.8	1.0	0.0	0.0	4.8	5.8	15
ZS048	00	208/230	1	130.0	19.6	4.0	0.0	0.0	23.6	28.5	45
	01	208/230	1	130.0	19.6	4.0	0.5	0.0	24.1	29.0	45
	10	208/230	1	130.0	19.6	4.0	0.0	5.5	29.1	34.0	50
	11	208/230	1	130.0	19.6	4.0	0.5	5.5	29.6	34.5	50
	20	208/230	3	83.1	13.7	4.0	0.0	0.0	17.7	21.1	35
	21	208/230	3	83.1	13.7	4.0	0.5	0.0	18.2	21.6	35
	30/35	460	3	41.0	6.2	2.1	0.0	0.0	8.3	9.9	15
	40/45	575	3	33.0	4.8	3.1	0.0	0.0	7.9	9.1	15
ZS060	00	208/230	1	144.2	24.4	5.6	0.0	0.0	30.0	36.1	60
	01	208/230	1	144.2	24.4	5.6	0.5	0.0	30.5	36.6	60
	10	208/230	1	144.2	24.4	5.6	0.0	5.5	35.5	41.6	60
	11	208/230	1	144.2	24.4	5.6	0.5	5.5	36.0	42.1	60
	20	208/230	3	110.0	16.0	5.6	0.0	0.0	21.6	25.6	40
	21	208/230	3	110.0	16.0	5.6	0.5	0.0	22.1	26.1	40
	30/35	460	3	52.0	7.8	2.6	0.0	0.0	10.4	12.4	20
	40/45	575	3	38.9	5.7	2.1	0.0	0.0	7.8	9.2	15
ZS072	00	208/230	1	178.0	30.8	5.6	0.0	0.0	36.4	44.1	70
	01	208/230	1	178.0	30.8	5.6	0.5	0.0	36.9	44.6	70
	10	208/230	1	178.0	30.8	5.6	0.0	5.5	41.9	49.6	80
	11	208/230	1	178.0	30.8	5.6	0.5	5.5	42.4	50.1	80
	20	208/230	3	136.0	19.6	5.6	0.0	0.0	25.2	30.1	50
	21	208/230	3	136.0	19.6	5.6	0.5	0.0	25.7	30.6	50
	30/35	460	3	66.1	8.2	2.6	0.0	0.0	10.8	12.9	20
	40/45	575	3	55.3	6.6	2.1	0.0	0.0	8.7	10.4	15

Notes:

1. All line and low voltage wiring must adhere to the National Electrical Code and local codes, whichever is the most stringent.
2. In determining the correct supply wire size and maximum length, reference NFPA 70, Section 310. If the calculation is close to the maximum allowable ampacity of a particular wire size, use the next size up. This will ensure that no adverse effects occur, such as light dimming and/or shortened compressor life.
3. Min/Max Voltage: 208/230/60 = 187-252, 460/60 = 432-504, 265/60 = 249-291, 115/60 = 108-126
4. See Wiring Diagrams for proper 460V power.

*The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 048-072 and two pumps for 006-036.

Section 5: Unit Piping Installation

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.

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).

Note: PVC is not allowed on pressurized systems.

WATER QUALITY TABLE

Potential	Problem Chemical(s) or Condition	Range for Copper Heat Exchangers	Range for Cupro-Nickel Heat Exchangers	Range for Stainless Steel BPHE
Scaling	Calcium & Magnesium	Less than 350 ppm	Less than 350 ppm	Less than 0.1 ppm
	pH Range	7 - 9	7 - 9	7 - 9
Corrosion	Total Dissolved Solids	Less than 1000 ppm	Less than 1500 ppm	No rigid setpoint
	Ammonia, Ammonium Hydroxide	Less than 0.5 ppm	Less than 0.5 ppm	No Limit
	Ammonium Chloride, Ammonium	Less than 0.5 ppm	Less than 0.5 ppm	Less than 2-20 ppm
	Calcium Chloride / Sodium	Less than 125 ppm	Less than 125 ppm	Not Allowed
	Chlorine	Less than 0.5 ppm	Less than 0.5 ppm	Not Allowed
	Hydrogen Sulfide	None Allowed	None Allowed	Less than 0.05 ppm
Biological	Iron Bacteria	None Allowed	None Allowed	Not Allowed
	Iron Oxide	Less than 1 ppm	Less than 1 ppm	Less than 0.2 ppm
Erosion	Suspended Solids	Less than 10 ppm	Less than 10 ppm	16-20 mesh strainer recommended
	Water Velocity	Less than 8ft/s	Less than 12 ft/s	Less than 5.5 m/s in the port

1. Hardness in ppm is equivalent to hardness in mg/l.Notes
2. Grains/gallon = ppm divided by 17.1.
3. Unit internal heat exchangers are not recommended for pool applications or water outside the range of the table. Secondary heat exchangers are required for pool or other 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.
5. Filter for maximum of 600 micron size.

Section 5: Unit Piping Installation

PIPE INSULATION TABLE

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

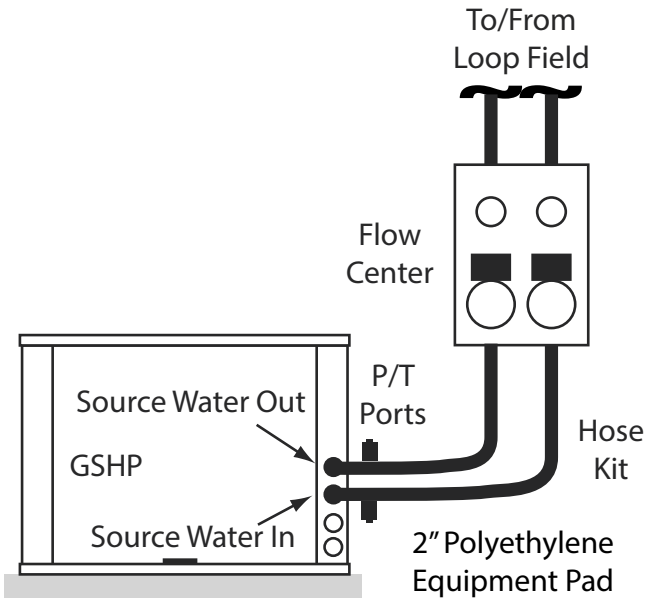
The flow centers are insulated and contain all flushing and circulation connections for residential and light commercial earth loops that require a flow rate of no more than 20 gpm. 1-1/4” fusion x 1” double o-ring fittings (AGA6PES) are furnished with the double o-ring flow centers for HDPE loop constructions.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

Note: Threaded flow centers all have 1” FPT connections. Matching hose kits come with the AGBA55 adapter needed to transition from 1” FPT to 1” hose.

Typical Non-Pressurized Flow Center Installation

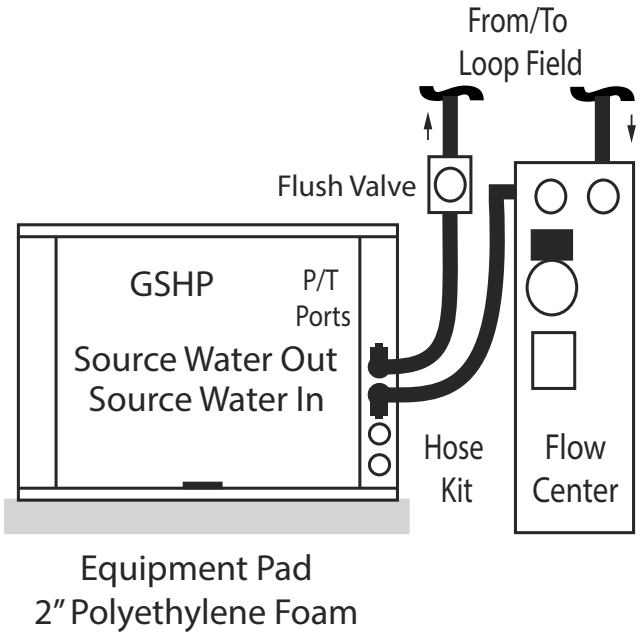
Standing column flow centers are designed to operate with no static pressure on the earth loop. The design is such that the column of water in the flow center is enough pressure to prime the pumps for proper system operation and pump reliability. The flow center does have a cap/seal, so it is still a 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.

Typical Pressurized Unit Piping Connection



Note: P/T ports should be angled away from the unit for ease of gauge reading.

Typical Non-Pressurized Unit Piping Connection



Section 5: Unit Piping Installation

Wye Strainer Installation (MANDATORY ON UNITS WITH BPHE)

Enertech provides a Wye Strainer and 4" brass nipple which must be installed on the Source Side input. Failure to do so may cause fouling of the heat exchanger, shorten unit life expectancy and void the warranty. Proper orientation is shown in the picture. Always point the screen leg toward the unit and straight down. Use caution to assure clearance for strainer screen removal and hanger bracket use is maintained. Wye strainer is required only on units utilizing a BPHE source coil. Units utilizing a COAX as the source coil do not require the use of a wye strainer.

Pressurized Flow Center and Pump Mounting

The flow center can be mounted with the flow paths either vertical or horizontal (see Figure 4). However, the flow center cannot be mounted on its back, upside down, or at an angle, as premature pump failure will occur when the pump shaft is not in the horizontal position.

Figure 4: Acceptable mounting positions for Flo-Link and GPM series flow centers

Equally important to pump longevity is terminal box orientation. See Figure 5, for proper control box orientation. The pump terminal box must be located in a position to avoid condensation running into the control box, and also to take advantage of the "weep holes" designed to drain any condensation that may have formed (Figure 6). "Weep holes" are located on three sides of the pump.

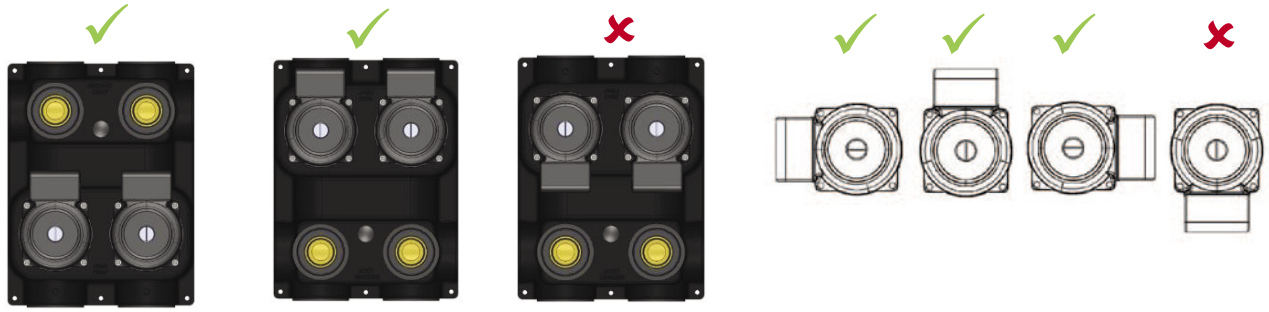


Figure 5: Acceptable terminal box locations for UPS26-99, UP26-99, and UP26-116 pumps.

Section 5: Unit Piping Installation

Flushing & Charging a Pressurized Flow Center

The Enertech Manufacturing flush cart has been designed to effectively and efficiently flush the earth loop and to facilitate injecting and mixing of the antifreeze. The single most important element in flow center reliability is the ability to remove all the air and debris from the loop and to provide the proper working pressure.

Removing Debris During Flushing

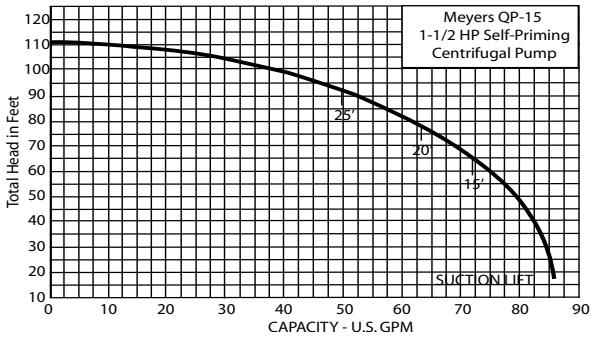
Most flow center or pump failures are a result of poor water quality or debris. Debris entering the loop during fusion and installation can cause noise and premature pump failure. Enertech recommends a double flush filtering method during purging. When purging, use a 100 micron bag filter until air bubbles are removed. Remove the 100 micron bag, replace it with a 1 micron bag and restart the flushing.

Features of the flush cart:

Cylinder: HDPE, SDR15.5, 10" dia. (10 Gallons)
Pump: Myers High Head QP15, 1.5hp, 115V
Hose connections: Cam Lock quick connects - 1-1/2" hoses
Hand Truck: 600lb rating with pneumatic tires
Wiring: Liquid Tight metal on/off switch
Tubing: SDR11 HDPE
Connections: 2 - 3/4" connections for antifreeze and discharge
Drain: one on the pump and the tank

Enertech Flush Cart

Flush Cart Pump Curve Chart



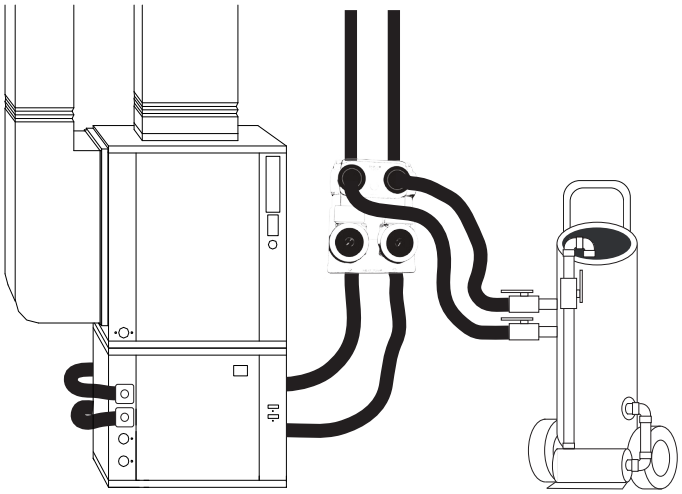
Step 1: Flushing the Earth Loop

- Connect flush cart hoses to flow center flush ports using proper adapters #AGAFP.
- Connect water supply to hose connection on return line of flush cart.
- Turn both 3-way valves on flow center to flush ports and loop position.
- Turn on water supply (make sure water is of proper quality).
- As the reservoir fills up, turn the pump on and off, sucking the water level down. Do not allow the water level to drop below intake fitting to the pump.
- Once the water level remains above the water outlet in the reservoir leave the pump running continuously.
- Once the water level stays above the "T" in the reservoir, turn off the water supply (this also allows observation of air bubbles).
- Run the pump for a minimum of 2 hours for proper flushing and purging (depending on system size it may take longer).
- "Dead head" the pump every so often and watch the water level in the reservoir. Once all the air is removed there should not be more than a 1" to 2" drop in water level in the reservoir. If there is more than a 2" drop, air is still trapped in the system. This is the only way to tell if air is still trapped in the system.
- To dead head the pump, shut off the return side ball valve on the flush cart. This will provide a surge in pressure to the system piping, helping to get the air bubbles moving. Do not reverse flow during flushing.

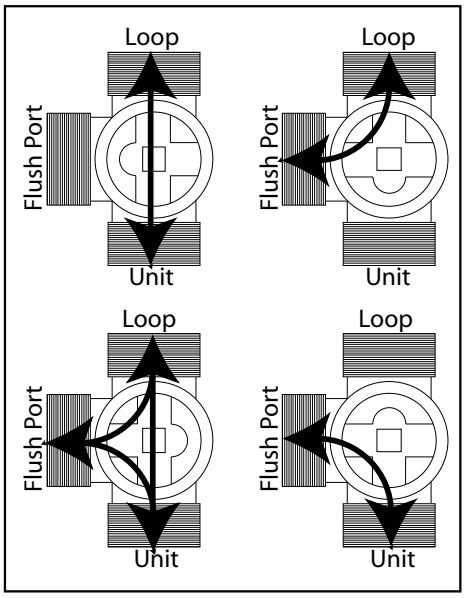
Water Quality: Even on a closed loop system water quality is an issue. The system needs to be filled with clean water. If the water on site has high iron content, high hardness, or the PH is out of balance, premature pump failure may result. Depending upon water quality, it may need to be brought in from off site.

Section 5: Unit Piping Installation

Flush Cart Connections



Flow Center 3-Way Valves



Step 2: Flushing the Unit

1. Turn off the pump on the flush cart.
2. Turn both 3-way valves to the unit and flush port position.
3. Turn the pump back on. It may be necessary to turn the water supply back on to keep the water level in the reservoir above the return tee.
4. This should only take 5 to 10 minutes to purge the unit.
5. Once this is done, the entire system is now full of water, and the flush cart pump may be turned off.

Step 3: Adding Antifreeze by Displacement

If the antifreeze was not added when the loop was being filled, it will be necessary to follow the next few steps.

1. Turn both 3-way "Ts" back to the original position for flushing the loop only.
2. Close the return side ball valve on the flush cart.
3. Connect hose to the return side discharge line and run it to a drain. Open the ball valve on discharge line on flush cart.
4. Turn pump on until water level is sucked down just above the water outlet in the reservoir, and turn pump off. Be sure not to suck air back into the system.
5. Fill the reservoir back up with the antifreeze.
6. Repeat steps 5 and 6 until all the antifreeze is in the system and reservoir.
7. Turn the discharge line ball valve off at the flush cart. Turn the return line ball valve back to the on position.
8. It may be necessary to add some water into the reservoir to keep the water level above the return tee so that the solution does not foam.
9. The system must be run for 3 to 4 hours to mix the antifreeze and water in the reservoir. The fluid will not mix inside the loop.
10. Check the antifreeze level every so often to insure that the proper amount was added to the system (see antifreeze charging on page 40).

Step 4: Final Pressurization of System

Once all of the air and debris has been removed, and the antifreeze has been added and mixed, the system is ready for final pressurization.

1. Turn one of the 3-way valves so that it is open to all 3 ports, the unit, loop, and flush port. Turn the other valve so it is only open to the loop and flush port (pressure is also applied to the hose kit in this arrangement).
2. Turn the flush cart pump on and allow the system to start circulating.
3. With the pump running, turn the return line ball valve to the off position on the flush cart, "dead heading" the pump.
4. There should be a maximum of 1" to 2" inches of drop in the water level in the reservoir. This only takes about 3-5 seconds.
5. Next, turn the supply line ball valve to the off position on the flush cart (isolates the flow center from the flush cart).
6. Now that the system is isolated from the reservoir the pump can be turned off. Do not open the main flush cart ball valves yet.
7. Connect the water supply back to the discharge line hose connection, and open the ball valve. Turn on the water supply and leave it on for 20 to 30 minutes. This will stretch the pipe properly to insure that the system will not have a "flat" loop during cooling operation.

8. Once the loop is pressured (recommended pressure on initial start up is 50 to 70 psi), turn the water supply off. Turn off the discharge line ball valve, and disconnect the water supply. Maximum pressure should never exceed 100 psi under any circumstance!
9. Turn the 3-way valves on the flow center back to the normal operation mode, which closes the flush port connections.
10. Open the ball valves on the flush cart to relieve pressure on the hoses. Disconnect the hoses from the flow center.

Note: Pressurized flow centers and Grundfos UP series pumps need a minimum of 3psi on the suction side of the pump to operate. Maximum operating pressure is 100 psi.

Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the summer months. In the cooling mode the heat pump is rejecting heat, which relaxes the pipe. This fluctuation is normal and needs to be considered when charging and pressuring the system initially. Typical operating pressures of an earth loop are 15 to 50 psi.

Note: Burping pump(s): On flow center initial start up, the pumps must be bled of air. Start the system and remove the bleed screw from the back side of the pump(s). This allows any trapped air to bleed out. It also floods the pump shaft, and keeps the pump(s) cool. Failure to do this could result in premature pump failure.

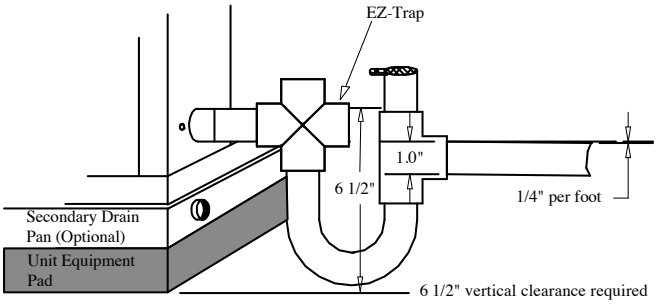
Flushing the Interior Piping (Non-Pressurized)

Do not use the flush cart to purge the interior piping and flow center in a non-pressurized system. Once the loop has been flushed the ball valves may be opened above the flush ports. Take a garden hose from the flush port connected to the water out to the loop pipe, and run the other end of the hose into the top of the canister. Fill the canister with water and turn the pumps on. Continue to fill the canister until the water level stays above the dip tube. Once filling is complete, remove the hose and close the flush port. Turn the system on. Any air that may still be in the system will burp itself out of the top of the canister. Leave the top open for the first 1/2 hour of run time to ensure that all of the air is bled out. Tighten the cap on the flow center to complete the flushing and filling procedure (hand tighten only -- do not use a wrench).

Condensation Drain Connection

Follow all local plumbing codes. Connecting the EZ-Trap (ACDT1A - EZ-Trap ¾" Kit, ACDT2A - EZ-Trap 1" Kit) to the condensate drain requires a minimum 6 1/2 inches of vertical clearance. The drain must be pitched away from the unit a minimum of 1/4" per foot. For full instructions see EZ-Trap Kit installation sheet.

Condensation Drain Connection Example



Section 5: Unit Piping Installation

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 Pipe Fluid Volume and Antifreeze Percentages by Volume Tables on 41 page 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.

Notes:
- Consult with your representative or distributor if you have any questions regarding antifreeze selection or use.
- 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 the **Pipe Fluid Volume Table on page 41** 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 **(See Antifreeze Percentages by Volume Table on page 41)** for the freeze protection required in your area. Then, double check calculations during installation with the proper hydrometer and specific gravity chart **(See Antifreeze Specific Gravity Table on page 41**) to determine if the correct amount of antifreeze was added.

Section 5: Unit Piping Installation

Pipe Fluid Volume, Antifreeze Percentages, and Antifreeze Specific Gravity chart(s)

Pipe Fluid Volume Table

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

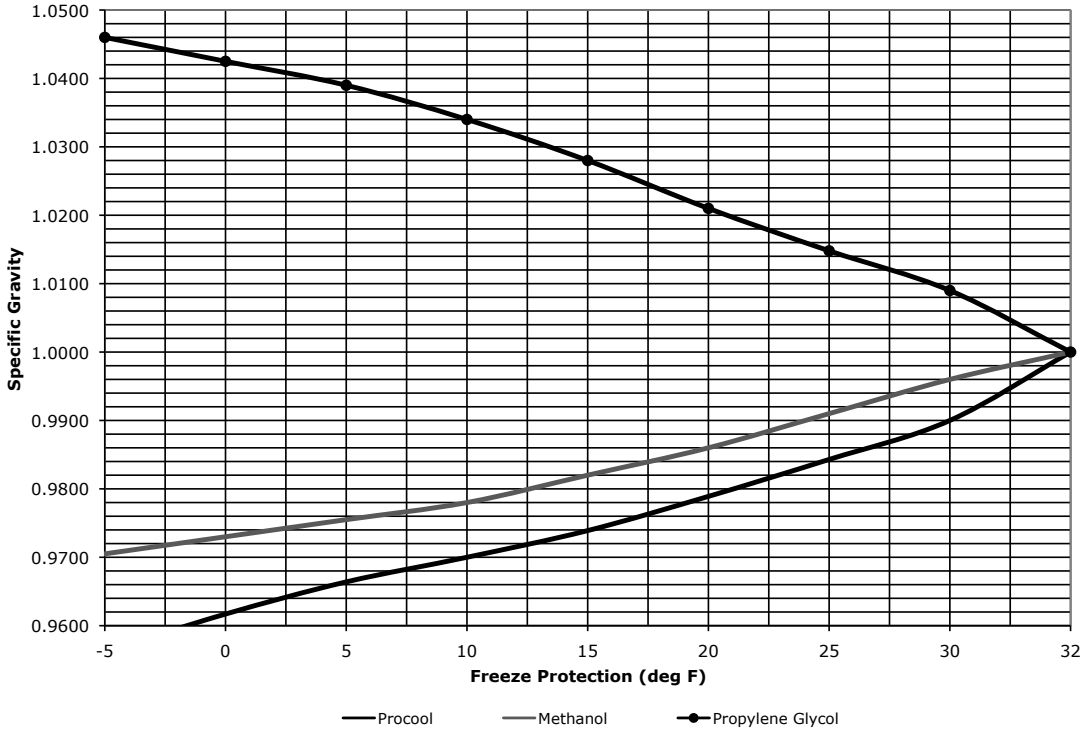
Unit coaxial heat exchanger = 1 Gallon
Flush Cart = 8-10 Gallons
10' of 1" Rubber Hose = 0.4 Gallons

Antifreeze Percentages by Volume Table

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%
Heat Transfer Fluid (HTF)	Mix according to manufacturer's directions on container label			

Antifreeze solutions are shown in pure form - not premixed
HTF is a premixed Methanol solution

Antifreeze Specific Gravity Table



Section 5: Unit Piping Installation

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.

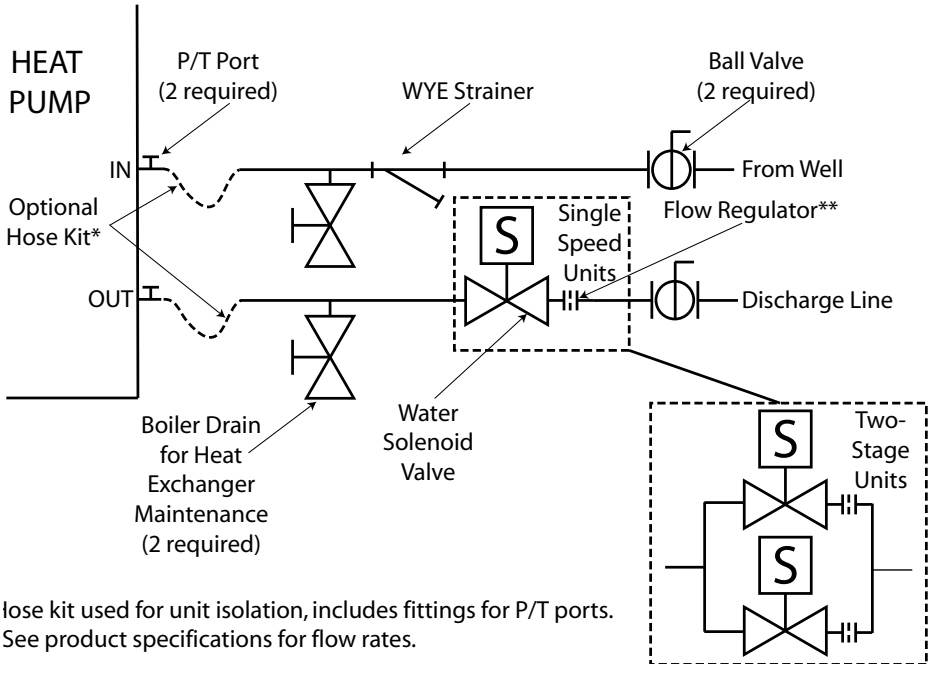
Other necessary components include a strainer, boiler drains for heat exchanger flushing, P/T ports and ball valves. Ball valves allow the water to be shut off for service, and also help when velocity noise is noticeable through the flow regulator. Spreading some of the pressure drop across the ball 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 part load 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 part load, 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.

Open Loop Piping Example



lose kit used for unit isolation, includes fittings for P/T ports. See product specifications for flow rates.

Note:

- When sizing the first stage flow regulator, be sure to allow enough flow to close the flow switch. If takes a minimum of 3.5 GPM to close the flow switch.
- Smaller tonnage two-stage units may only utilize one solenoid valve and flow regulator.

Section 5: Unit Piping Installation

Hot Water Generator (HWG) Installation

Units that ship with a factory installed Hot Water Generator (HWG) must be connected to a water heater/storage tank. Follow the installation instructions (part # 20D052-01NN) included with the Hot Water Generator (HWG) Fitting Kit shipped in every Hot Water Generator (HWG) equipped unit.

Contents of the Hot Water Generator (HWG)Fitting Kit:
(1) p/n 20D052-01NN, Installation Instructions
(1) p/n 33P211-01BN, 3/4"x 3/4"x 3/4" FPT Brass Tee
(1) p/n 33P210-01NN, ¾" Boiler Drain Valve
(1) p/n 11080005001, ¾" MPT x 3-1/2" Brass Nipple
(3) p/n 11080006001, ½" SWT x ¾" MPT Copper Adaptor
(1) p/n 11080007001, ¾" x ¾" x ½" SWT Copper Tee

Notes:

- Copper is the only approved material for Hot Water Generator (HWG) piping.
- Units that are shipped with a Hot Water Generator (HWG) do not have the Hot Water Generator (HWG) pump wires connected to the electrical circuit, to prevent accidentally running the pump while dry. The wet rotor pump has to be connected to the electric circuit (master contactor) after the lines from the water heater are installed, filled with water & all air is purged from the system.
- Hot Water Generator (HWG) capacity is based on 0.4 GPM Flow per nominal ton at 90°F entering hot water temperature.

Plumbing Installation

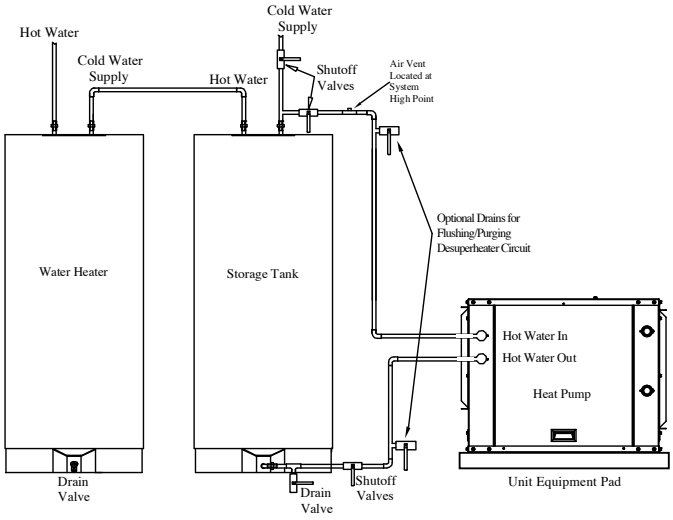
Notes:

- All plumbing and piping connections must comply with local building and plumbing codes.
- 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.

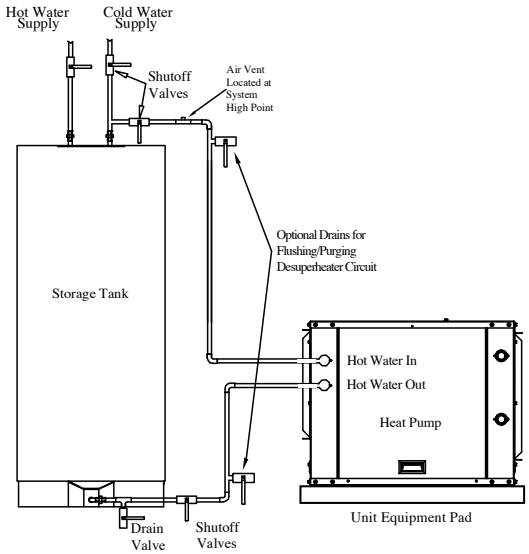
⚠ WARNING ⚠

IT IS RECOMMENDED THAT AN ANTI-SCALD MIXING VALVE IS INSTALLED ON THE HOT WATER SUPPLY LINE INTO THE HOME. EVEN THOUGH HOT WATER TANK TEMPERATURES COULD APPEAR TO BE SET AT LOWER LEVELS, HIGH TEMPERATURE WATER FROM THE HOT WATER GENERATOR (HWG) COULD RAISE TANK TEMPERATURES TO UNSAFE LEVELS.

Hot Water Generator (HWG) Installation with Preheat Tank



Hot Water Generator (HWG) Installation with Water Heater



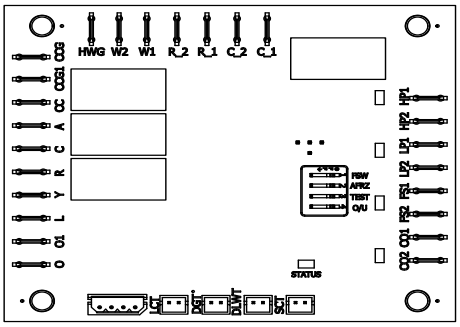
Note: All enertech Hot Water Generator (HWG) refrigerant to water heat exchangers are double walled and vented for use in potable water systems.

Section 6: Controls

Features

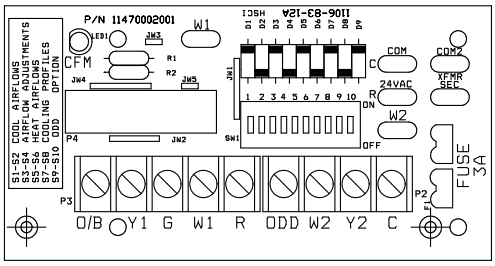
Enertech Global geothermal heat pump controls leverage a modular approach for controlling heat pump operation. The control system uses a combination of printed circuit boards, depending upon the features equipped in a particular unit. This approach simplifies installation and troubleshooting, and eliminates features that are not applicable for some units.

Lockout Board



The Lockout Board controls the inputs to the unit as well as outputs for current mode, faults, and diagnostics. A status LED and different combination of four LEDs for each fault are provided for diagnostics. The Lockout Board Terminal (L) puts out the number of corresponding 24VAC pulses to indicate the Lockout condition on the Thermostat (if equipped and wired).

ECM Control Board



Water-to-air models equipped with an electrically commutated motor (ECM) use an ECM control board providing field selectable airflow and dehumidification mode. The green LED on the ECM fan control board flashes one time per 100 cubic feet per minute (CFM) when the fan is operating to indicate airflow.

Startup/Random Start

The unit will not operate until all the inputs and safety controls are checked for normal conditions. A ten to twenty second random start delay is added at power up and whenever a Y1 call is received. This avoids multiple units from being energized at the outs.

Short Cycle Protection

A built-in five minute anti-short cycle (ASC) timer provides short cycle protection ensuring that the compressor isn't damaged due to rapid cycling.

Component Sequencing Delays

Components are sequenced and delayed for reduction in surge current, and to reduce startup noise of the system. The accessory terminal on the Lockout Board engages 10 seconds prior to the compressor. This provides increased time for items such as external pumps to provide adequate water flow prior to the system starting.

Test Mode

The Lockout Board allows the technician to shorten timing delays for faster diagnostics by placing the DIP switch 'TEST' switch in the ON position (See 'Settings' section). It should be moved back to OFF for normal operation after testing. The status LED will not be illuminated during the TEST mode.

Water Solenoid Valve Connections

If equipped, the accessory terminal strip provides a field connection for a valve with an end switch, which is recommended (see wiring diagram). An accessory relay terminal, "A", can be used for solenoid valves without an end switch. This terminal is energized 10 seconds before the compressor contactor. A valve without an end switch could cause a water hammer effect and is not recommended.

Humidifier/Dehumidification Connections

Connections for a humidistat are provided for some models, which automatically engage 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 of the variable speed ECM fan motor, which automatically lowers the fan speed when the space humidity is higher than the humidistat set point. Either connection may be used with a thermostat that includes humidifier/ dehumidification outputs.

Safety

The lockout board receives feedback signals for high pressure, low pressure, load heat exchanger temperature, source heat exchanger temperature, condensate overflow, and hot gas temperature faults. Upon a continuous 10-second measurement of all faults (except the high pressure) the compressor operation is suspended. The high pressure fault is tripped instantly. The different combination of LED(s) indicate each temporary fault.

