Geothermal/Water Source Heat Pump

R-410A Refrigerant
0.75-6 Ton

Design Features

Factory Options

Accessories

Dimensional Data

Physical Data

Performance Data

Engineering Guide Specifications

ENERGY STAR

AHRI CERTIFIED
www.ahridirectory.org

GEOSMART ENERGY

SPECIFICATION CATALOGUE

Table of Contents

Model Nomenclature

1	2	3-5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20-21	22
Z	S	036	T	L	0	0	0	C	A	N	N	2	1	N	0	0	SS	A

Model Type
Z = Z Series

Operation Range
S = Single Speed

Unit Capacity
009, 012, 015, 018,
023 (horizontal),
024, 030, 036,
041 (vertical),
042, 048, 060, 070

Discharge Configuration
T = Top (vertical)
E = End (horizontal)
S = Side (horizontal)

Air Configuration
L = Left
R = Right

Voltage
0 = 208-230/60/1
2 = 265-277/60/1 (009-030)
3 = 208-230/60/3 (023-070)
4 = 460/60/3 (023-070)
5 = 575/60/3 (041-070)

Hot Water Generation Option
0 = No HWG, No GeoStart™
2 = HWG w/o pump, No GeoStart (V015-070)
3 = No HWG, GeoStart
5 = HWG w/o pump, GeoStart (V024-070)

Blower Option
0 = PSC Blower
1 = ECM2.3 Blower (015-070)
2 = High Static ECM2.3 Blower (042-048)
3 = High Static PSC Blower (024, 030, 042, 048)

Coax
C = Copper
N = Cupronickel

Sound Kit
A = None
B = Sound Kit

Vintage
A = Current

Non-Standard Option Details
SS = Standard Option

Drain Pan Options
0 = Composite, No Secondary Connection
1 = Composite, Secondary Connection
2 = Stainless Steel, No Secondary Connection
3 = Stainless Steel, Secondary Connection

Cabinet
0 = Unpainted, 1” MERV 4, Filter Rail
1 = Painted, 1” MERV 4, Filter Rail
2 = Unpainted, 2” MERV 13, Filter Rail
3 = Painted, 2” MERV 13, Filter Rail
4 = Unpainted, 1” MERV 4, Filter Rack
5 = Painted, 1” MERV 4, Filter Rack
6 = Unpainted, 2” MERV 13, Filter Rack
7 = Painted, 2” MERV 13, Filter Rack

Phase Guard
N = No Phase Guard, No Disconnect
D = No Phase Guard, Disconnect
P = Phase Guard, No Disconnect
B = Phase Guard, Disconnect

Air Coil/Insulation Options
1 = FormiShield/Extended Range
2 = FormiShield/Standard Range
3 = No Coating/Extended Range
4 = No Coating/Standard Range

Controls Option
2 = Versatec Microprocessor
4 = FX10 std. no communication

Water Control
N = None
R = Water Flow Regulator (015-070)
V = 2-Way Valve (015-070)
B = 2-Way Valve w/Water Flow Regulator (015-070)

Hot Gas Bypass/Reheat
N = None
G = Hot Gas Bypass (015-070)
R = Hot Gas Reheat (015-070)
B = Hot Gas Bypass w/Hot Gas Reheat (015-070)

NOTES: Phase guard only available on 208-230/60/3, 460/60/3, and 575/60/3
GeoStart only available on 208-230/60/1
ECM, Hot Gas Reheat/Bypass, and 2-Way Valve only available on FX10

The ECO-Z

The **ECO-Z** represents a significant improvement in the commercial water source heat pump (wshp). The R-410A product features high efficiency with industry leading standard options in a compact cabinet suitable for both retrofit and new construction applications. The product is also targeted to provide optimum performance and flexibility in both water loop and geothermal applications. The new product features the following options (see nomenclature for more details):

- Wide selection of capacities from 009-070 kBtuh output
- Complete commercial voltage selection of 208-230 V/60 Hz/1ph, 265/60/1, 208-230/60/3, 460/60/3, and 575/60/3
- Industry leading quality through engineering and manufacturing using quality components
    - — High Efficiency and reliable rotary compressors 009-018
    - — High Efficiency and reliable scroll compressors 023-070
    - — High Efficiency 3 speed PSC blower motor or optional variable speed ECM2.3
- High efficiency performance for maximizing LEED points
    - — With PSC Blower Motor Up to 15.0 EER and 4.8 COP (ISO/AHRI 13256-1-WLHP)
    - — With Variable ECM2.3 Blower Motor Up to 15.7 EER and 5.1 COP (ISO/AHRI 13256-1-WLHP)
    - — EnergyStar Rating on selected models
- Small cabinet footprint for easy retrofit of much lower efficiency legacy product
    - — Compact height and length horizontal cabinet matches legacy product - 12 in. high 009-0012, 17 in. high 015-018, 19 in. high 024-036, and 21 in. high 042-070
    - — Short vertical cabinet
    - — Special models for specific replacement sizes
        - - Horizontal 023 model is 22.5 in.wide x 17.2 in. high x 42.0 in. long
        - - Vertical 041 model is 22.5 in. wide x 26.2 in. deep x 44.2 in. high
- Wide array of standard factory installed options including:
    - — Configurations – horizontal left and right return, end or side discharge (field switchable); vertical left and right return
    - — 3 speed- PSC or variable speed ECM2.3 blower motor with high static options
    - — Internal hot water generator coil (vertical only)
    - — Copper or cupronickel heat exchanger and optional low temperature insulation
    - — Hot Gas reheat and/or bypass
    - — Corrosion-proof composite or stainless steel drain pan; including internally mounted secondary drain connection option
    - — Filter options: standard 1 in. MERV 4 or optional 2 in. MERV 13 factory installed with either filter rails or optional deluxe filter rack both field switchable between 1 in. and 2 in.
    - — Versatec or FX10 control with N2, LonWorks, or BACnet cards
    - — Factory mounted internal water valve and/or flow regulator for variable speed pumping systems saving on installation costs
    - — Other Options: Sound Kit, coated air coil, phase guard, factory mounted power disconnect, GeoStart soft starter (208-230/60/1 only), painted cabinet

Vertical ECO-Z
Models ZS 009-070 (3/4-6 tons) Single Speed

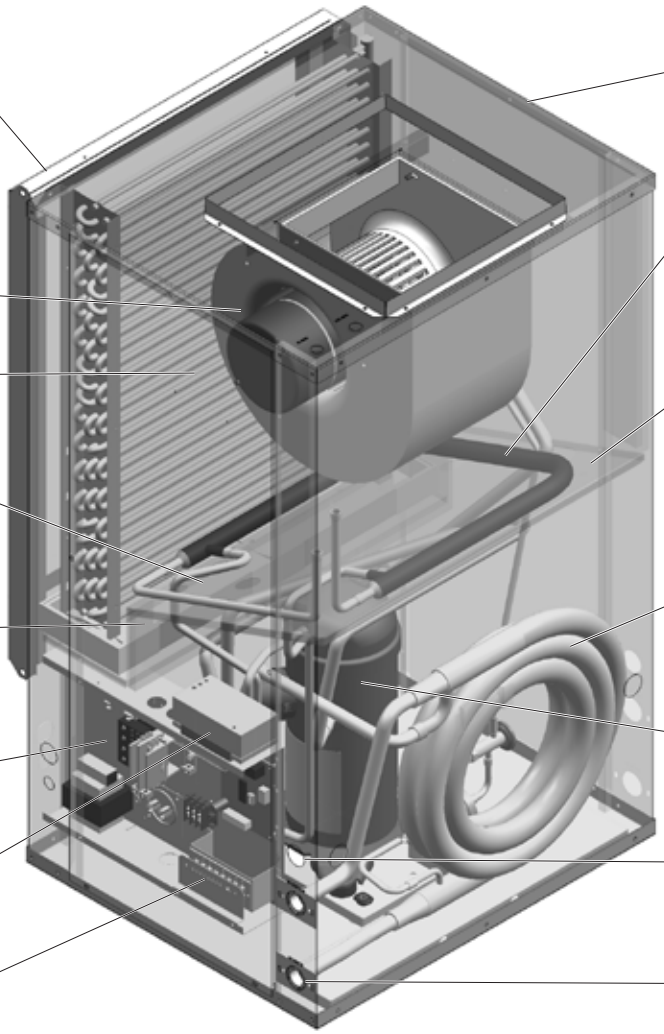
Horizontal ECO-Z
Models ZS 009-070 (3/4-6 tons) Single Speed

All ECO-Z products are safety listed under UL1995 thru ETL and performance listed with AHRI in accordance with standard 13256-1. The ECO-Z is also Energy Star rated.

The ECO-Z cont.

Product Features: Vertical Cabinet

ECO-Z vertical units are designed for high efficiency, maximum flexibility, and primary servicing from the front.



Standard filter rail, field switchable for 1 in. or 2 in. filters
Optional factory mounted deluxe filter rack (shown), field switchable for 1 in. or 2 in. filters

Removable inlet rings for easy blower removal

Oversized rifled tube/lanced fin air coil (optional Form-iShield coating).

Corrosion-resistant, composite drain pan with overflow protection, optional secondary drain connection

Optional stainless steel drain pan with overflow protection, optional secondary drain connection

Microprocessor control
Versatec - Standard
FX10 - Optional

Optional GeoStart reduces starting current by 60-70% (208-230/60/1 only)

Fault and status LEDs (Versatec microprocessor controls only)

Optional powder coated, heavy-gauge steel cabinet

Optional factory installed water heating system with built-in coil (vertical only, no factory installed pump)

Insulated divider panel

Optional ThermaShield coated coaxial heat exchanger

High efficiency rotary or scroll compressor

Internally trapped condensate line

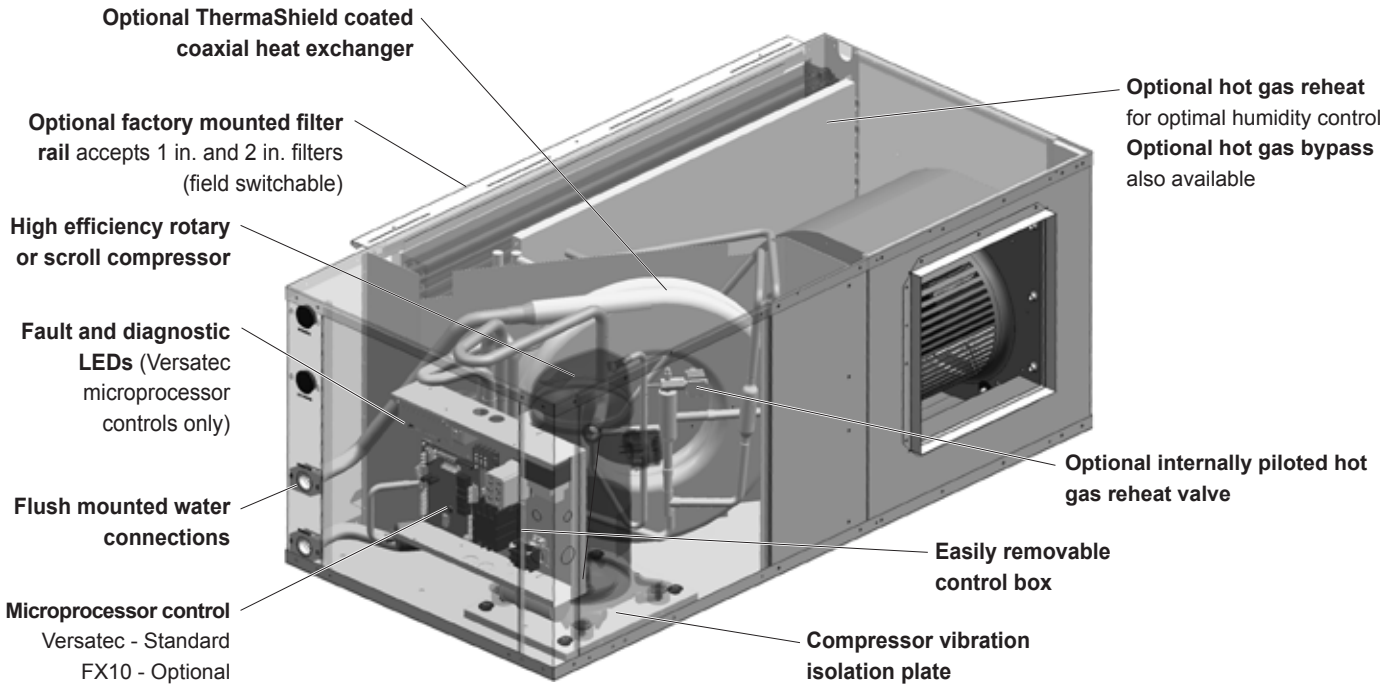
Flush mounted water connections (no backup wrenches needed)

A true left and right return option is available.