Once the unit is locked out (see fault retry page 46), the Lockout Board outputs a number of 24VAC pulses equal to the numbered fault code.

Low Pressure (LP)
If the low pressure switch is open continuously for 10 seconds, the compressor operation will be interrupted and the control will go into fault retry mode. At startup, the low pressure switch monitoring is suspended for 30 seconds to avoid nuisance faults. However, if the low pressure switch is open before startup then the unit will not start upon receiving an Y1 call and will lock out instead.

Flow Switch (FS)
A flow switch ensures the source water maintains the minimum required flow rate. This ensures that pumps are working and water connections remain intact. The flow switch will also trip when the source water begins to freeze, providing additional protection. A Flow Switch is utilized on units with a BPHE source coil. A Flow Switch is not included on units utilizing a COAX source coil.

High Pressure (HP)
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 between the time the switch opens and the board entering into fault retry mode. There is also no delay of switch monitoring at startup. (If the high pressure switch is open before startup then the unit will not start upon receiving an Y1 call and will lock out instead.)

Load Heat Exchanger Freeze (LCT)
When in cooling mode, if the heat exchanger temperature is lower than 30°F for 10 continuous seconds, the compressor operation will be interrupted, and the control will go into fault retry mode. This sensor is located on the refrigerant line in between the heat exchanger and TXV (refrigerant inlet of heat exchanger in cooling mode).

Source Heat Exchanger Freeze (SCT)
When in heating mode, if the heat exchanger is lower than the setpoint for 10 continuous seconds, the compressor operation will be interrupted, and the control will go into fault retry mode. The setpoint is 12°F for closed loop (DIP switch AFRZ = ON) and 30°F for open loop (DIP switch AFRZ = OFF). At startup, the flow sensor is not monitored for 30 seconds to avoid nuisance faults. This sensor is located on the refrigerant line in between the source heat exchanger and TXV (refrigerant inlet of heat exchanger in heating mode)

Condensate Overflow (CO)
The control board utilizes a sensor at the top of the drain pan to sense conductivity of liquid.

When water touches the sensor it completes the circuit and CO fault occurs. If the fault is present for 10 continuous seconds, the lockout board indicates condensate overflow fault. The control will go into fault retry mode. There is no delay of switch monitoring at startup.
Hot Discharge Gas Temperature (DGT)
When the hot discharge gas temperature is above 220°F for 30 continuous seconds, the compressor operation will be interrupted. The control will go into fault retry mode.
Desuperheater Leaving Water Temp (DLWT)
If equipped, controls monitor the desuperheater leaving water temperature (DLWT). The hot water generator pump is de-energized when the leaving water temperature (DLWT) is above 130°F or when the compressor discharge line (DGT) is cooler than leaving water temperature (DLWT).

Note: If not equipped with desuperheater, a 10k resistor pigtail is installed on the DLWT terminal.

Thermistor Sensors
The following table indicates the normal operating range of the temperature sensing thermistors. Readings outside this range are indicative of a bad sensor. The Lockout Board will display the associated fault.

Sensor	Range (°F)
LCT	10 – 220
DGT	20 – 257
DLWT	20 – 220
SCT	10 – 220

When diagnosing a possible bad sensor, the following table may be used to verify a valid temperature reading.

TEMP. (°F)	Resistance (KΩ)	TEMP. (°F)	Resistance (KΩ)
10	46.95	130	3.60
15	41.39	200	1.16
20	36.50	220	0.87
30	28.61	250	0.59
77	10.00	257	0.54

Over/Under Voltage Protection
The lockout board protects the compressor from operating when an over/under voltage condition exists.

The control monitors secondary voltage from the transformer (24VAC) to determine an over/under voltage condition is occurring on the primary side of the transformer. Under voltage (<18VAC) causes the compressor to disengage and restart when the voltage returns to >20VAC. Over voltage (>31VAC) causes the compressor to disengage and restart when the voltage returns to <29VAC.

When an O/U Voltage condition occurs, the board will initiate a fault, shut down the compressor, and start the five minute ASC period. All four fault LEDs will flash and the thermostat "Call For Service" indicator will be flashing 11 pulses. This feature is self- resetting and never retries or locks out. If voltage returns to normal range, normal operation will resume if/when the ASC period is over. When normal operation is restored the four fault LED's will stop flashing and the "Call For Service" indicator will turn off.

Fault Retry
All faults (except O/U Voltage and Bad Thermistor Sensors) are retried twice before finally locking the unit out (three faults total).

The fault retry feature is designed to prevent nuisance service calls. There is an anti-short cycle (ASC) period of 5 minutes between fault retries. On the third fault of the same sensor, within 30 minutes, the board will go into lockout mode and the "Call For Service" indicator on the thermostat will flash the number of pulses that correspond to the fault as shown in Fault Indication Table (page 47).

Intelligent Lockout Reset
If the thermostat is powered off (Y1 removed) for one minute then back on (soft reset), the board will reset and the last fault is stored in memory for troubleshooting. If main power is interrupted to the board, the fault memory will be cleared (hard reset).

Lockout with Emergency Heat
While in lockout mode, if the thermostat is calling for auxiliary heat (W1), emergency heat mode will energize. The second stage (W2) is energized two minutes after W1 is energized.

Hot Water Generator (HWG) Pump
Controls check for HWG temperature (DLWT) and compressor hot gas discharge line temperature (DGT). The hot water generator pump is de-energized when the leaving water temperature (DLWT) is above 130°F or when the compressor discharge line (DGT) is cooler than leaving water temperature (DLWT).

These conditions will disengage the HWG pump (via the HWG signal from the lockout board) and are considered normal operating sequences (they will not fault or lockout the compressor). However, if the DGT sensor detects temperatures >220°F, a fault will be thrown. Systems not equipped with HWG will have a 10k resistor pigtail in place of a thermistor in the DLWT socket (this allows monitoring DGT).

Control Board Switch Settings and Diagnostics
For fast and simple control board diagnosis, the lockout board includes five LEDs: Green, Orange, Red, Yellow, and a Green status indicator.

Following page (47) is the Lockout Board LED Identification Table.

Section 6: Controls

Lockout Board LED Identification

LOCKOUT BOARD LED IDENTIFICATION & L TERMINAL STATUS						
CONDITION	GREEN HP	ORANGE LP	RED FS	YELLOW CO	GREEN STATUS	L TERMINAL- 24 VAC[8,9]
NORMAL MODE					FLASH	
TEST MODE[1]						
HP FAULT	FLASH				FLASH	
HP LOCKOUT	ON				FLASH	FLASH-2 PULSES
LP FAULT		FLASH			FLASH	
LP LOCKOUT		ON			FLASH	FLASH-4 PULSES
WF FAULT (FS)[3]			FLASH		FLASH	
WF LOCKOUT (FS)[3]			ON		FLASH	FLASH- 6 PULSES
LOAD/ AIR COIL FRZ FAULT (LCT)[2, 3]		FLASH	FLASH		FLASH	
LOAD/ AIR COIL FRZ LOCKOUT (LCT)[2, 3]		ON	ON		FLASH	FLASH-8 PULSES
SOURCE COIL FRZ FAULT (SCT)			FLASH	FLASH		
SOURCE COIL FRZ LOCKOUT (SCT)			ON	ON		FLASH-19 PULSES
CO FAULT[3]				FLASH	FLASH	
CO LOCKOUT[3]				ON	FLASH	FLASH-10 PULSES
O/ U VOLTAGE	FLASH	FLASH	FLASH	FLASH	FLASH	FLASH-11 PULSES
LCT SENSOR LOCKOUT/FAULTY[4]	FLASH			ON	FLASH	FLASH-12 PULSES
DGT SENSOR FAULTY[3,4]		FLASH		ON	FLASH	FLASH-13 PULSES
DLWT SENSOR FAULTY[4,7]			FLASH	ON	FLASH	FLASH-14 PULSES
SCT SENSOR LOCKOUT/ FAULTY[4]		ON		FLASH	FLASH	FLASH-15 PULSES
LCT & SCT SWAPPED[5]	ON			ON		FLASH-16 PULSES
DGT > 220˚F FAULT[3,6]	FLASH		FLASH	ON	FLASH	
DGT > 220˚F LOCKOUT[3,6]	ON		ON	ON	FLASH	FLASH-18 PULSES

LOCKOUT BOARD DIP SWITCHES		
DIP SWITCH	OFF	ON
FSW[11]	LCT & SCT SENSORS AND 'FS' TERMINALS MONITORED FOR FLOW	FS' TERMINALS MONITORED FOR FLOW
AFRZ	OPEN LOOP MODE- 30˚F SETTING FOR SCT	CLOSED LOOP MODE- 12˚F SETTING FOR SCT
TEST	OPERATES IN NORMAL MODE WITH STANDARD DELAYS	OPERATES IN TEST MODE WITH DELAYS SPED UP
O/ U	FEATURE IS INACTIVE	FEATURE IS ACTIVE

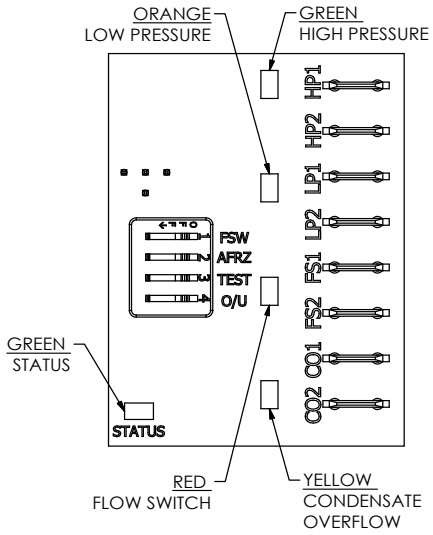
NOTES:

1. WHEN TEST MODE DIP SWITCH IS 'ON', GREEN STATUS LED WILL BE OFF.
2. THE LOAD/ AIR COIL FREEZE PROTECTION SENSOR IS LOCATED BETWEEN THE TXV AND LOAD COAX IN WATER-TO-WATER UNITS, AND BETWEEN THE TXV AND AIR COIL IN WATER-TO-AIR UNITS.
3. NOT ALL MODELS HAVE THIS FEATURE.
4. THIS FAULT INDICATES A BAD SENSOR (OPEN, SHORTED, DISCONNECTED, OR INVALID VALUE).
5. THE CHECK TO DETERMINE IF THE LCT AND SCT SENSORS ARE SWAPPED, OCCURS IN TEST MODE ONLY, 120 SECONDS AFTER THE 'CC' TERMINAL IS ENERGIZED.
6. THIS FAULT/ LOCKOUT INDICATES THAT THE DISCHARGE GAS TEMPERATURE IS ABOVE 220°F.
7. UNITS WITHOUT DESUPERHEATER (HWG) HAVE A 10K RESISTOR IN POSITION T3 (DLWT).
8. CONNECT A MULTIMETER ACROSS THE 'L' AND 'C' TERMINALS TO CHECK FOR 24 VAC LOCKOUT SIGNAL. THERMOSTAT TURNS ON/FLASHES 'CALL FOR SERVICE' INDICATION.
9. THE 'L' TERMINAL CONTROLS A FAULT LED AT THE THERMOSTAT OR DRIVES AN AUXILLIARY FAULT RELAY.
10. UNITS THAT DO NOT CONTAIN A FLOW SWITCH, WILL CONTAIN A JUMPER BETWEEN THE 'FS1' AND 'FS2' TERMINALS.
11. FSW DIP SWITCH SHOULD NOT BE MODIFIED IN THE FIELD. FACTORY SETTING SHOULD BE MAINTAINED (OFF).

Section 6: Controls

Lockout Board DIP Switches

The lockout board has four DIP switches for field selection of features shown below.



Load/Source Temperature Sensing (FSW)

When the DIP switch FSW is OFF, the board operates in dual protection mode. The load and source heat exchanger temperatures are monitored (with LCT and SCT thermistors) as well as the factory installed flow switch. When the DIP switch FSW is ON, the board operates in thermistor override mode and monitors only the flow switch (LCT and SCT are ignored).

Note: No setting allows ignoring of the flow switch. This ensures greatest protection of the heat exchangers.

Anti-Freeze (AFRZ)

When DIP switch AFRZ is OFF, the Lockout Board operates in open loop mode. The setpoint for the source heat exchanger freeze sensor is set to 30°F. When DIP switch AFRZ is ON, the board operates in the closed loop mode. The setpoint for the source heat exchanger freeze sensor is 12°F in closed loop mode.

Test Mode (TEST)

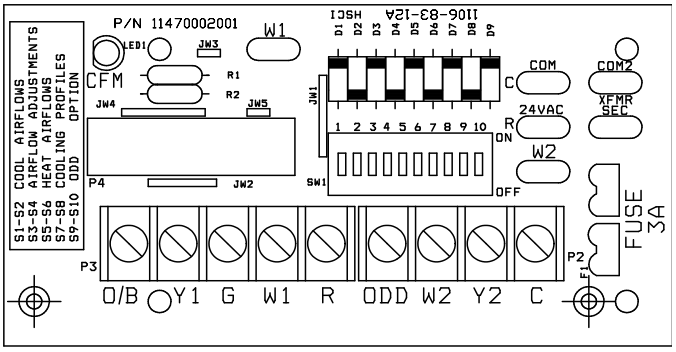
When DIP switch TEST is OFF, the Lockout board operates in the normal mode. When DIP switch TEST is ON, the board operates in test mode, which speeds up all delays for easier troubleshooting. While in the test mode the LCT & SCT sensors will be checked for the proper location based on temperature. Sensors are swapped if LCT > SCT in cooling or LCT < SCT in heating. This fault will only show up in the test mode. When service is complete, the DIP switch TEST must be returned to the OFF position in order to make sure the unit operates with normal sequencing delays.

While the unit is in Test Mode, the status light (bottom green) will remain off. The Lockout Board will revert back to normal mode after one (1) hour (green status light blinks), if DIP switch TEST is not moved to OFF position.

Over/Under Voltage Disable (O/U)

When the DIP switch O/U is ON, the over/under voltage feature is active. When the DIP switch O/U is OFF, 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 to disabling of the feature. However, disabling the feature could cause the unit to run under adverse conditions, and therefore should not be turned off without contacting Enertech technical services. An over/under voltage condition could cause premature component failure or damage to the unit controls. Any condition causing this fault must be thoroughly investigated before taking any action regarding disabling O/U feature. Likely causes of an over/under voltage condition include power company transformer selection, insufficient entrance wire sizing, defective breaker panel, incorrect 24VAC transformer tap (unit control box), or other power-related issues like brownouts.

ECM Fan Feature DIP Switch Selection



Note: For switch settings refer to the ECM Fan Performance Data Table in Section 4: Unit Data Information of this manual or the label found inside your ZS/ZT unit.

Section 6: Controls

Sequence of Operation

The description below is based on Water-to-Air Units, Two-Stage Compressor, with ECM Fan.

Timings assume the ASC timer is expired. If the ASC timer is not expired the ECM fan will start immediately but the accessory, compressor, and loop pump operation do not start until the ASC timer is expired.

Heating 1st Stage, (Y1, G) ZS and ZT models

The ECM fan immediately ramps up to 75% of 1st stage airflow (CFM) level (based on DIP switch settings), the Accessory (A) terminal output is energized after the random start timer (10s-20s) expires. Next, after another 10s delay, the compressor first stage and the loop pump(s) are energized. Then the ECM fan adjusts to 100% (of 1st stage operation) CFM level 90 seconds after the "Y1" input.

Heating 2nd Stage, (Y1, Y2, G) ZT models

The ECM fan adjusts to 2nd stage airflow (CFM) level (based on DIP switch settings), and the compressors second stage (full load) solenoid is energized.

Heating 3rd Stage, (Y1, Y2, W1, G) ZT models Heating 2nd Stage, (Y1, W1, G) ZS models

ECM fan remains at 100% of 2nd stage airflow (CFM) level (based on DIP switch settings), and the first stage of electric heat is energized.

Second stage of electric heat (W2) is energized ten minutes after first stage electric heat (W1) is energized. (W2 is only available with 10kW, 15kW and 20kW electric heaters)

Emergency Heat (W1, G) ZS and ZT models

The fan is started immediately at 2nd stage airflow (CFM) level (based on DIP switch settings), and the electric heat is energized. Second stage of electric heat (W2) is energized two minutes after first stage electric heat (W1) is energized. (W2 is only available with 10kW, 15kW and 20kW electric heaters)

Cooling Operation

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

Cooling 1st stage (Y1, 0, G) ZS and ZT models

ECM fan immediately ramps up to 75% of 1st stage airflow (CFM) level (based on DIP switch settings), the Accessory (A) terminal output is energized after the random start timer (10s-20s) expires then first stage compressor and the loop pump(s) are energized 10 seconds after A. The ECM fan adjusts to 100% (of 1st stage operation) CFM level 90 seconds after the "Y1" input.

Cooling 2nd Stage (Y1, Y2, O, G) ZT models

The ECM fan adjusts to 2nd stage airflow (CFM) level (based on DIP switch settings), and the compressors second stage (full load) solenoid is energized.

Cooling, Dehumidification Mode

The ECM fan control board includes two types of dehumidification modes, Constant Dehumidification mode, and On Demand Dehumidification (ODD). If the ECM control board is set to Constant Dehumidification mode, the ECM fan runs at normal airflow (CFM) in all heating stages, but all cooling operation will be 85% of the current stage airflow (CFM) level (based on DIP switch settings). The dehumidification mode lowers the airflow (CFM) through the evaporator coil, to improve latent (dehumidification) 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 airflow (CFM) in the cooling mode. Otherwise, the airflow is at the normal airflow (CFM) level. The signal is ignored in the heating mode.

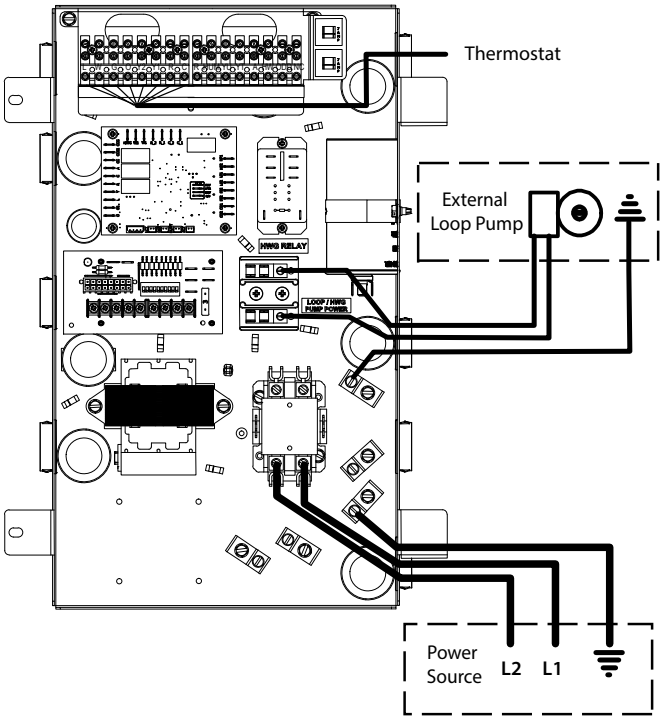
Fan Only

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 airflow (CFM) level (based on DIP switch settings shown in following table).

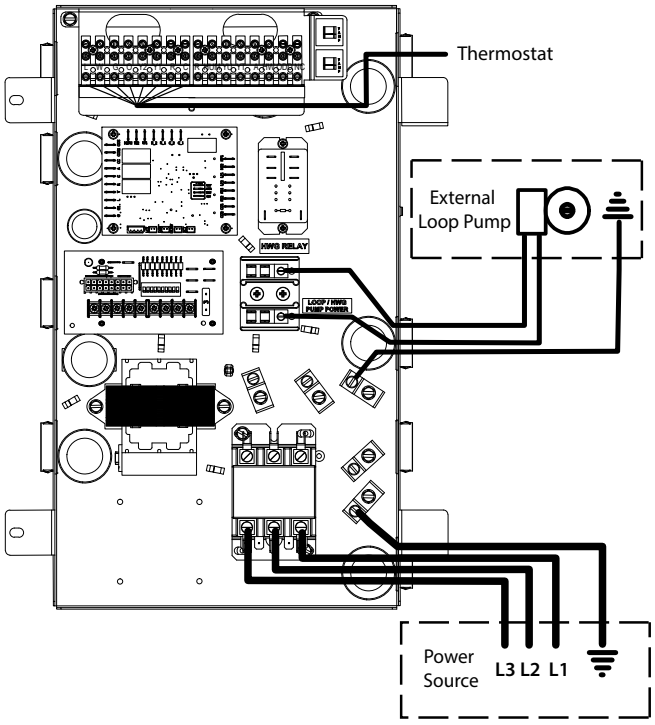
Section 7: Electrical Connections

Control Box Wiring Recommendations

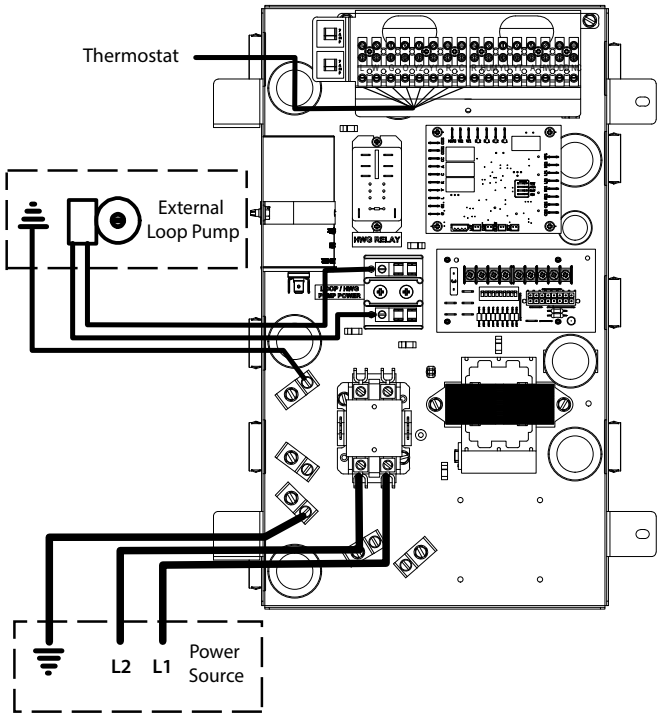
Single Phase Connections
High and Low Voltage (Left Return Shown)



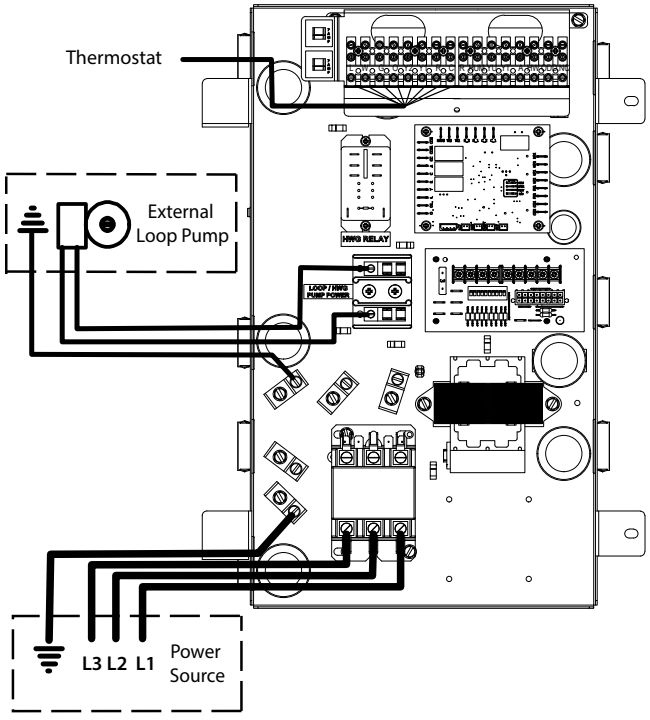
Three Phase Connections
High and Low Voltage (Left Return Shown)



Single Phase Connections
High and Low Voltage (Right Return Shown)



Three Phase Connections
High and Low Voltage (Right Return Shown)



NOTES:
All wiring should enter through the side plastic bushings installed on the hinged side of the control box
Route and trim wiring to leave enough slack to open, close or remove control box
All drawings are for reference only, models and revisions may change components and/or locations

Section 8: Soft Start Controls

Soft Start Module

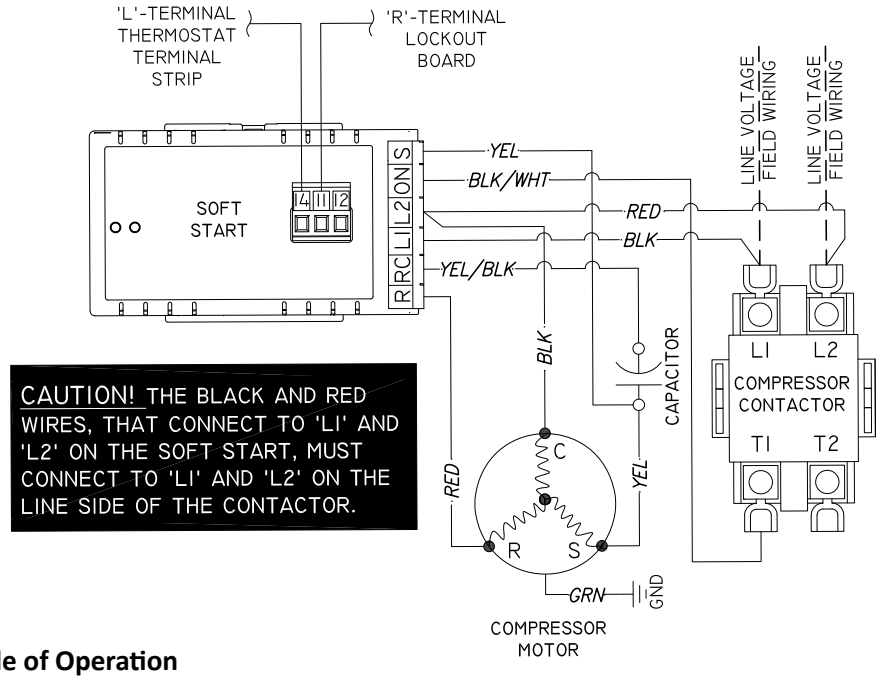
Enertech offers a factory installed single-phase Soft Start Module that reduces compressor starting currents and hence limits the peak energy demand. The Soft Start Module provides a one-package solution for compressor soft starting and starting capacitor control.

The Soft Start Module has a dedicated algorithm and in built current limit settings specifically for scroll compressor starting. To limit the peak energy demand resulting in expensive utility contracts by the end-users.

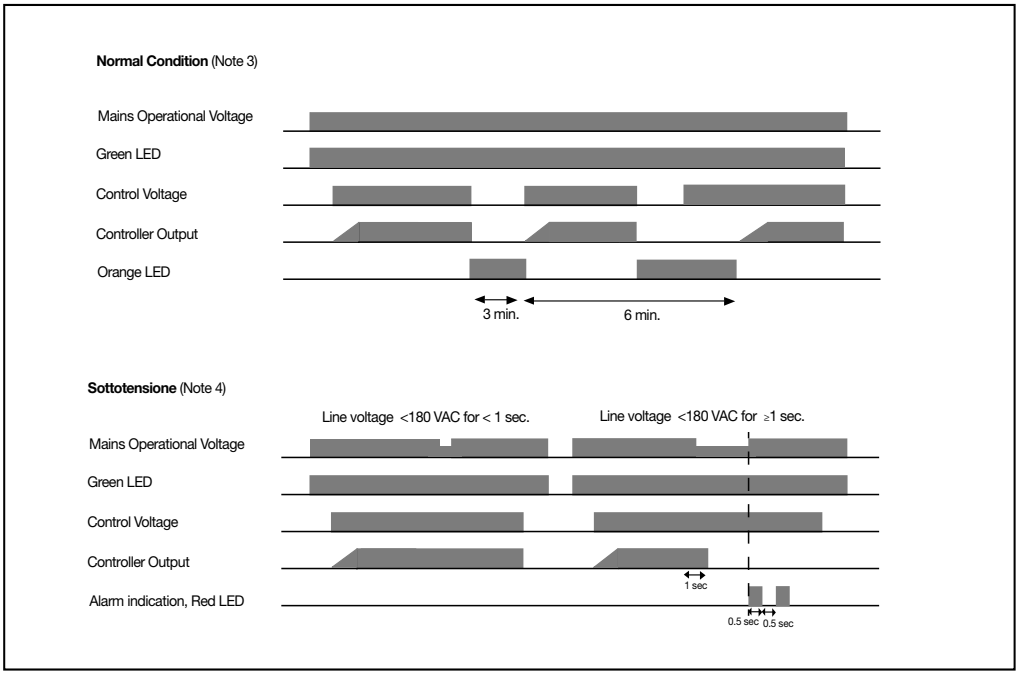
The Soft Start Module complies with Class B (residential) limits for conducted and radiated emissions which ensures that neighboring equipment is not negatively affected by any interference generated by the soft starter switching.

The Soft Start Module HP provides a dynamic current limit that ensures compressor starting even at higher starting pressures.

Wiring Diagram

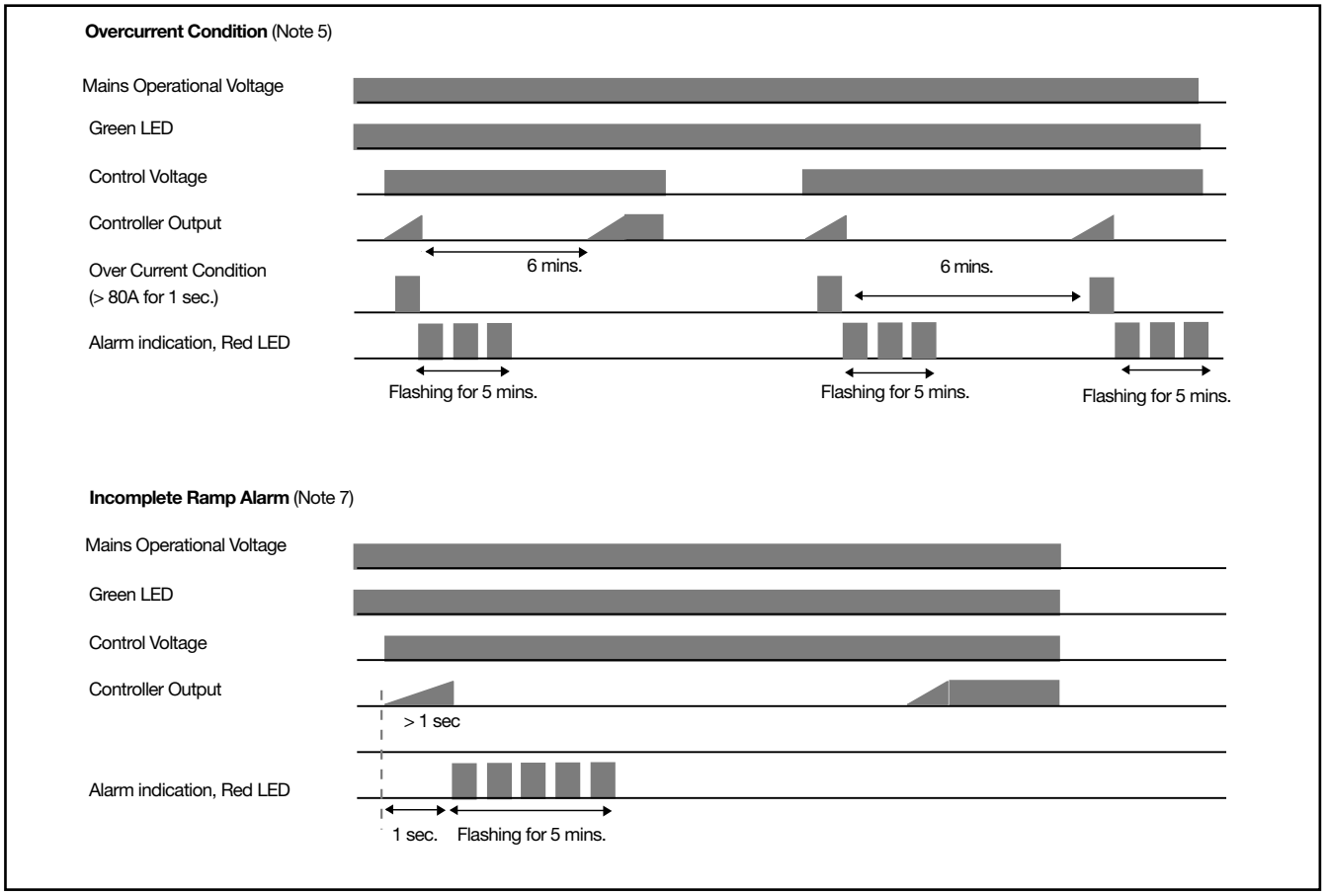


Mode of Operation



Section 8: Soft Start Controls

Mode of Operation (Cont.)