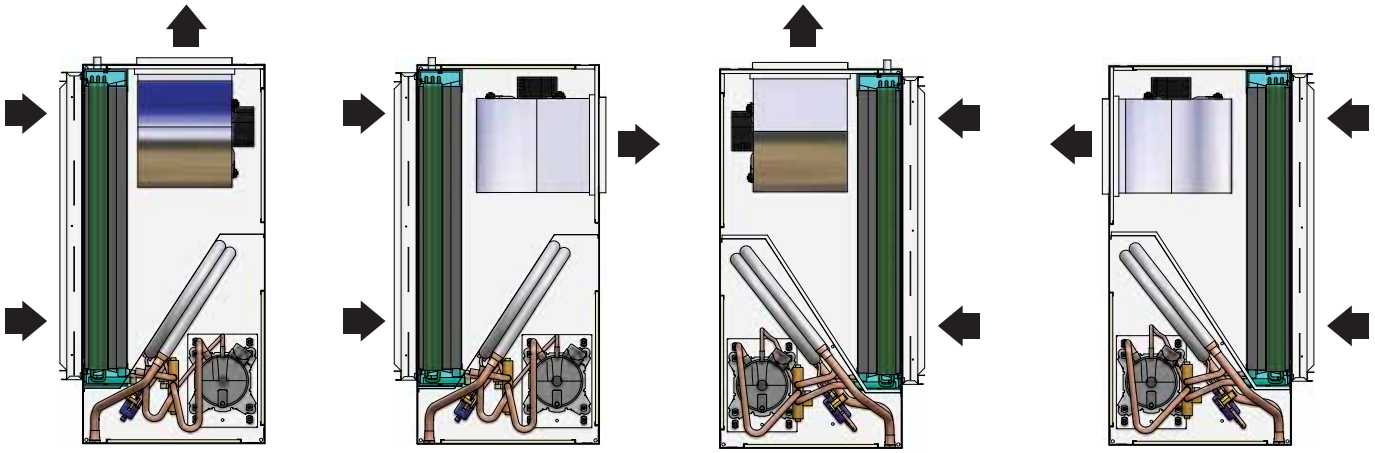
The ECO-Z cont.

Product Features: Horizontal Cabinet

ECO-Z Horizontal units are available in seven cabinet sizes. The cabinets are designed for high efficiency, maximum flexibility, and primary servicing from the front.



Four blower deck options are available. Factory or field conversion option of end or side discharge using switchable access panels and a factory only option of true left or right return air coil.



Left hand return with end discharge

Left hand return with side discharge

Right hand return with end discharge

Right hand return with side discharge

The ECO-Z cont.

Flexible Product with Several Standard Options

- Compact cabinet design, vertical and horizontal with true left and right return configurations
- Horizontal end and side discharge with vertical top discharge air configurations
- Capacities of 9,000 through 70,000 Btuh
- All commercial voltages including 208-230/60/1, 265-277/60/1, 208-230/60/3, 460/60/3, and 575/60/3.
- Hot water generation (hot water generator - vertical only)
- GeoStart soft starter (208-230/60/1 only)
- 3 speed PSC or optional variable speed ECM2.3 blower motors (high static options available)
- FormiShield coated air coils
- Copper or cupronickel heat exchangers
- Extended range insulation option
- Super Quiet Sound Package, including multi-density compressor blanket
- Quiet rotary or scroll compressors in all models
- 2-dimension refrigerant piping vibration loops to isolate the compressor
- Double isolated compressor mounting utilizing eight durometer selected rubber grommets and high density steel
- Heavy gauge cabinet and 4 vibration isolating hanger brackets
- Hot Gas Bypass and Reheat (015-072)
- Internally mounted water flow regulator and/or water solenoid valve for variable speed pumping systems
- Standard Versatec microprocessor or FX10 Control
- Phase guard with optional ‘dial’ disconnect
- Optional painted cabinet
- Polymer composite drain pan or stainless steel drain pan with optional secondary drain connection
- 1 in. MERV 4 or 2 in. MERV 13 filters

Other options are available by special request, contact your sales representative.

High Efficiency

The ECO-Z is a high efficiency watersource heat pump in a compact vertical and horizontal cabinet. The product features highly efficient and reliable single capacity rotary or scroll compressors mated with large blowers driven by efficient 3 speed PSC blower motors with optional highly efficient variable speed ECM2.3 blower motors.

Quiet Operation

All ECO-Z product incorporates several noise reduction technologies and is ARI 260 sound rated using third party sound testing. Room Noise Criteria Curves (NC Curve) may be calculated using data from the ARI 260 ratings giving the engineer total flexibility in assuring a quiet environment. Please refer to our separate catalog Sound Ratings and Performance Catalog concerning this standard and ECO-Z sound performance data.

Super Quiet Option

An optional Super Quiet Sound Package is also available for a modest cost and features:

- Multi-density steel laminate compressor ‘mass’ base plate designed to suppress low frequency compressor noise.
- Multi-density laminate lined compressor blanket designed to completely surround the compressor on all six sides and suppress low frequency noise.

Indoor Air Quality (IAQ)

All ECO-Z features several IAQ benefits:

- Corrosion-free composite double-sloped drain pan to eliminate standing water and prevent bacterial growth
- Foil-faced fibre insulation in all air handler compartments to allow cleanability and inhibit bacteria growth. Optional non-fibrous closed cell insulation is also available for more sensitive applications.
- Open filter rail comes standard for non-ducted return applications. Filter rail is field switchable from 1 in. to 2 in. [2.54 to 5.1 cm] for more filter options.
- Optional factory mounted, four sided, deluxe filter rack that is field switchable from 1 in. to 2 in. [2.54 to 5.1 cm] is available for ducted return applications.
- Standard supplied filter is a pleated MERV 4, 1 in. [2.54 cm]. An optional low static high efficiency 2 in. [5.1 cm] MERV 13, for LEED certification points, is also available.

The ECO-Z cont.

Hot Gas Reheat - Dehumidification

With tighter construction and more and more ventilation air coming into buildings, there is more need now than ever for dehumidification. Ensuring dehumidification can provide: consistent employee comfort, a reduction in mold liability, a reduction in cooling costs. Reduced humidity also provides an improvement in indoor air quality (IAQ) thru lower humidity levels which can reduce allergen levels, inhibit mold and bacterial growth, and provide an improved computer environment. Reheat can be used wherever moisture is a problem. In schools, high latent auditoriums and theaters, makeup air units, computer rooms, and indoor swimming pool rooms are typical applications. The option consists of a reheat air coil located after the evaporator air coil and a reclaim valve that diverts the hot gas into the reheat coil. Neutral air will be provided at typical WLHP loop temperature.

The reheat option is only available with the FX10 control. With this control we have three control schemes available:

Room wall dehumidistat – An optional room wall dehumidistat that controls the reheat mode thru a 24VAC 'Hum' input (On or Off). Setpoint and deadband is determined by the dehumidistat.

Duct humidity sensor – An optional duct humidity sensor is installed. The FX10 control reads the humidity from the sensor and determines operation mode. Setpoint and deadband are internally set by the FX10 control and are adjustable. Continuous blower operation is a requirement for this mode to accurately measure relative humidity during the off cycle.

Room wall humidity sensor – An optional wall humidity sensor is installed. The FX10 control reads the humidity from the sensor and determines operation mode. Setpoint and deadband are internally set by the FX10 control and are adjustable. Continuous blower operation is NOT a requirement for this mode.

Hot Gas Bypass

The hot gas bypass (HGB) option is designed to limit the minimum evaporating pressure in the cooling mode to prevent the air coil from icing. The HGB valve senses pressure at the outlet of the evaporator by an external equalizer. If the evaporator pressure decreases to 115 psig the HGB valve will begin to open and bypass hot discharge gas in the inlet of the evaporator. The valve will continue to open as needed until it reaches its maximum capacity. Upon a raising of suction pressure the valve will begin to close back off and normal cooling operation will resume.

Flexible Control Options

The standard Versatec microprocessor control board provides complete monitoring and control with fault, status, and I/O LED indication for easy servicing. The Versatec features a robust microprocessor control that monitors LP, HP, Condensate, field selectable thermistor freeze detection, while providing a fault output scheme.

The optional FX10 control provides unparalleled capability in several areas including performance monitoring, zoning, humidity, energy management, and service diagnosis, and then communicates it all thru standard DDC protocols like N2, Lon, and BACnet (MS/TP @ 19,200 Baud rate).

Versatec

FX10

The most unique feature is integrating the FX10 into the ECO-Z as both the heat pump and DDC controller providing both a cost advantage and features not typically found on WLHP controls. This integration allows heat pump monitoring sensors, status and service diagnosis faults to be communicated thru the DDC direct to the building automation system (BAS), giving building supervisors detailed and accurate information on every piece of equipment without removing an access panel!

Easy Maintenance and Service Advantages

- 2 removable compressor access panels
- Horizontal units have separate air handler and compressor section permitting service testing without air bypass.
- Designed for front panel access.
- Quick attach wiring harnesses are used throughout for fast servicing.
- High and low pressure refrigerant service ports.
- Removable blower inlet rings allow for ease of service without removing the blower housing.
- Internal drop out blowers (vertical) and access panel view of all blower motors (horizontal).

Optional user interface for diagnostics & commissioning of FX controls.

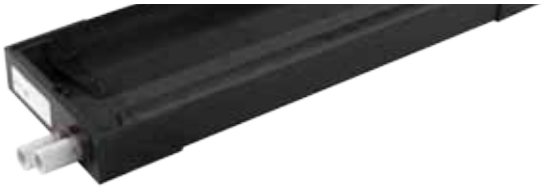
The ECO-Z cont.

Internally Mounted Solenoid Valve Option

When variable speed circulating pump systems are designed, low pressure drop (high Cv) solenoid valves are specified at each unit to vary the pump according to flow required. It is important that these valves be low pressure drop to avoid unwanted pump watts. This option factory installs this valve inside the unit.

Secondary Drain Connection Option (Special)

Some local building authority's interpretation of codes require more condensate overflow protection than standard microprocessor based condensate sensors offer. In these areas a full secondary drain pan might be required causing both increased cost and unit service access issues. In many of these cases a secondary drain connection option can be added to the unit to pass this local interpretation of condensate drain redundancy. This option adds a second PVC drain connection to the drain pan at a higher level.



Phase Guard

Factory mounted phase guard device is available to protect the compressor against loss of phase and reverse rotation.

Disconnect (Special)

An optional factory mounted, internally wired disconnect is available to avoid scheduling problems with the electrical contractor. Other features include:

- Non-fused, 'dial' type switch with "on/off" position
- Compact design
- "Lockout/Tagout" feature to keep the unit "off" during service

Factory Quality

- All refrigerant brazing is performed in a nitrogen environment.
- Computer controlled deep vacuum and refrigerant charging system.
- All joints are leak detected for maximum leak rate of less than 1/4 oz. per year.
- Computer bar code equipped assembly line insures all components are correct.
- All units are computer run-tested with water to verify both function and performance.

Inside the ECO-Z

Refrigerant
ECO-Z products all feature zero ozone depletion and low global warming potential refrigerant R410A.

Cabinet
All units are constructed of corrosion resistant galvanized sheet metal with optional white polyester powder coat paint rated for more than 1,000 hours of salt spray. One large lift-out access panel provides access to the compressor and air handler section to allow servicing of blower motor, blower, and drain pan. Refrigerant circuit is designed to allow primary serviceability from the front. Seven (7) horizontal and seven (7) vertical cabinets are provided for application flexibility. The blower motor and blower can be completely serviced or replaced without removal of the unit. Service of the blower and blower motor is made easier via the removable orifice ring on the housing.

Flexible configurations include four (4) blower deck options for horizontals and a true left and right return on both horizontal and vertical.

Filter Rack
All units come standard with an open filter rail, for use in open return applications, or an optional deluxe filter rack/duct collar for use with ducted returns. Both filter options are field switchable between 1 in. [2.54 cm] and 2 in. [5.1 cm] thick filters for filter flexibility. A MERV 4, 1 in. [2.54 cm] is standard with an optional 2 in. [5.1 cm] MERV 13 for LEED certification points and high efficiency filtration.

Electrical Box
Unit controls feature quick connect wiring harnesses for easy servicing. Separate knockouts for LV, and two for power on two sides allow easy access to the control box. Large 75VA transformer assures adequate controls power for accessories.

Water Connections
Flush mount FPT water connection fittings allow one wrench leak-free connections and do not require a backup wrench.

Horizontal Hanger Kits
Each horizontal unit includes a hanger kit to meet seismic specification requirements while still allowing filter access.

Drain Pan
All condensate connections are PVC glue for economical corrosion free connections. Bacteria resistant composite drain pan is sloped to promote complete drainage and will never rust or corrode. Complete drainage helps to inhibit bacterial or microbial growth. Vertical units feature an internally trapped condensate line using clear PVC hose for easy inspection and reduced installation cost. Optional factory installed stainless steel drain pans are also available.

Inside the ECO-Z cont.

Compressors
High efficiency R410A rotary or scroll compressors are used on every model. Rotary or scrolls provide both the highest efficiency available and great reliability. Single speed scroll models are available in commercial voltages.

Compressor Dual Isolation Mounting
Double isolated compressor mounting utilizing eight durometer selected rubber grommets and high density steel. This isolation greatly reduces the primary noise frequency range of 100-300 Hz.

Air Handler Insulation
Foil Faced air handler insulation provides cleanability to further enhance IAQ.

Thermostatic Expansion Valve
All ECO-Z models utilize a balanced port bidirectional thermostatic expansion valve (TXV) for refrigerant metering. This allows precise refrigerant flow in a wide range of entering water variation (20 to 120°F [-7 to 49 °C]) found in geothermal systems. The TXV is located in the compressor compartment for easy access.

Water-to-Refrigerant Coaxial Heat Exchanger Coil
Large oversized coaxial refrigerant to water heat exchangers provide unparalleled efficiency. The coaxes are designed for low pressure drop and low flow rates. All coaxes are pressure rated to 450 psi water side and 600 psi on the refrigerant side. Optional ThermaShield coating is available on the water-to-refrigerant heat exchanger to prevent condensation in low temperature loop operation.

Service Connections and Serviceability
Two Schrader service ports are provided in every unit. The suction side and discharge side ports are for field charging and servicing access. All valves are 7/16″ SAE connections. All water and electrical connections are made from the front of the unit. Unit is designed for front access serviceability.

Inside the ECO-Z cont.

4-Way Reversing Valve

ECO-Z units feature a reliable all-brass pilot operated refrigerant reversing valve. The reversing valve operation is limited to change of mode by the control to enhance reliability.

Air Coil

Large low velocity air coils are constructed of lanced fin and rifled tube. Each model features 3 rows for added moisture removal. An optional FormiShield™ air coil coating is available to further inhibit formicary corrosion.

Blower Motor and Housing

High efficiency low rpm galvanized direct drive blower featuring 3 speed permanently split capacitor (PSC) motor and optional variable speed ECM2.3 blower motor. The ECM2.3 motor is controlled directly through the unit's FX10 microprocessor control. The lower rpm blower also reduces air noise. All PSC motors have speed selection terminal strip on the motor for easy speed change. All motors are vibration isolated to reduce noise. High static options are available in some models for both PSC and ECM2.3 motor versions. Horizontal units can be field converted from end to side discharge as well.

GeoStart™

The optional GeoStart single phase soft starter will reduce the normal start current (LRA) by 60-70%. This allows the heat pump to go off-grid. Using GeoStart also provides a substantial reduction in light flicker, reduces start-up noise, and improves the compressor's start behavior. GeoStart is available in a field retrofit kit or as a factory installed option for all ECO-Z units.

Controls

Versatec Control

The standard Versatec microprocessor control board provides complete monitoring and control with fault, status, and I/O LED indication for easy servicing. The Versatec features a robust microprocessor control that monitors LP, HP, Condensate, field selectable thermistor freeze detection, while providing a fault output scheme.

FX10 Control

The optional FX10 control provides unparalleled capability in several areas including performance monitoring, zoning, humidity, energy management, and service diagnosis, and then communicates it all thru standard DDC protocols like N2, Lon and BACnet (MS/TP @ 19,200 Baud rate).

The most unique feature is integrating the FX10 into the ECO-Z as both the heat pump and DDC controller providing both a cost advantage and providing features not typically found on WLHP controls. This integration allows heat pump monitoring sensors, status and service diagnosis faults to be communicated thru the DDC direct to the building automation system (BAS), giving building supervisors detailed and accurate information on every piece of equipment without removing an access panel!

Control	General Description	Application	Display/Interface	Protocol
Versatec Control 	The Versatec microprocessor control is self contained control featuring LP, HP, LWT, and condensate overflow fault modes that are displayed on an 8 LED fault board. Multiple DIP switches allow several field configurations. This control is suited for single capacity compressor with PSC blower motors. Input and outputs can be viewed on LED board. Connections for thermostat are made through a removable 9 pin connector.	Residential and commercial applications using single capacity compressors with PSC blower motors. Cannot be integrated with centralized building automation systems (BAS).	8 LED Fault/Mode Display Board attached to control box is standard.	Standalone
FX10 	The FX10 microprocessor control is self contained control featuring LP, LOC, HP, LWT, and condensate overflow fault modes can be displayed on BAS system. Optional handheld Medium User Interface (MUI) Control can be used for additional setup or servicing. Program customization is possible. This control is suited for both single and dual capacity compressors as well as PSC and ECM2.3 blower motors.	Commercial applications using single and dual capacity compressors with either PSC or ECM2.3 blower motors. Also suitable for multi-compressor products. Cannot be integrated with centralized building automation systems. Software can be customized for specific projects.	Optional Medium User Interface (MUI) can be used as a field service tool.	Standalone
FX10 w/N2 	FX10 Control functions as both unitary heat pump control and DDC communication, therefore detail operational and fault information is available to BAS. Other features are same as FX10 with addition of Johnson Controls N2 compatibility.	Same as FX10 with Johnson Controls N2 BAS compatibility.	Optional Medium User Interface (MUI) can be used as a field service tool.	Johnson Controls N2 network
FX10 w/LonWorks 	FX10 Control functions as both unitary heat pump control and DDC communication, therefore detail operational and fault information is available to BAS. Other features are same as FX10 with addition of LonWorks compatibility.	Same as FX10 with LonWorks BAS compatibility.	Optional Medium User Interface (MUI) can be used as a field service tool.	LonWorks
FX10 w/BACnet 	FX10 Control functions as both unitary heat pump control and DDC communication, therefore detail operational and fault information is available to BAS. Other features are same as FX10 with addition of BACnet compatibility.	Same as FX10 with BACnet BAS compatibility. Due to communication speed, no more than 30 units should be connected to a single trunk of the network.	Optional Medium User Interface (MUI) can be mounted or used as field service tool.	BACnet - MS/TP (19,200 Baud Rate)

Controls - Versatec Microprocessor

Standard Versatec Microprocessor

Flexible Control Options
The ECO-Z control system is a microprocessor-based printed circuit board, (PCB), conveniently located in the unit control box for accessibility. The microprocessor control is specifically designed for water source heat pumps to integrate compressors and advanced features needed in water source heat pump applications. The microprocessor provides control of the entire unit as well as outputs for status modes, faults, and diagnostics. Low voltage thermostat terminal strips provide convenient field connections. LEDs are located on the control box to assist the technician when servicing the unit.

Startup
The unit will not operate until all the inputs and safety controls are checked for normal conditions. At first powerup, a five minute delay is employed before the compressor is energized.

Component Sequencing Delays
Components are sequenced and delayed for optimum space conditioning performance.

Short Cycle Protection
The control allows a minimum on time of two minutes and a minimum off time of 5 minutes for short cycle protection.

Condensate Overflow Protection
The Versatec control board incorporates an impedance sensing liquid sensor at the top of the drain pan. Upon a continuous 30-second sensing of the condensate, compressor operation is suspended (see Fault Retry), and the condensate overflow lockout LED begins flashing.

Safety Controls
The Versatec control receives separate signals for a high pressure switch for safety, a low pressure switch to prevent loss of charge damage, and a low suction temperature thermistor for freeze sensing. Upon a continuous 30-second measurement of the fault (immediate for high pressure), compressor operation is suspended, the appropriate lockout LED begins flashing. (Refer to the “Fault Retry” section).

Testing
The Versatec control allows service personnel to shorten most timing delays for faster diagnostics.

Fault Retry
All faults are retried twice before finally locking the unit out. An output signal is made available for a fault LED at the thermostat. The “Fault Retry” feature is designed to prevent nuisance service calls.

Diagnostics
The Versatec control board allows all inputs and outputs to be displayed on the LEDs for fast and simple control board diagnosis.

Emergency Shutdown
A grounded signal to common or connecting 24 VAC to the ES terminal places the controller into the emergency shutdown mode. The compressor and blower operation are suspended while in the emergency shutdown mode.

Heating Operation
Heating (Y1)
The blower motor is started immediately after the “Y1” input is received, and the compressor is energized 10 seconds after the “Y1” input.

Cooling Operation
In all cooling operations, the reversing valve directly tracks the “O” input. Thus, anytime the “O” input is present, the reversing valve will be energized.

Cooling (Y1,O)
The blower motor is started immediately after the “Y1” input is received, and the compressor is energized 10 seconds after the “Y1” input.

Blower (G only)
The blower motor is started immediately after the “G” input is received; and it will remain on for 30 seconds at the end of each heating or cooling cycle.

Lockout Conditions
During lockout mode, the appropriate unit and thermostat lockout LEDs will illuminate. The compressor and accessory outputs are de-energized. If the thermostat calls for heating, emergency heat operation will occur. All other lockout modes can be reset at the thermostat after turning the unit off, and then on, which restores normal operation but keeps the unit lockout LED illuminated. Interruption of power to the unit will reset lockout without a waiting period and clear all lockout LEDs.

High Pressure
This lockout mode occurs when the normally closed safety switch is opened momentarily (set at 600 PSI).

Controls - Versatec Microprocessor cont.

Low Pressure
This lockout mode occurs when the normally closed low pressure switch is opened for 30 continuous seconds (set at 40 PSI).

Freeze Detection
(Water Flow)
This lockout mode occurs when the freeze thermistor temperature is at or below the selected freeze detection point (well 30°F or loop 15°F) for 30 continuous seconds.

DIP Switch Settings

Prior to powering unit, ensure that all DIP switches on SW1 are set properly according to the table below.

FACTORY SETUP DIP SWITCHES (SW1)				
Dip Switch Number		**Description**	**"OFF" Position**	**"ON" Position**
SW1-	**1**	**Service Test Mode** On the control, allows field selection of "NORMAL" or "TEST" operational modes, Test mode accelerates most timing functions 16 times to allow faster troubleshooting. Test mode also allows viewing the "CURRENT" status of the fault inputs on the LED display.	Test Mode	Normal Speed Operation
SW1-	**2**	**Freeze Detection Setting** This DIP switch allows field selection of low source water thermistor fault sensing for "WELL" water (30°F) or "LOOP" (15°F) for antifreeze protected earth loops.	"LOOP" (15°F)	"WELL" (30°F)
SW1-	**3**	**Not Available**	N/A	Normal Operation
SW1-	**4**	**I/O Display Mode** This DIP switch enables Input/Output Display or Status/Current Fault on LED Board. Refer to SW2 for operation and positioning.	Input/Output Display Mode	Status/Current Fault Display Mode
SW1-	**5**	**Not Available**	N/A	Normal Operation
SW2-		**LED Display (On LED Board)** This DIP switch enables Normal Status or Input display mode in the "OFF" position and Current Fault or Output display mode in the "ON" position.	Status or Inputs Display Mode	Current Fault or Output Display Mode

Operation Logic Data Table

Mode	Inputs	Blower	Comp	RV
Htg	Y	Auto	ON	OFF
Clg	Y, O	Auto	ON	ON
Blower Only	G/Y2	ON	OFF	OFF

Controls - FX10 (optional)

FX10 Advanced Control Overview

The Johnson Controls FX10 board is specifically designed for commercial heat pumps and provides control of the entire unit as well as input ports for Open N2, LonTalk, BACnet (MS/TP @ 19,200 Baud rate) communication protocols as well as an input port for a user interface. The user interface is an accessory item that can be used to aid in diagnostics and unit setup. A 16-pin low voltage terminal board provides terminals for common field connections. The FX10 Control provides:

- Operational sequencing
- High and low-pressure switch monitoring
- General lockout
- Freeze Detection
- Condensate overflow sensing
- Lockout mode control
- Emergency shutdown mode
- Random start and short cycle protection

Short Cycle Protection

Allows a minimum compressor “OFF” time of four minutes and a minimum “ON” time of two minutes.