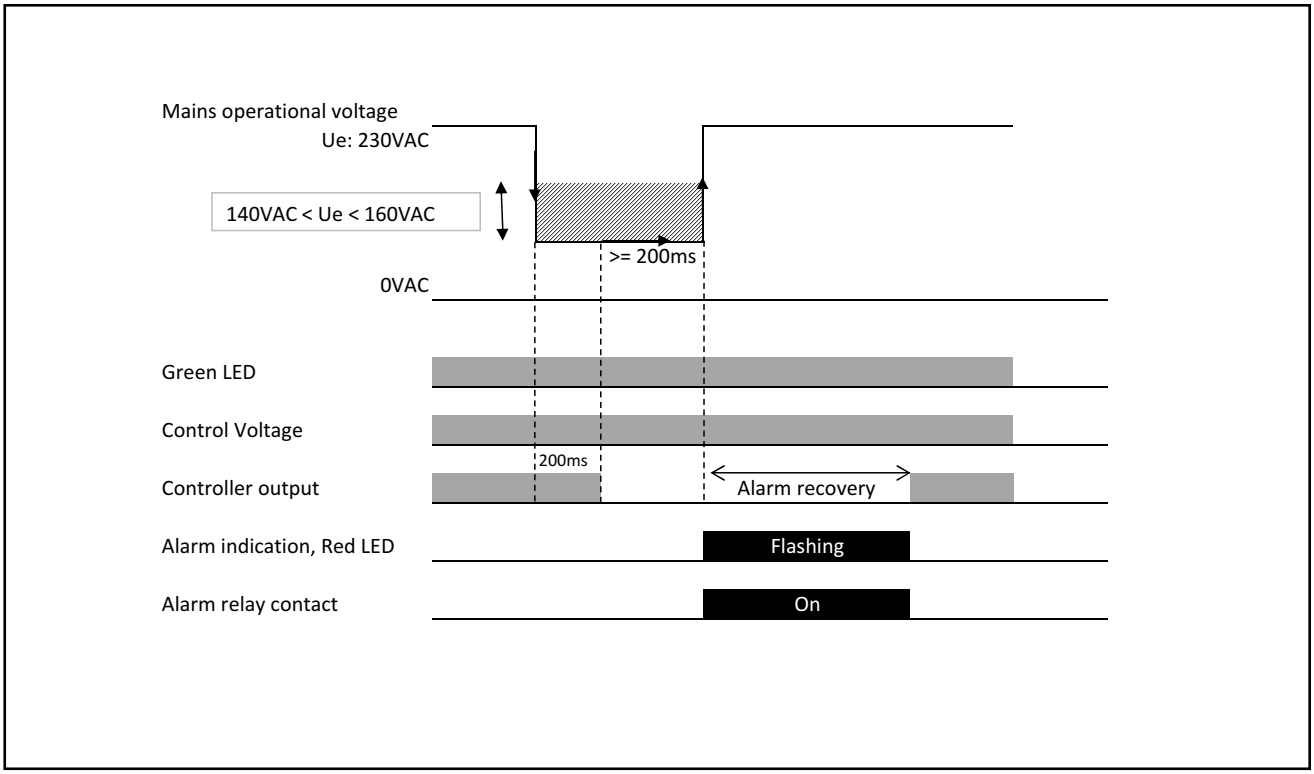


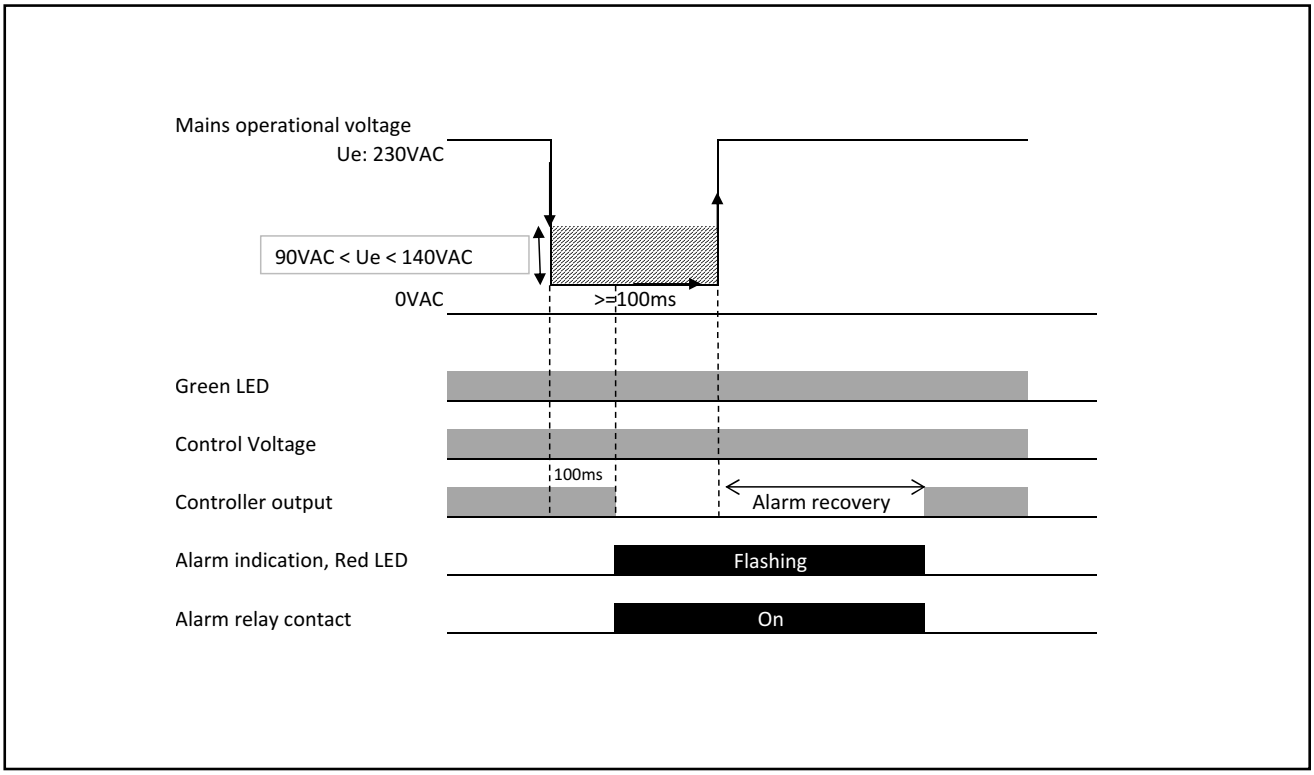
Notes:

1. The RSBS has 2 indication LEDs on board. The green LED indicates the status of the on-board power supply, whilst the red LED indicates an alarm condition or in the case of the recovery time between starts, the LED will be orange (Fully ON) .
2. Once the mains voltage is present, the green LED will be fully ON. In case the mains voltage is less than the stated pickup voltage alarm value, the green LED will be flashing. In case mains voltage is higher than the stated pick-up voltage and green LED is flashing, then this may indicate that the on-board power supply is faulty. (Power Supply Alarm)
3. Upon closing K1, the RSBS will start ramping, duration of which is < 1 second, provided that the minimum time from stop to start is respected. When opening K1, the RSBS will stop without any ramp down.
4. In the case of an undervoltage, the RSBS will shut down and the Red LED flashes 2 times as long as the undervoltage is present. Once the mains voltage is restored the red LED will continue flashing for 5 minutes. After 6 minutes, the RSBS will start ramping function in the case K1 is closed. The device can be reset at any time by removing power on L1 - N connection. When the power is reapplied, the soft starter will start ramping up as soon as K1 is closed, provided that the minimum time between starts and the minimum time from stop to start are respected.
5. If an overcurrent (>80A for 1 sec.) is sensed, the RSBS will shut down and the red LED will flash 3 times indicating an overcurrent situation. This continues for 5 minutes. In the case that the overcurrent is still present at the second attempt, user intervention is required to reset the controller by cycling power for the device to operate again as this implies that there are problems in the system.
6. A detection circuitry provides protection in case of a faulty starting capacitor EMR. In such a situation, the red LED will flash 4 times for 5 minutes. RSBS will check the status of the starting capacitor EMR before attempting a ramping function (in the case K1 is closed). If the starting capacitor EMR is found faulty at the second attempt, user intervention is required to reset the controller by cycling power for the device.
7. In the case of incomplete ramping of the softstarter, the red LED will flash 5 times. This flashing will be indicated by the red LED for 5 minutes. If after the second attempt there is another incomplete ramp alarm, user intervention is required to reset controller.
8. During recovery from Undervoltage, Overcurrent, Incomplete ramp alarms, the red LED will flash at twice the normal flashing frequency, using the same number of flashes. The figure shows the flashing in case of a recovery from an undervoltage alarm.
9. During the recovery time between starts, the orange LED will be continuously ON until the necessary recovery time elapses.[1]
10. If supply on RSBS is removed before the recovery period has elapsed, when supply is restored the delay will continue until the remaining recovery time from the last start/ stop (before supply removal) is over. Following this, another start may be attempted. If supply is removed during alarm recovery (red LED Flashing), upon re-applying supply, the alarm will be reset and the RSBS will only wait for the respective delays between starts and/or stop to start to elapse before attempting another start (assuming K1 is closed.)

Section 8: Soft Start Controls

Mode of Operation (Voltage Interruptions)



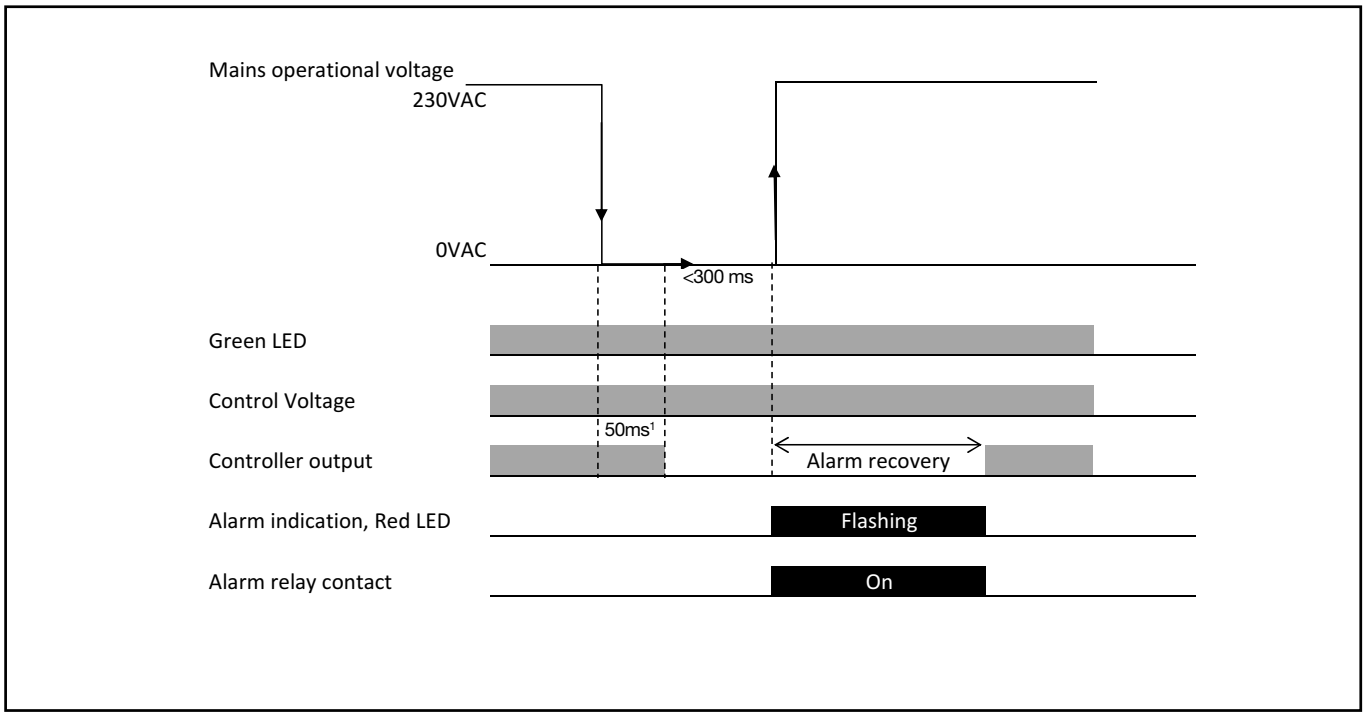


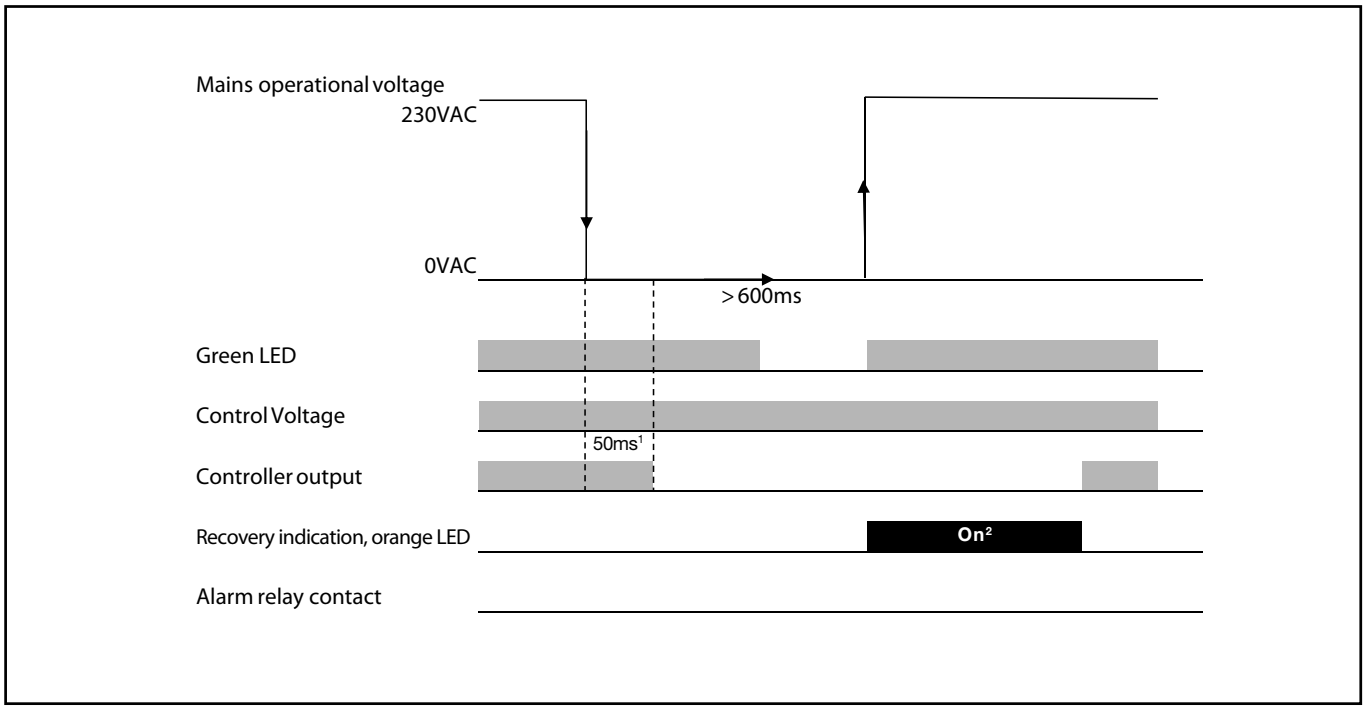
Note:

1. When a voltage dip and/or interruption is detected the Under voltage alarm will be triggered (2 flashes on red LED).
2. If, during bypass, the current (Ie) is <=2.5AACrms for Ue>=180VAC, the under-voltage alarm will also be triggered as this might indicate a voltage interruption condition.
3. Voltage dips/interruptions occurring during recovery between starts and/or alarm recovery shall be ignored.
4. Voltage dips/interruptions are not monitored during ramping and idle (control OFF) states.

Section 8: Soft Start Controls

Mode of Operation (Voltage Dips)





1 For a 50Hz supply, minimum interruption detection is of 50ms (+20ms/ -0ms).

2 Orange LED will be ON if the time between starts and/or time from stop to start has not elapsed.
Following the recovery between starts and/or from stop to start, if control voltage is present, the RSBS shall try to restart the compressor.

LED Status Indication

The RSBS...SM28 shall try to softstart the compressor at 45AACrms current limit. Depending on the load requirement, the current limit will be gradually increased up to a maximum of 80AACrms after which the RSBS will switch into bypass mode.

The RSBS SM29 shall try to softstart the compressor at 25AACrms current limit. Depending on the load requirement, the current limit will be gradually increased up to a maximum of 40AACrms after which the RSBS will start to switch into bypass mode.

If ramping is not achieved after a maximum of 1 second, the Incomplete Ramp Alarm (5 flashes on red LED) will be triggered and the RSBS will enter into a recovery mode for 5 mins. If, at the second consecutive attempt the RSBS raises again the Incomplete Ramp Alarm, then a manual user intervention to reset power on the RSBS shall be required as this might indicate a real locked rotor condtion.

LED Status Indication

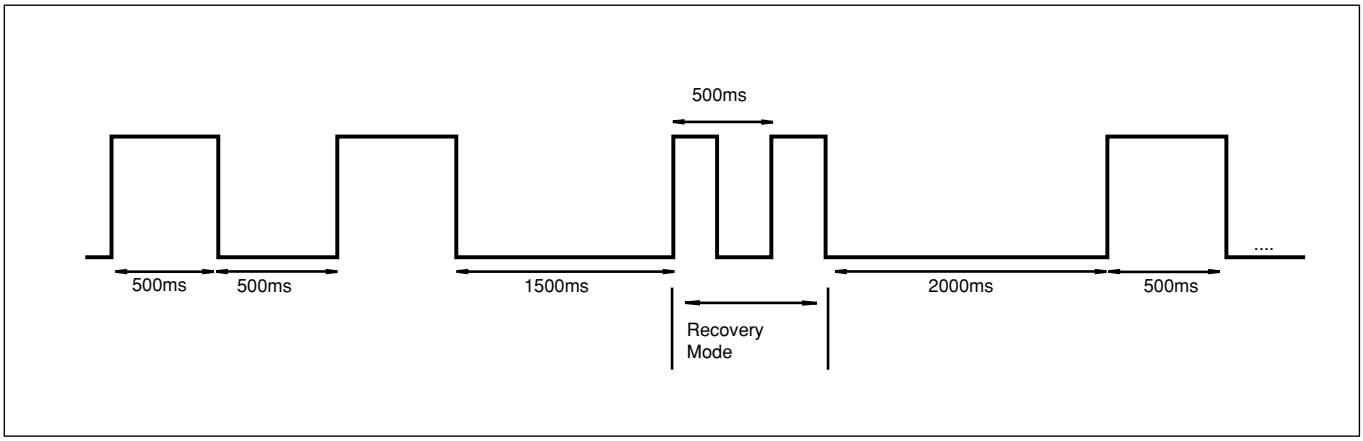
Orange LED	Relay Contact	Condition	Action
Fully ON[1]	11/12	Min. recovery time between starts and/or recovery time between stop to start	Auto reset when minimum recovery time elapses.
Red LED	**Relay Contact**	**Condition**	**Action**
2 flashes	11/14	Undervoltage (Ue < 180VAC)****	Auto reset with 5 mins recovery **
3 flashes	11/14	Overcurrent (>80A for 1 sec.)	Auto reset with 5 mins recovery
4 flashes	11/14	Relay protection	Auto reset with 5 mins recovery ***
5 flashes	11/14	Incomplete ramp	Auto reset with 5 mins recovery
N/A	11/12	Supply phase loss	Physical check
N/A	11/12	Idle state	
N/A	11/12	Ramping state	
N/A	11/12	Bypass mode	
Green LED	**Relay Contact**	**Condition**	**Action**
Flashing	11/12	Power supply alarm	Contact Carlo Gavazzi representative
Fully ON	11/12	Idle state	RSBS waiting for control signal to start

** Monitored during bypass

*** Refer to note 6 in Mode of operation section

**** Refer to voltage dips and interruptions section for mode of operation

Flashing Sequence

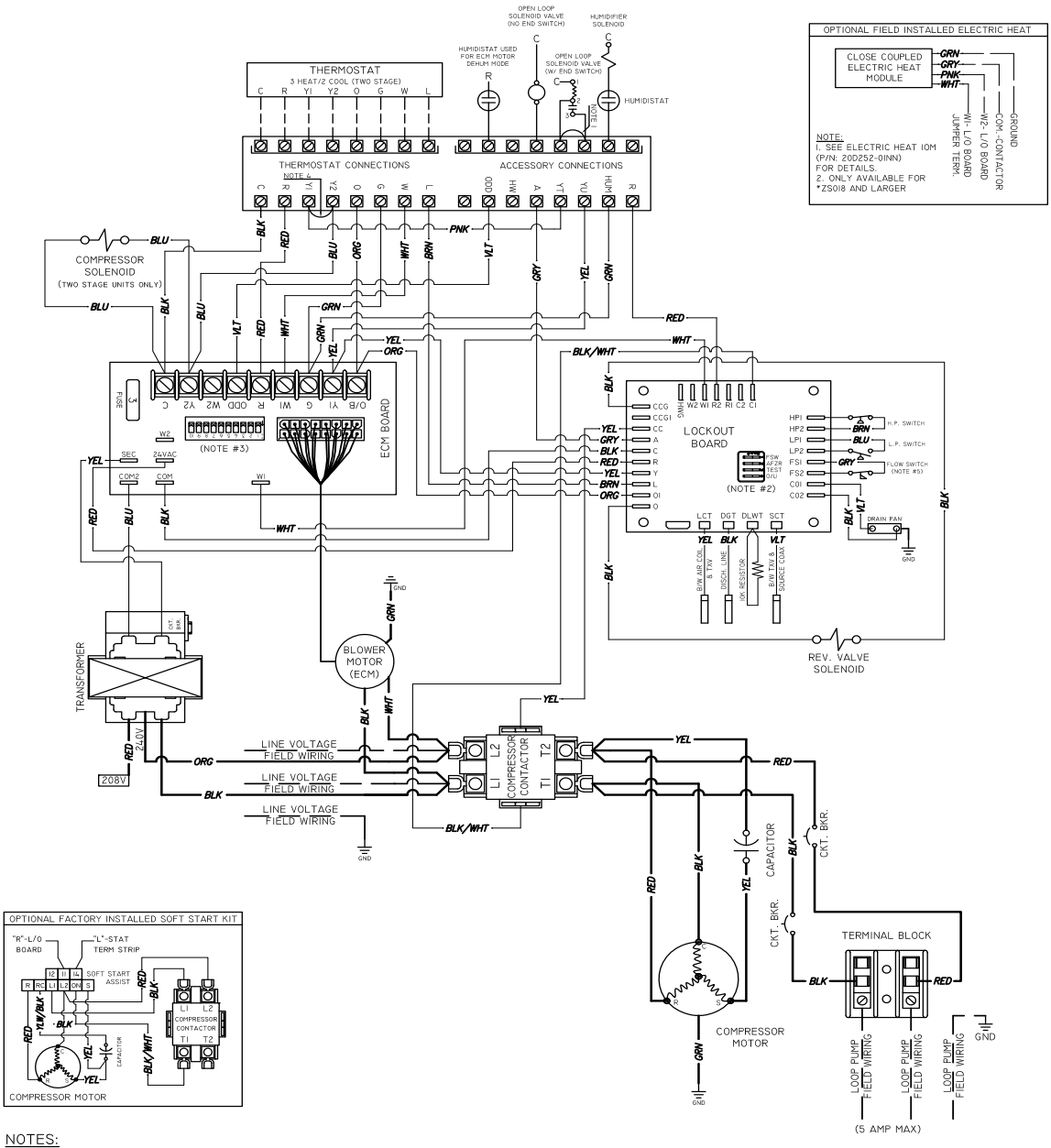


Note: During recovery from an alarm condition, the red LED will flash at twice the normal flashing frequency between successive flashing cycles as shown above to indicate that the softstarter is in recovery mode which recovery lasts for 5 minutes

Section 9A: Wiring Diagrams (ECM Fans Only)

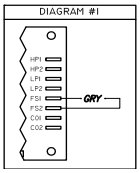
208/230V, Single Phase, 60Hz, Single or Two Stage, ECM, Residential

WATER-TO-AIR UNIT, SINGLE STAGE OR TWO STAGE, ECM FAN,
SINGLE PHASE, 208/230V, 60HZ, RESIDENTIAL *ZS/*ZT SERIES



NOTES:

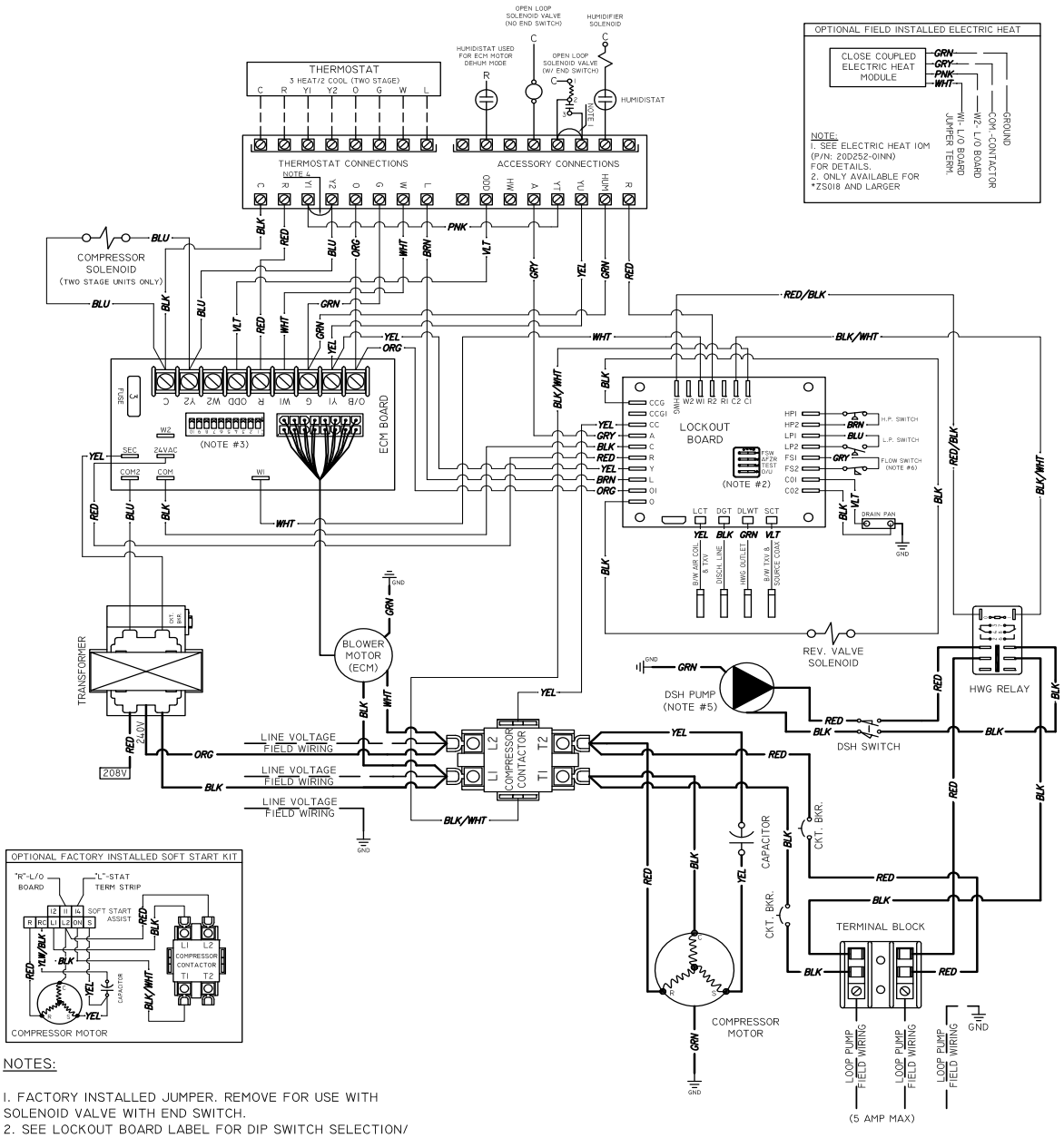
1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.
5. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 9A: Wiring Diagrams (ECM Fans Only)

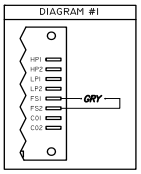
208/230V, Single Phase, 60Hz, Single or Two Stage, ECM, DSH, Residential

WATER-TO-AIR UNIT, SINGLE STAGE OR TWO STAGE, ECM FAN, SINGLE PHASE, 208/230V, DSH, 60HZ, RESIDENTIAL/COMMERCIAL *ZS/*ZT SERIES



NOTES:

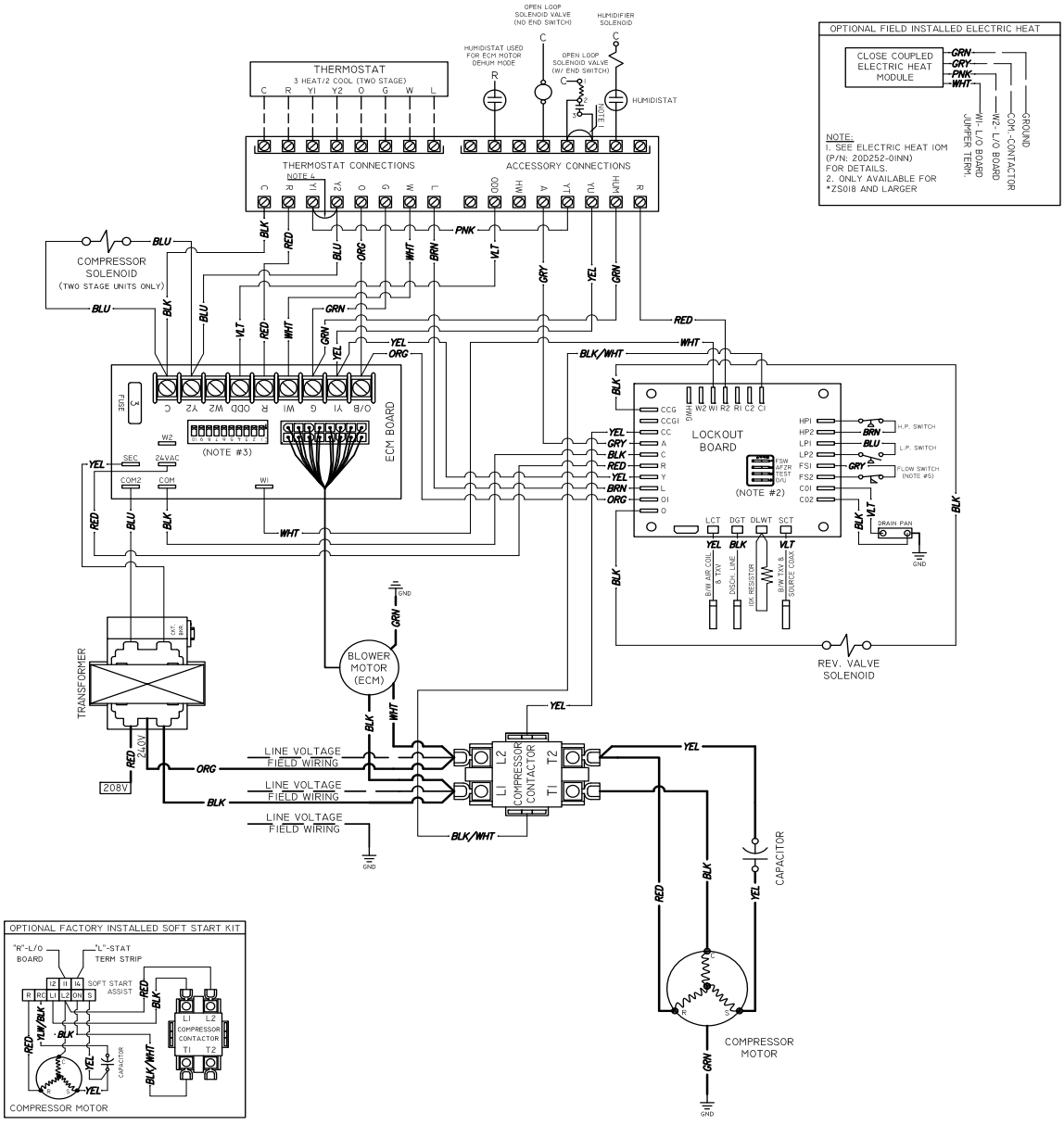
1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.
5. DESUPERHEATER PUMP POWER HARNESS IS NOT CONNECTED AT THE FACTORY. DO NOT CONNECT THE WIRES UNTIL THE PIPING IS COMPLETED AND PURGED OF AIR. RUNNING THE PUMP WITHOUT WATER WILL DAMAGE THE PUMP.
6. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 9A: Wiring Diagrams (ECM Fans Only)

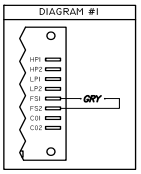
208/230V, Single Phase, 60Hz, Single or Two Stage, ECM, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE OR TWO STAGE, ECM FAN,
SINGLE PHASE, 208/230V, 60HZ, COMMERCIAL *ZS/*ZT SERIES



NOTES:

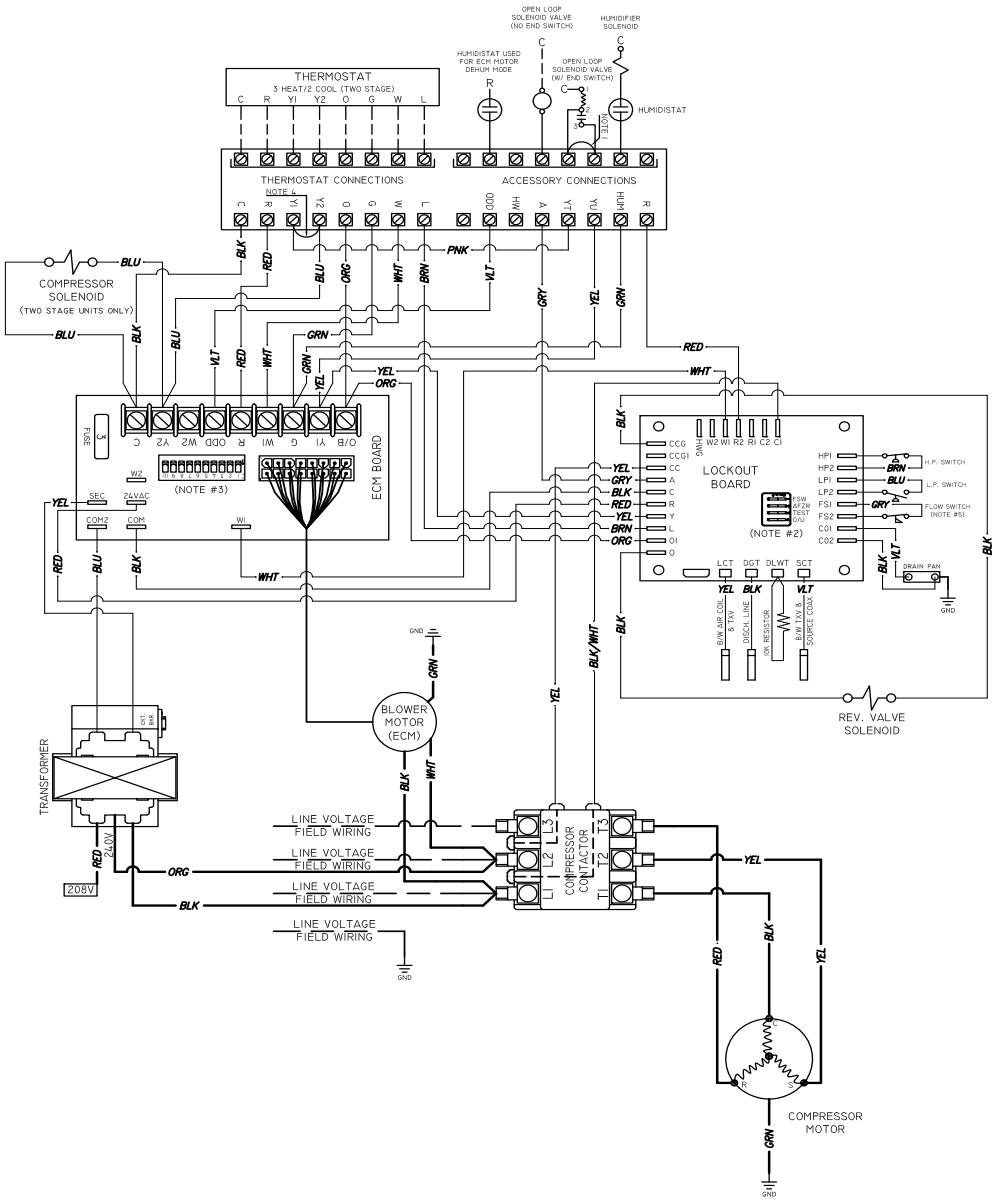
1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.
5. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 9A: Wiring Diagrams (ECM Fans Only)

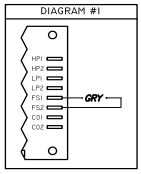
208/230V, Three Phase, 60Hz, Single or Two Stage, ECM, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE OR TWO STAGE, ECM FAN,
THREE PHASE, 208/230V, 60Hz, COMMERCIAL *ZS/*ZT SERIES



NOTES:

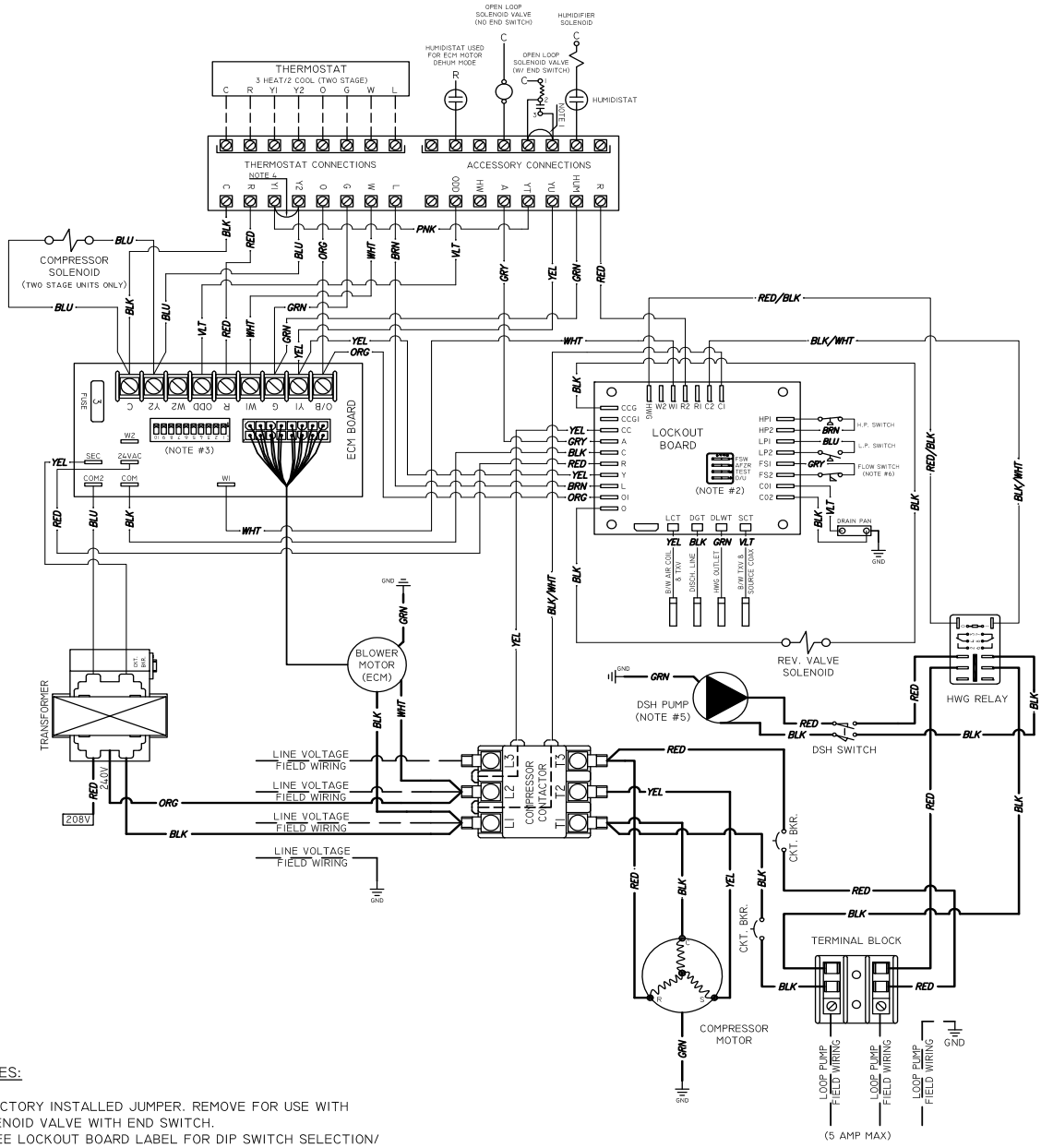
1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.
5. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 9A: Wiring Diagrams (ECM Fans Only)

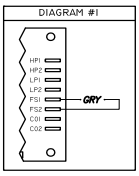
208/230V, Three Phase, 60Hz, Single or Two Stage, ECM, DSH, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE OR TWO STAGE, ECM FAN, THREE PHASE, 208/230V, 60HZ, DSH, COMMERCIAL *ZS/*ZT SERIES



NOTES:

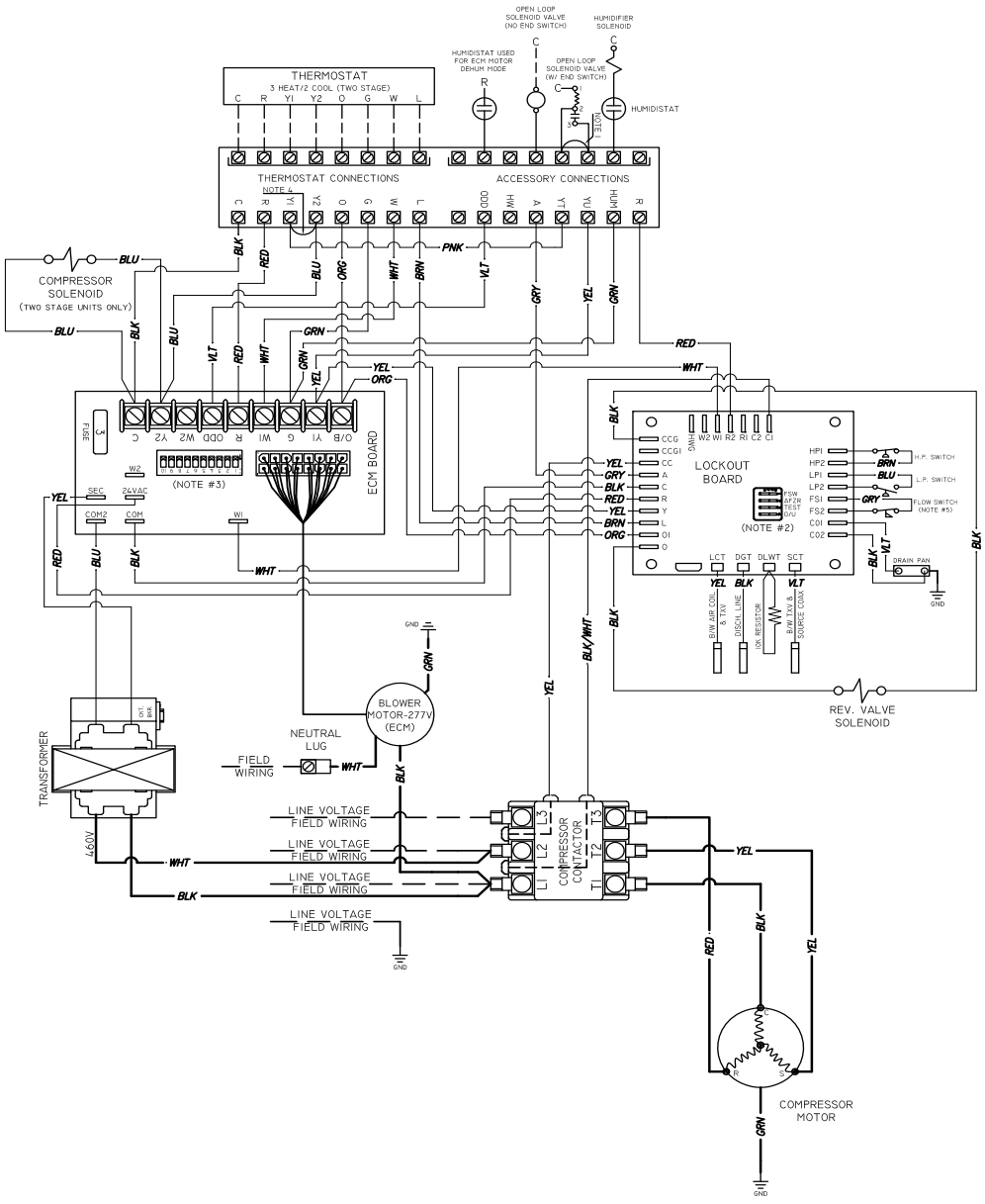
1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.
5. DESUPERHEATER PUMP POWER HARNESS IS NOT CONNECTED AT THE FACTORY. DO NOT CONNECT THE WIRES UNTIL THE PIPING IS COMPLETED AND PURGED OF AIR. RUNNING THE PUMP WITHOUT WATER WILL DAMAGE THE PUMP.
6. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 9A: Wiring Diagrams (ECM Fans Only)

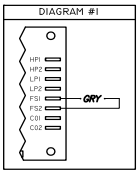
460V Three Phase, 60Hz, Single or Two Stage, ECM, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE OR TWO STAGE, ECM FAN,
THREE PHASE, 460V, 60HZ, COMMERCIAL *ZS/*ZT SERIES



NOTES:

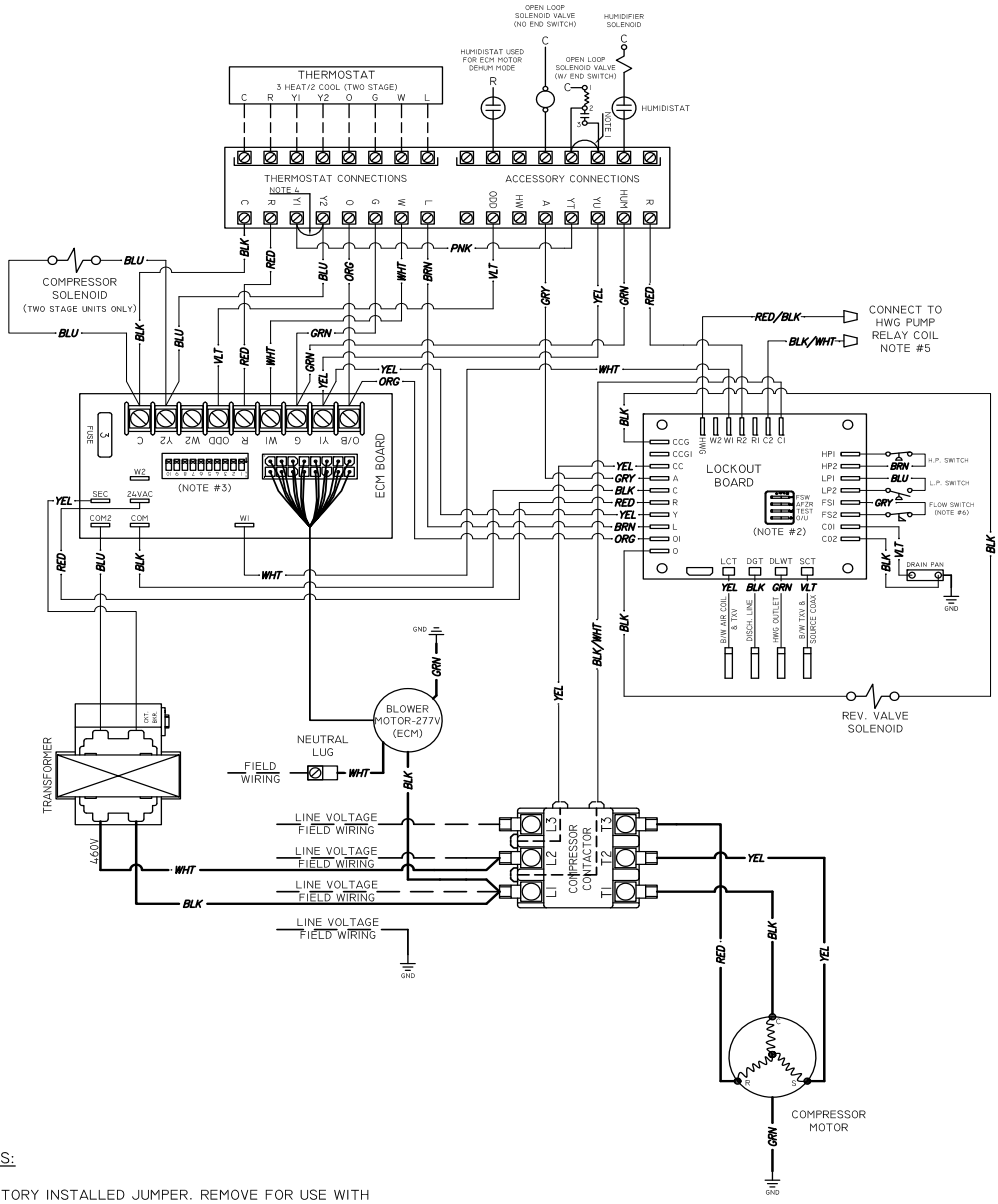
1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.
5. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 9A: Wiring Diagrams (ECM Fans Only)

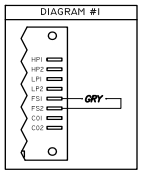
460V Three Phase, 60Hz, Single or Two Stage, ECM, DSH, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE OR TWO STAGE, ECM FAN,
THREE PHASE, 460V, 60HZ, DSH, COMMERCIAL *ZS/*ZT SERIES



NOTES:

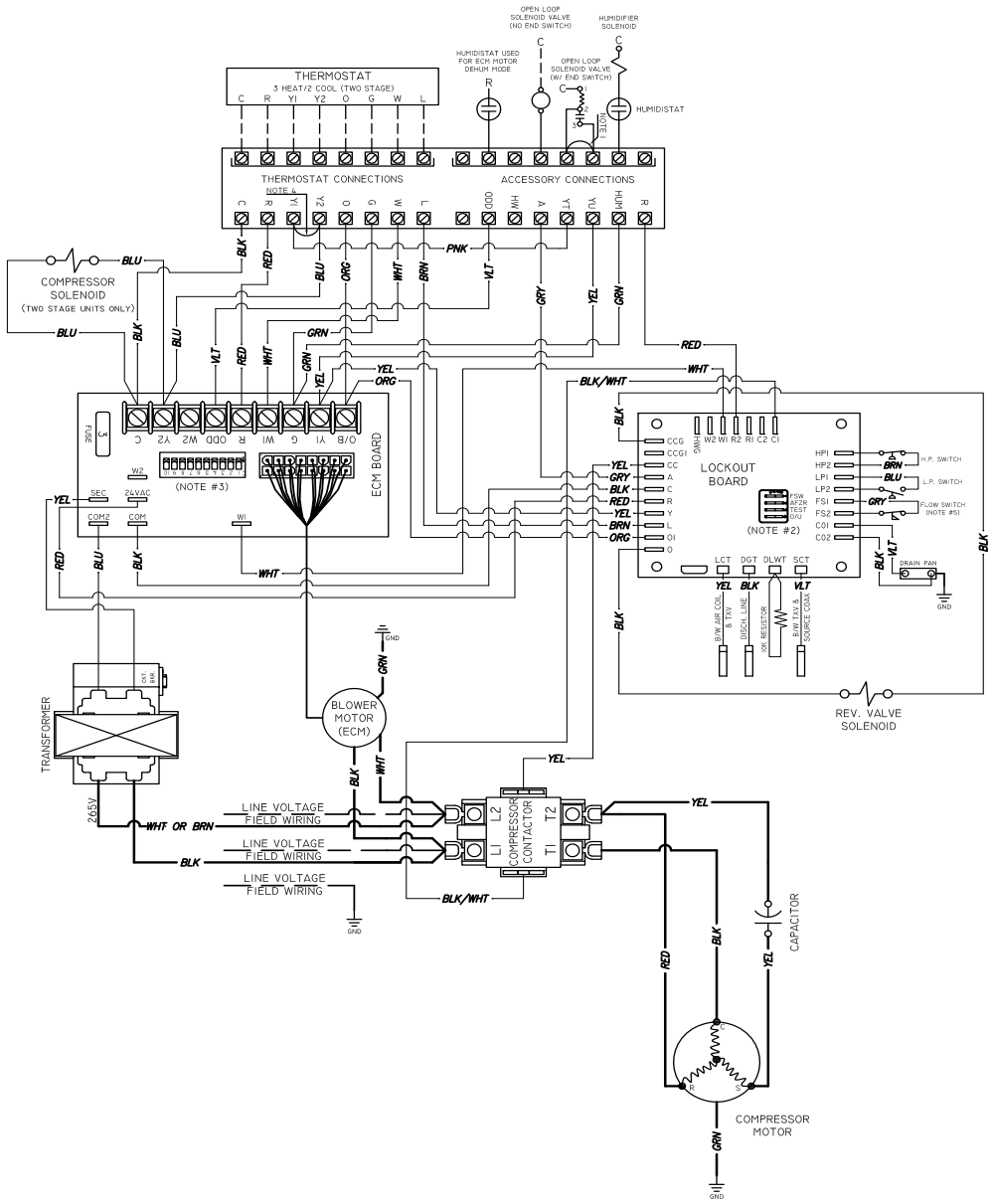
1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.
5. CONNECT WIRES TO HWG PUMP RELAY COIL. RELAY IS TO BE PROVIDED BY THE INSTALLER AND IS A N.C. RELAY THAT WILL INTERRUPT POWER TO THE PUMP WHEN CONDITIONS ARE INAPPROPRIATE FOR WATER HEATING. IF WIRES ARE NOT CONNECTED TO RELAY, SCALDING CAN OCCUR.
6. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 9A: Wiring Diagrams (ECM Fans Only)

265V, Single Phase, 60Hz, Single or Two Stage, ECM, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE OR TWO STAGE, ECM FAN,
SINGLE PHASE, 265V, 60HZ, COMMERCIAL *ZS/*ZT SERIES



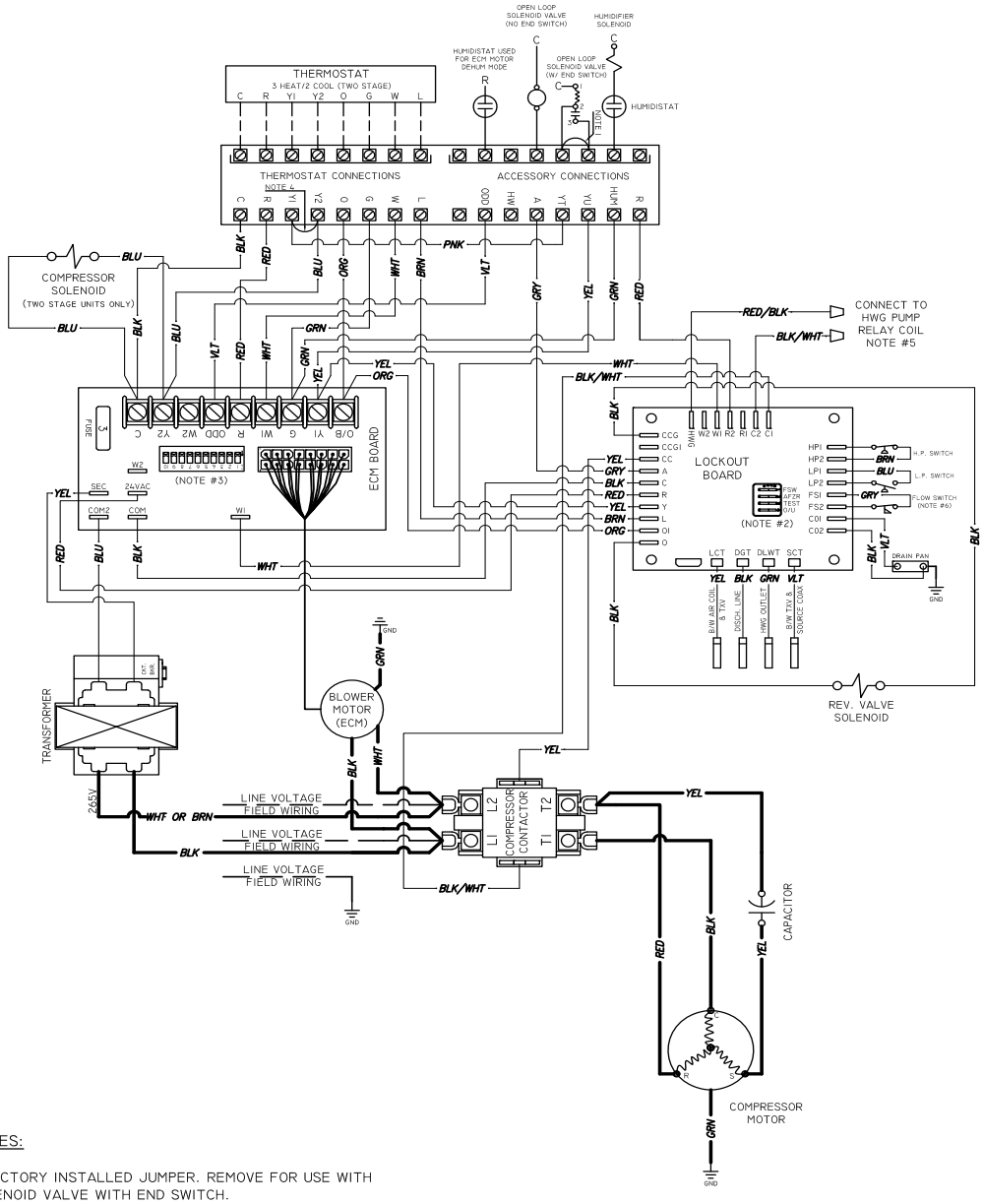
NOTES:

1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.
5. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FS1 AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.

Section 9A: Wiring Diagrams (ECM Fans Only)

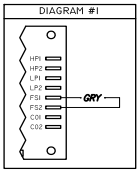
265V, Single Phase, 60Hz, Single or Two Stage, ECM, DSH, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE OR TWO STAGE, ECM FAN,
SINGLE PHASE, 265V, 60HZ, DSH, COMMERCIAL *ZS/*ZT SERIES



NOTES:

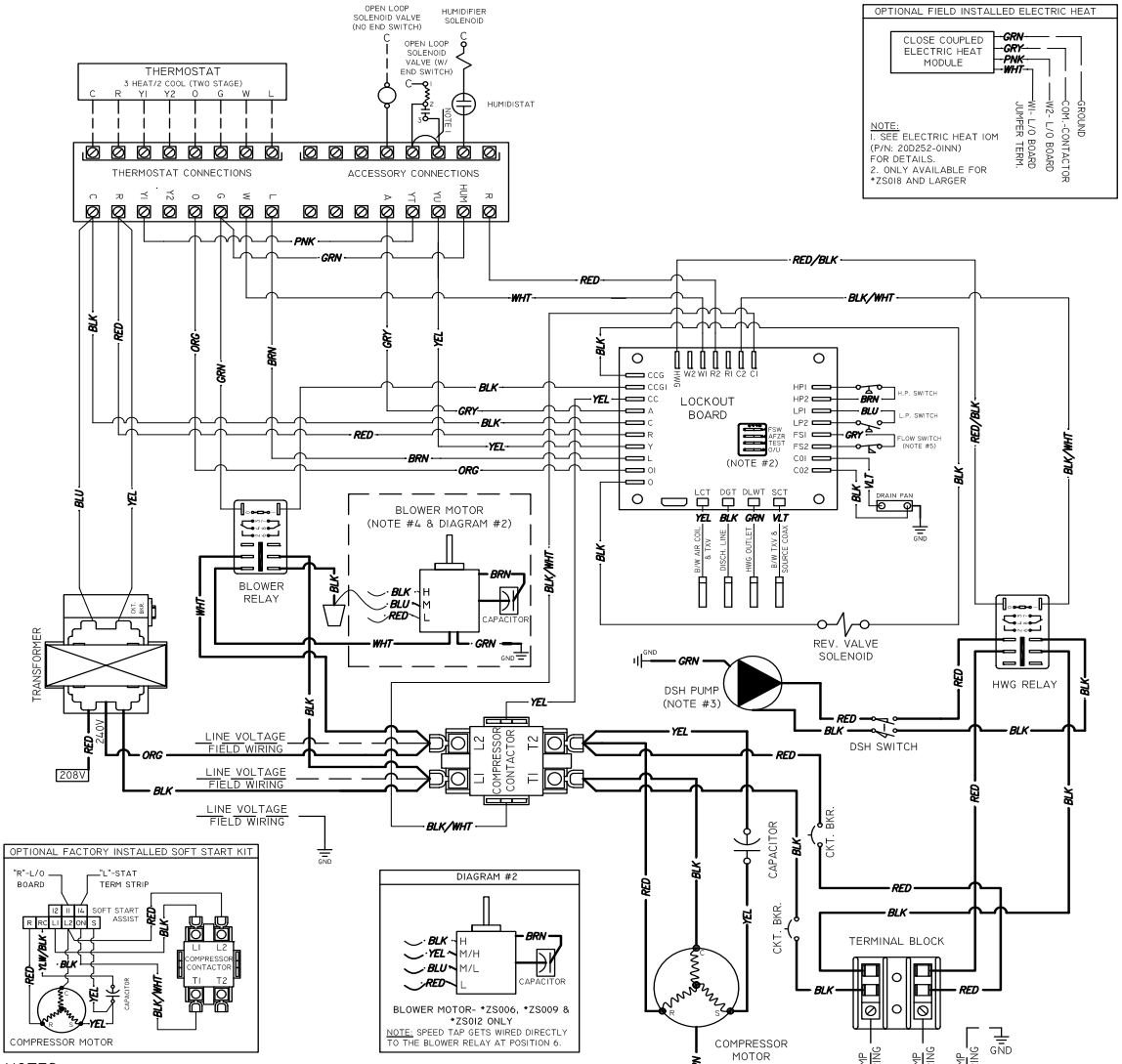
1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SEE CFM CHART FOR DIP SWITCH CHOICES BY MODEL.
4. FACTORY INSTALLED JUMPER FOR SINGLE STAGE UNITS.
5. CONNECT WIRES TO HWG PUMP RELAY COIL. RELAY IS TO BE PROVIDED BY THE INSTALLER AND IS A N.C. RELAY THAT WILL INTERRUPT POWER TO THE PUMP WHEN CONDITIONS ARE INAPPROPRIATE FOR WATER HEATING. IF WIRES ARE NOT CONNECTED TO RELAY, SCALDING CAN OCCUR.
6. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 9B: Wiring Diagrams (PSC Fan Only)

208/230V, Single Phase, 60Hz, Single-Stage, PSC, DSH, Residential/Commercial

WATER-TO-AIR UNIT, SINGLE STAGE, PSC FAN, SINGLE PHASE, 208/230V, DSH, 60HZ, RESIDENTIAL/COMMERCIAL *ZS SERIES



NOTES:

1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. DESUPERHEATER PUMP POWER HARNESS IS NOT CONNECTED AT THE FACTORY. DO NOT CONNECT THE WIRES UNTIL THE PIPING IS COMPLETED AND PURGED OF AIR. RUNNING THE PUMP WITHOUT WATER WILL DAMAGE THE PUMP.
4. SPEED SHOULD BE SET TO THE FOLLOWING:

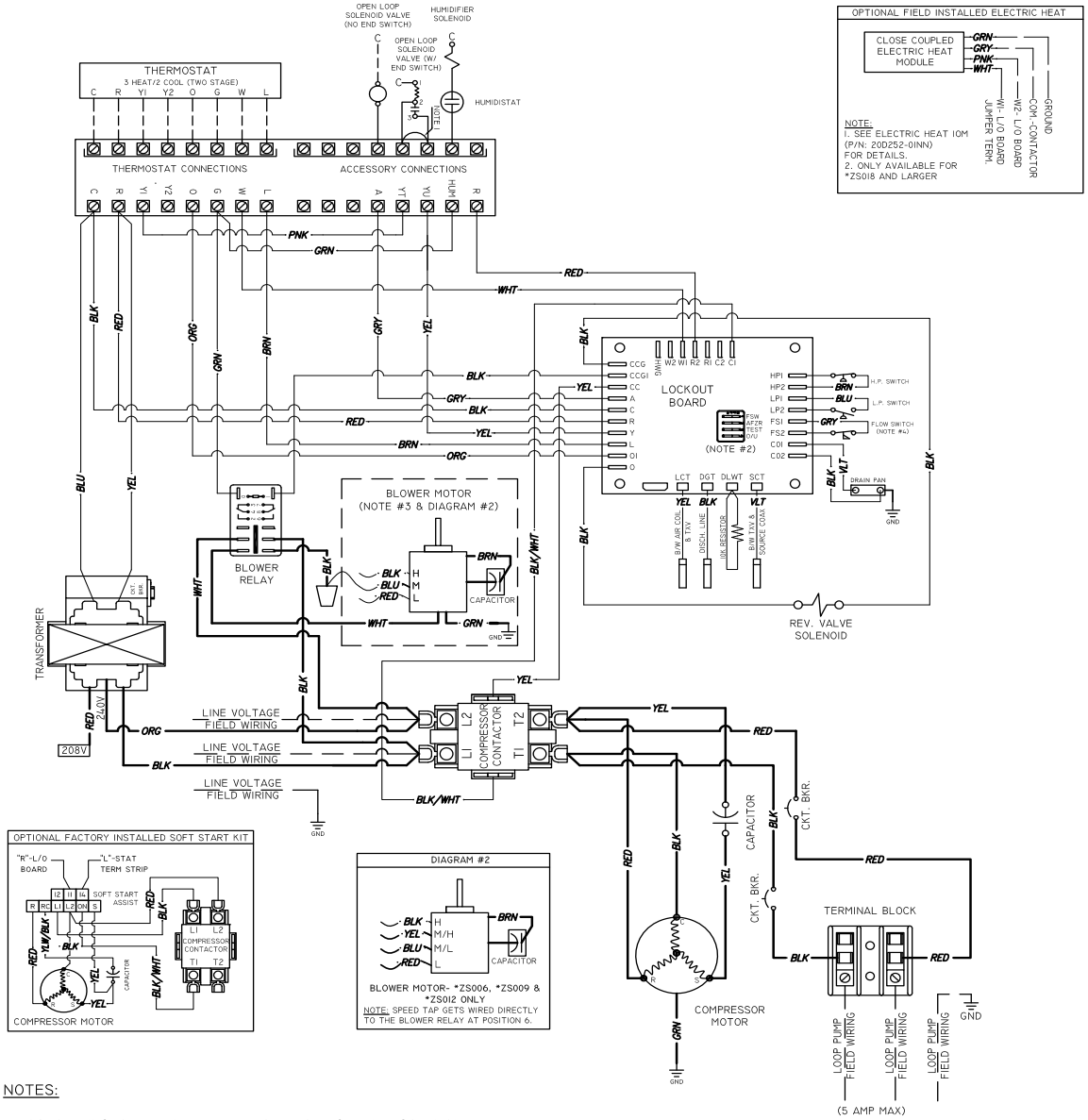
*ZS006= MED/LOW	*ZS009 = HIGH	*ZS012= HIGH
*ZS015= MED	*ZS017= HIGH	*ZS018= MED
*ZS024= MEDIUM	*ZS030= HIGH	*ZS036= HIGH
*ZS042= HIGH	*ZS048= MEDIUM	*ZS060= MEDIUM
*ZS072= HIGH		

5. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FS1 AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.

Section 9B: Wiring Diagrams (PSC Fan Only)

208/230V, Single Phase, 60Hz, Single-Stage, PSC, Residential

WATER-TO-AIR UNIT, SINGLE STAGE, PSC FAN, SINGLE PHASE, 208/230V, 60HZ, RESIDENTIAL *ZS SERIES



NOTES:

1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SPEED SHOULD BE SET TO THE FOLLOWING:

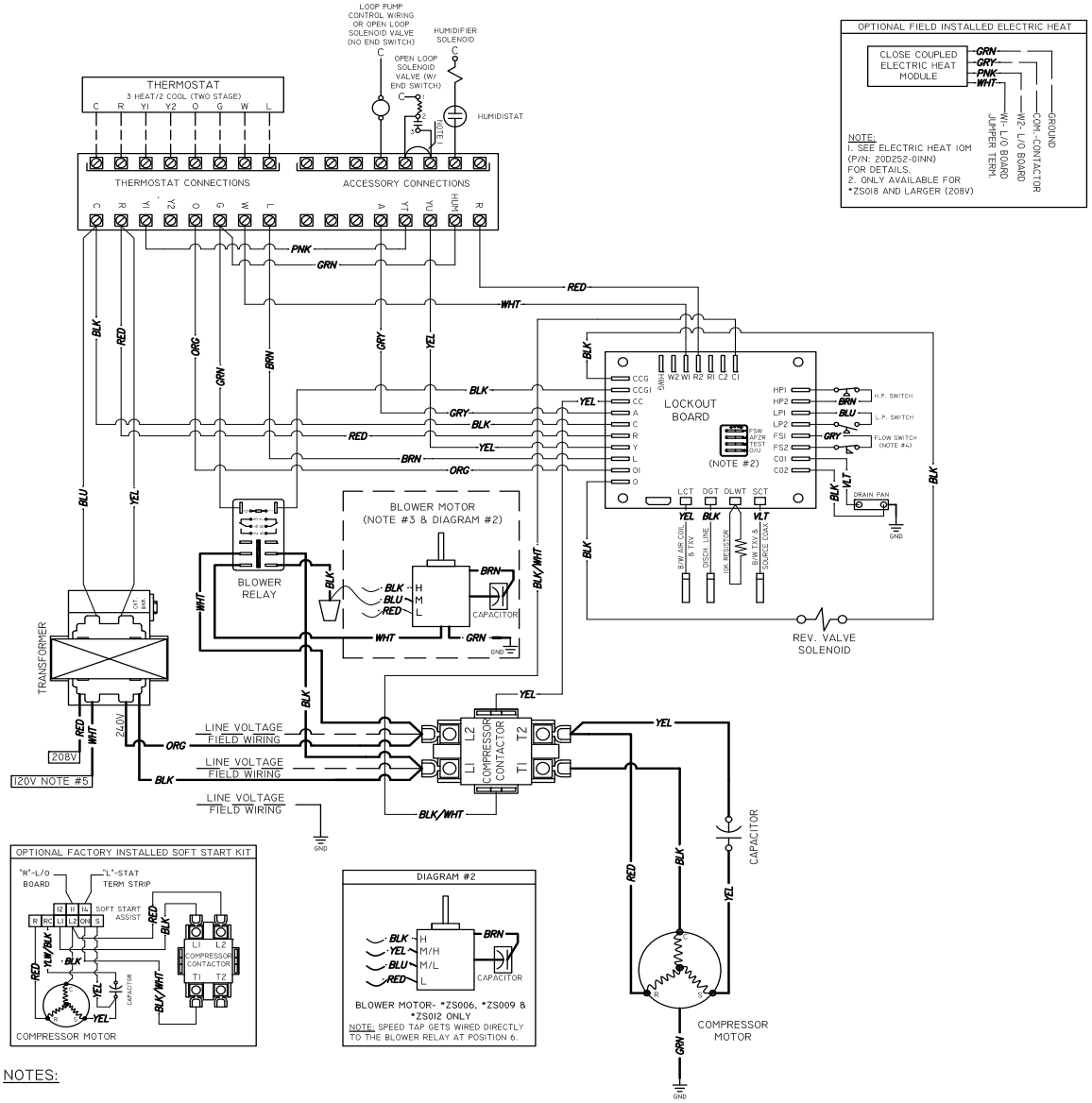
*ZS006= MED/LOW	*ZS009 = HIGH	*ZS012= HIGH
*ZS015= MED	*ZS017= HIGH	*ZS018= MED
*ZS024= MEDIUM	*ZS030= HIGH	*ZS036= HIGH
*ZS042= HIGH	*ZS048= MEDIUM	*ZS060= MEDIUM
*ZS072= HIGH		

4. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.