Random Start

A delay of 1 to 120 seconds is generated after each power-up to prevent simultaneous startup of all units within a building after the release from an unoccupied cycle or power loss.

Emergency Shutdown

A field-applied dry contact can be used to place the control into emergency shutdown mode. During this mode, all outputs on the board are disabled.

Freeze Detection

Field selectable for 15° or 30°F (-9° or -1°C)

Installation Options

- Standalone controlled by standard room thermostat
- Standalone with a Zone Temperature Sensor (must have user interface to change set points beyond the allowed +/- 5°F)
- Integrated into BAS by adding communication module

Accessory Outputs

Quantity 2, one cycled with blower, other with compressor

User Interface

4 x 20 backlit LCD

Main FX 10 Board

Optional Plug-in Communication Modules - (compatible with standard BAS protocols)

- Open N2
- LonTalk
- BACnet (MS/TP @ 19,200 Baud rate)

Display

Requires DLI Card/Kit. Up to 2 displays, either 1 local and 1 remote, or 2 remote. (A 2-display configuration requires identical displays.) Local display can be up to 3 meters from the controller, power supply, and data communication. Remote display can be up to 300 meters from the controller. Remote display must be independently powered with data communication done via 3 pole shielded cable.

Control Timing & Fault Recognition Delays

Lead compressor “ON” delay .....90 seconds
(not applicable for single compressor models)
Minimum compressor “ON” time.....2 minutes
(except for fault condition)
Short cycle delay .....5 minutes
Random start delay .....0-120 seconds
High pressure fault ..... <1 second
Low pressure fault .....30 seconds
Freeze Detection fault .....30 seconds
Condensate overflow fault.....30 seconds
Low pressure fault bypass.....2 minutes
Freeze sensing fault bypass.....2 minutes

Controls - FX10 (optional) cont.

Optional FX10 Microprocessor and BAS Interface

The FX10 is a microprocessor based control that not only monitors and controls the heat pump but also can communicate any of this information back to the building automation system (BAS). This means that not only does the control monitor the heat pump at the unit you can also monitor and control many the features over the BAS. This clearly puts the FX10 in a class of its own.

The control will enumerate all fault conditions (HP, LP, CO, LOC, and Freeze Detection) over a BAS as well as display them on a medium user interface (MUI). HP, LP, CO and Freeze Detection faults can all be reset over a BAS. A Loss Of Charge fault can not be reset or bypassed until the problem has been corrected. A MUI is invaluable as a service tool for the building service team.

The unit can be commanded to run by a typical heat pump thermostat or run based on heating and cooling set points supplied by a BAS. The control board is wired with quick connect harnesses for easy field change out of a bad control board. All ECM2.3 variable blower speed settings can be changed over a BAS or with a MUI. The control has an input programmed to enable field installed emergency heat in the event that the compressor is locked out. This input can also be commanded on from a BAS as needed. An alarm history can be viewed through the MUI and will be held in memory until the unit is power cycled. Relative humidity can be read by a 0-5VDC humidity sensor that is displayed over the network. If you are using an ECM2.3 blower motor the control can enable dehumidification mode based on a set point in the control. The dehumidification set point itself can also be changed over a BAS or with a MUI. Dehumidification mode can also be enabled by the BAS. Because the FX10 is not factory configured to read CO^2 levels, contact the factory for application assistance.

The FX10 control has unused analog and digital inputs for field installed items such as air temperature, water temperature, CO^2 or current status switches. The control has unused binary and PWM outputs that can be commanded over the BAS for field use.

An optional Medium User Interface (MUI) for control setup and advanced diagnostics is available with some mounting kits, MUIK1 - Panel mount version and the MUIK2-Wall mount version.

Zone Sensors

There are two options for zone sensors that can be used with the FX10 control. Both sensors use a Johnson controls A99 positive temperature coefficient type sensor. The TAXXJ02 has a set point adjustment now which will give the end user a +/- 5°F adjustment from the set point as well as a push button that can be used for temporary occupancy. The control leaves the factory set to operate with a TAXXJ02 sensor and can be changed to read the TAXXA04 sensor through a building automation system or with a user interface.

Standard Features

- Anti Short Cycle
- High Pressure Protection
- Low Pressure Protection
- Freeze Detection
- Loss Of Charge Detection
- Random Start
- Display for diagnostics
- Reset Lockout at disconnect or through BAS
- 2 Accessory outputs
- Optional BAS add-on controls

DDC Operation & Connection

Other optional network protocol boards that can be added to the FX10 are:

- Johnson Control N2
- LonWorks
- BACnet
  - MS/TP @ 19,200 Baud rate
  - Limit devices to 30 on a single trunk line

Control and Safety Feature Details

Emergency Shutdown

The emergency shutdown mode can be activated by a command from a facility management system or a closed contact on BI-2. The default state for the emergency shutdown data point is off. When the emergency shutdown mode is activated, all outputs will be turned off immediately and will remain off until the emergency shutdown mode is de-activated. The first time the compressor starts after the emergency shutdown mode has been de-activated, there will be a random start delay present.

Lockout Mode

Lockout mode can be activated by any of the following fault signals: refrigerant system high pressure, refrigerant system low pressure, freeze detection, and condensate overflow. When any valid fault signal remains continuously active for the length of its recognition delay, the controller will go into fault retry mode, which will turn off the compressor. After the Compressor short cycle delay, the compressor will attempt to operate once again. If three consecutive faults occur in 60 minutes during a single heating or cooling demand, the unit will go into lockout mode, turning off the compressor, enabling the alarm output, and setting the blower back to low speed operation until the controller is reset. If the control

Controls - FX10 (optional) cont.

faults due to the low pressure input (BI-3) being open during the pre-compressor startup check, the control will go into lockout mode immediately, disabling the compressor from starting and enabling the alarm output (BO-6). The lockout condition can be reset by powering down the controller, by a command from the BAS, or by the holding the ESC and Return keys on the MUI for 5 seconds.

Freeze Detection (AI-5)

The freeze detection sensor will monitor the liquid refrigerant temperature entering the water coil in the heating mode. If the temperature drops below the freeze detection trip point for the recognition delay period, the condition will be recognized as a fault. The freeze detection trip point will be factory set for 30°F and will be field selectable for 15°F by removing a jumper wire on BI-5. The freeze detection fault condition will be bypassed 2 minutes at normal compressor startup, to allow the refrigeration circuit to stabilize. If the freeze detection sensor becomes unreliable at any time compressor operation will immediately be suspended until the problem is corrected. This should be displayed as an alarm on the BAS and the MUI. This alarm will be reported a “Water Low Temp Limit” fault.

High Pressure (BI-11)

The high-pressure switch shall be a normally closed (NC) switch that monitors the systems refrigerant pressure. If the input senses the high-pressure switch is open it must disable the compressor output immediately and count the fault. The compressor minimum on time does not apply if the high-pressure switch opens. The compressor will not restart until the compressor short cycle time delay has been satisfied.

Low Pressure (BI-3)

The low-pressure switch shall be a normally closed (NC) switch that monitors the systems refrigerant pressure. The input shall be checked 15 seconds before compressor start up to be sure the pressure switch is closed and then ignored for the first 2 minutes after the compressor output (BO-2) is enabled. If the switch is open continuously for (30) seconds during compressor operation the compressor output (BO-2) will be disabled. The compressor will not restart until the compressor short cycle time delay has been satisfied.

Condensate Overflow

The condensate overflow sensing circuit will monitor the condensate level as a resistance input to AI-3. If the condensate water level rises resulting in the input resistance rising above the set point for the recognition delay period, the condition will be recognized as a fault. The condensate will be subjected to a (30) second lockout delay which requires that the fault be sensed for a continuous (30) seconds before suspending unit operation.

Alarm Output (BO-6)

The alarm output will be enabled when the control is in the lockout mode and will be disabled when the lockout is reset.

Test Mode

Raising the zone temperature input (AI-1) reading to 180–220°F or by holding the ESC and down arrow keys on the MUI for 5 seconds will put the control into test mode. In test mode the random start delay and the compressor fixed on delay time will both be shortened to 5 seconds and the reversing valve will be allowed to cycle with out shutting down the compressor. If an MUI is connected to the control LED 8 will flash and the words “Test Mode Enabled” will be shown on the LCD display when the control is in test mode. Test mode will be disabled after a power cycle, 30 minute timeout, or by holding the ESC and Up arrow keys on the MUI.

Sequence of Operation

Power Fail Restart

When the controller is first powered up, the outputs will be disabled for a random start delay. The delay is provided to prevent simultaneous starting of multiple heat pumps. Once the timer expires, the controller will operate normally.

Random Start Delay

This delay will be used after every power failure, as well as the first time the compressor is started after the control exits the unoccupied mode or the emergency shutdown mode. The delay should not be less than 1 second and not longer than 120 seconds. If the control is in test mode the random start delay will be shortened to 5 seconds.

Compressor Fixed On Delay Time

The Compressor Fixed On Delay Time will ensure that the compressor output (B02) is not enabled for 90 seconds after the control receives a call to start the compressor. This delay is adjustable from 30 – 300 seconds over a BAS or a MUI. If the control is in test mode the Compressor Fixed On Delay Timer will be shortened to 5 seconds.

Compressor Minimum On Delay

The compressor minimum on delay will ensure that the compressor output is enabled for a minimum of two (2) minute each time the compressor output is enabled. This will apply in every instance except in the event the high pressure switch is tripped or emergency shutdown then the compressor output will be disable immediately.

Compressor Short Cycle Delay Time

The compressor short cycle time delay will ensure that the compressor output will not be enabled for a minimum of five (5) minutes after it is disabled. This allows for the system refrigerant pressures to equalize after the compressor is disabled.

Controls - FX10 (optional) cont.

Heating Cycle

On a call for heating, the blower enable output and accessory output 2 will turn on immediately after the random start delay timer has been satisfied. If the compressor short cycle time delay has been satisfied, the compressor will turn on after the blower enable and accessory output 2 are on and the fixed compressor start delay timers have been satisfied.

Auxiliary heat output can be controlled over the BAS.

Set Point Control Mode

In set point control mode the reversing valve output will be disabled. As the temperature drops below the heating set point and begins to operate in the heating proportional band, the low capacity compressor output (BO-2) will be enabled. A PI loop in the programming of the control will determine when the full capacity compressor output (BO-4) is to be enabled. The compressor must be operating in low capacity for a minimum of 30 seconds before the full capacity compressor output can be enabled. During low capacity compressor operation the ECM2.3 blower will operate in medium speed and will operate in high speed when the compressor is operating at full capacity.

Thermostat Control Mode

In thermostat mode the compressor will be cycled based on Y1 and Y2 calls from a room thermostat. When the control receives a Y1 command (BI-7) from the thermostat the low capacity compressor output (BO2) will be enabled and the ECM2.3 blower will operate in medium speed. When the control receives a Y2 command (BI-8) from the thermostat the ECM2.3 blower will operate in high speed. During the heating cycle the reversing valve will be commanded into the off position.

Cooling Cycle

On a call for cooling, the blower enable output and accessory output 2 will turn on immediately after the random start delay timer has been satisfied. If the compressor short cycle time delay has been satisfied, the compressor will turn on after the blower enable and accessory output 2 are on and the fixed compressor start delay timers have been satisfied.

Set Point Control Mode

In set point control mode the reversing valve output will be enabled. As the temperature falls below the cooling set point and begins to operate in the cooling proportional band, the compressor (low capacity for two stage compressors) output (BO-2) will be enabled. For units with two stage compressors, a PI loop in the programming of the control will determine when the full capacity compressor output (BO-4) is to be enabled. The compressor must be operating in low capacity for a minimum of 30 seconds before the full capacity compressor output can be enabled. During low capacity compressor operation the ECM2.3 blower will operate in medium speed and will operate in high speed when the compressor is operating at full capacity.

Thermostat Control Mode

In thermostat mode the compressor will be cycled based on Y1 and Y2 calls from a room thermostat. When the control receives a Y1 command (BI-7) from the thermostat the compressor (low capacity for two stage compressors) output (BO2) will be enabled and the ECM2.3 blower will operate in medium speed. When the control receives a Y2 command (BI-8) from the thermostat the full capacity compressor output will be enabled and the ECM2.3 blower will operate in high speed. During the cooling cycle the reversing valve will be commanded into the “ON” position.