Section 9B: Wiring Diagrams (PSC Fan Only)

208/230V, Single Phase, 60Hz, Single-Stage, PSC, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE, PSC FAN, SINGLE PHASE, 208/230V OR 115V, 60Hz, COMMERCIAL *ZS SERIES



NOTES:

1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SPEED SHOULD BE SET TO THE FOLLOWING:

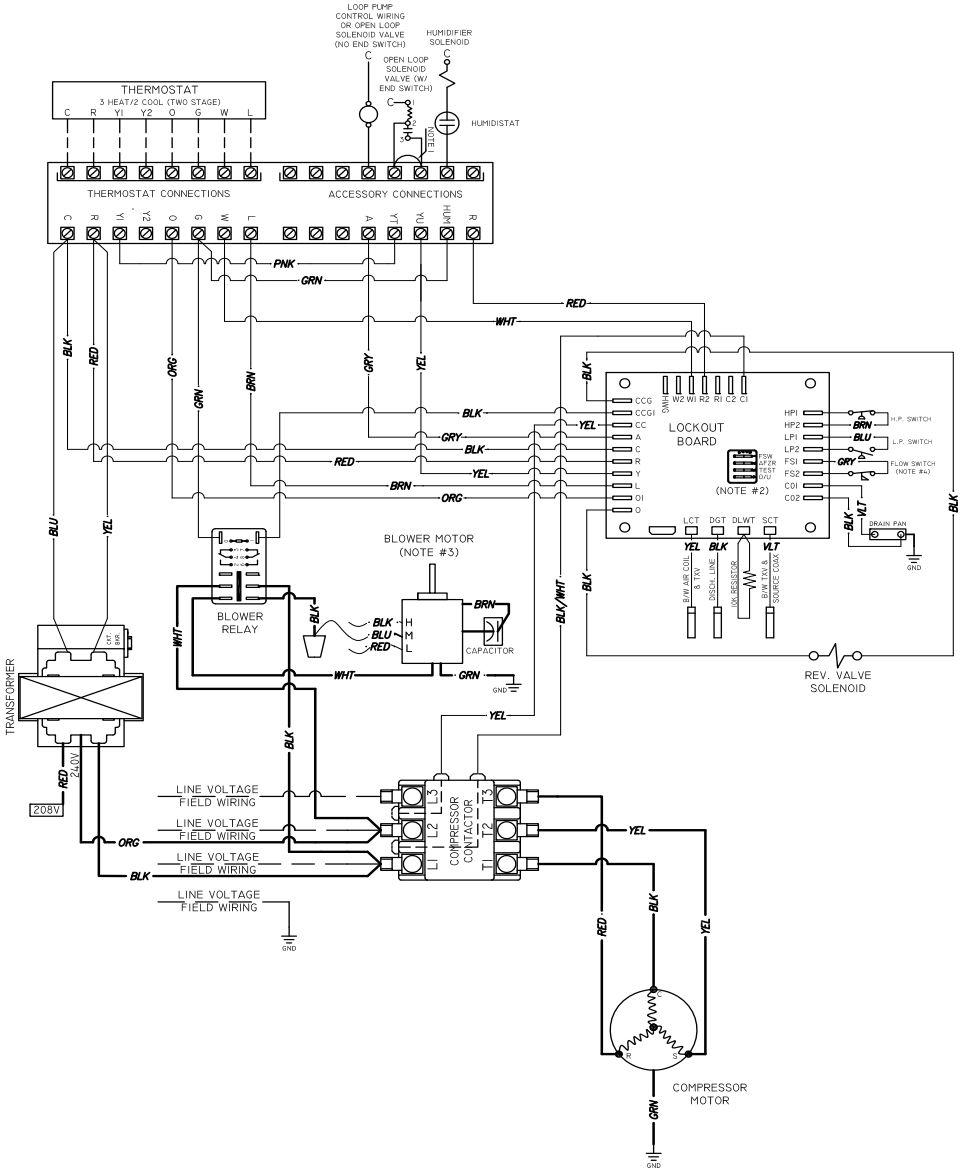
*ZS006= MED/LOW	*ZS009 = HIGH	*ZS012= HIGH
*ZS015= MED	*ZS017= HIGH	*ZS018= MED
*ZS024= MEDIUM	*ZS030= HIGH	*ZS036= HIGH
*ZS042= HIGH	*ZS048= MEDIUM	*ZS060= MEDIUM
*ZS072= HIGH		

4. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.
5. WHITE WIRE WILL BE HOOKED TO L2-TERMINAL AT THE CONTACTOR FOR 115V UNITS.

Section 9B: Wiring Diagrams (PSC Fan Only)

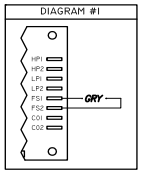
208/230V, Three Phase, 60Hz, Single-Stage, PSC, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE, PSC FAN, THREE PHASE, 208/230V, 60HZ, COMMERCIAL *ZS SERIES

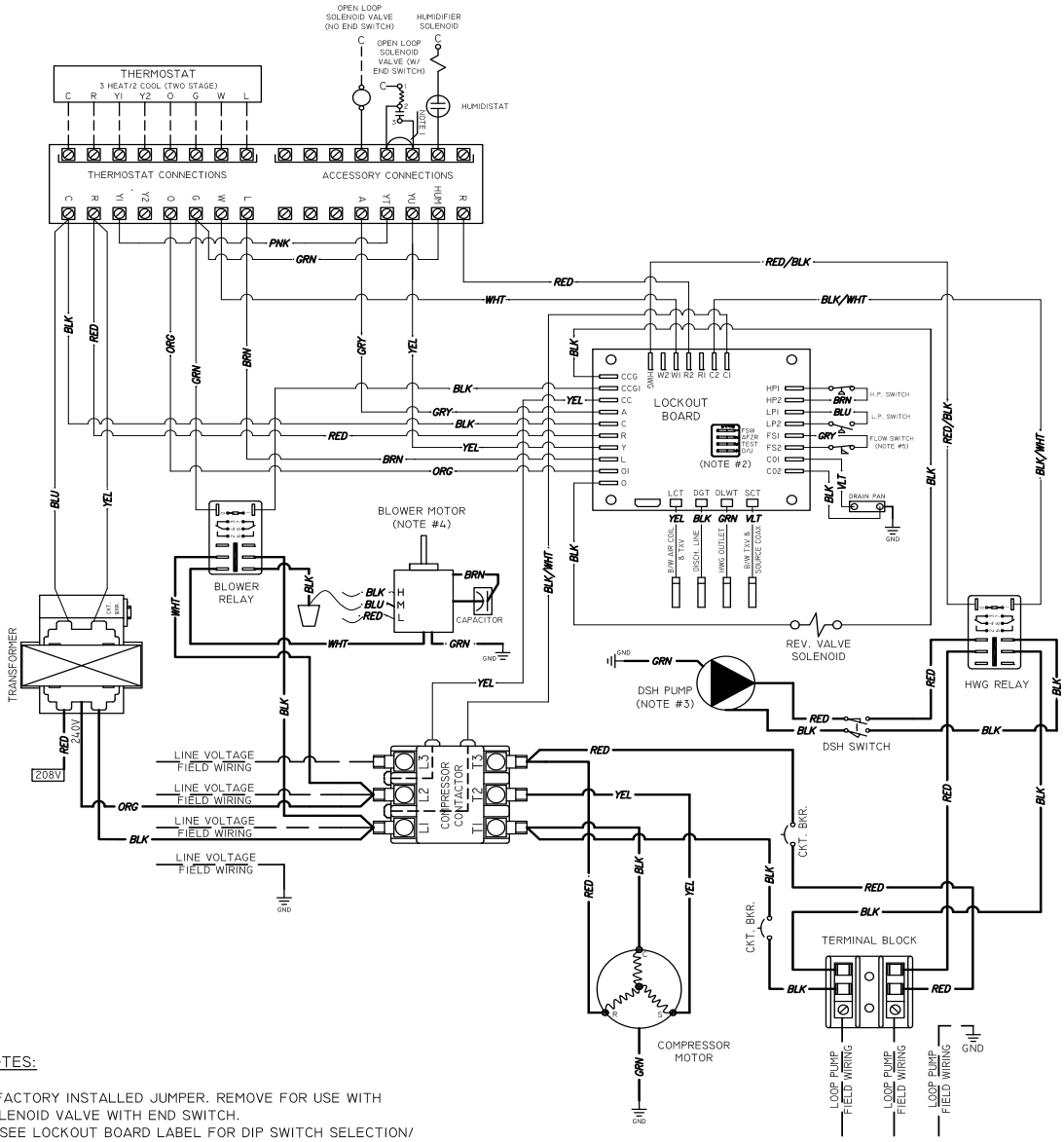


NOTES:

1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SPEED SHOULD BE SET TO THE FOLLOWING:
   *ZS024= MEDIUM *ZS030= HIGH
   *ZS036= HIGH *ZS042= HIGH
   *ZS048= MEDIUM *ZS060= MEDIUM
   *ZS072= HIGH
4. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.

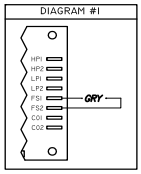


Water-to-Air Unit, Single Stage, PSC Fan, Three Phase, 208/230V, 60Hz, DSH, Commercial *ZS Series



NOTES:

1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. DESUPERHEATER PUMP POWER HARNESS IS NOT CONNECTED AT THE FACTORY. DO NOT CONNECT THE WIRES UNTIL THE PIPING IS COMPLETED AND PURGED OF AIR. RUNNING THE PUMP WITHOUT WATER WILL DAMAGE THE PUMP.
4. SPEED SHOULD BE SET TO THE FOLLOWING:
*ZS024= MEDIUM *ZS030= HIGH
*ZS036= HIGH *ZS042= HIGH
*ZS048= MEDIUM *ZS060= MEDIUM
*ZS072= HIGH
5. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 9B: Wiring Diagrams (PSC Fan Only)

460 or 575V, Three Phase, 60Hz, Single-Stage, PSC, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE, PSC FAN, THREE PHASE, 460V OR 575V, 60Hz, COMMERCIAL *ZS SERIES

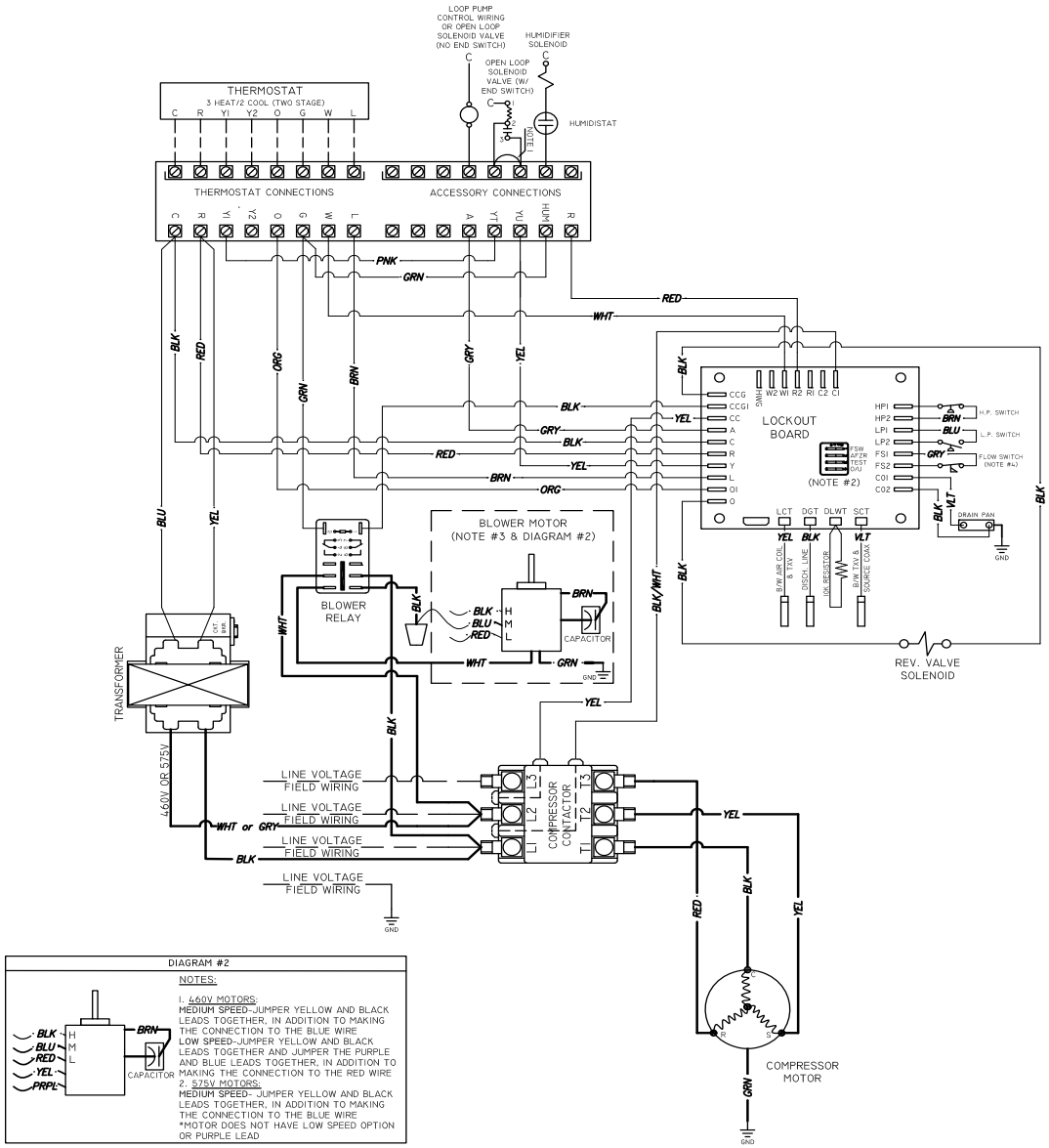


DIAGRAM #2

NOTES:

1. 460V MOTORS:
MEDIUM SPEED-JUMPER YELLOW AND BLACK LEADS TOGETHER, IN ADDITION TO MAKING THE CONNECTION TO THE BLUE WIRE
LOW SPEED-JUMPER YELLOW AND BLACK LEADS TOGETHER AND JUMPER THE PURPLE AND BLUE LEADS TOGETHER, IN ADDITION TO MAKING THE CONNECTION TO THE RED WIRE
2. 575V MOTORS:
MEDIUM SPEED- JUMPER YELLOW AND BLACK LEADS TOGETHER, IN ADDITION TO MAKING THE CONNECTION TO THE BLUE WIRE
*MOTOR DOES NOT HAVE LOW SPEED OPTION OR PURPLE LEAD

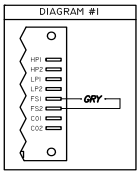
NOTES:

1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SPEED SHOULD BE SET TO THE FOLLOWING:

*ZS024= MEDIUM	*ZS030= HIGH
*ZS036= HIGH	*ZS042= HIGH
*ZS048= MEDIUM	*ZS060= MEDIUM
*ZS072= HIGH	

4. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.

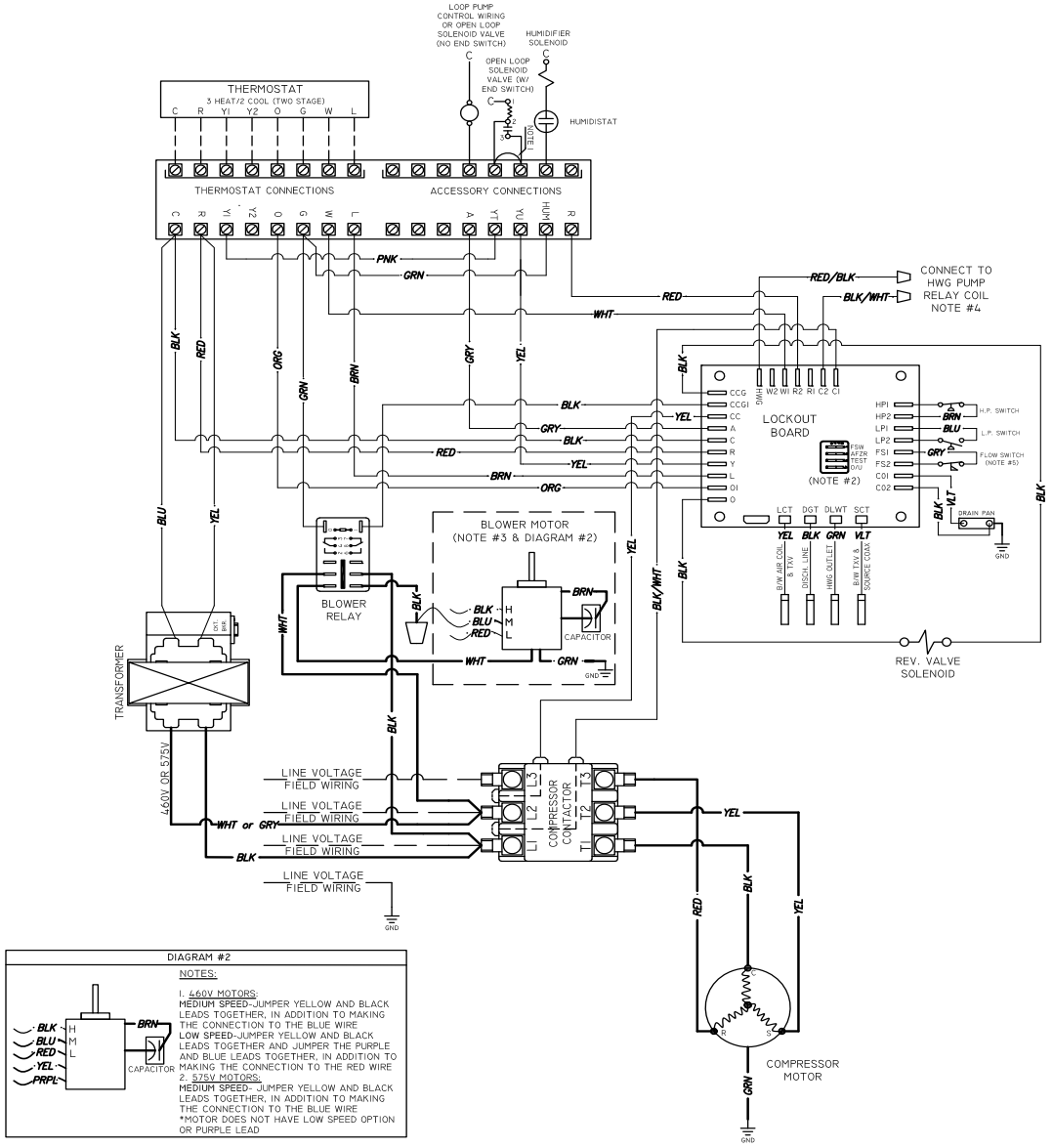
DIAGRAM #1



Section 9B: Wiring Diagrams (PSC Fan Only)

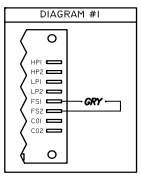
460 or 575V, Three Phase, 60Hz, Single-Stage, PSC, DSH, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE, PSC FAN, THREE PHASE, 460V OR 575V, 60HZ, DSH, COMMERCIAL *ZS SERIES



NOTES:

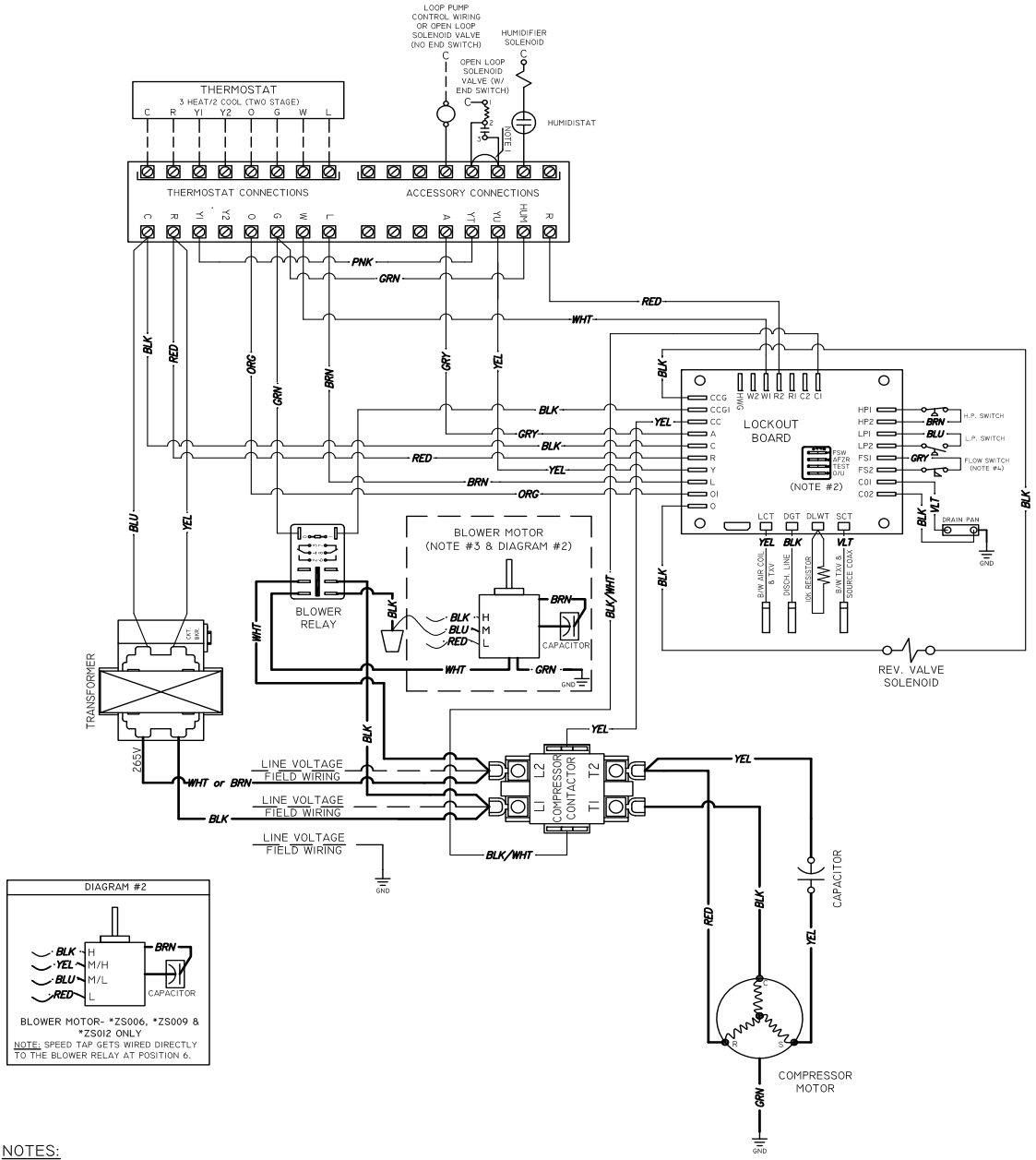
1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SPEED SHOULD BE SET TO THE FOLLOWING:
*ZS024= MEDIUM *ZS030= HIGH
*ZS036= HIGH *ZS042= HIGH
*ZS048= MEDIUM *ZS060= MEDIUM
*ZS072= HIGH
4. CONNECT WIRES TO THE HWG RELAY COIL. RELAY IS TO BE PROVIDED BY THE INSTALLER AND IS A N.C. RELAY THAT WILL INTERRUPT POWER TO THE PUMP WHEN CONDITIONS ARE INAPPROPRIATE FOR WATER HEATING. IF WIRES ARE NOT CONNECTED TO RELAY, SCALDING CAN OCCUR.
5. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 9B: Wiring Diagrams (PSC Fan Only)

265V, Single Phase, 60Hz, Single-Stage, PSC, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE, PSC FAN, SINGLE PHASE, 265V, 60HZ, COMMERCIAL *ZS SERIES



NOTES:

1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SPEED SHOULD BE SET TO THE FOLLOWING:

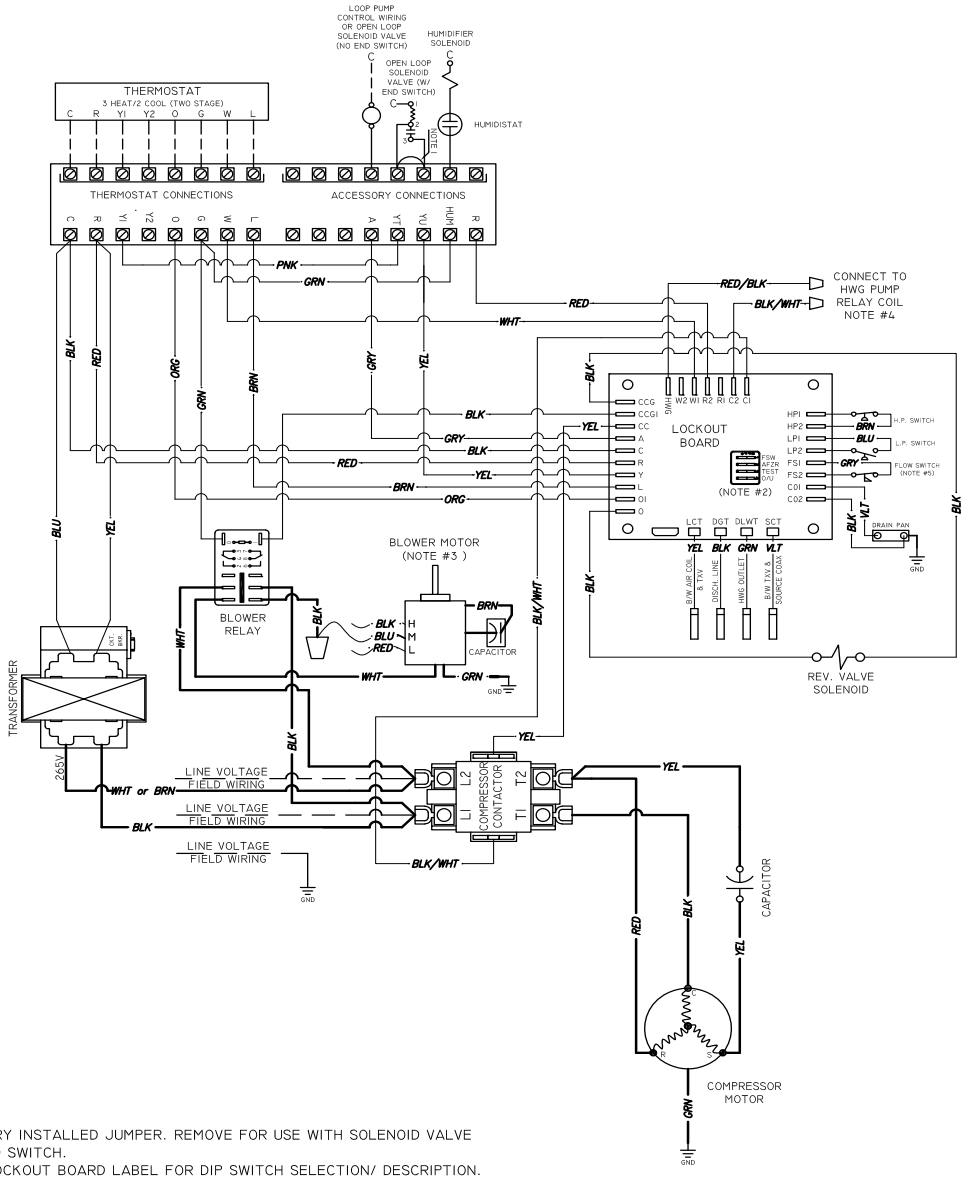
*ZS006= MED/LOW	*ZS009 = HIGH	*ZS012= HIGH
*ZS015= MEDIUM	*ZS017= HIGH	*ZS018= MEDIUM
*ZS024= MEDIUM	*ZS030= HIGH	*ZS036= HIGH

4. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.

Section 9B: Wiring Diagrams (PSC Fan Only)

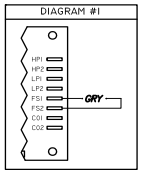
265V, Single Phase, 60Hz, Single-Stage, PSC, DSH, Commercial

WATER-TO-AIR UNIT, SINGLE STAGE, PSC FAN, SINGLE PHASE, 265V, 60HZ, DSH, COMMERCIAL *ZS SERIES



NOTES:

1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH.
2. SEE LOCKOUT BOARD LABEL FOR DIP SWITCH SELECTION/ DESCRIPTION.
3. SPEED SHOULD BE SET TO THE FOLLOWING:
*ZS015= MEDIUM *ZS017= HIGH *ZS018= MEDIUM
*ZS024= MEDIUM *ZS030= HIGH *ZS036= HIGH
4. CONNECT WIRES TO THE HWG RELAY COIL. RELAY IS TO BE PROVIDED BY THE INSTALLER AND IS A N.C. RELAY THAT WILL INTERRUPT POWER TO THE PUMP WHEN CONDITIONS ARE INAPPROPRIATE FOR WATER HEATING. IF WIRES ARE NOT CONNECTED TO RELAY, SCALDING CAN OCCUR.
5. UNITS THAT CONTAIN A COAXIAL HEAT EXCHANGER, WILL NOT HAVE A FLOW SWITCH. A GRAY JUMPER WIRE WILL BE INSTALLED BETWEEN THE FSI AND FS2 TERMINALS, AS SHOWN IN DIAGRAM #1.



Section 10: Accessories

Auxiliary Electric Heat

The AXCH, Revision 'B' electric heaters are designed specifically for the Enertech ZS/ZT Series Geothermal Heat Pump units. Good performance depends on proper application and correct installation. Follow the directions and information contained in document number 20D252-01NN, ZS/ZT Electric Heater IOM that is shipped with each heater purchased. Below is a reference compatibility table. Always refer to the IOM shipped with the heater for updated information.

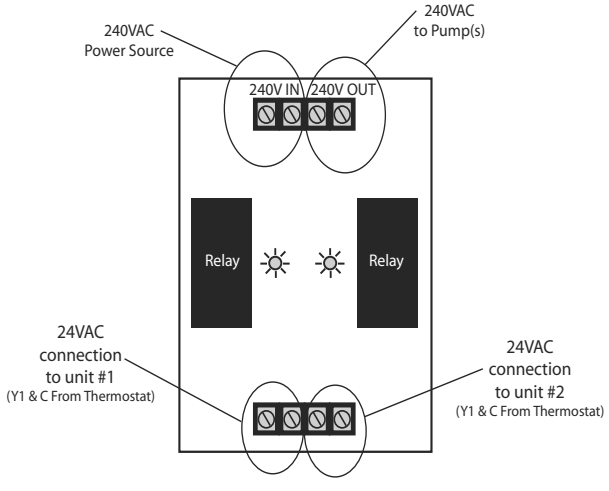
HEATER COMPATIBILITY TABLE:

Electric Heat Model	Description	ZS/ZT Models
AXCH051MB	5kW, 60Hz, 1 Phase, w/ Circuit Breaker	018-036, & 042* (*PSC Only)
AXCH101MB	10kW, 60Hz, 1 Phase, w/ Circuit Breaker	024-048
AXCH151MB	15kW, 60Hz, 1 Phase, w/ Circuit Breaker & Single Point Connection	042-048
AXCH101LB	10kW, 60Hz, 1 Phase, w/ Circuit Breaker	060-072
AXCH151LB	15kW, 60Hz, 1 Phase, w/ Circuit Breaker & Single Point Connection	060-072

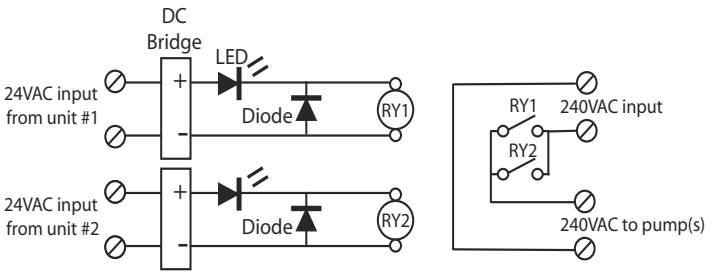
APSMA Pump Sharing Module

The pump sharing module, part number APSMA, 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 APSMA Module Layout Diagram, below. In the next column the APSMA Module Wiring Schematic provides a layout 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.

APSMA MODULE LAYOUT DIAGRAM



APSMA MODULE WIRING SCHEMATIC



Section 11: Equipment Start-Up Procedures

Equipment Start-Up Process

Check the following before power is applied to the equipment
Caution: Do not start-up the unit until the new structure is ready to be occupied

Electrical:

- High voltage wiring and breakers are properly sized and installed
- Auxiliary electric heaters are wired and installed correctly
- Circulator pumps are wired properly and connected to the proper terminal block
- Low voltage wiring is correct and completely installed
- Source voltage is correct and matches dataplate
- HWG pump is not wired or is switched off until all piping is correct and air is purged from the system
- Lockout board jumpers are properly selected for installation, i.e., A-FRZ jumper removed for closed loop

Plumbing:

- Piping is completed, properly sized and purged of all air and debris, loop, HWG and load side
- Pumps are properly sized and purged of all air
- Correct amount of antifreeze has been added
- All valves are open including flow center
- Condensate is trapped and properly piped to drain

Mechanical:

- Filter is installed and clean
- Packaging and shipping brackets are removed from the blower assembly
- Blower turns freely
- Canvas connections installed on supply plenum & return drop
- Replace all service panels and screws

Equipment Start-Up:

1. Energize geothermal unit with high voltage.
2. Make sure secondary/low voltage is between 20V and 29V. Check the transformer's primary connections at the main contactor for the correct voltage (Orange & Black = 230V; Red & Black = 208V). Correct any possible voltage drops in the main voltage.
3. Set the thermostat to "Heat" or "Cool." Adjust set point to energize the unit. System will energize after delays expire (typically a five minute delay).
4. Check water flow with a flow meter (non-pressurized) or pressure drop conversion (pressurized). Pressure drop tables must be used to convert the pressure drop to GPM. The pressure drop can be obtained by checking water pressure in and water pressure out at the P/T ports. Check the geothermal unit's electrical readings listed in the Unit Electrical Data table.
5. Check the source water temperature in and out at the P/T ports (use insertion probe). Allow 10 minutes of operation before recording temperature drop.
6. Calculate the heat of extraction or heat of rejection.
7. Check the temperature difference of the load coax (water-to-water) or air coil (water-to-air). P/T ports are recommended for use on the load side, but the line temperatures can be used to check the temperature difference.
8. Change the mode of the thermostat and adjust the set point to energize the unit. Check the data in opposite mode as the previous tests. Amp draws as well as temperature differences and flow rate should be recorded.
9. Check auxiliary heat operation by adjusting the thermostat set point 5°F above the room temperature in "Heat" mode or set thermostat to "Emergency." Record voltage, amperage, and air temperature difference.
10. Connect HWG wires or turn switch (if equipped) to on position.

Section 11: Equipment Start-Up Procedures

Glossary of Terms

ASC = Anti-Short Cycle	HGT = Hot Gas Temperature
AFRZ = Anti-Freeze	HP = High Pressure
CFM = Airflow, Cubic Feet/Minute	HR = Total Heat Of Rejection, Btu/hr
CO = Condensate Overflow	HWG = Hot Water Generator
COP = Coefficient of Performance = BTU Output / BTU input	KW = Total Power Unit Input, Kilowatts
DGT = Hot Discharge Gas Temperature	LAT = Leaving Air Temperature, Fahrenheit
DH = Desuperheater Capacity, Btu/hr	LC = Latent Cooling Capacity, Btu/hr
DLWT = Domestic Leaving Water Temperature	LCT = Load Coil (Heat Exchanger) Temperature (Freeze)
EAT = Entering Air Temperature, Fahrenheit (Dry/Wet Bulb)	LLT = Leaving Load Water Temperature, Fahrenheit
ECM = Electronically Commutated Motors	LP = Low Pressure
EER = Energy Efficiency Ratio = BTU output/Watts input	LWT = Leaving Source Water Temperature, Fahrenheit
ELT = Entering Load Water Temperature, Fahrenheit	O/U = Over/Under
EWT = Entering Source Water Temperature, Fahrenheit	ODD = On Demand Dehumidification
FS = Factory Setting	SC = Sensible Cooling Capacity, Btu/hr
FSW Flow Switch	SCT Source Coil (Heat Echanger) Temperature (Freeze)
GPM = Water Flow, Gallons Per Minute	TC = Total Cooling Capacity, Btu/hr
HC = Total Heating Capacity, Btu/hr	TEST = Test Mode
HE = Total Heat Of Extraction, Btu/hr	WPD = Water Pressure Drop, PSI & Feet of Water

Heating & Cooling Calculations

Heating	Cooling
$LAT = EAT + \frac{HC}{CFM \times 1.08}$	$LAT\ (DB) = EAT\ (DB) - \frac{SC}{CFM \times 1.08}$
$LWT = EWT - \frac{HE}{GPM \times 500}$	$LWT = EWT + \frac{HR}{GPM \times 500}$
	LC = TC - SC

Note: 500 for water - 485 for brine

Water Flow Selection

Proper flow rate is crucial for reliable operation of geothermal heat pumps. The performance data shows three flow rates for each entering water temperature (EWT column). The general "rule of thumb" when selecting flow rates is the following:

For COAX units:
Top flow rate: Open loop systems (1.5 to 2.0 gpm per ton)
Middle flow rate: Minimum closed loop system flow rate(2.25 to 2.50 gpm/ton)
Bottom flow rate: Nominal (optimum) closed loop system flow rate (3.0 gpm/ton)

For BPHE units:
Top flow rate: A minimum of 5 GPM for ZS/ZT015-024; a GPM (>5) that is above the flow switch click-on requirement with a typical 15% safety margin for ZS/ZT030-072;
Middle flow rate: 3 to 4.8 gpm/ton for ZS/ZT015-024; 2.5-2.9 gpm/ton for ZS/ZT030-072;
Bottom flow rate: Recommended closed loop system flow rate (3.0 gpm/ton) for ZS/ZT030-072; 3.5-5.6 gpm/ton for ZS/ZT015-024.