ECM2.3 Blower Operation

Blower speeds will be selected through the user interface or the facility management system. There will be a total of 12 speeds selectable with only three being selected at any one time. The lowest numbered speed selection set to ON will select the low-speed blower setting, the middle selection set to ON will select the medium-speed blower setting and the highest selection set to ON will select the high-speed blower setting. If all selections are set to OFF the software shall select speed setting 10 for low-speed, 11 for medium-speed, and will select speed setting 12 for high speed. If only one selection is set to ON, that selection will set the low-speed blower setting, the medium-speed setting will be 11, and the high-speed setting will be speed 12. The maximum low-speed setting will be speed 10 and the minimum high-speed setting will be speed 3. In addition there is a low limit setting in the software to prevent the ECM2.3 blower speed from being set below acceptable limits for each unit size.

ECM2.3 Blower air flow “Soft Switch Settings”

A set of 12 “soft switches” accessible through the user interface or building automation system are used to select the three blower speed settings for the ECM2.3 blower motor. The 12 soft switches work in exactly the same way as the hardware switches used on the Premier control (Refer to Blower Performance Data - ECM2.3 Motor for proper settings). No more than three soft switches may be set to the “ON” position. The first “ON” switch (the lowest number switch) determines the “low speed blower” setting. The second determines the “medium speed blower” setting, and the third determines the “high speed blower” setting.

Emergency Heat/Network Enabled Output (BO5)

This output is set from the factory to enable/disable emergency heat. If a problem occurs with the unit resulting in the compressor being locked out in heating mode, the control will automatically enable this output to turn on field installed electric heat. This output is interlocked with the blower proving input BI-6 (Blower proving sensors must be field supplied and installed). BI-6 must be connected to PB2 position 3 (see unit schematic) in the field if no blower proving sensor is desired. There is a configurable parameter available through a BAS network that must be enabled if this output is to be commanded over the BAS network.

Controls - FX10 (optional) cont.

MUI Alarm History Reporting

If a fault occurs the fault will be recorded in history for display on the medium user interface in the History Menu. Each fault type will be displayed in the history menu with a number between 0 and 3. A reading of 3+ will mean that fault has occurred more than three times in the past. The history menu can be cleared with a power cycle only. Alarm date and time are not included in the history.

Inputs and Outputs Configuration

Field Selectable Options

Freeze Detection Set Point (BI-5)

The freeze detection set point input allows you to adjust the freeze detection set point (AI-5). When the jumper is installed on BI-5 (Wire #24) the freeze detection set point is factory set for 30°F. When the jumper on BI-5 (Wire #24) is removed the freeze detection set point will be 15°F.

Accessory Outputs (BO-7 and BO-8)

Accessory Output 1 will be energized 90 seconds prior to the compressor output being energized. Accessory Output 2 will be energized with the blower output (BO-1). When the corresponding compressor output is turned off the accessory output will be deactivated immediately. These outputs are selectable for normally open or normally closed operation through the Medium User interface or through the Building Automation System.

Control Accessories

Zone Sensors

- TAXXJ02 Room Command Module
- TAXXA04 LCD Room Command Module
- A99 Sensor

MUI (LCD User interface) for diagnostics and commissioning.

- MUIK1 - Panel Mount, Portable
- MUIK2 - Wall Mount

SINGLE and DUAL STAGE WATER-TO-AIR			
Input Name	**Input**	**Output Name**	**Output**
Zone Temp 1	AI 1	Fan Enable	BO1
Relative Humidity Input	AI 2	Comp – Low Capacity	BO2
Condensate Level	AI 3	Reversing Valve	BO3
Universal Temp Input	AI 4	Comp – Full Capacity	BO4
Water Coil Low Temperature Limit	AI 5	Network Output/EH Output	BO5
Warm/Cool Adjust and Temp Occ	AI 6	Alarm	BO6
		Accessory 1 Output	BO7
Occupied	BI 1	Accessory 2 Output	BO8
Emergency Shutdown	BI 2	Network Controlled Output	B09
Stage 1 Low Pressure	BI 3		
Network Viewable Input 1	BI 4	ECM2.3 Blower	PWM1
Water Coil Low Temp Limit Set Point	BI 5	Network Controlled Output	PWM2
Network Viewable Input 2	BI 6		
Thermostat Y1	BI 7		
Thermostat Y2	BI 8		
Thermostat O	BI 9		
Thermostat G	B10		
Stage 1 High Pressure	BI11		
Compressor Proving	BI12		
XP10 Expansion Card			
Input Name	**Input**	**Output Name**	**Output**
Unused	AI 1	Unused	BO 1
Unused	AI 2	Unused	BO 2
Unused	AI 3	Unused	BO 3
Unused	AI 4	Unused	BO 4

Hot Gas Reheat Dehumidification Overview

Dehumidification - The Need for Reheat

With tighter construction and more and more ventilation air being introduced into buildings, there is more need now than ever for proper humidity control. Ensuring dehumidification can provide; consistent employee comfort, a reduction in mold liability, a reduction in cooling costs. Reduced humidity also provides an improvement in indoor air quality (IAQ) thru lower humidity levels which can reduce allergen levels, inhibit mold and bacterial growth, and provide an improved computer environment. ASHRAE 90.1 speaks of an acceptable humidity range in all commercial buildings.

Typical Reheat Applications

Reheat can be used wherever moisture is a problem. In schools, high latent auditorium and theaters, makeup air units*, computer rooms, indoor swimming pool rooms are typical applications. Although reheat equipped watersource heat pumps (wshp's) can condition limited amounts of outdoor air, the percentage of this outdoor air should never exceed 50% of the return air to the unit limiting the mixed return air temperature to a minimum of 50°F. When cold entering air conditions are anticipated, hot gas bypass option should be considered to prevent air coil freeze up.

*A dedicated outdoor air system (DOAS) should be investigated for 100% outdoor air applications.

The Design of Reheat Equipment

Hot gas reheat can help maintain specific humidity levels and neutral air in a building. ASHRAE recommends a relative humidity range of 30-60% with levels greater than 65% making mold growth a possibility. The dehumidification relative humidity set points of 57% (on) and 52% (off) are recommended. During reheat the leaving air temperature (LAT) will approximate neutral air. The included chart (Leaving Air Temperature vs. Entering Water and Air Conditions Chart) shows the LAT vs entering water temperature (EWT) to the unit at differing entering air conditions. At 86-90°F EWT the unit will provide nearly neutral air.

Moisture Removal Capacity

The amount of moisture removal may be calculated by subtracting the sensible cooling capacity from the total cooling capacity in the equipment performance data of the specifications catalog or submittal data. An example is shown below:

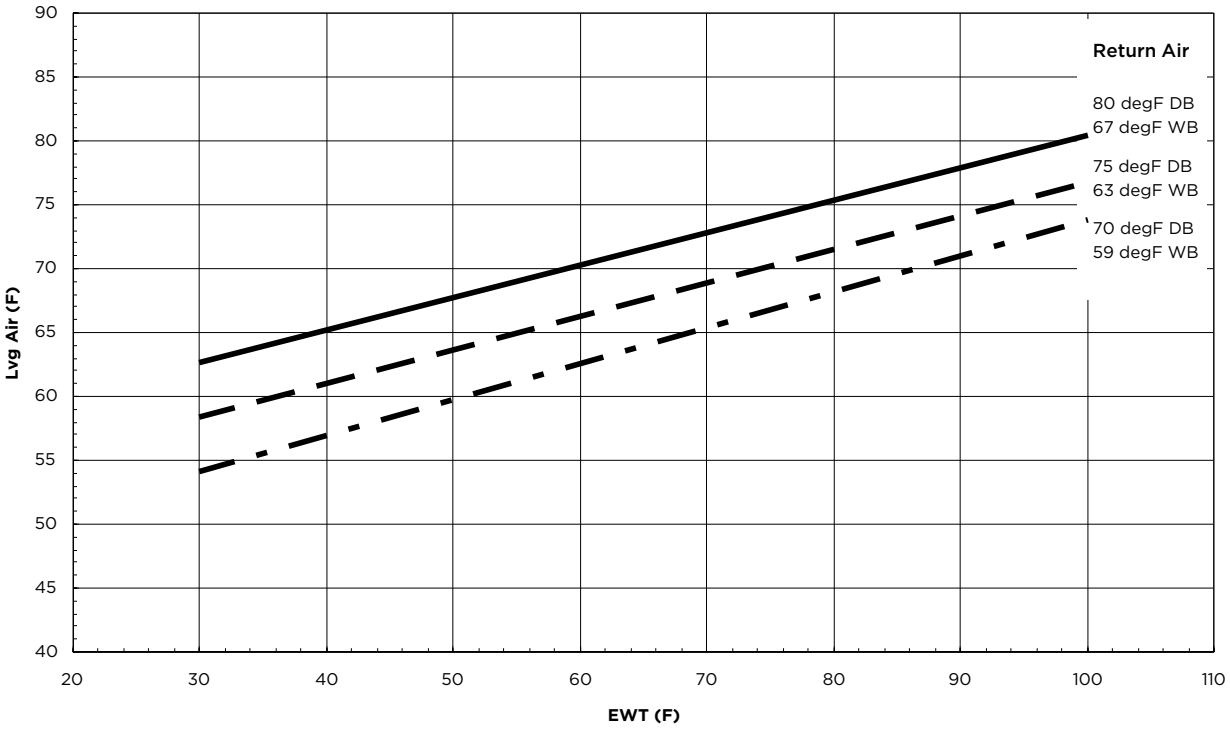
Model ZS*048, 1360 cfm, 12 gpm, 90°F EWT

TC – SC = LC
50.4 – 35.6 kBtu/hr = 14.8 kBtu/hr

Where TC = total cooling capacity, SC=sensible capacity, LC=latent capacity

Btu/hr may be converted to lbs/hr or grains per hour as shown in the equations below.

Leaving Air Temperature vs. Entering Water and Air Conditions Chart



Hot Gas Reheat Dehumidification Overview cont.

14,800 Btu/hr / 1,069 Btu/lb of water vapor
at 80/67 DB/WB°F = 13.84 lbs/hr

13.84 lbs/hr x 7,000 grains/lb = 96,880 grains/hr

Performance with a reheat coil installed will be approximately 5% less than AHRI performance.

External Static Pressure Adjustment

With a reheat coil option installed an adjustment for external static pressure (ESP) needs to be made. The following table will show the reduction in ESP for any model relating coil air velocity and ESP.

ESP vs. Coil Velocity Table

Coil Velocity (fpm)	250	300	350	400
ESP Increase (in. wg.)	0.10	0.14	0.17	0.20

ECM2.3 models will generally compensate up to their maximum ESP of 0.5 in. wg. for 1/2 hp and 0.75 in. wg. for 1 hp.

Model ZSH048, 1600 cfm,

H x W = SA
20 x 35 = 700 in.^{2} = 4.86 ft.^{2}

Where H=fin height of air coil, W=fin length of air coil, SA=fin surface area

Adjustment must be made for dehumidification mode, 85% of cfm,

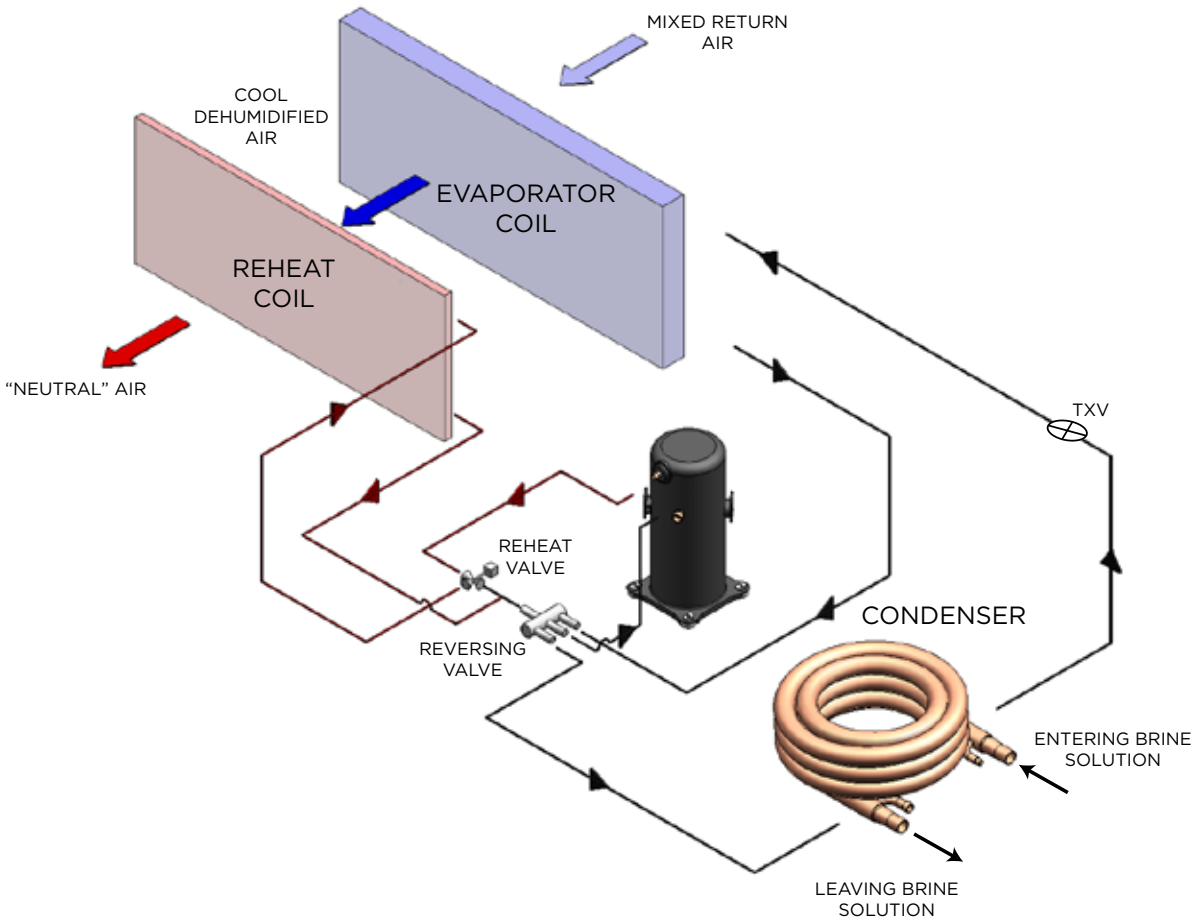
1600 x 0.85 = 1360 cfm

Calculate air velocity, fpm, cfm / SA

1360 cfm / 4.86 ft.^{2} = 279 fpm

Refer to the ESP vs. Coil Velocity Table and look up the fpm to find ESP increase. If air velocity is below 250 cfm assume 0.10 increase in ESP. Interpolation of data within the table is permitted.

Hot Gas Reheat Layout



Hot Gas Reheat - Controls

The reheat option is only available with the FX10 control. With this control we have three control schemes available:

Room wall dehumidistat
An optional room wall dehumidistat that controls the reheat mode thru a 24VAC 'Hum' input (On or Off). Setpoint and deadband is determined by the dehumidistat.

Duct humidity sensor
An optional duct humidity sensor is installed. The FX10 control reads the humidity from the sensor and determines operation mode. Setpoint and deadband are internally set by the FX10 control and are adjustable. Continuous blower operation is a requirement for this mode to accurately measure relative humidity during the off cycle.

Room wall humidity sensor
An optional wall humidity sensor is installed. The FX10 control reads the humidity from the sensor and determines operation mode. Setpoint and deadband are internally set by the FX10 control and are adjustable. Continuous blower operation is NOT a requirement for this mode.

The unit will cycle thru a 'flush cycle' to purge refrigerant and oil from the idle heat exchanger once every 24 hours when in cooling mode. The FX10 control will provide an option to set back reheat to an adjustable unoccupied humidity set point during unoccupied time periods. This option is factory set to "OFF" so reheat will control to one set point at all times. If set back is required during unoccupied times the option must be set to "ON" in the field by the building automation system or a user interface. The dehumidification set back will only work when using a duct humidity sensor or room wall humidity sensor.

Mode of Operation

Please refer to the refrigeration circuit diagram (Hot Gas Reheat - Refrigerant section) and the hot gas reheat wiring schematic.

Heating Mode Operation
Upon a call for heating (Y), blower relay is energized immediately, and the compressor contactor will be energized after a 90 second delay.

Cooling Mode Operation
Upon a call for cooling (Y, O), blower relay and reversing valve coil are energized immediately, and the compressor contactor is energized after a 90 second delay. If there is a call from the de-humidistat or the internal control logic see the humidity sensor has reached set point the blower cfm will be reduced by 15% to increase the unit's latent capacity.

Dehumidification Mode Operation
Upon a call for dehumidification, the blower relay and reversing valve coil are energized immediately, and the compressor contactor will energize after a 90 second delay. The reheat valve coil will energize once the compressor has been operational for 30 seconds.

If a call for space heating is received during reheat operation the compressor will shut down for 5 minutes and the unit will restart in the heating mode. Once the requirement for space heating has been satisfied the unit will shut down for 5 minutes and re-start in reheat mode.

If a call for space cooling is received during reheat operation the reheat valve coil will be disabled until the space cooling requirements have been satisfied. Once the space cooling requirements have been satisfied the reheat valve coil will be energized with out shutting down the compressor.

Dehumidification Set Point
(used only with a humidity sensor)
The factory default set point for dehumidification is 52% this is field adjustable from 30% to 60%. In addition there is a factory default differential of 5% field adjustable from 5% to 15%. The control will enable re-heat when the space humidity rises above the set point plus the differential. Depending upon the environmental conditions within the building and the operating parameters of the water source heat pump, the unit may not be capable of maintaining the lower control limit of 30% relative humidity over extended periods of time.

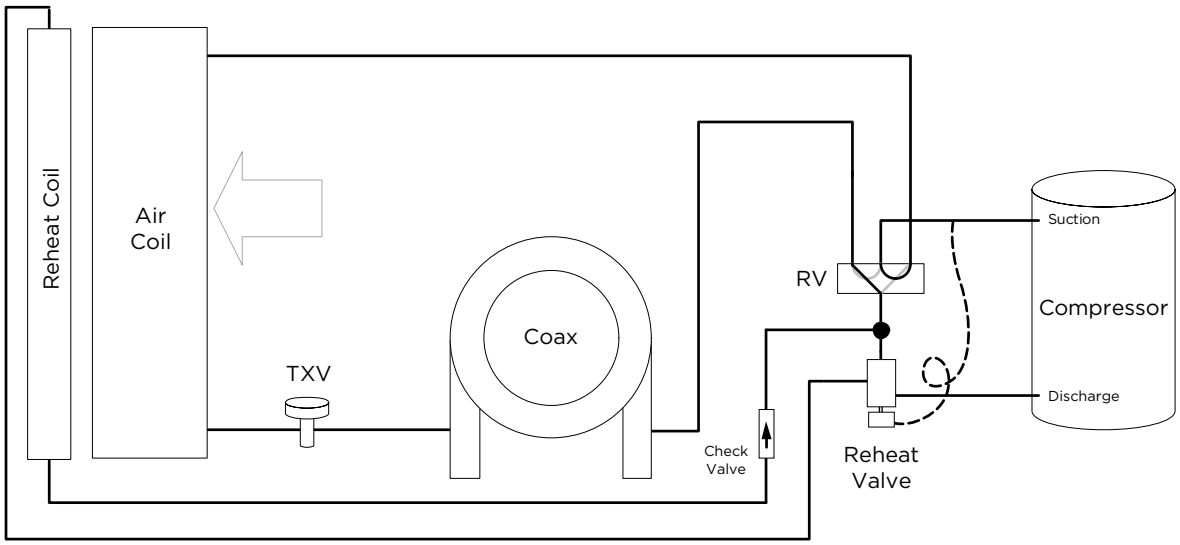
Reheat operation during periods of un-occupancy
This unoccupied set point is useful to reduce energy use in dehumidification. Many system designs greatly reduce or even eliminate fresh air makeup during the unoccupied hours and the need for reheat is lessened. The control logic contains an unoccupied set point that can be used for periods of un-occupancy if desired. The factory default for the set point is 60% and is adjustable from 30% to 60%. The unoccupied setback must be enabled either through a building automation system or with a user interface. Factory default for unoccupied setback is off.

Space Humidity High and Low Alarm Limit
(building automation system only)
The control has a high and low alarm limit that can be enumerated over a building automation system. The factory default set point for these alarm limits is 0% for the low alarm and 100% for the high alarm limit. These limits can be adjusted though a building automation system. Caution should be used in selecting these limits so as not to cause nuisance alarms.

Hot Gas Reheat - Refrigerant Circuit

Description

The refrigerant flows in normal heat pump path in heating and cooling mode. During the Reheat mode, the operation begins with superheated vapor leaving the compressor going through the reheat valve to the reheat air coil. In the reheat coil the high temperature high pressure gas reheats the air exiting the unit to near neutral. Next, the refrigerant exits the reheat coil and passes through a check valve, which is used to prevent refrigerant flow into the reheat coil during normal heating and cooling operation. The refrigerant passes through the check valve and is then diverted to the coaxial heat exchanger by the four way reversing valve. The hot gas enters the coaxial heat exchanger which will condense the gas to a high pressure liquid due to heat being rejected to the loop fluid. The high pressure liquid leaves the coax and enters the inlet of the TXV. After passing through the TXV the low pressure mixture of liquid/vapor refrigerant expands in the air coil evaporating into a low pressure low temperature gas and moves back through the reversing valve and into the compressor suction. The cycle then starts again by compressing the low pressure low temperature gas into a superheated vapor. A small copper bleed line is located on the reheat/reclaim valve to allow refrigerant that has migrated to the reheat coil to escape.



Hot Gas Reheat - Application Notes

Geothermal and open loop applications

Some earth loops may exhibit lower entering water temperatures in early spring during cooling and may cause an increase in cooling capacity resulting in low discharge (10 – 13°F see chart) temperature differential during reheat mode. Open loop systems may act similarly with cold well water temperatures.

Swimming pool room dehumidification

The air temperature in a pool room should be maintained a minimum of 2-3°F above the pool temperature to limit 'runaway' dehumidification. All air coils should be suitably coated for swimming pool use.

Makeup air in cold climates

In cold climates, the makeup air should be limited in the cooling mode to a mixed temperature of 50°F Entering Air Temperature (EAT) with no more than 50% outside air*. When cold entering air conditions are anticipated, hot gas bypass option should be considered as well to prevent air coil freeze up.

*A dedicated outdoor air system (DOAS) should be investigated for 100% outdoor air applications.

Troubleshooting Notes

Is the reclaim valve working?

1. Use MUI to check fault status.
2. Check for 130-145°F hot gas at reheat coil or valve.
3. Check 24VAC at valve
4. Activate HUM input with 24VAC to 'rock' back and forth for operation.

Hot Gas Reheat - Application Notes cont.

Zone has too high of humidity?

1. Check dehumidification setpoint either on dehumidistat or in FX10?
2. Cooling/reheat runtime?
3. Check unit using troubleshooting sheet.
4. Excessive cooling operation with high airflow (lower latent removal).
5. Lower cooling airflow to 325 cfm per ton

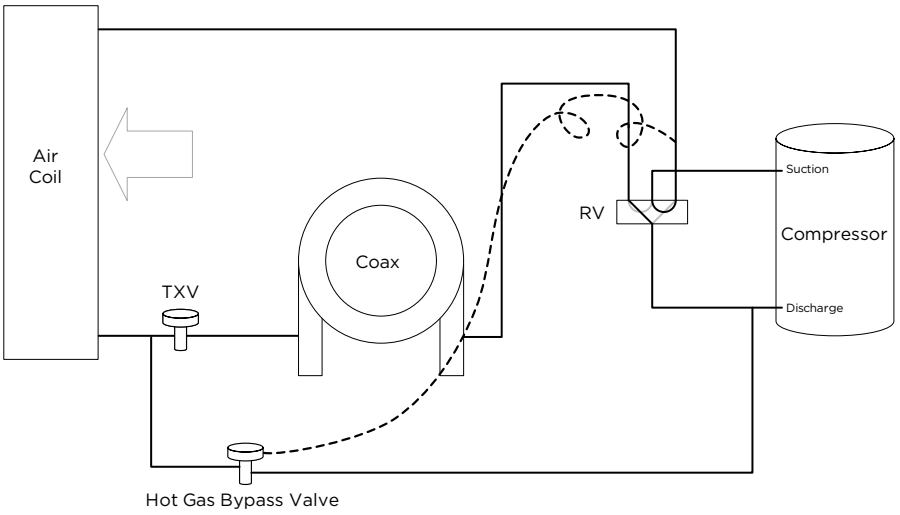
Delivers cold air in reheat mode?

1. Check and make sure the reheat valve is energized
2. Check entering water temperature is not too cold.
3. Check the return air temperature.