Although the industry standard is adequate in most areas of North America, it is important to consider the application type before applying this "rule of thumb." Antifreeze is generally required for all closed loop (geothermal) applications. Extreme Southern U.S. locations are the only exception. Open loop (well water) systems cannot use antifreeze, and must have enough flow rate in order to avoid freezing conditions at the Leaving Source Water Temperature (LWT) connection.

Calculations must be made for all systems without antifreeze to determine if the top flow rate is adequate to prevent LWT at or near freezing conditions. The following steps should taken in making this calculation:

Section 11: Equipment Start-Up Procedures

Determine minimum EWT based upon your geographical area.

Go to the performance data table for the heat pump model selected and look up the the Heat of Extraction (HE) at the "rule of thumb" water flow rate (GPM) and at the design Entering Air Temperature (EAT).

Calculate the temperature difference (TD) based upon the HE and GPM of the model.
TD = HE / (GPM x 500).
Calculate the LWT.
LWT = EWT - TD.

If the LWT is below 35-38°F, there is potential for freezing conditions if the flow rate or water temperature is less than ideal conditions, and the flow rate must be increased.

Example 1:
EWT = 50°F.
Model ZT048 COAX unit, full-load heating capacity. Flow rate = 6 GPM.
Air Flow = 1580 CFM. HE = 35,300 Btuh.
TD = 35,300 / (6 x 500) = 11.8°F
LWT = 50 - 11.8 = 38.2°F
Since the water flow is leaving at approximately 38.2°F, the flow rate is acceptable.

Example 2:
EWT = 40°F.
Model ZT048 COAX unit, full-load heating capacity. Flow rate = 6 GPM.
Air Flow = 1580 CFM. HE = 30,800 Btuh.
TD = 30,800 / (6 x 500) = 10.3°F
LWT = 40 - 10.3 = 29.7°F
Water flow rate must be increased or adding more antifreeze solution to avoid freezing.

Section 11: Equipment Start-Up Procedures

Equipment Start-Up Form

Customer Name:_____

Customer Address:_____

Model #:_____ Serial #:_____

Dealer Name:_____

Distributor Name:_____ Start-up Date:_____

Loop Type: Open Closed (Circle One)								
Flow Rate	**Cooling**		**Heating**		**Unit Electrical Data**	**Cooling**		**Heating**	
Source Water Pressure In		PSI		PSI	Line Voltage		V		
Source Water Pressure Out		PSI		PSI	Total Unit Amps		A		A
Source Water Pressure Drop		PSI		PSI	Compressor Amps		A		A
Flow Rate		GPM		GPM	Wire Size		GA		
*Check pressure drop chart for GPM					Circuit Breaker Size		A		

Source Water Temp. Difference	**Cooling**		**Heating**	
Source Water Temperature In		ºF		ºF
Source Water Temperature Out		ºF		ºF
Source Water Temperature Difference		ºF		ºF
Heat of Rejection/Extraction	**Cooling**		**Heating**	
Heat of Rejection		BTU/HR		
Heat Of Extraction				BTU/HR

Heat of Extraction/Rejection = GPM X Water Temp. Difference X 500 (Water - Open Loop)
Heat of Extraction/Rejection = GPM X Water Temp. Difference X 485 (Water & Antifreeze - Closed Loop)

Load Water Temp. Difference	**Cooling**		**Heating**	
Load Water Temperature In		ºF		ºF
Load Water Temperature Out		ºF		ºF
Load Water Temperature Difference		ºF		ºF
Air Temperature Difference	**Cooling**		**Heating**	
Supply Air Temperature		ºF		ºF
Return Air Temperature		ºF		ºF
Air Temp. Difference		ºF		ºF
*Confirm auxiliary heaters are de-energized for the above readings.				
Auxiliary Heat Operation Only			**Heating**	
Supply Air Temperature				ºF
Return Air Temperature				ºF
Air Temp. Difference				ºF
Auxiliary Heat Electrical Data			**Heating**	
Line Voltage				V
Total Amperage (Full kW - All Stages)				A
Wire Size				GA
Breaker Size				A
CFM = (Watts X 3.413) ÷ (Air Temp. Difference X 1.08)				
Watts = Volts X Auxiliary Heater Amps				

Installer/Technician:_____ Date:_____

Section 11: Equipment Start-Up Procedures

ZS - PSC BPHE Heat of Extraction/Heat of Rejection Tables

Model (PSC Unit)	GPM	CFM (Heating/Cooling)	BPHE Unit - Heat of Extraction (MBtuh)				BPHE Unit - Heat of Rejection (MBtuh)			
			30 °F	50 °F	70 °F	90 °F	50 °F	70 °F	90 °F	110 °F
ZS015	3.8	525/525	8.0	11.2	14.5	18.0	19.9	19.1	18.3	17.0
	4.5		8.2	11.4	14.8	18.4	19.8	19.0	18.2	17.0
	5.0		8.3	11.6	15.0	18.5	19.8	19.0	18.2	16.9
ZS017	3.8	600/600	8.7	12.3	16.1	20.2	23.1	22.5	21.2	20.2
	4.5		9.0	12.6	16.6	20.8	23.1	22.5	21.2	20.1
	5.0		9.1	12.8	16.8	21.0	23.1	22.5	21.1	20.1
ZS018	3.8	600/600	9.5	13.5	17.9	21.4	25.5	25.6	24.5	23.5
	4.5		9.8	13.9	18.4	22.0	25.5	25.6	24.4	23.4
	5.0		9.9	14.1	18.6	22.3	25.4	25.5	24.4	23.4
ZS024	3.8	750/750	12.4	17.5	23.1	27.8	32.1	32.4	31.4	30.4
	5.0		13.0	18.3	24.0	29.0	32.0	32.3	31.2	30.1
	6.0		13.3	18.8	24.6	29.7	32.0	32.2	31.1	30.0
ZS030	5.8	1000/1000	14.9	21.1	26.9	32.4	37.2	37.9	36.3	35.0
	6.5		15.2	21.6	27.5	33.1	37.3	37.9	36.3	35.0
	7.5		15.6	22.2	28.2	33.9	37.3	37.9	36.3	34.9
ZS036	8.0	1100/1100	18.5	25.9	33.7	40.5	45.8	46.3	44.7	43.2
	8.5		18.6	26.1	34.0	40.8	45.8	46.3	44.7	43.2
	9.0		18.8	26.3	34.3	41.1	45.7	46.3	44.6	43.1
ZS042	9.3	1400/1400	22.7	31.2	40.3	50.0	53.4	53.4	50.9	49.2
	10.0		22.9	31.4	40.6	50.4	53.4	53.3	50.8	49.2
	10.5		23.0	31.6	40.8	50.6	53.4	53.3	50.8	49.1
ZS048	9.3	1500/1500	27.4	37.4	47.5	57.6	61.9	61.3	58.8	56.7
	11.0		27.9	38.1	48.3	58.5	61.9	61.2	58.6	56.5
	12.0		28.0	38.3	48.5	58.8	61.8	61.1	58.6	56.4
ZS060	11.7	1900/1900	33.5	46.2	58.7	71.9	74.6	75.5	74.1	72.8
	13.0		34.1	46.9	59.6	73.0	74.6	75.4	74.0	72.6
	15.0		34.7	47.8	60.7	74.3	74.5	75.3	73.8	72.4
ZS072	11.7	2200/2200	36.7	50.9	64.0	77.5	83.3	86.5	86.0	83.6
	15.0		38.3	53.0	66.6	80.5	83.1	86.2	85.6	83.1
	18.0		39.2	54.2	68.1	82.3	82.9	86.0	85.4	82.8

1. Capacity data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
2. Heating data is based on 70°F EAT. Cooling data is based on 80/67°F EAT. Any condition outside performance table(s) requires correction factor(s).
3. Performance data accurate within ±15%.
4. Unit performance test is run without hot water generation.
5. Capacity data includes fan power but not pump power and it does not reflect fan or pump power correction for AHRI/ISO condition
6. Performance data is based upon the lower voltage of dual voltage rated units.
7. Interpolation of unit performance data is permissible; extrapolation is not.
8. Performance data is a result of lab testing and is not related to warranty.
9. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 11: Equipment Start-Up Procedures

ZS - PSC Coax Heat of Extraction/Heat of Rejection Tables

Model (PSC Unit)	GPM	CFM (Heating/Cooling)	COAX Unit - Heat of Extraction (MBtuh)				COAX Unit - Heat of Rejection (MBtuh)			
			30 °F	50 °F	70 °F	90 °F	50 °F	70 °F	90 °F	110 °F
ZS006	0.8	275/275	3.2	4.5	6.1	7.5	9.3	8.9	8.5	7.8
	1.1		3.3	4.6	6.2	7.7	9.3	8.9	8.4	7.7
	1.5		3.4	4.8	6.4	7.9	9.4	8.9	8.4	7.7
ZS009	1.1	350/350	4.7	6.7	8.8	11.0	13.4	12.8	12.2	11.4
	1.7		5.0	7.2	9.4	11.8	13.5	12.8	12.2	11.3
	2.3		5.2	7.4	9.7	12.1	13.6	12.8	12.2	11.3
ZS012	1.5	350/350	5.6	7.7	9.8	10.9	14.9	14.4	14.2	13.9
	2.3		5.8	8.0	10.2	11.4	14.8	14.3	14.0	13.7
	3.0		6.0	8.3	10.4	11.7	14.8	14.2	14.0	13.7
ZS015	1.9	525/525	7.5	10.6	13.9	17.2	19.1	18.1	17.7	17.0
	2.8		7.9	11.1	14.5	18.0	19.2	18.1	17.6	16.8
	3.8		8.2	11.6	15.1	18.6	19.2	18.1	17.6	16.7
ZS017	2.3	600/600	8.5	12.1	15.9	19.8	23.1	22.3	21.5	20.7
	3.4		9.0	12.7	16.6	20.7	23.3	22.4	21.5	20.6
	4.5		9.3	13.2	17.2	21.4	23.3	22.3	21.4	20.5
ZS018	2.3	600/600	8.9	13.1	17.2	19.8	24.7	25.2	24.7	23.7
	3.4		9.4	13.8	18.1	20.8	24.7	25.2	24.5	23.4
	4.5		9.8	14.2	18.6	21.4	24.6	25.1	24.4	23.3
ZS024	3.0	750/750	12.0	17.2	22.7	27.6	32.8	32.3	31.3	30.3
	4.5		12.5	18.0	23.6	28.8	32.7	32.2	31.0	29.9
	6.0		12.9	18.5	24.3	29.6	32.7	32.1	30.9	29.7
ZS030	3.8	1000/1000	15.3	21.0	26.7	32.3	36.5	37.0	35.8	34.5
	5.6		16.2	22.1	28.0	33.8	36.6	37.1	35.7	34.3
	7.5		16.7	22.7	28.7	34.7	36.6	37.0	35.6	34.1
ZS036	4.5	1100/1100	17.6	24.2	32.3	39.7	47.0	46.8	45.1	43.6
	6.8		18.8	25.8	34.3	42.2	47.5	47.2	45.4	43.7
	9.0		19.5	26.8	35.6	43.7	46.9	46.5	44.6	42.8
ZS042	5.3	1400/1400	19.2	27.0	34.8	42.6	51.5	51.9	50.5	48.9
	7.9		20.3	28.4	36.5	44.7	51.5	51.8	50.3	48.5
	10.5		20.8	29.1	37.4	45.7	51.4	51.7	50.0	48.2
ZS048	6.0	1500/1500	23.3	31.9	40.8	50.2	61.9	62.0	60.1	58.2
	9.0		24.8	34.0	43.3	53.3	61.9	61.8	59.8	57.7
	12.0		25.6	35.0	44.5	54.7	62.0	61.9	59.7	57.5
ZS060	7.5	1900/1900	31.7	42.0	53.2	66.0	75.5	75.3	71.1	69.2
	11.3		33.5	44.2	56.0	69.4	75.5	75.1	70.7	68.6
	15.0		34.6	45.6	57.6	71.3	75.4	75.0	70.5	68.3
ZS072	9.0	2200/2200	33.8	47.0	60.4	74.8	87.8	88.4	84.5	80.7
	13.5		35.8	49.6	63.6	78.6	87.8	88.2	84.1	79.9
	18.0		36.9	51.0	65.4	80.9	87.5	87.8	83.6	79.3

1. Capacity data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
2. Heating data is based on 70°F EAT. Cooling data is based on 80/67°F EAT. Any condition outside performance table(s) requires correction factor(s).
3. Performance data accurate within ±15%.
4. Unit performance test is run without hot water generation.
5. Capacity data includes fan power but not pump power and it does not reflect fan or pump power correction for AHRI/ISO conditions.
6. Performance data is based upon the lower voltage of dual voltage rated units.
7. Interpolation of unit performance data is permissible; extrapolation is not.
8. Performance data is a result of lab testing and is not related to warranty.
9. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 11: Equipment Start-Up Procedures

ZS - ECM BPHE Heat of Extraction/Heat of Rejection Tables

Model (ECM Unit)	GPM	CFM (Heating/Cooling)	BPHE Unit - Heat of Extraction (MBtuh)				BPHE Unit - Heat of Rejection (MBtuh)			
			30 °F	50 °F	70 °F	90 °F	50 °F	70 °F	90 °F	110 °F
ZS015	3.8	500/500	7.9	11.0	14.3	17.7	19.7	18.9	18.2	16.9
	4.5		8.1	11.3	14.7	18.1	19.7	18.9	18.1	16.9
	5.0		8.2	11.4	14.8	18.3	19.7	18.9	18.1	16.8
ZS017	3.8	620/620	8.8	12.4	16.2	20.4	23.2	22.6	21.3	20.3
	4.5		9.1	12.7	16.7	20.9	23.2	22.7	21.3	20.3
	5.0		9.2	12.9	16.9	21.2	23.2	22.6	21.3	20.2
ZS018	3.8	630/630	9.6	13.7	18.1	21.7	25.8	25.9	24.7	23.7
	4.5		9.9	14.1	18.6	22.2	25.7	25.8	24.7	23.6
	5.0		10.1	14.3	18.9	22.5	25.7	25.8	24.7	23.6
ZS024	3.8	850/860	12.7	17.8	23.4	28.2	32.5	32.8	31.8	30.8
	5.0		13.2	18.5	24.4	29.3	32.4	32.7	31.6	30.5
	6.0		13.6	19.0	25.0	30.1	32.3	32.6	31.5	30.4
ZS030	5.8	1070/960	15.0	21.3	27.2	32.6	37.0	37.7	36.1	34.8
	6.5		15.4	21.8	27.7	33.3	37.0	37.7	36.1	34.7
	7.5		15.8	22.4	28.5	34.1	37.1	37.7	36.1	34.7
ZS036	8.0	1230/1260	19.5	27.2	35.5	42.5	47.6	48.2	46.5	45.0
	8.5		19.7	27.5	35.7	42.8	47.5	48.1	46.4	44.9
	9.0		19.8	27.7	36.0	43.1	47.5	48.1	46.4	44.8
ZS042	9.3	1270/1410	22.3	30.7	39.7	49.3	53.5	53.4	51.0	49.3
	10.0		22.5	30.9	40.0	49.6	53.4	53.4	50.9	49.2
	10.5		22.6	31.1	40.2	49.9	53.4	53.4	50.9	49.2
ZS048	9.3	1580/1710	27.7	37.7	47.8	58.0	63.7	63.1	60.5	58.5
	11.0		28.1	38.3	48.6	58.9	63.6	63.0	60.4	58.3
	12.0		28.3	38.5	48.9	59.2	63.6	62.9	60.3	58.2
ZS060	11.7	2000/1900	33.7	46.4	58.9	72.2	74.6	75.5	74.1	72.8
	13.0		34.3	47.2	59.9	73.3	74.6	75.4	74.0	72.6
	15.0		34.9	48.1	61.0	74.6	74.5	75.3	73.8	72.4
ZS072	11.7	2200/2230	37.0	51.0	64.2	77.6	83.3	86.5	86.1	83.7
	15.0		38.6	53.1	66.8	80.7	83.1	86.2	85.7	83.1
	18.0		39.5	54.3	68.3	82.4	82.9	86.1	85.4	82.9

1. Capacity data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
2. Heating data is based on 70°F EAT. Cooling data is based on 80/67°F EAT. Any condition outside performance table(s) requires correction factor(s).
3. Performance data accurate within ±15%.
4. Unit performance test is run without hot water generation.
5. Capacity data includes fan power but not pump power and it does not reflect fan or pump power correction for AHRI/ISO conditions.
6. Performance data is based upon the lower voltage of dual voltage rated units.
7. Interpolation of unit performance data is permissible; extrapolation is not.
8. Performance data is a result of lab testing and is not related to warranty.
9. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 11: Equipment Start-Up Procedures

ZS - ECM Coax Heat of Extraction/Heat of Rejection Tables

Model (ECM Unit)	GPM	CFM (Heating/Cooling)	COAX Unit - Heat of Extraction (MBtuh)				COAX Unit - Heat of Rejection (MBtuh)			
			30 °F	50 °F	70 °F	90 °F	50 °F	70 °F	90 °F	110 °F
ZS015	1.9	500/500	7.2	10.3	13.5	16.7	18.2	17.3	17.0	16.3
	2.8		7.6	10.8	14.1	17.5	18.3	17.3	16.9	16.1
	3.8		8.0	11.3	14.7	18.2	18.4	17.4	16.9	16.1
ZS017	2.3	620/620	8.5	12.1	15.9	19.8	23.3	22.5	21.6	20.9
	3.4		9.0	12.8	16.7	20.8	23.5	22.6	21.6	20.8
	4.5		9.3	13.2	17.3	21.5	23.4	22.5	21.5	20.6
ZS018	2.3	630/630	9.0	13.2	17.3	19.8	25.1	25.7	25.2	24.2
	3.4		9.5	13.9	18.2	20.9	25.1	25.6	25.0	23.8
	4.5		9.8	14.3	18.7	21.5	25.1	25.6	24.9	23.8
ZS024	3.0	850/860	12.2	17.6	23.1	28.1	33.4	33.0	32.0	31.0
	4.5		12.8	18.3	24.0	29.2	33.4	32.9	31.7	30.6
	6.0		13.2	18.9	24.7	30.1	33.4	32.8	31.6	30.4
ZS030	3.8	1070/960	15.4	21.1	26.8	32.4	36.3	36.8	35.6	34.3
	5.6		16.3	22.2	28.1	33.9	36.4	36.8	35.5	34.1
	7.5		16.7	22.8	28.8	34.8	36.3	36.8	35.3	33.9
ZS036	4.5	1230/1260	17.8	24.4	32.4	39.9	47.4	47.3	45.6	44.2
	6.8		19.0	26.0	34.5	42.4	47.3	47.1	45.3	43.7
	9.0		19.7	27.0	35.7	43.9	47.2	46.9	45.1	43.3
ZS042	5.3	1270/1410	19.1	26.8	34.5	42.3	51.5	52.0	50.6	49.0
	7.9		20.1	28.2	36.3	44.4	51.6	51.9	50.3	48.5
	10.5		20.6	28.8	37.1	45.4	51.4	51.7	50.1	48.2
ZS048	6.0	1580/1710	23.6	32.4	41.3	50.8	63.1	63.1	61.4	59.8
	9.0		25.2	34.4	43.9	53.9	63.0	62.9	61.0	59.1
	12.0		25.9	35.4	45.1	55.4	62.8	62.6	60.7	58.7
ZS060	7.5	2000/1900	32.1	42.4	53.7	66.5	75.5	75.3	71.1	69.3
	11.3		33.9	44.7	56.6	70.0	75.5	75.1	70.7	68.6
	15.0		35.0	46.0	58.2	72.0	75.4	75.0	70.5	68.3
ZS072	9.0	2200/2230	33.9	47.0	60.4	74.7	87.9	88.5	84.7	80.9
	13.5		35.8	49.6	63.6	78.6	87.8	88.2	84.1	80.0
	18.0		36.9	51.0	65.4	80.9	87.5	87.9	83.7	79.4

1. Capacity data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).

2. Heating data is based on 70°F EAT. Cooling data is based on 80/67°F EAT. Any condition outside performance table(s) requires correction factor(s).
3. Performance data accurate within ±15%.
4. Unit performance test is run without hot water generation.
5. Capacity data includes fan power but not pump power and it does not reflect fan or pump power correction for AHRI/ISO conditions.
6. Performance data is based upon the lower voltage of dual voltage rated units.
7. Interpolation of unit performance data is permissible; extrapolation is not.
8. Performance data is a result of lab testing and is not related to warranty.
9. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 11: Equipment Start-Up Procedures

ZT BPHE Heat of Extraction/Heat of Rejection Tables

Model		GPM	CFM (Heating/Cooling)	BPHE Unit - Heat of Extraction (MBtuh)				BPHE Unit - Heat of Rejection (MBtuh)			
				30 °F	50 °F	70 °F	90 °F	50 °F	70 °F	90 °F	110 °F
ZT024	Part Load	3.8	650/650	8.3	12.2	16.7	21.9	24.3	23.8	23.0	21.7
		5.0		8.8	12.9	17.6	23.0	24.2	23.8	22.9	21.4
		6.0		9.1	13.2	18.1	23.7	24.2	23.7	22.8	21.3
	Full Load	3.8	850/860	11.8	16.3	22.5	27.6	33.2	33.4	32.5	31.3
		5.0		12.7	17.5	24.0	29.4	33.1	33.2	32.2	30.9
		6.0		13.2	18.1	24.9	30.5	33.0	33.1	32.1	30.7
ZT030	Part Load	5.8	840/750	12.1	17.6	23.4	29.4	31.0	30.2	28.9	27.5
		6.5		12.1	17.7	23.5	29.5	31.1	30.3	29.0	27.6
		7.5		12.0	17.5	23.3	29.3	31.6	30.7	29.4	28.0
	Full Load	5.8	1070/960	15.9	23.0	29.8	34.7	41.1	41.5	39.9	38.1
		6.5		16.3	23.5	30.4	35.3	41.2	41.5	39.9	38.1
		7.5		16.7	24.0	31.1	36.1	41.2	41.5	39.9	38.1
ZT036	Part Load	8.0	980/910	13.3	19.2	26.1	33.9	34.4	34.0	31.7	29.6
		8.5		13.4	19.3	26.2	34.0	34.3	34.0	31.7	29.6
		9.0		13.4	19.4	26.3	34.1	34.3	34.0	31.7	29.6
	Full Load	8.0	1230/1260	19.1	26.2	34.0	42.4	43.7	47.5	44.6	41.6
		8.5		19.3	26.5	34.3	42.8	43.7	47.5	44.6	41.6
		9.0		19.4	26.7	34.6	43.2	43.7	47.5	44.6	41.5
ZT042	Part Load	9.3	1010/1200	16.3	23.2	30.5	38.2	40.9	40.0	38.2	36.3
		10.0		16.2	23.0	30.3	38.0	41.3	40.5	38.6	36.7
		10.5		16.0	22.9	30.1	37.7	41.8	40.9	39.1	37.1
	Full Load	9.3	1270/1410	24.2	32.4	41.0	48.3	53.7	54.9	52.5	49.8
		10.0		24.4	32.7	41.4	48.8	53.6	54.8	52.4	49.7
		10.5		24.6	32.8	41.7	49.1	53.6	54.8	52.4	49.7
ZT048	Part Load	9.3	1230/1510	17.6	25.3	34.1	41.8	46.9	45.2	43.8	41.3
		11.0		18.2	26.1	35.2	43.0	47.2	45.5	44.1	41.6
		12.0		18.8	26.8	36.1	44.1	47.7	46.1	44.6	42.1
	Full Load	9.3	1580/1710	24.9	34.6	44.8	54.1	58.8	60.1	57.8	55.1
		11.0		25.5	35.3	45.7	55.2	58.8	60.1	57.7	55.0
		12.0		25.7	35.6	46.1	55.7	58.8	60.1	57.7	54.9
ZT060	Part Load	11.7	1560/1500	23.7	34.0	46.4	55.5	56.6	55.6	54.6	52.5
		13.0		23.9	34.2	46.7	55.9	56.5	55.5	54.5	52.3
		15.0		24.1	34.6	47.2	56.5	56.5	55.5	54.5	52.2
	Full Load	11.7	2000/1900	35.2	47.1	60.9	73.5	72.8	74.0	71.6	69.6
		13.0		35.9	48.1	62.1	74.9	72.8	73.9	71.4	69.4
		15.0		36.8	49.2	63.5	76.7	72.7	73.8	71.3	69.2
ZT072	Part Load	11.7	1900/1820	28.0	39.7	52.8	65.2	66.8	68.4	65.8	62.0
		15.0		29.0	41.1	54.5	67.2	66.8	68.3	65.6	61.6
		18.0		30.1	42.6	56.5	69.7	67.0	68.6	65.9	62.0
	Full Load	11.7	2200/2230	38.0	51.9	67.2	80.0	86.2	91.3	89.3	85.3
		15.0		39.5	53.8	69.6	82.8	86.0	91.1	89.0	84.8
		18.0		40.4	55.0	71.1	84.6	85.9	90.9	88.8	84.5

1. Capacity data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
2. Heating data is based on 70°F EAT. Cooling data is based on 80/67°F EAT. Any condition outside performance table(s) requires correction factor(s).
3. Performance data accurate within ±15%.
4. Unit performance test is run without hot water generation.
5. Capacity data includes fan power but not pump power and it does not reflect fan or pump power correction for AHRI/ISO conditions.
6. Performance data is based upon the lower voltage of dual voltage rated units.
7. Interpolation of unit performance data is permissible; extrapolation is not.
8. Performance data is a result of lab testing and is not related to warranty.
9. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 11: Equipment Start-Up Procedures

ZT Coax Heat of Extraction/Heat of Rejection Tables

Model		GPM	CFM (Heating/Cooling)	COAX Unit - Heat of Extraction (MBtuh)				COAX Unit - Heat of Rejection (MBtuh)			
				30 °F	50 °F	70 °F	90 °F	50 °F	70 °F	90 °F	110 °F
ZT024	Part Load	2.0	650/650	7.7	11.8	16.0	20.6	25.1	24.5	23.5	22.2
		3.0		8.2	12.4	16.9	21.6	25.3	24.6	23.5	21.9
		4.0		8.6	13.0	17.6	22.5	25.3	24.6	23.4	21.7
	Full Load	3.0	850/860	12.3	17.1	22.6	27.9	34.4	34.4	33.0	31.6
		4.5		13.0	18.0	23.7	29.2	34.5	34.4	32.9	31.3
		6.0		13.4	18.6	24.4	30.1	34.5	34.4	32.8	31.1
ZT030	Part Load	2.5	840/750	12.3	17.6	22.8	27.8	29.8	29.1	28.0	26.9
		3.8		12.9	18.3	23.6	28.9	29.8	29.0	27.9	26.7
		5.0		12.9	18.3	23.7	29.0	29.9	29.1	27.9	26.7
	Full Load	3.8	1070/960	16.6	22.7	28.2	33.0	38.4	39.6	38.6	36.7
		5.6		17.5	23.9	29.6	34.7	38.8	40.0	38.9	37.0
		7.5		17.9	24.4	30.2	35.4	38.9	40.1	39.0	37.1
ZT036	Part Load	3.0	980/910	12.3	17.2	22.8	29.2	35.3	34.3	33.5	32.3
		4.5		13.2	18.3	24.2	30.9	35.5	34.3	33.3	31.9
		6.0		13.7	19.0	25.1	32.1	35.6	34.3	33.1	31.5
	Full Load	4.5	1230/1260	17.4	24.3	31.6	39.1	48.3	47.6	45.8	44.2
		6.8		18.5	25.7	33.3	41.3	48.4	47.5	45.7	43.8
		9.0		19.0	26.5	34.3	42.5	48.3	47.4	45.5	43.6
ZT042	Part Load	3.5	1010/1200	15.6	21.4	27.7	34.5	41.3	40.0	38.6	37.8
		5.3		16.6	22.7	29.3	36.3	41.6	40.2	38.4	37.3
		7.0		17.0	23.2	29.9	37.2	41.6	40.0	38.2	36.8
	Full Load	5.3	1270/1410	22.6	30.2	38.4	47.2	54.3	54.3	52.7	51.1
		7.9		23.9	31.8	40.4	49.7	54.5	54.4	52.5	50.7
		10.5		24.4	32.5	41.3	50.7	54.7	54.5	52.6	50.6
ZT048	Part Load	4.0	1230/1510	15.7	23.3	31.3	37.4	47.7	45.8	44.1	43.2
		6.0		17.1	25.3	33.9	40.3	48.0	45.8	43.8	42.6
		8.0		18.5	27.2	36.3	43.2	47.9	45.6	43.5	42.1
	Full Load	6.0	1580/1710	26.2	35.3	44.1	53.2	63.5	62.1	60.2	58.8
		9.0		27.6	37.0	46.3	55.7	63.4	61.8	59.8	58.2
		12.0		28.5	38.2	47.6	57.4	63.2	61.6	59.5	57.8
ZT060	Part Load	5.0	1560/1500	21.3	29.0	38.0	47.3	53.8	53.9	51.3	48.4
		7.5		22.9	31.1	40.7	50.4	54.0	53.8	50.9	47.6
		10.0		23.8	32.3	42.2	52.2	54.0	53.8	50.7	47.2
	Full Load	7.5	2000/1900	33.5	44.0	56.9	67.9	73.7	75.6	73.5	70.4
		11.3		35.6	46.7	60.2	71.8	73.6	75.3	73.0	69.6
		15.0		36.3	47.6	61.4	73.3	73.4	75.1	72.7	69.2
ZT072	Part Load	6.0	1900/1820	21.7	33.3	45.2	56.9	65.1	64.7	61.6	57.4
		9.0		23.3	35.5	48.0	60.3	65.8	65.2	61.6	56.9
		12.0		24.1	36.6	49.4	62.0	66.2	65.4	61.6	56.6
	Full Load	9.0	2200/2230	34.0	47.6	61.5	73.9	84.0	86.7	83.6	78.4
		13.5		36.2	50.5	65.1	78.1	84.0	86.6	83.3	77.8
		18.0		38.1	52.9	68.2	81.8	83.9	86.4	83.0	77.4

1. Capacity data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
2. Heating data is based on 70°F EAT. Cooling data is based on 80/67°F EAT. Any condition outside performance table(s) requires correction factor(s).
3. Performance data accurate within ±15%.
4. Unit performance test is run without hot water generation.
5. Capacity data includes fan power but not pump power and it does not reflect fan or pump power correction for AHRI/ISO conditions.
6. Performance data is based upon the lower voltage of dual voltage rated units.
7. Interpolation of unit performance data is permissible; extrapolation is not.
8. Performance data is a result of lab testing and is not related to warranty.
9. Due to variations in installation, actual unit performance may vary from the tabulated data.
10. Continuous research and development may result in a change to the current product design and specifications without notice.