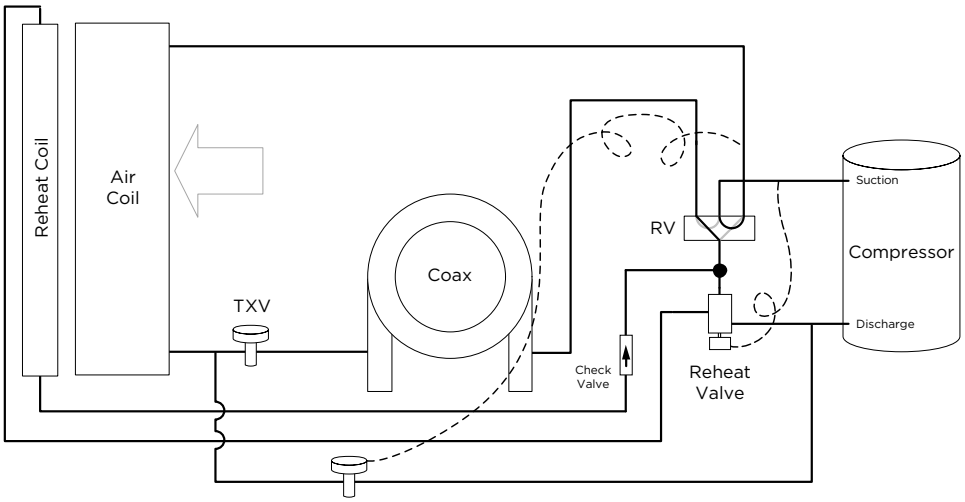
Hot Gas Bypass - Overview

Description

The hot gas bypass (HGB) option is designed to limit the minimum evaporating pressure in the cooling mode to prevent the air coil from icing. The HGB valve senses pressure at the outlet of the evaporator by an external equalizer. If the evaporator pressure decreases to 115 psig the HGB valve will begin to open and bypass hot discharge gas in the inlet of the evaporator. The valve will continue to open as needed until it reaches its maximum capacity. Upon an increasing of suction pressure the valve will begin to close back off and normal cooling operation will resume.



Hot Gas Bypass with Hot Gas Reheat

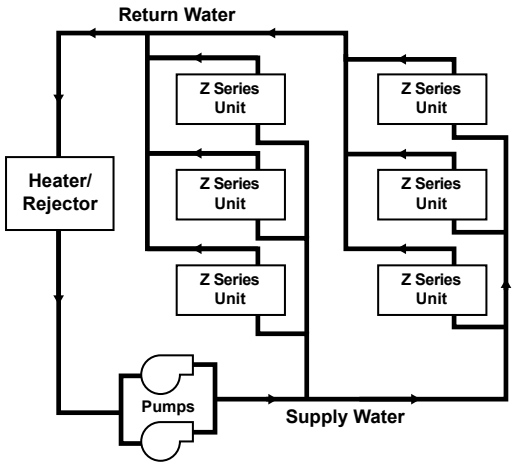


Application Notes

The Closed Loop Heat Pump Concept

The basic principle of a water source heat pump is the transfer of heat into water from the space during cooling, or the transfer of heat from water into the space during heating. Extremely high levels of energy efficiency are achieved as electricity is used only to move heat, not to produce it. Using a typical ECO-Z, one unit of electricity will move four to five units of heat.

When multiple water source heat pumps are combined on a common circulating loop, the ultimate in energy efficiency is created: The heat pump units on cooling mode are adding heat to the loop which the units in heating mode can absorb, thus removing heat from the area where cooling is needed, recovering and redistributing that heat for possible utilization elsewhere in the system. In modern commercial structures, this characteristic of heat recovery from core area heat generated by lighting, office equipment, computers, solar radiation, people or other sources, is an important factor in the high efficiency and low operating costs of closed source heat pump systems.



In the event that a building's net heating and cooling requirements create loop temperature extremes, ECO-Z units have the extended range capacity and versatility to maintain a comfortable environment for all building areas. Excess heat can be stored for later utilization or be added or removed in one of three ways; by ground-source heat exchanger loops: plate heat exchangers connected to other water sources, or conventional cooler/boiler configurations. Your sales representative has the expertise and computer software to assist in determining optimum system type for specific applications.

The Closed Loop Advantage

A properly applied water source heat pump system offers many advantages over other systems. First costs are low because units can be added to the loop on an “as needed basis”- perfect for speculative buildings. Installed costs are low since units are self-contained and can be located adjacent to the occupied space, requiring minimal ductwork. Maintenance can be done on individual units without system shut-down. Conditions remain comfortable since each unit operates separately, allowing cooling in one area and heating in another. Tenant spaces can be finished and added as needed. Power billing to tenants is also convenient since each unit can be individually metered: each pays for what each uses. Nighttime and/or weekend uses of certain areas are possible without heating or cooling the entire facility. A decentralized system also means if one unit should fault, the rest of the system will continue to operate normally, as well as eliminating air cross-contamination problems and expensive high pressure duct systems requiring an inefficient electric resistance reheat mode.

The ECO-Z Approach

There are a number of proven choices in the type of ECO-Z system which would be best for any given application. Most often considered are:

Vertical - Closed Loop/Ground Source

• ***Closed Loop/Ground-Source Systems*** utilize the stable temperatures of the earth to maintain proper water source temperatures (via vertical or horizontal closed loop heat exchangers) for ECO-Z extended range heat pump system. Sizes range from a single unit through many hundreds of units. When net cooling requirements cause closed loop water temperatures to rise, heat is dissipated into the cooler earth through buried high strength plastic pipe “heat exchangers.” Conversely if net space heating demands cause loop heat absorption beyond that heat recovered from building core areas, the loop temperature will fall causing heat to be extracted from the earth. Due to the extended loop temperatures, AHRI/ISO 13256-1 Ground Loop Heat Pumps are required for this application.

Application Notes cont.

Because auxiliary equipment such as a fossil fuel boiler and cooling tower are not required to maintain the loop temperature, operating and maintenance costs are very low.

Ground-source systems are most applicable in residential and light commercial buildings where both heating and cooling are desired, and on larger envelope dominated structures where core heat recovery will not meet overall heating loads. Both vertical and horizontally installed closed-loops can be used. The land space required for the “heat exchangers” is 100-250 sq. ft./ton on vertical (drilled) installations and 750-1500 sq. ft./ton for horizontal (trenched) installations. Closed loop heat exchangers can be located under parking areas or even under the building itself.

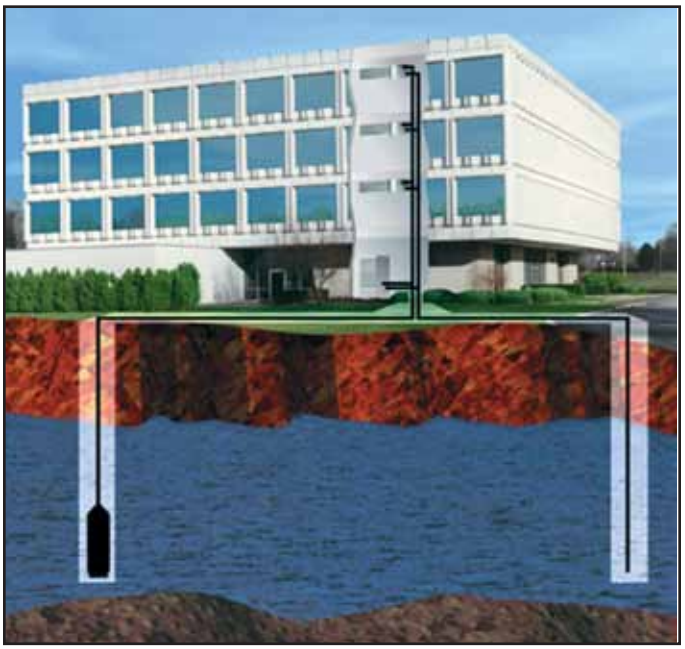
On large multi-unit systems, sizing the closed loop heat exchanger to meet only the net heating loads and assisting cooling loads with a closed circuit cooling tower may be the most cost effective choice.

Surface Water - Closed Loop/Ground Source

• ***Closed Loop/Ground-Source Surface Water Systems*** also utilize the stable temperatures of Surface Water to maintain proper water source temperatures for ECO-Z extended range heat pump systems. These systems have all of the advantages of horizontal and vertical closed loop systems. Due to the extended loop temperatures, AHRI/ISO 13256-1 Ground Water or Ground Loop Heat Pumps are required for this application.

In cooling dominated structures, the ground-source surface water systems can be very cost effective especially where local building codes require water retention ponds for short term storage of surface run-off. Sizing requirements for the surface water is a minimum of 500 sq. ft./ton of surface area at a minimum depth of 8 feet. Your sales representative should be contacted when designs for heating dominated structures are required.

Plate Heat Exchanger - Closed Loop/Ground Water



• ***Closed Loop/Ground Water Plate Heat Exchanger Systems*** utilize lake, ocean, well water or other water sources to maintain closed loop water temperatures in multi-unit ECO-Z systems. A plate frame heal exchanger isolates the units from any contaminating effects of the water source, and allows periodic cleaning of the heat exchanger during off peak hours.

Operation and benefits are similar to those for ground-source systems. Due to the extended loop temperatures, AHRI/ISO 13256-1 Ground Loop Heat Pumps are required for this application. Closed loop plate heat exchanger systems are applicable in commercial, marine, or industrial structures where the many benefits of a water source heat pump system are desired, regardless of whether the load is heating or cooling dominated.

Application Notes cont.

Cooler/Boiler - Closed Loop

• ***Closed Loop /Cooler-Boiler Systems*** utilize a closed heat recovering loop with multiple water source heat pumps in the more conventional manner. Typically a boiler is employed to maintain closed loop temperatures above 60°F and a cooling tower to maintain loop temperatures below 90°F. These systems are applicable in medium to large buildings regardless of whether the load is heating or cooling dominated. Due to the moderate loop temperatures, AHRI/ISO 13256-1 Water Loop Heat Pumps are required for this application.

Water Quality

In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, a closed loop system is recommended. The heat exchanger coils in ground water systems may, over a period of time, lose heat exchange capabilities due to a buildup of mineral deposits inside. These can be cleaned, but only by a qualified service mechanic, as special solutions and pumping equipment are required. Hot water generator coils can likewise become scaled and possibly plugged.

In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional flushing.

Units with cupronickel heat exchangers are recommended for open loop applications due to the increased resistance to build-up and corrosion, along with reduced wear caused by acid cleaning.

Material		Copper	90/10 Cupro-Nickel	316 Stainless Steel
pH	**Acidity/Alkalinity**	7- 9	7 - 9	7 - 9
Scaling	Calcium and Magnesium Carbonate	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm
Corrosion	Hydrogen Sulfide	Less than .5 ppm (rotten egg smell appears at 0.5 PPM)	10 - 50 ppm	Less than 1 ppm
	Sulfates	Less than 125 ppm	Less than 125 ppm	Less than 200 ppm
	Chlorine	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Chlorides	Less than 20 ppm	Less than125 ppm	Less than 300 ppm
	Carbon Dioxide	Less than 50 ppm	10 - 50 ppm	10- 50 ppm
	Ammonia	Less than 2 ppm	Less than 2 ppm	Less than 20 ppm
	Ammonia Chloride	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Ammonia Nitrate	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Ammonia Hydroxide	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Ammonia Sulfate	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Total Dissolved Solids (TDS)	Less than 1000 ppm	1000-1500 ppm	1000-1500 ppm
	LSI Index	+0.5 to -.05	+0.5 to -.05	+0.5 to -.05
Iron Fouling (Biological Growth)	Iron, Fe^{2}+ (Ferrous) Bacterial Iron Potential	< .2 ppm	< .2 ppm	< .2 ppm
	Iron Oxide	Less than 1 ppm. Above this level deposition will occur.	Less than 1 ppm. Above this level deposition will occur.	Less than 1 ppm. Above this level deposition will occur.
Erosion	Suspended Solids	Less than 10 ppm and filtered for max of 600 micron size	Less than 10 ppm and filtered for max of 600 micron size	Less than 10 ppm and filtered for max of 600 micron size
	Threshold Velocity (Fresh Water)	< 6 ft/sec	< 6 ft/sec	< 6 ft/sec