Section 11: Equipment Start-Up Procedures

ZS BPHE Pressure Drop Tables

Model	GPM	BPHE Unit - Source Brine Pressure Drop							
		30 °F		50 °F		70 °F		90 °F	
		PSI	FT HD	PSI	FT HD	PSI	FT HD	PSI	FT HD
ZS015	3.8	0.8	1.8	0.7	1.6	0.7	1.6	0.7	1.6
	5.0	1.2	2.8	1.1	2.5	1.0	2.3	1.0	2.3
	6.0	1.5	3.5	1.4	3.2	1.3	3.0	1.3	3.0
	7.0	1.9	4.4	1.8	4.2	1.7	3.9	1.6	3.7
ZS017	3.8	0.8	1.9	0.8	1.8	0.7	1.7	0.7	1.7
	5.0	1.2	2.8	1.1	2.5	1.1	2.5	1.1	2.5
	6.0	1.6	3.7	1.5	3.5	1.4	3.2	1.4	3.2
	7.0	2.1	4.8	1.9	4.4	1.8	4.2	1.8	4.2
ZS018	3.8	0.7	1.7	0.7	1.6	0.7	1.5	0.6	1.5
	5.0	1.0	2.3	0.9	2.1	0.9	2.1	0.9	2.1
	6.0	1.3	3.0	1.2	2.8	1.2	2.8	1.1	2.5
	7.0	1.7	3.9	1.6	3.7	1.5	3.5	1.5	3.5
ZS024	3.8	0.8	1.7	0.7	1.6	0.6	1.5	0.6	1.4
	5.0	1.0	2.3	0.9	2.1	0.9	2.1	0.9	2.1
	6.0	1.3	3.0	1.2	2.8	1.1	2.5	1.1	2.5
	7.0	1.7	3.9	1.5	3.5	1.4	3.2	1.4	3.2
ZS030	5.8	1.3	3.0	1.2	2.8	1.1	2.5	1.1	2.5
	6.5	1.5	3.5	1.4	3.2	1.3	3.0	1.3	3.0
	7.5	1.8	4.2	1.7	3.9	1.6	3.7	1.5	3.5
	9.0	2.4	5.5	2.2	5.1	2.1	4.8	2.0	4.6
ZS036	8.0	1.4	3.2	1.3	3.0	1.2	2.8	1.2	2.8
	8.5	1.5	3.5	1.4	3.2	1.3	3.0	1.3	3.0
	9.0	1.6	3.7	1.5	3.5	1.4	3.2	1.3	3.0
	10.5	1.9	4.4	1.8	4.2	1.7	3.9	1.7	3.9
ZS042	9.3	1.6	3.7	1.5	3.5	1.5	3.5	1.4	3.2
	10.0	1.7	3.9	1.7	3.9	1.6	3.7	1.6	3.7
	10.5	1.9	4.4	1.8	4.2	1.7	3.9	1.7	3.9
	12.0	2.3	5.3	2.2	5.1	2.1	4.8	2.1	4.8
ZS048	9.3	1.7	3.9	1.5	3.5	1.4	3.2	1.3	3.0
	11.0	2.1	4.8	1.9	4.4	1.7	3.9	1.6	3.7
	12.0	2.3	5.3	2.1	4.8	1.9	4.4	1.9	4.4
	15.0	3.2	7.4	2.9	6.7	2.7	6.2	2.6	6.0
ZS060	11.7	1.8	4.2	1.7	3.9	1.6	3.7	1.6	3.7
	13.0	2.1	4.8	2.0	4.6	1.9	4.4	1.9	4.4
	15.0	2.6	6.0	2.5	5.8	2.4	5.5	2.4	5.5
	18.0	3.6	8.3	3.4	7.8	3.3	7.6	3.2	7.4
ZS072	11.7	1.8	4.2	1.8	4.2	1.7	3.9	1.6	3.7
	15.0	2.7	6.2	2.6	6.0	2.5	5.8	2.5	5.8
	18.0	3.7	8.5	3.5	8.1	3.4	7.8	3.3	7.6
	20.0	4.3	9.9	4.2	9.7	4.0	9.2	3.9	9.0

1. Pressure drop data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
2. Pressure drop data accurate within ±25%.
3. Unit performance test is run without hot water generation.
4. Interpolation of unit pressure drop data is permissible; extrapolation is not.
5. Pressure drop data is a result of lab testing and is not related to warranty.
6. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 11: Equipment Start-Up Procedures

ZS Coax Pressure Drop Tables

Model	GPM	COAX Unit - Source Brine Pressure Drop							
		30 °F		50 °F		70 °F		90 °F	
		PSI	FT HD	PSI	FT HD	PSI	FT HD	PSI	FT HD
ZS006	0.8	0.6	1.4	0.6	1.4	0.5	1.2	0.5	1.2
	1.1	0.9	2.1	0.8	1.8	0.7	1.6	0.7	1.6
	1.5	1.4	3.2	1.2	2.8	1.1	2.5	1.0	2.3
	3.0	3.8	8.8	3.3	7.6	2.9	6.7	2.7	6.2
ZS009	1.1	1.1	2.5	0.9	2.1	0.8	1.8	0.8	1.8
	1.7	1.9	4.4	1.6	3.7	1.5	3.5	1.3	3.0
	2.3	2.8	6.5	2.5	5.8	2.2	5.1	2.0	4.6
	3.5	5.1	11.8	4.5	10.4	4.0	9.2	3.6	8.3
ZS012	1.5	1.6	3.7	1.3	3.0	1.2	2.8	1.1	2.5
	2.3	2.8	6.5	2.4	5.5	2.2	5.1	1.9	4.4
	3.0	4.1	9.5	3.6	8.3	3.1	7.2	2.8	6.5
	4.0	6.3	14.5	5.5	12.7	4.8	11.1	4.4	10.1
ZS015	1.9	1.4	3.2	1.2	2.8	1.0	2.3	0.9	2.1
	2.8	2.3	5.3	2.0	4.6	1.7	3.9	1.5	3.5
	3.8	3.6	8.3	3.1	7.2	2.6	6.0	2.3	5.3
	5.0	5.5	12.7	4.7	10.8	4.0	9.2	3.6	8.3
ZS017	2.3	1.6	3.7	1.4	3.2	1.2	2.8	1.1	2.5
	3.4	3.0	6.9	2.6	6.0	2.2	5.1	2.0	4.6
	4.5	4.8	11.1	4.1	9.5	3.6	8.3	3.2	7.4
	6.0	7.4	17.1	6.4	14.8	5.6	12.9	5.0	11.5
ZS018	2.3	1.5	3.5	1.2	2.8	1.1	2.5	0.9	2.1
	3.4	2.3	5.3	1.9	4.4	1.7	3.9	1.5	3.5
	4.5	3.4	7.8	2.8	6.5	2.4	5.5	2.2	5.1
	6.0	5.0	11.5	4.2	9.7	3.6	8.3	3.2	7.4
ZS024	3.0	2.0	4.6	1.6	3.7	1.4	3.2	1.3	3.0
	4.5	3.5	8.1	2.9	6.7	2.5	5.8	2.2	5.1
	6.0	5.2	12.0	4.3	9.9	3.7	8.5	3.3	7.6
	7.5	7.2	16.6	6.0	13.8	5.2	12.0	4.6	10.6
ZS030	3.8	2.7	6.2	2.3	5.3	2.0	4.6	1.8	4.2
	5.6	4.5	10.4	3.8	8.8	3.4	7.8	3.0	6.9
	7.5	6.8	15.7	5.8	13.4	5.0	11.5	4.5	10.4
	9.0	8.9	20.5	7.5	17.3	6.6	15.2	5.9	13.6
ZS036	4.5	1.8	4.2	1.6	3.7	1.4	3.2	1.3	3.0
	6.8	3.0	6.9	2.6	6.0	2.4	5.5	2.1	4.8
	9.0	4.4	10.1	3.8	8.8	3.4	7.8	3.1	7.2
	10.5	5.4	12.5	4.8	11.1	4.3	9.9	3.9	9.0
ZS042	5.3	2.1	4.8	1.9	4.4	1.6	3.7	1.5	3.5
	7.9	3.6	8.3	3.1	7.2	2.8	6.5	2.5	5.8
	10.5	5.4	12.5	4.7	10.8	4.1	9.5	3.7	8.5
	12.0	6.5	15.0	5.7	13.1	5.0	11.5	4.6	10.6
ZS048	6.0	2.4	5.5	2.1	4.8	1.8	4.2	1.6	3.7
	9.0	4.3	9.9	3.7	8.5	3.3	7.6	3.0	6.9
	12.0	6.7	15.5	5.8	13.4	5.1	11.8	4.6	10.6
	15.0	9.5	21.9	8.2	18.9	7.2	16.6	6.5	15.0
ZS060	7.5	3.8	8.8	3.2	7.4	2.8	6.5	2.5	5.8
	11.3	6.6	15.2	5.6	12.9	4.9	11.3	4.4	10.1
	15.0	10.0	23.1	8.5	19.6	7.4	17.1	6.7	15.5
	18.0	13.2	30.4	11.2	25.8	9.7	22.4	8.8	20.3
ZS072	9.0	4.6	10.6	4.1	9.5	3.6	8.3	3.2	7.4
	13.5	8.3	19.1	7.3	16.8	6.4	14.8	5.8	13.4
	18.0	12.9	29.8	11.3	26.1	9.9	22.8	9.0	20.8
	20.0	15.2	35.1	13.3	30.7	11.7	27.0	10.5	24.2

1. Pressure drop data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
2. Pressure drop data accurate within ±25%.
3. Unit performance test is run without hot water generation.
4. Interpolation of unit pressure drop data is permissible; extrapolation is not.
5. Pressure drop data is a result of lab testing and is not related to warranty.
6. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 11: Equipment Start-Up Procedures

ZT BPHE Pressure Drop Tables

Model	GPM	BPHE Unit - Source Brine Pressure Drop							
		30 °F		50 °F		70 °F		90 °F	
		PSI	FT HD	PSI	FT HD	PSI	FT HD	PSI	FT HD
ZT024 Part Load	3.8	0.7	1.6	0.7	1.5	0.6	1.4	0.6	1.4
	5.0	1.0	2.3	1.0	2.3	0.9	2.1	0.9	2.1
	6.0	1.3	3.0	1.2	2.8	1.2	2.8	1.1	2.5
	7.0	1.7	3.9	1.5	3.5	1.5	3.5	1.4	3.2
ZT024 Full Load	3.8	0.8	1.8	0.7	1.6	0.6	1.5	0.6	1.4
	5.0	1.1	2.5	1.0	2.3	0.9	2.1	0.8	1.8
	6.0	1.3	3.0	1.2	2.8	1.1	2.5	1.1	2.5
	7.0	1.7	5.8	1.5	5.8	1.4	5.8	1.4	4.8
ZT030 Part Load	5.8	1.2	2.8	1.1	2.5	1.0	2.3	1.0	2.3
	6.5	1.5	3.5	1.4	3.2	1.3	3.0	1.2	2.8
	7.5	1.9	4.4	1.8	4.2	1.6	3.7	1.6	3.7
	9.0	2.7	6.2	2.5	5.8	2.3	5.3	2.2	5.1
ZT030 Full Load	5.8	1.2	2.8	1.1	2.5	1.1	2.5	1.0	2.3
	6.5	1.4	3.2	1.4	3.2	1.3	3.0	1.2	2.8
	7.5	1.8	4.2	1.7	3.9	1.6	3.7	1.6	3.7
	9.0	2.5	5.8	2.3	5.3	2.2	5.1	2.1	4.8
ZT036 Part Load	8.0	1.2	2.8	1.2	2.8	1.1	2.5	1.1	2.5
	8.5	1.3	3.0	1.3	3.0	1.3	3.0	1.2	2.8
	9.0	1.5	3.5	1.4	3.2	1.4	3.2	1.4	3.2
	10.5	2.0	4.6	2.0	4.6	1.9	4.4	1.9	4.4
ZT036 Full Load	8.0	1.4	3.2	1.3	3.0	1.2	2.8	1.2	2.8
	8.5	1.5	3.5	1.4	3.2	1.3	3.0	1.3	3.0
	9.0	1.5	3.5	1.5	3.5	1.4	3.2	1.3	3.0
	10.5	1.9	4.4	1.8	4.2	1.7	3.9	1.6	3.7
ZT042 Part Load	9.3	1.7	3.9	1.6	3.7	1.5	3.5	1.4	3.2
	10.0	1.8	4.2	1.7	3.9	1.7	3.9	1.6	3.7
	10.5	2.0	4.6	1.9	4.4	1.8	4.2	1.7	3.9
	12.0	2.5	5.8	2.3	5.3	2.2	5.1	2.1	4.8
ZT042 Full Load	9.3	1.7	3.9	1.6	3.7	1.5	3.5	1.5	3.5
	10.0	1.8	4.2	1.7	3.9	1.7	3.9	1.6	3.7
	10.5	1.9	4.4	1.9	4.4	1.8	4.2	1.7	3.9
	12.0	2.4	5.5	2.3	5.3	2.2	5.1	2.1	4.8
ZT048 Part Load	9.3	1.4	3.2	1.3	3.0	1.2	2.8	1.1	2.5
	11.0	1.7	3.9	1.6	3.7	1.5	3.5	1.4	3.2
	12.0	1.9	4.4	1.8	4.2	1.7	3.9	1.6	3.7
	15.0	2.7	6.2	2.5	5.8	2.3	5.3	2.2	5.1
ZT048 Full Load	9.3	1.7	3.9	1.6	3.7	1.5	3.5	1.3	3.0
	11.0	2.1	4.8	1.9	4.4	1.8	4.2	1.6	3.7
	12.0	2.3	5.3	2.2	5.1	2.0	4.6	1.8	4.2
	15.0	3.2	7.4	3.0	6.9	2.8	6.5	2.6	6.0
ZT060 Part Load	11.7	1.7	3.9	1.6	3.7	1.6	3.7	1.6	3.7
	13.0	2.0	4.6	1.9	4.4	1.9	4.4	1.9	4.4
	15.0	2.5	5.8	2.4	5.5	2.4	5.5	2.3	5.3
	18.0	3.5	8.1	3.4	7.8	3.3	7.6	3.3	7.6
ZT060 Full Load	11.7	1.7	3.9	1.7	3.9	1.6	3.7	1.6	3.7
	13.0	2.1	4.8	2.0	4.6	1.9	4.4	1.9	4.4
	15.0	2.6	6.0	2.5	5.8	2.4	5.5	2.3	5.3
	18.0	3.5	8.1	3.4	7.8	3.3	7.6	3.2	7.4
ZT072 Part Load	11.7	2.0	4.6	1.9	4.4	1.9	4.4	1.8	4.2
	15.0	2.9	6.7	2.8	6.5	2.7	6.2	2.6	6.0
	18.0	3.6	8.3	3.5	8.1	3.4	7.8	3.3	7.6
	20.0	4.0	9.2	3.8	8.8	3.7	8.5	3.6	8.3
ZT072 Full Load	11.7	1.9	4.4	1.8	4.2	1.7	3.9	1.7	3.9
	15.0	2.7	6.2	2.6	6.0	2.5	5.8	2.5	5.8
	18.0	3.7	8.5	3.5	8.1	3.4	7.8	3.3	7.6
	20.0	4.3	9.9	4.1	9.5	4.0	9.2	3.9	9.0

1. Pressure drop data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
2. Pressure drop data accurate within ±25%.
3. Unit performance test is run without hot water generation.
4. Interpolation of unit pressure drop data is permissible; extrapolation is not.
5. Pressure drop data is a result of lab testing and is not related to warranty.
6. Due to variations in installation, actual unit performance may vary from the tabulated data.

ZT Coax Pressure Drop Tables

Model	GPM	COAX Unit - Source Brine Pressure Drop							
		30 °F		50 °F		70 °F		90 °F	
		PSI	FT HD	PSI	FT HD	PSI	FT HD	PSI	FT HD
ZT024 Part Load	2.0	1.2	2.8	1.0	2.3	0.8	1.8	0.7	1.6
	3.0	1.9	4.4	1.6	3.7	1.4	3.2	1.2	2.8
	4.0	2.8	6.5	2.3	5.3	2.0	4.6	1.8	4.2
	5.0	3.8	8.8	3.2	7.4	2.8	6.5	2.4	5.5
ZT024 Full Load	3.0	2.0	4.6	1.7	3.9	1.4	3.2	1.3	3.0
	4.5	3.4	7.8	2.8	6.5	2.4	5.5	2.3	5.3
	6.0	5.1	11.8	4.2	9.7	3.6	8.3	3.4	7.8
	7.5	7.1	16.4	5.9	13.6	5.1	11.8	4.5	10.4
ZT030 Part Load	2.5	1.6	3.7	1.3	3.0	1.2	2.8	1.0	2.3
	3.8	2.6	6.0	2.2	5.1	1.9	4.4	1.7	3.9
	5.0	3.8	8.8	3.2	7.4	2.8	6.5	2.5	5.8
	6.0	4.9	11.3	4.2	9.7	3.6	8.3	3.2	7.4
ZT030 Full Load	3.8	2.7	6.2	2.3	5.3	2.0	4.6	1.8	4.2
	5.6	4.5	10.4	3.8	8.8	3.3	7.6	2.9	6.7
	7.5	6.8	15.7	5.7	13.1	5.0	11.5	4.5	10.4
	9.0	8.9	20.5	7.5	17.3	6.5	15.0	5.8	13.4
ZT036 Part Load	3.0	1.1	2.5	1.0	2.3	0.9	2.1	0.8	1.8
	4.5	1.7	3.9	1.5	3.5	1.4	3.2	1.3	3.0
	6.0	2.4	5.5	2.2	5.1	2.0	4.6	1.8	4.2
	7.0	2.9	6.7	2.6	6.0	2.4	5.5	2.2	5.1
ZT036 Full Load	4.5	1.7	3.9	1.5	3.5	1.4	3.2	1.2	2.8
	6.8	2.9	6.7	2.6	6.0	2.3	5.3	2.1	4.8
	9.0	4.3	9.9	3.8	8.8	3.4	7.8	3.1	7.2
	10.5	5.3	12.2	4.7	10.8	4.2	9.7	3.8	8.8
ZT042 Part Load	3.5	1.3	3.0	1.2	2.8	1.0	2.3	0.9	2.1
	5.3	2.1	4.8	1.8	4.2	1.6	3.7	1.5	3.5
	7.0	3.0	6.9	2.6	6.0	2.3	5.3	2.1	4.8
	8.0	3.5	8.1	3.1	7.2	2.8	6.5	2.5	5.8
ZT042 Full Load	5.3	2.1	4.8	1.8	4.2	1.6	3.7	1.5	3.5
	7.9	3.5	8.1	3.1	7.2	2.7	6.2	2.5	5.8
	10.5	5.3	12.2	4.6	10.6	4.1	9.5	3.7	8.5
	12.0	6.5	15.0	5.7	13.1	5.0	11.5	4.5	10.4
ZT048 Part Load	4.0	1.4	3.2	1.3	3.0	1.1	2.5	1.0	2.3
	6.0	2.4	5.5	2.1	4.8	1.8	4.2	1.6	3.7
	8.0	3.6	8.3	3.1	7.2	2.7	6.2	2.5	5.8
	10.0	4.9	11.3	4.3	9.9	3.8	8.8	3.4	7.8
ZT048 Full Load	6.0	2.5	5.8	2.1	4.8	1.9	4.4	1.7	3.9
	9.0	4.3	9.9	3.7	8.5	3.3	7.6	3.0	6.9
	12.0	6.5	15.0	5.6	12.9	5.0	11.5	4.5	10.4
	15.0	9.1	21.0	7.9	18.2	7.0	16.1	6.3	14.5
ZT060 Part Load	5.0	2.2	5.1	1.9	4.4	1.6	3.7	1.4	3.2
	7.5	3.7	8.5	3.1	7.2	2.7	6.2	2.4	5.5
	10.0	5.5	12.7	4.6	10.6	4.0	9.2	3.6	8.3
	12.0	7.1	16.4	6.0	13.8	5.2	12.0	4.7	10.8
ZT060 Full Load	7.5	3.7	8.5	3.1	7.2	2.7	6.2	2.5	5.8
	11.3	6.6	15.2	5.5	12.7	4.8	11.1	4.4	10.1
	15.0	10.0	23.1	8.4	19.4	7.3	16.8	6.6	15.2
	18.0	13.2	30.4	11.1	25.6	9.6	22.1	8.8	20.3
ZT072 Part Load	6.0	2.8	6.5	2.4	5.5	2.1	4.8	1.8	4.2
	9.0	4.8	11.1	4.0	9.2	3.5	8.1	3.2	7.4
	12.0	7.1	16.4	6.1	14.1	5.3	12.2	4.7	10.8
	15.0	9.9	22.8	8.4	19.4	7.3	16.8	6.6	15.2
ZT072 Full Load	9.0	4.7	10.8	4.0	9.2	3.5	8.1	3.2	7.4
	13.5	8.5	19.6	7.2	16.6	6.4	14.8	5.8	13.4
	18.0	13.1	30.2	11.1	25.6	9.8	22.6	8.9	20.5
	20.0	15.4	35.5	13.1	30.2	11.5	26.5	10.4	24.0

1. Pressure drop data is based on 15% (by mass) methanol antifreeze solution (multiplier: 485).
2. Pressure drop data accurate within ±25%.
3. Unit performance test is run without hot water generation.
4. Interpolation of unit pressure drop data is permissible; extrapolation is not.
5. Pressure drop data is a result of lab testing and is not related to warranty.
6. Due to variations in installation, actual unit performance may vary from the tabulated data.

Section 12: Troubleshooting

ZS BPHE Superheat Subcooling Tables

EWT	Flow	BPHE Unit - Heating - No Hot Water Generation																			
		ZS015		ZS017		ZS018		ZS024		ZS030		ZS036		ZS042		ZS048		ZS060		ZS072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
30	2.7-3	-	-	-	-	-	-	6-14	9-14	7-12	6-12	10-19	11-18	14-24	12-17	15-24	9-15	17-26	7-14	25-33	7-14
	2.5-4	3-8	9-17	8-13	8-15	8-14	8-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	2.7-3	-	-	-	-	-	-	5-12	8-13	7-12	7-12	12-21	10-17	11-19	11-16	14-21	8-14	16-24	7-13	18-25	8-14
	2.5-4	4-9	9-17	7-11	8-15	4-9	6-13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	2.7-3	-	-	-	-	-	-	5-11	8-13	6-11	9-14	12-21	10-16	9-16	11-16	11-17	8-14	13-20	6-13	15-22	9-16
	2.5-4	7-11	10-21	4-8	8-16	5-10	7-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	2.7-3	-	-	-	-	-	-	3-11	12-19	4-10	13-19	5-14	12-19	4-11	11-17	3-8	9-15	5-12	6-13	13-20	11-18
	2.5-4	8-13	14-26	2-6	10-18	5-11	15-23	-	-	-	-	-	-	-	-	-	-	-	-	-	-

EWT	Flow	BPHE Unit - Cooling - No Hot Water Generation																			
		ZS015		ZS017		ZS018		ZS024		ZS030		ZS036		ZS042		ZS048		ZS060		ZS072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
50	2.7-3	-	-	-	-	-	-	10-21	17-25	12-20	18-25	11-18	21-27	11-16	18-24	12-17	17-21	11-18	18-25	9-16	27-36
	2.5-4	2-11	8-15	7-17	10-20	10-19	19-26	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	2.7-3	-	-	-	-	-	-	10-21	5-12	11-18	6-13	10-17	8-12	12-17	7-13	12-17	5-10	12-19	5-11	7-13	10-19
	2.5-4	3-13	3-10	6-16	4-12	9-18	7-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	2.7-3	-	-	-	-	-	-	10-22	4-11	10-17	5-11	9-16	6-11	13-19	5-11	13-18	4-9	13-20	5-10	10-16	4-12
	2.5-4	6-16	4-11	6-16	5-13	8-17	6-11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110	2.7-3	-	-	-	-	-	-	10-22	3-10	11-18	3-10	9-16	5-10	12-18	3-9	12-17	2-7	12-19	3-8	9-16	2-10
	2.5-4	6-15	4-11	7-17	6-13	8-17	5-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.

SC=Subcooling; SH=Superheat

ZS Coax Superheat Subcooling Tables

EWT	Flow	COAX Unit - Heating - No Hot Water Generation																							
		ZS006		ZS009		ZS012		ZS015		ZS017		ZS018		ZS024		ZS030		ZS036		ZS042		ZS048		ZS060		ZS072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
30	1.5	8-14	13-18	9-15	12-16	9-15	11-15	7-14	10-16	11-17	10-16	11-19	9-17	6-13	7-14	22-30	8-14	14-28	9-16	13-24	13-18	15-22	12-18	21-30	11-15	13-22	8-15
	3	8-14	12-17	9-15	10-15	9-15	10-14	6-13	9-15	10-16	8-15	10-17	8-16	7-13	6-13	19-26	7-13	15-25	8-15	13-24	12-17	15-22	10-17	18-27	9-14	12-22	7-13
50	1.5	7-12	12-17	7-12	9-14	7-13	10-14	8-15	8-14	7-12	8-14	5-11	6-14	6-12	6-12	18-25	7-13	14-24	8-15	9-18	11-16	12-19	9-15	19-27	9-14	12-20	7-14
	3	7-12	12-17	7-12	9-13	7-12	11-15	7-14	8-14	6-11	7-14	3-9	6-14	6-11	6-12	14-21	7-13	13-22	8-15	9-18	11-16	12-19	8-15	15-23	9-14	11-19	7-14
70	1.5	6-11	11-16	6-11	8-12	7-11	14-18	7-13	8-14	6-10	8-14	5-11	7-15	5-10	5-12	15-22	7-13	15-24	7-14	8-16	12-17	9-15	7-14	15-23	8-12	9-17	6-13
	3	6-10	13-18	5-9	9-13	6-11	15-19	6-12	9-15	4-9	9-15	3-8	8-16	5-9	6-13	10-17	9-15	13-22	8-15	8-16	13-18	8-14	8-15	11-18	9-13	7-15	8-14
90	1.5	5-9	12-17	5-9	7-12	6-11	25-29	7-14	10-16	7-11	10-16	7-13	16-24	2-6	6-13	13-20	10-16	13-22	7-14	5-12	14-19	3-6	7-14	8-16	7-11	6-14	6-13
	3	5-9	14-19	3-8	10-14	6-10	28-32	6-13	12-18	5-9	12-18	5-10	19-27	2-5	9-16	7-14	13-19	11-20	9-17	4-11	16-21	2-5	9-16	3-10	9-14	4-12	9-15

EWT	Flow	COAX Unit - Cooling - No Hot Water Generation																							
		ZS006		ZS009		ZS012		ZS015		ZS017		ZS018		ZS024		ZS030		ZS036		ZS042		ZS048		ZS060		ZS072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
50	1.5	22-27	11-16	23-28	6-11	17-22	18-21	14-20	6-13	18-22	8-15	18-28	20-27	16-23	11-17	13-20	20-27	18-24	16-24	13-20	20-28	18-24	18-27	16-25	11-19	18-22	21-29
	3	14-18	13-17	15-19	7-12	10-15	18-22	6-13	7-12	11-15	9-15	12-22	23-30	10-16	13-18	9-16	21-28	10-16	18-25	7-15	21-29	10-16	20-28	10-18	12-21	11-15	23-30
70	1.5	25-30	6-11	26-30	3-8	18-23	6-10	18-24	7-12	20-24	4-10	17-26	8-14	17-24	5-11	11-19	7-14	14-21	5-12	11-19	7-14	19-25	4-13	13-22	3-11	16-20	8-14
	3	16-20	8-13	16-21	4-9	10-15	7-10	9-15	6-12	12-16	4-10	11-21	10-16	11-18	6-12	7-14	8-15	9-15	7-14	6-13	8-15	10-16	6-15	6-15	4-12	8-12	9-15
90	1.5	26-30	4-9	26-30	3-8	19-24	4-8	21-27	6-11	19-24	4-10	15-25	4-9	20-27	4-10	11-18	4-11	13-20	4-11	10-18	4-11	19-25	3-10	8-17	8-17	12-16	5-12
	3	17-21	6-11	17-21	4-9	11-16	5-8	12-19	5-11	12-16	4-11	10-19	6-12	13-20	5-11	7-14	5-12	8-15	5-12	6-14	5-11	10-17	3-12	2-11	9-18	4-8	6-13
110	1.5	25-30	3-8	25-30	3-8	18-23	3-7	22-28	6-12	18-23	4-10	15-24	3-8	21-28	3-8	12-19	3-10	14-20	3-9	10-18	3-10	20-27	3-9	7-17	5-13	11-15	4-10
	3	15-19	5-10	15-19	4-9	10-15	4-8	12-18	6-12	10-14	5-11	9-18	5-11	14-22	4-10	8-15	4-11	9-15	4-11	5-13	4-11	10-17	4-11	1-10	6-14	2-6	5-11

Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.

SC=Subcooling; SH=Superheat

Section 12: Troubleshooting

ZT BPHE Superheat Subcooling Tables

EWT	Flow	BPHE Unit - Full Load Heating - No Hot Water Generation													
		ZT024		ZT030		ZT036		ZT042		ZT048		ZT060		ZT072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
30	2.5-2.7*	7-13	12-18	9-16	6-12	14-20	12-18	11-16	9-15	17-25	11-17	18-24	9-15	22-26	6-12
	3**	7-13	11-17	9-16	6-12	14-20	12-18	11-16	9-15	18-25	10-17	19-24	9-15	21-26	6-12
50	2.5-2.7*	4-10	10-16	10-17	7-13	11-16	12-18	12-17	9-16	13-20	9-15	16-21	8-14	19-24	5-12
	3**	4-10	10-17	10-17	7-13	11-16	12-18	13-18	9-16	14-21	9-15	16-22	8-14	19-23	6-12
70	2.5-2.7*	4-10	10-17	11-18	10-16	12-18	12-18	11-16	10-16	11-18	10-16	13-19	8-14	18-23	6-13
	3**	4-10	11-17	11-18	10-16	12-18	11-17	11-16	10-16	11-18	10-16	13-19	8-14	17-22	7-13
90	2.5-2.7*	3-9	10-16	13-20	17-24	14-19	14-20	4-9	14-20	2-7	11-17	3-9	8-14	12-16	9-15
	3**	3-9	11-17	13-20	17-23	14-19	14-20	5-9	14-20	3-8	11-17	3-9	8-14	11-15	10-16

EWT	Flow	BPHE Unit - Full Load Cooling - No Hot Water Generation													
		ZT024		ZT030		ZT036		ZT042		ZT048		ZT060		ZT072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
50	2.5-2.7*	13-17	16-22	16-20	19-26	12-16	24-32	12-16	22-27	14-18	21-27	14-18	17-24	12-16	19-25
	3**	11-15	16-23	16-20	19-26	11-16	24-32	11-15	22-27	13-18	21-27	13-17	17-24	11-15	20-26
70	2.5-2.7*	14-18	7-13	17-21	6-13	13-18	8-15	11-15	8-13	14-18	9-15	14-18	8-15	12-16	7-13
	3**	12-16	7-14	17-21	6-13	12-17	8-16	10-14	8-13	13-17	9-15	13-17	8-15	11-15	8-14
90	2.5-2.7*	16-20	5-11	18-22	5-11	14-18	3-11	11-15	5-10	14-18	6-12	14-18	7-15	13-17	4-10
	3**	13-17	5-12	18-22	5-11	13-17	3-11	9-14	5-10	13-17	6-12	13-17	7-15	12-16	5-11
110	2.5-2.7*	17-21	5-11	19-23	4-10	13-18	5-12	10-14	3-8	14-18	4-10	15-19	6-14	14-18	3-8
	3**	14-18	5-11	18-23	4-11	12-17	5-13	9-13	3-8	13-18	4-10	13-17	6-14	12-17	4-9

EWT	Flow	BPHE Unit - Part Load Heating - No Hot Water Generation													
		ZT024		ZT030		ZT036		ZT042		ZT048		ZT060		ZT072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
30	3.75-4.05***	4-8	6-10	9-17	5-11	10-17	6-13	12-15	4-11	11-16	7-14	16-20	4-8	14-19	3-8
	4.5****	4-8	5-9	10-17	5-11	10-17	6-13	11-15	5-12	10-15	8-14	16-20	4-8	18-22	3-8
50	3.75-4.05***	3-7	8-12	8-16	8-14	6-13	9-16	10-13	7-14	8-12	9-15	11-17	7-11	9-13	6-11
	4.5****	3-7	8-12	9-16	8-14	6-13	9-15	9-12	7-13	6-11	8-15	11-17	7-11	12-17	5-10
70	3.75-4.05***	2-6	5-9	6-14	6-12	9-16	6-12	8-11	7-13	7-12	7-13	6-11	2-6	7-11	4-9
	4.5****	2-6	3-7	7-14	6-12	9-16	6-12	8-11	7-14	6-11	7-13	7-11	2-6	11-15	3-9
90	3.75-4.05***	2-5	5-9	3-10	7-13	11-18	7-13	4-7	8-15	2-7	7-14	1-4	2-7	2-6	6-11
	4.5****	2-5	3-7	3-11	7-13	11-18	7-13	3-6	9-16	1-5	8-14	1-4	2-6	6-10	5-11

EWT	Flow	BPHE Unit - Part Load Cooling - No Hot Water Generation													
		ZT024		ZT030		ZT036		ZT042		ZT048		ZT060		ZT072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
50	3.75-4.05***	6-10	15-21	8-13	12-19	6-10	16-22	7-11	16-21	9-13	14-20	8-12	9-13	7-11	13-19
	4.5****	5-9	15-21	6-11	12-19	6-10	16-23	9-13	17-21	10-15	14-21	7-12	9-13	9-13	13-18
70	3.75-4.05***	7-11	7-13	9-14	4-11	7-11	7-14	6-10	8-13	10-14	8-14	9-13	6-11	7-11	5-10
	4.5****	5-10	7-13	7-12	5-12	7-11	8-14	8-13	9-13	12-16	8-14	8-12	6-11	9-13	5-10
90	3.75-4.05***	8-12	7-14	10-16	6-12	7-11	6-12	6-10	8-12	12-16	6-12	10-14	5-10	8-12	2-8
	4.5****	7-11	7-14	8-14	6-13	7-11	6-12	9-13	8-13	14-18	6-13	10-14	6-10	10-14	2-7
110	3.75-4.05***	11-15	8-14	12-18	6-13	7-11	5-11	7-12	4-9	13-17	4-10	10-14	4-8	9-13	2-7
	4.5****	9-14	8-14	10-16	7-13	7-11	5-11	11-15	5-9	15-19	5-11	10-14	4-8	11-15	2-7

Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.
CFM is typically 350-520 CFM/Ton for heating and cooling.
SC=Subcooling; SH=Superheat
*Full-load GPM/Ton is 2.5-2.7 for ZT024-072.
**Full-load GPM/Ton is 3 for ZT024-072.
***Part-load GPM/Ton is 3.75-4.05 for ZT024-072.
****Part-load GPM/Ton is 4.5 for ZT024-072.

Section 12: Troubleshooting

ZT Coax Superheat Subcooling Tables

EWT	Flow	COAX Unit - Full Load Heating - No Hot Water Generation													
		ZT024		ZT030		ZT036		ZT042		ZT048		ZT060		ZT072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
30	1.5	15-21	10-16	24-30	5-12	15-23	11-17	27-35	10-16	25-32	9-15	20-31	9-15	19-23	7-13
	3	13-19	8-15	21-27	6-12	14-22	10-16	24-32	9-15	23-30	8-14	19-30	7-13	18-22	5-12
50	1.5	8-15	8-14	18-24	6-12	11-19	9-16	19-27	9-15	18-25	7-13	16-26	7-13	16-20	6-12
	3	5-12	8-15	14-20	8-14	10-17	10-16	15-23	9-15	15-22	7-13	14-24	7-13	14-18	6-12
70	1.5	8-14	8-14	13-20	8-14	12-20	8-15	16-24	8-15	12-19	7-13	13-23	7-13	13-17	6-12
	3	4-10	9-16	9-15	10-18	11-18	9-16	11-19	10-16	8-15	8-14	10-21	8-14	10-15	8-14
90	1.5	8-14	9-15	16-23	15-21	13-20	9-15	14-22	11-17	5-10	7-14	9-19	9-15	8-12	10-16
	3	4-10	12-18	12-19	20-26	11-18	11-18	8-17	13-19	2-6	10-16	6-17	11-17	6-10	13-19

EWT	Flow	COAX Unit - Full Load Cooling - No Hot Water Generation													
		ZT024		ZT030		ZT036		ZT042		ZT048		ZT060		ZT072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
50	1.5	24-30	13-21	19-25	23-29	18-22	14-20	19-24	19-25	18-25	16-23	22-25	21-27	21-25	18-24
	3	15-21	14-22	11-19	24-32	9-13	13-20	11-15	19-26	10-16	18-24	14-17	24-30	14-18	21-28
70	1.5	26-32	5-13	18-25	9-15	19-23	7-13	19-23	7-13	18-24	5-12	20-23	6-13	20-24	5-12
	3	16-22	6-14	10-16	11-17	10-14	7-13	9-13	8-14	9-15	7-13	11-14	9-15	12-16	9-15
90	1.5	28-34	4-12	19-25	4-10	21-25	8-13	19-23	5-11	19-25	4-10	17-20	4-11	17-21	3-9
	3	17-23	5-13	10-16	6-12	11-15	8-13	9-13	6-12	9-15	5-11	8-11	7-14	8-14	6-12
110	1.5	29-35	3-12	20-26	3-9	22-26	6-11	20-24	4-9	21-27	2-9	15-18	4-10	12-16	4-10
	3	17-23	5-13	11-17	5-11	11-15	6-11	9-13	5-10	10-17	3-10	6-9	7-13	3-7	7-13

EWT	Flow	COAX Unit - Part Load Heating - No Hot Water Generation													
		ZT024		ZT030		ZT036		ZT042		ZT048		ZT060		ZT072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
30	1.5	17-23	9-13	21-28	6-12	9-16	9-16	19-26	7-13	20-27	8-14	16-19	7-11	13-18	4-10
	3	15-21	8-12	18-25	5-12	9-16	8-15	17-23	6-12	17-25	7-13	14-20	6-10	14-18	3-9
50	1.5	9-14	7-11	14-21	7-14	6-13	8-14	14-20	6-12	11-19	6-13	13-16	6-10	7-11	4-10
	3	6-12	7-11	11-18	8-14	5-12	8-15	10-17	6-12	8-15	6-13	11-17	6-10	7-11	4-10
70	1.5	5-11	6-10	10-17	8-14	6-13	8-14	9-16	5-11	9-17	5-11	8-12	5-9	3-8	4-10
	3	4-8	8-12	6-13	8-14	6-13	9-15	5-12	6-12	5-12	6-12	6-13	6-10	3-8	5-11
90	1.5	6-12	6-11	5-15	8-14	10-17	8-14	5-12	5-11	3-10	5-11	4-8	6-10	3-6	5-11
	3	4-8	9-14	4-11	8-14	9-16	10-17	2-7	7-13	2-5	7-13	2-9	9-13	2-6	8-14

EWT	Flow	COAX Unit - Part Load Cooling - No Hot Water Generation													
		ZT024		ZT030		ZT036		ZT042		ZT048		ZT060		ZT072	
		SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH	SC	SH
°F	GPM/Ton	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
50	1.5	22-27	7-13	8-14	14-20	16-20	8-13	15-19	11-16	13-17	8-14	15-22	10-17	17-22	9-13
	3	12-17	8-14	4-11	15-21	6-10	9-15	5-11	9-17	3-8	9-15	7-14	11-18	8-13	10-14
70	1.5	23-28	4-10	7-13	6-12	17-21	6-11	13-18	6-10	13-18	4-10	15-21	5-11	16-22	4-8
	3	13-18	5-11	3-10	7-13	7-11	7-12	4-9	6-11	2-8	6-12	6-12	6-12	6-12	6-10
90	1.5	25-30	3-9	8-14	4-10	19-23	3-8	14-19	4-9	16-21	3-9	14-20	5-12	17-22	2-6
	3	14-19	4-10	4-10	5-11	7-11	4-10	4-9	5-9	5-10	4-10	4-11	6-13	6-12	4-8
110	1.5	27-32	2-8	10-16	3-9	20-24	3-8	17-22	2-7	20-25	2-8	13-19	4-11	16-21	1-5
	3	15-20	3-9	6-13	4-10	8-12	4-9	7-11	3-8	8-14	3-9	3-10	5-12	5-10	3-7

Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.
CFM is typically 350-520 CFM/Ton for heating and cooling.
SC=Subcooling; SH=Superehat

Section 12: Troubleshooting

ZS BPHE Operating Parameters

EWT	Flow	BPHE Unit - Heating - No Hot Water Generation			
		Discharge	Suction	Water Temp Drop	Air Temp Rise
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
30	2-2.7*	233-360	63-87	2-10	12-30
	2.7-3**	239-367	65-90	1-6	12-30
50	2-2.7	261-389	93-118	4-14	16-38
	2.7-3	268-394	96-121	2-8	17-39
70	2-2.7	292-444	121-156	5-18	20-48
	2.7-3	300-452	132-162	3-10	22-48
90	2-2.7	327-489	136-198	7-22	25-55
	2.7-3	336-498	150-210	4-12	26-56

EWT	Flow	BPHE Unit - Cooling - No Hot Water Generation			
		Discharge	Suction	Water Temp Rise	Air Temp Drop
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
50	2-2.7*	164-234	102-144	7-27	15-27
	2.7-3**	147-206	100-144	5-14	15-27
70	2-2.7	232-316	108-156	7-26	15-27
	2.7-3	208-276	105-156	5-14	15-27
90	2-2.7	316-414	118-160	7-25	14-25
	2.7-3	285-361	116-160	4-13	14-25
110	2-2.7	415-530	125-165	6-23	12-24
	2.7-3	379-462	125-165	4-12	12-24

Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.

CFM is typically 300-500 CFM/Ton for heating and cooling.

*GPM/Ton is 2-2.7 for ZS024-072, 2.5-3.5 for ZS015-018.

**GPM/Ton is 2.7-3 for ZS024-072, 3.5-4 for ZS015-018.

ZS Coax Operating Parameters

EWT	Flow	COAX Unit - Heating - No Hot Water Generation			
		Discharge	Suction	Water Temp Drop	Air Temp Rise
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
30	1.5	233-345	58-79	6-10	12-29
	3	239-354	64-85	3-6	12-32
50	1.5	261-379	85-107	9-14	16-37
	3	268-390	95-120	4-8	17-40
70	1.5	292-427	119-145	12-18	20-47
	3	300-439	132-162	6-10	22-50
90	1.5	327-486	136-187	13-22	25-56
	3	336-501	150-210	7-12	26-60

EWT	Flow	COAX Unit - Cooling - No Hot Water Generation			
		Discharge	Suction	Water Temp Rise	Air Temp Drop
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
50	1.5	192-248	102-145	18-27	16-27
	3	169-220	100-144	9-14	16-27
70	1.5	265-326	108-152	18-26	14-27
	3	234-290	105-152	8-14	14-27
90	1.5	356-419	118-157	18-25	14-25
	3	315-372	116-157	8-13	14-25
110	1.5	470-535	131-165	17-23	12-24
	3	417-472	128-162	8-12	12-24

Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.

CFM is typically 300-500 CFM/Ton for heating and cooling.

Section 12: Troubleshooting

ZT BPHE Operating Parameters

EWT	Flow	BPHE Unit - Full Load Heating - No Hot Water Generation			
		Discharge	Suction	Water Temp Drop	Air Temp Rise
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
30	2.5-2.7*	259-334	64-83	4-7	17-27
	3**	263-337	65-85	3-6	17-28
50	2.5-2.7*	290-373	95-114	5-9	22-34
	3**	294-376	96-117	5-8	23-35
70	2.5-2.7*	330-429	130-152	7-11	30-43
	3**	334-433	134-156	7-10	30-43
90	2.5-2.7*	366-469	171-200	9-13	37-49
	3**	371-473	173-204	9-12	38-50

EWT	Flow	BPHE Unit - Full Load Cooling - No Hot Water Generation			
		Discharge	Suction	Water Temp Rise	Air Temp Drop
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
50	2.5-2.7*	176-216	110-138	9-15	17-27
	3**	174-214	110-138	9-12	17-27
70	2.5-2.7*	249-290	120-149	10-15	17-28
	3**	246-282	119-148	9-12	17-28
90	2.5-2.7*	336-380	124-152	10-14	16-27
	3**	331-368	124-152	9-12	16-27
110	2.5-2.7*	437-487	131-157	9-14	14-25
	3**	429-471	131-157	8-12	14-25

EWT	Flow	BPHE Unit - Part Load Heating - No Hot Water Generation			
		Discharge	Suction	Water Temp Drop	Air Temp Rise
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
30	3.75-4.05***	255-315	74-91	2-5	15-26
	4.5****	256-325	74-92	2-4	15-27
50	3.75-4.05***	283-343	104-125	4-7	21-33
	4.5****	283-354	103-126	3-6	21-34
70	3.75-4.05***	321-385	143-166	5-9	28-41
	4.5****	322-397	141-168	5-7	28-42
90	3.75-4.05***	363-424	188-215	7-10	36-48
	4.5****	365-438	188-218	7-9	36-49

EWT	Flow	BPHE Unit - Part Load Cooling - No Hot Water Generation			
		Discharge	Suction	Water Temp Rise	Air Temp Drop
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
50	3.75-4.05***	155-194	120-145	7-11	17-28
	4.5****	155-197	120-143	7-9	17-28
70	3.75-4.05***	220-260	128-151	7-11	16-28
	4.5****	220-264	128-151	7-9	16-28
90	3.75-4.05***	297-340	133-154	7-10	15-27
	4.5****	297-345	133-153	6-9	15-27
110	3.75-4.05***	386-435	139-159	6-10	14-26
	4.5****	386-441	139-159	6-8	14-26

Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.

CFM is 350-520 CFM/Ton for heating and cooling.

*Full-load GPM/Ton is 2.5-2.7 for ZT024-072.

Section 12: Troubleshooting

ZT Coax Operating Parameters

EWT	Flow	COAX Unit - Full Load Heating - No Hot Water Generation			
		Discharge	Suction	Water Temp Drop	Air Temp Rise
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
30	1.5	265-353	62-77	7-10	16-26
	3	271-365	70-85	3-6	18-27
50	1.5	291-382	91-106	10-13	22-32
	3	299-395	102-116	5-8	24-34
70	1.5	328-428	123-140	13-17	28-38
	3	337-443	137-155	7-9	30-41
90	1.5	367-468	158-177	16-20	35-45
	3	376-484	177-196	8-11	38-48

EWT	Flow	COAX Unit - Full Load Cooling - No Hot Water Generation			
		Discharge	Suction	Water Temp Rise	Air Temp Drop
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
50	1.5	216-256	114-141	18-25	18-27
	3	186-227	112-141	8-13	18-27
70	1.5	297-343	126-147	19-25	18-27
	3	256-297	124-147	9-13	18-27
90	1.5	385-448	134-151	18-24	17-26
	3	338-388	131-151	8-12	17-26
110	1.5	482-571	139-156	17-23	16-24
	3	427-494	136-156	8-12	16-24

EWT	Flow	COAX Unit - Part Load Heating - No Hot Water Generation			
		Discharge	Suction	Water Temp Drop	Air Temp Rise
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
30	1.5	248-302	65-82	6-10	14-24
	3	256-321	73-90	3-6	15-26
50	1.5	272-334	96-111	10-13	19-30
	3	280-355	107-122	5-8	21-33
70	1.5	307-367	128-146	14-18	25-37
	3	317-385	142-161	7-10	27-41
90	1.5	352-399	165-185	18-22	31-43
	3	362-419	183-205	10-13	34-47

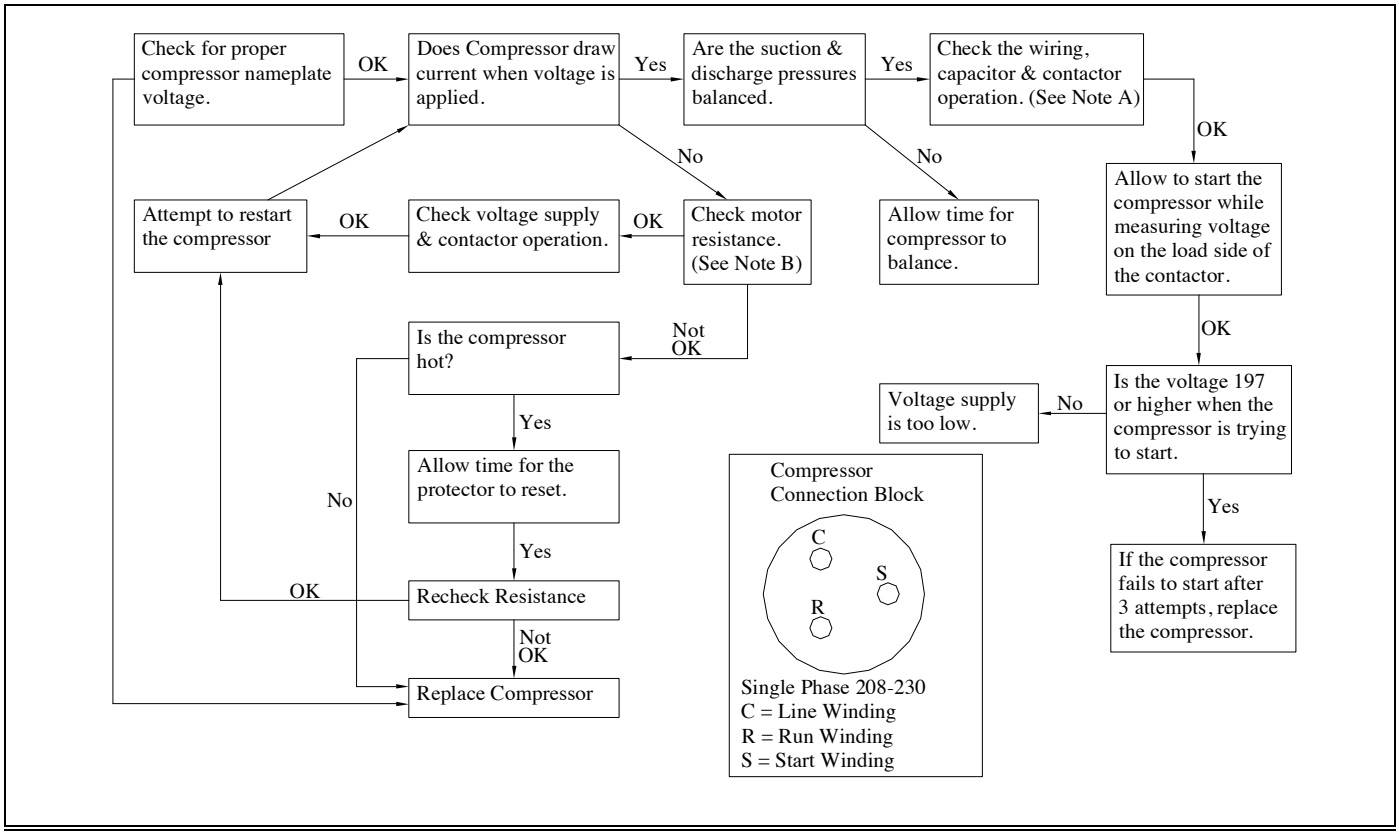
EWT	Flow	COAX Unit - Part Load Cooling - No Hot Water Generation			
		Discharge	Suction	Water Temp Rise	Air Temp Drop
°F	GPM/Ton	PSIG	PSIG	°F	°F - DB
50	1.5	208-244	122-155	21-27	17-28
	3	175-213	119-154	10-14	17-29
70	1.5	288-325	131-160	21-26	16-27
	3	243-280	128-159	10-14	17-27
90	1.5	382-426	135-165	20-25	16-26
	3	323-366	133-163	9-13	16-27
110	1.5	486-544	142-169	18-24	15-25
	3	415-468	139-167	9-12	15-25

Heating data based on 70°F EAT. Cooling data based on 80/67°F EAT.
CFM is 350-520 CFM/Ton for heating and cooling.

Section 12: Troubleshooting

Compressor Troubleshooting

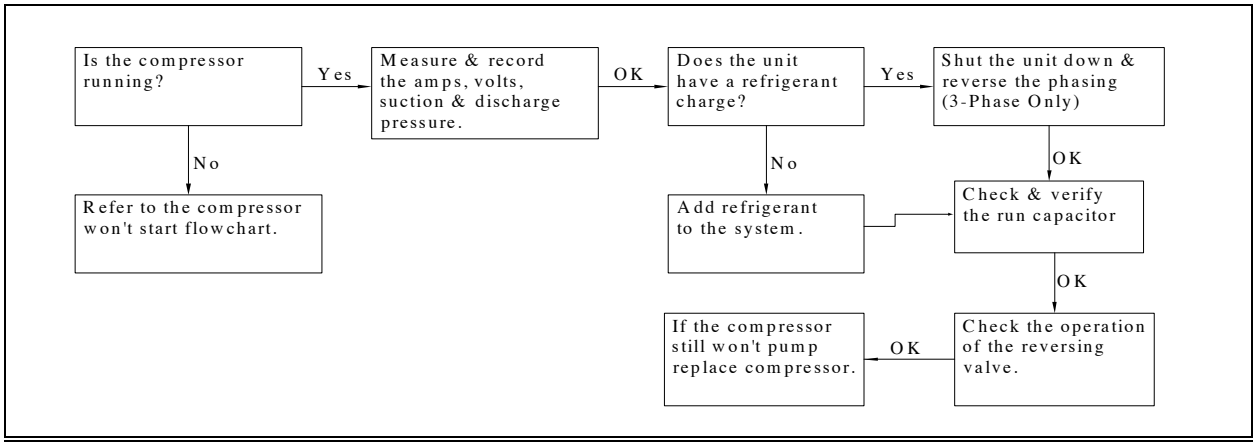
COMPRESSOR WON'T START



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.

COMPRESSOR WON'T PUMP CHART



Section 12: Troubleshooting

Refrigeration Troubleshooting

Condition	Mode	Discharge Pressure	Suction Pressure	Superheat	Subcooling	Air TD	Water TD	Compressor Amps
Under Charge	Heat	Low	Low	High	Low	Low	Low	Low
	Cool	Low	Low	High	Low	Low	Low	Low
Over Charge	Heat	High	High/Normal	Normal	High	High	Normal	High
	Cool	High	High/Normal	Normal	High	Normal	High	High
Low Air Flow	Heat	High	High/Normal	Normal	High/Normal	High	Low	High
	Cool	Low	Low/Normal	Low	Normal	High	Low	High/Normal
Low Source Water Flow	Heat	Low	Low/Normal	Low	Normal	High	Low	High/Normal
	Cool	High	High/Normal	Normal	High/Normal	High	Low	High
Low Load Water Flow	Heat	High	High/Normal	Normal	High/Normal	High	Low	High
	Cool	Low	Low/Normal	Low	Normal	High	Low	High/Normal
Restricted TXV	Heat	High	Low	High	High	Low	Low	Low
	Cool	High	Low	High	High	Low	Low	Low
TXV Stuck Open	Heat	Low	High/Normal	Low	Low	Low	Low	High
	Cool	Low	High/Normal	Low	Low	Low	Low	High
Inadequate Compression	Heat	Low	High	High/Normal	Low/Normal	Low	Low	Low
	Cool	Low	High	High/Normal	Low/Normal	Low	Low	Low

Superheat/Subcooling Conditions

Superheat	Subcooling	Condition
Normal	Normal	Normal operation
Normal	High	Overcharged
High	Low	Undercharged
High	High	Restriction or TXV is stuck almost closed
Low	Low	TXV is stuck open

Section 12: Troubleshooting

Troubleshooting Worksheet

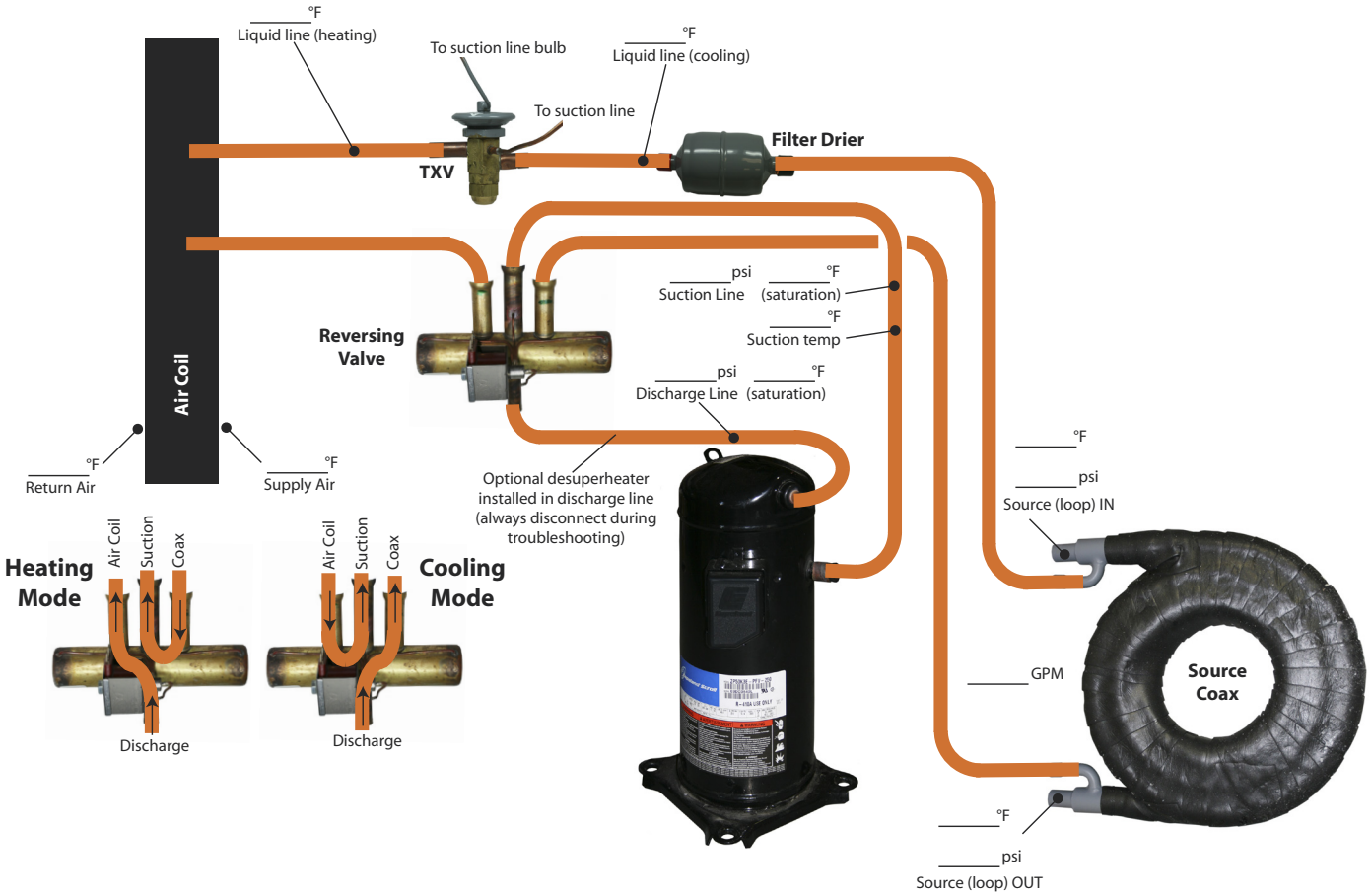
Customer/Job Name:_____ Date:_____

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. - Liq. Line Temp.



Section 12: Troubleshooting

Troubleshooting Tips

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/	Check fuse size, replace fuse or reset circuit breaker. Check low voltage circuit breaker.
Tripped Circuit Breakers	Check fuse size, replace fuse or reset 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.

B: BLOWER RUNS BUT COMPRESSOR WILL NOT START (COMPRESSOR OVERLOAD, BAD CAPACITOR, HP FAULT)

Logic Board	Check if status light is on and logic board is working properly. Check fault lights. See LED Identification chart in Controls Section
Defective Sensors	Check status/fault lights. Sensor is out of normal range for resistance values, open, or shorted. Compare sensor resistance values with the charted resistance in Controls Section
Defective Capacitor	Check capacitor. If defective, replace.
Failed Compressor	See charts M and N for compressor diagnostic. If compressor still doesn't run, replace it.
Low Pressure Switch	Low refrigerant charge. Check for pressure. Check for leaks.

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.	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. .
Defective Sensors	Check status/fault lights. Sensor is out of normal range for resistance values, open, or shorted. Compare sensor resistance values with the charted resistance in Controls Section
Water Flow (Source Heat Exchanger Freeze Fault)	Check status/fault lights. To check water flow remove the FS jumper (see Controls Section for location) and jumper the two FS terminals (located between blue and violet wires on the right side of the board) together to complete the flow switch circuit. Determine if the required water pressure drop is present. If required pressure drop is present, check the resistance of T4 source sensor (15°F=41.39kΩ; 30°F=28.61kΩ) and temperature of the refrigerant line between the source heat exchanger and TXV.
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, refrigerant pressures, and ambient temperature. WARNING: Only allow compressor to run for a couple of seconds with the high pressure switch jumped.
Defective Logic Board Relay	Jump R to Y directly on lockout board. Check for 24V at Y. If no operation and no faults occur, replace lockout board.
Hot Gas Temperature>220°F	Check status/fault lights. Check hot gas/discharge line temperature with a thermocouple type thermometer. WARNING: Let the unit remain off for several minutes and touch the thermocouple to the discharge line to check if it is cooled enough to strap/tape a thermocouple to it. Check the discharge line temperature during the next operation cycle to compare the temperature to the lockout temperature of 220°F. Check water/air flow. If water/air flow is present, check the refrigerant pressures.
Condensate Overflow (CO)	Check status/fault lights. Check sensors for contact with water, debris, or a loose sensor touching metal. Clean sensors if contacting debris. Flush drain lines if the drain pan is full. If no debris is present and drain pan is empty, remove violet wire from CO terminal on lockout board (lower right). If CO lockout occurs with violet wire removed replace the lockout board.
Over/Under Voltage	Make sure secondary/low voltage is between 20V and 29V. Check the transformer's primary connections for the correct voltage (Orange & Black = 230V; Red & Black = 208V). Correct any possible voltage drops in the main voltage.
Load Heat Exchanger Frozen	Check status/fault lights. Check for reduced air flow due to dirty filter, obstructions, or poor blower performance. Check T1 sensor for the proper resistance (30°F = 28.61kΩ).

D: 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).

Section 12: Troubleshooting

Troubleshooting Tips

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.
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: 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.

G: 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.
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.

H: 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.

I: EXCESSIVE HEAD PRESSURE IN COOLING MODE

Inadequate water flow	Low water flow, increase flow.

J: EXCESSIVE HEAD PRESSURE IN HEATING MODE

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

K: 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.

L: WATER DRIPPING FROM UNIT

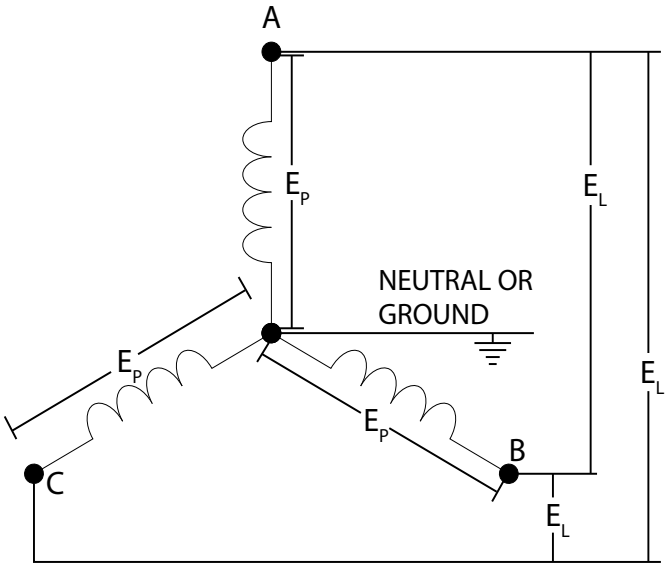
Unit not level	Level unit.
Condensation drain line plugged	Unplug condensation line.
Water sucking off the air coil in cooling mode	Too much airflow. Duct work not completely installed. If duct work is not completely installed, finish duct work. Check static pressure and compare with air flow chart in 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.

Unit Electrical Data

⚠ CAUTION ⚠

CHECK COMPRESSOR AMP DRAW TO VERIFY COMPRESSOR ROTATION ON THREE PHASE UNITS. COMPARE AGAINST UNIT ELECTRICAL TABLES. REVERSE ROTATION RESULTS IN HIGHER SOUND LEVELS, LOWER AMP DRAW, AND INCREASED COMPRESSOR WEAR. THE COMPRESSOR INTERNAL OVERLOAD WILL TRIP AFTER A SHORT PERIOD OF OPERATION.

EXAMPLE 1: WYE (STAR) ELECTRICAL CIRCUIT



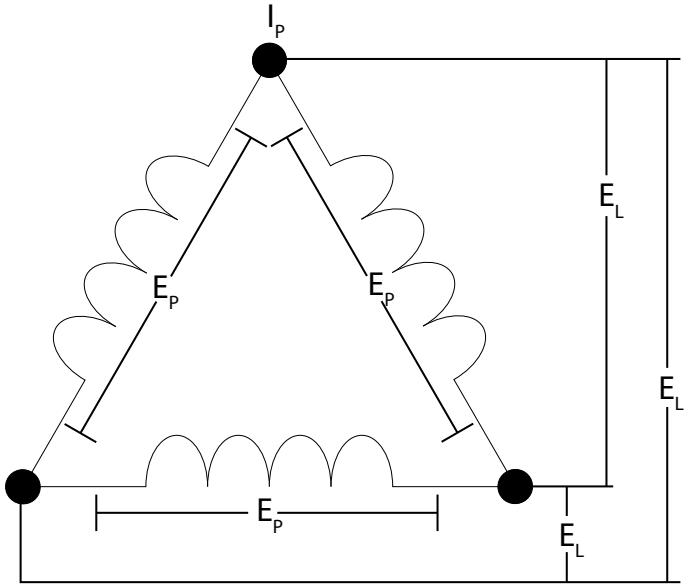
⚠ CAUTION ⚠

ALL VOLTAGE CODE "3" 460V UNITS UTILIZE A 277V ECM MOTOR WHICH REQUIRES A NEUTRAL WIRE. THE MOTORS ARE WIRED BETWEEN THE NEUTRAL AND ONE HOT LEG OF THE CIRCUIT. SOURCE WIRING MUST BE WYE (STAR) CONFIGURATION. 3-PHASE DELTA CONNECTIONS WILL NOT PROVIDE THE CORRECT WIRING AND WILL CAUSE THE UNIT NOT TO OPERATE.

Note: Proper Power Supply Evaluation

When any compressor bearing unit is connected to a weak power supply, starting current will generate a significant "sag" in the voltage which reduces the starting torque of the compressor motor and increases the start time. This will influence the rest of the electrical system in the building by lowering the voltage to the lights. This momentary low voltage causes "light dimming". The total electrical system should be evaluated with an electrician and HVAC technician. The evaluation should include all connections, sizes of wires, and size of the distribution panel between the unit and the utility's connection. The transformer connection and sizing should be evaluated by the electric utility provider.

EXAMPLE 2: DELTA ELECTRICAL CIRCUIT



Section 12: Troubleshooting

Select the topic for your maintenance need. Scan the QR code to access the video. Follow the directions and tips provided to make your project easier to complete:

- ECM Temporary Replacement

- ECM Motor Troubleshooting

- Troubleshooting a TXV

- Compressor Troubleshooting

- Variable Speed Flow Centers

- Return Conversion for and XT or CT

- Heat Of Extraction and Rejection

- Measuring Subcooling/Superheat

- Nitrogen Purge While Brazing

- Leak Testing an Air Coil

- Loop Flushing

- Repairing a Microchannel Air Coil

- Testing a Coaxial Heat Exchanger

- Troubleshooting a TXV

Section 13: Warranty Forms and Revision Table

Claim Form

ENERTECH
ENERGY + TECHNOLOGY

WARRANTY ORDER & CLAIM

PHONE : 618.664.9010 **FAX :** 618.664.4597 **EMAIL :** WARRANTY@ENERTECHGEO.COM

ALL WARRANTY REGISTRATIONS SHOULD BE SUBMITTED WITHIN 10 DAYS OF INSTALLATION

COMPANY NAME _____ (Form submitter) DATE _____

PHONE _____ FAX _____ EMAIL _____

ORDERED BY _____ JOB NAME/PO # _____

UNIT *Model #* _____ *Serial #* _____

FAILURE DATE _____

SHIP TO _____ HOMEOWNER _____
(If different than company) _____ ADDRESS _____

_____ _____

Required if claim is for defective flow center

FLOW CENTER MODEL # _____ FLOW CENTER SERIAL # _____

FAILURE CODES, DESCRIPTION AND LABOR REIMBURSEMENT MUST BE FOUND IN WARRANTY MANUAL

FAILURE CODE	DESCRIPTION	PART NUMBER
_____	_____	_____
_____	_____	_____
_____	_____	_____

LABOR REIMBURSEMENT REQUESTED ☐ *NO* ☐ *YES*

DO YOU NEED PARTS ORDERED? ☐ *NO* ☐ *YES* _____ _____

(If no, and replacement was purchased from another vendor, attach copy of bill if reimbursement is needed[3].)

OTHER NOTES _____

_____

FOR ENERTECH COMPANIES USE ONLY

SRO# _____ CREDIT MEMO# _____

1) See warranty coverage summary sheet for labor allowances, conditions and exclusions, etc. **2)** Warranty start date is ship date from Enertech facility unless proof of startup is presented. **3)** Outsourced warranty replacement parts will be reimbursed in the form of credit for the part only. Credit will be no more than the standard equivalent part cost through Enertech. **4)** Factory pre-approval is required for anything outside the scope of this document. **5)** Fuses, hose kits and items not mentioned on Warranty Coverage Summary are not covered under this program.

Section 13: Warranty Forms and Revision Table

Registration Form

ENERTECH
ENERGY + TECHNOLOGY

WARRANTY REGISTRATION

NOW REGISTER ONLINE AT WARRANTY-REGISTRATION.ENERTECHGEO.COM

WARRANTY REGISTRATIONS SHOULD BE SUBMITTED WITHIN 60 DAYS OF INSTALLATION

Model Number _____ Serial Number _____ Install Date _____

This unit is performing ☐ Satisfactorily ☐ Not Satisfactorily (please explain) _____

_____

Purchaser/User Name _____ Phone _____

Address _____ City _____ State/Prov _____

Postal Code _____ Email _____

Installer Company Name _____

City _____ State/Prov _____ Email _____

Application

☐ Residential New Construction ☐ Residential Geo Replacement ☐ Residential Replacement of Electric, Gas or Other
☐ Multi-Family (Condo/Townhome/Multiplex) ☐ Commercial ☐ Other _____

Use (check all that apply)

☐ Space Conditioning ☐ Domestic Water Heating ☐ Radiant Heat ☐ Swimming Pool ☐ Snow/Ice Melt
☐ Other _____

Loop Type

☐ Horizontal Loop ☐ Vertical Loop ☐ Pond Loop ☐ Open Loop

Demographics

Household Income ☐ Under $30,000 ☐ $30,000–$45,000 ☐ $45,000–$60,000 ☐ $60,000–$75,000 ☐ $75,000–$100,000 ☐ Over $100,000
Home Size ☐ Up to 1500 sq. ft. ☐ 1501 to 2500 sq. ft. ☐ 2501 to 4000 sq. ft. ☐ Over 4000 sq. ft.
Home Location ☐ Rural ☐ Urban ☐ Suburban
Value of Home ☐ Less than $100,000 ☐ $100,000–$250,000 ☐ $250,000–$500,000 ☐ $500,000–$1 mil ☐ Over $1 mil

Customer Satisfaction

How would you rate your overall satisfaction with your new geothermal system?
○ 1 (Very Dissatisfied) ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 (Very Satisfied)

How would you rate your overall satisfaction with your installing geothermal contractor?
○ 1 (Very Dissatisfied) ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 (Very Satisfied)

MAIL THIS FORM TO:
ENERTECH GLOBAL LLC
2506 SOUTH ELM STREET
GREENVILLE, IL 62246

EMAIL THIS FORM TO:
WARRANTY@ENERTECHGEO.COM

FAX THIS FORM TO:
ENERTECH GLOBAL LLC
618.664.4597

REGISTER ONLINE AT: warranty-registration.enertechgeo.com

Rev 30 DEC 2013B

Revision Table

Date	Description of Revision	Page
03MAR2021	ZS and ZT Nomenclatures updated.	4
24JUL2020	ZS/ZT Electricla Data Tables updated	24-27
20SEP2019	ZS/ZT Electrical Data Tables updated	24-27

Revision Table

Date	Description of Revision	Page
10JUN2019	AHRI Data removed	7
29APR2019	Updated ZT042 Coax F/L and P/L COP AHRI Data.	7
22APR2019	ZT BPHE SC/SH Tables updated.	90
	ZS BPHE SC/SH Tables updated.	89
	ZS BPHE Operating Parameter Tables updated.	92
	ZS BPHE WPD Table updated.	85
	ZS BPHE PSC HE/HR Table updated.	79
	ZS BPHE ECM HE/HR Table updated.	81
	ZT BPHE Operating Parameter Tables updated.	93
	ZT BPHE WPD Table updated.	87
	ZT BPHE HE/HR Table updated.	83
14JUN2018	Extended Data Tabvles, HE/HR Tables, WPD Table, SC/SH Table updated	-
	Extended Data Tabvles, HE/HR Tables, WPD Table, SC/SH Table updated	-
12APR2018	Updated Unit Data Information	18
09APR2018	Nomenclature drawings updated	4
20MAR2018	Lockout Board updated	43
30NOV2017	Updated Soft Start Wiring Diagram	--
14NOV2017	Updated Electrical Data	24,25
20OCT2017	PSC Electrical Data Table revised	28,29
22AUG2017	Added ZT SC/SH Tables	-
	Updated Filter Rack/Flange Diagram	16
	Updated HE/HR, WPD, Op Parameter Tables	77,79,83
07JUL2017	Unit Physical Data revised	21
26JUN2017	AHRI For ZS-ZT 006, 009, 012, 030 and 042	5,6
14JUN2017	Fan Chart Revised	22
	Unit Dimensional Data updated	16
06JUN2017	ZT Nomenclature Drawings revised	4
	Nomencalture Drawings revised	24
22MAY2017	Wiring Diagrams revised	68
	ZT Electrical Data Table revised	24
	ZS PSC Electrical Data Tables revised	27,28
24APR2017	Added SC SH Table per SC SH Tables	78
	Updated HE HR Tables	73-76
17APR2017	ZS017 changes made	---
	ZS015 changes made per	---
	Updated ZS/ZT Wiring Diagrams	51-68
13APR2017	Updated AHRI Data Tables	5
11APR2017	ZS PSC Fan Chart revised	23
24MAR2017	Updated ZS/ZT Wiring Diagrams	51-68
	Updated PSC Fan Performance Data	21,22
	Updated ECM Fan Performance Data	21,22
21MAR2017	Updated Electrical Data Tables	24-27
	Rev B document created	ALL

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