Grains = PPM divided by 17 • mg/l is equivalent to PPM

2/8/08

Installation Notes

Typical Unit Installation

Unit Location

Locate the unit in an indoor area that allows for easy removal of the filter and access panels. Location should have enough space for service personnel to perform maintenance or repair. Provide sufficient room to make water, electrical and duct connection(s). If the unit is located in a confined space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. On horizontal units, allow adequate room below the unit for a condensate drain trap and do not locate the unit above supply piping. **Care should be taken when units are located in unconditioned spaces to prevent damage from frozen water lines and excessive heat that could damage electrical components.**

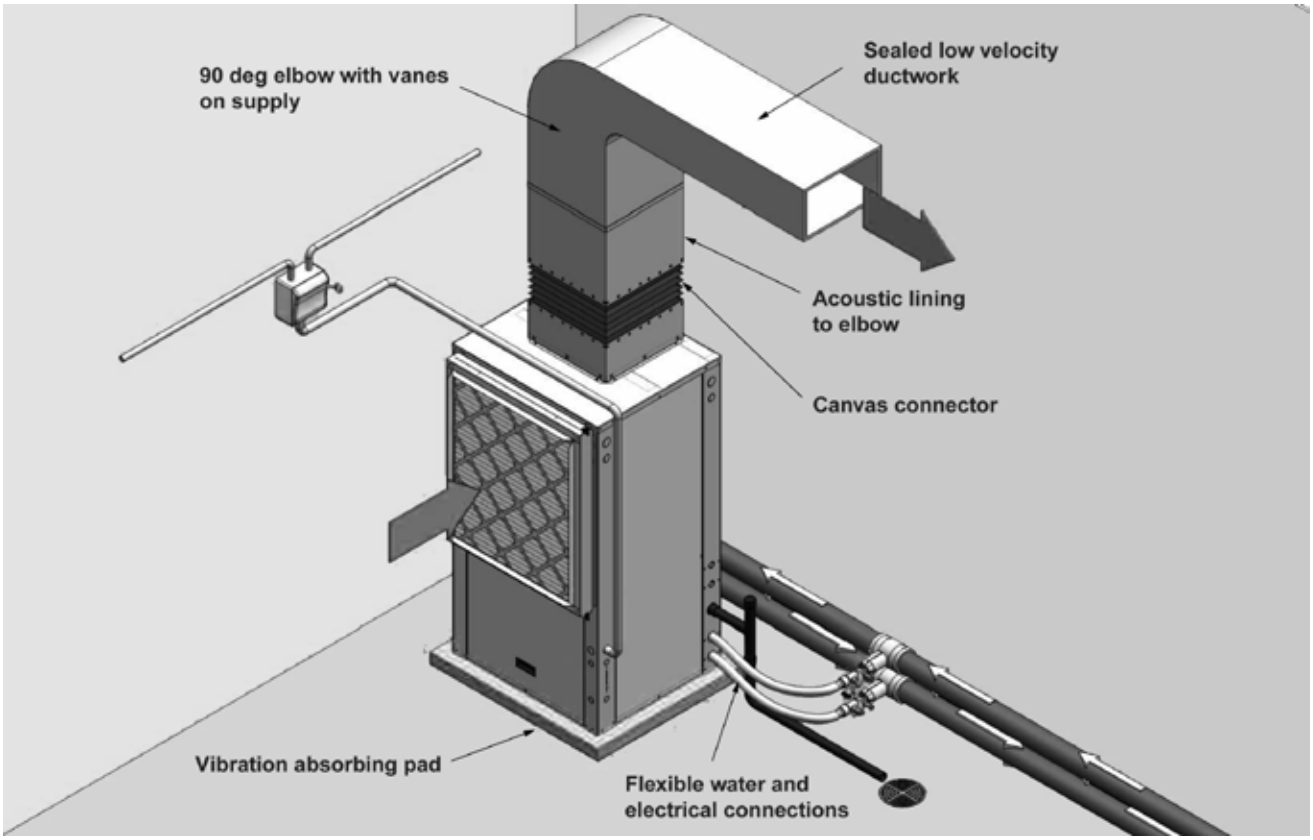
Installing Vertical Units

Prior to setting the unit in place, remove and discard the compressor hold down shipping bolt located at the front of the compressor mounting bracket. Vertical units are available in left or right air return configurations. Top flow vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to provide isolation between the unit and the floor. It is not necessary to anchor the unit to the floor.

WARNING: Before performing service or maintenance operations on a system, turn off main power switches to the indoor unit. If applicable, turn off the accessory heater power switch. Electrical shock could cause personal injury.

Installing and servicing heating and air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair or service heating and air conditioning equipment. Untrained personnel can perform the basic maintenance functions of cleaning coils and cleaning and replacing filters.

All other operations should be performed by trained service personnel. When working on heating and air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply. Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing operations and have a fire extinguisher available.



Installation Notes cont.

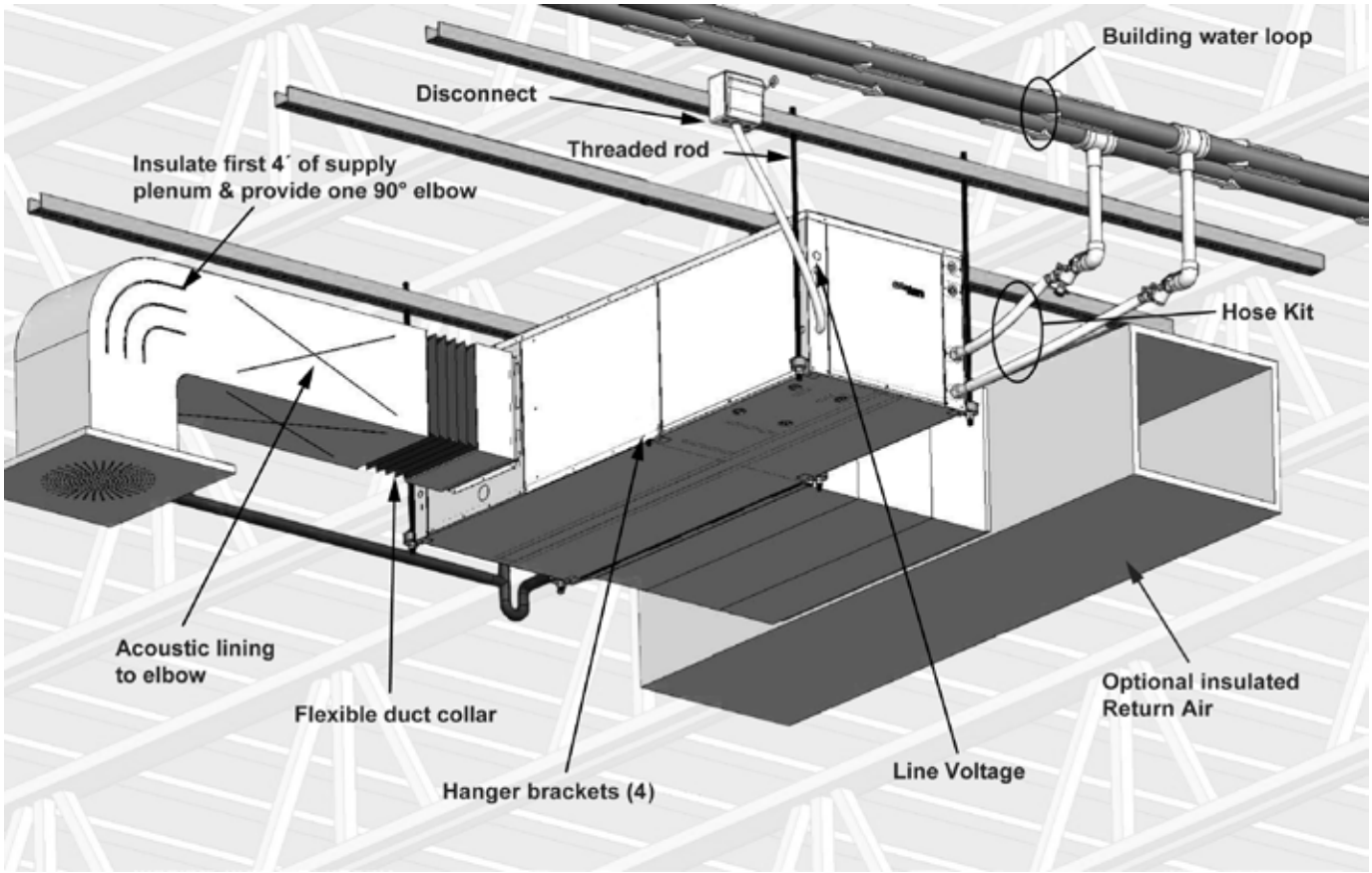
Installing Horizontal Units

Remove and discard the compressor hold down shipping screws located on the outside of the cabinet prior to setting the unit in place. Horizontal units are available with side or end discharge and may be easily field converted by flipping the blower discharge panel. Horizontal units are normally suspended from a ceiling by four 3/8 in. diameter threaded rods. The rods are usually attached to the unit by hanger bracket kits furnished with each unit. Lay out the threaded rods per the dimensions below. Assemble the hangers to the unit as shown. Securely tighten the brackets to the unit using the weld nuts located on the underside of the bottom panel. When attaching the hanger rods to the bracket, a double nut is required since vibration could loosen a single nut. To allow filter access, one bracket on the filter side should be installed 180° from the position shown in the figure below.

NOTE: The unit should be pitched approximately 1/4 in. towards the drain in both directions to facilitate the removal of condensate.

Use only the bolts provided in the kit to attach hanger brackets. The use of longer bolts could damage internal parts. Some residential applications require the installation of horizontal units on an attic floor. In this case, the unit should be set in a full size secondary drain pan on top of a vibration absorbing pad. The secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling. The secondary drain pan is usually placed on a plywood base isolated from the ceiling joists by additional layers of vibration absorbing material. Insulate supply plenum and use at least one 90° elbow and flexible duct collar to reduce noise.

CAUTION: Do not use rods smaller than 3/8 in. diameter since they may not be strong enough to support the unit. The rods must be securely anchored to the ceiling.



Installation Notes cont.

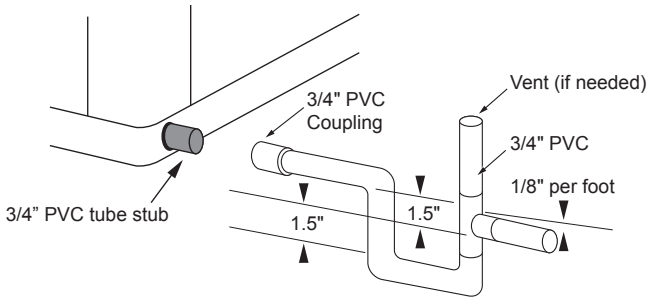
Water Piping

Piping is usually design as ‘reverse return’ to equalize flow paths through each unit. A short flexible pressure rated hose is used to make connection to the fixed building piping system. This hose is typically stainless steel braid and includes a swivel fitting on one end for easy removal and is flexible to help isolate the unit for quieter operation. Isolation valves for servicing, y-strainers for filtering and memory-stop flow valve or a balancing valve can be provided for consistent water flow through the unit.

All unit source water connections are fittings that accept a male pipe thread (MPT). Insert the connectors by hand, then tighten the fitting with a wrench to provide a leakproof joint. The open and closed loop piping system should include pressure/temperature ports for serviceability. The proper water flow must be provided to each unit whenever the unit operates. To assure proper flow, use pressure/temperature ports to determine the flow rate. These ports should be located at the supply and return water connections on the unit. The proper flow rate cannot be accurately set without measuring the water pressure drop through the refrigerant-to-water heat exchanger. Never use flexible hoses smaller than the inside diameter of the water connection at the unit. Limit hose length to 10 feet per connection. Check carefully for water leaks.

Condensate Drain

On vertical units, the internal condensate drain assembly consists of a drain tube which is connected to the drain pan, a 3/4 in. PVC female adapter and a flexible connecting hose. The female adapter may exit either the front or the side of the cabinet. The adapter should be glued to the field-installed PVC condensate piping. On vertical upflow units, a condensate hose is inside all cabinets as a trapping loop; therefore, an external trap is not necessary. On horizontal units with a composite drain pan, a PVC stub is provided for condensate drain piping connection. An external trap is required (see below). If a vent is necessary, an open stand pipe may be applied to a tee in the field-installed condensate piping.



Installation Notes cont.

Acoustical Considerations and Equipment Sound Performance

Sound Performance

The ECO-Z is third party sound rated in accordance with ARI 260. Please consult the Sound Performance Data Catalog for details on the AHRI standard and sound performance data.

Recommendations for Noise Reduction

Horizontal Unit Location

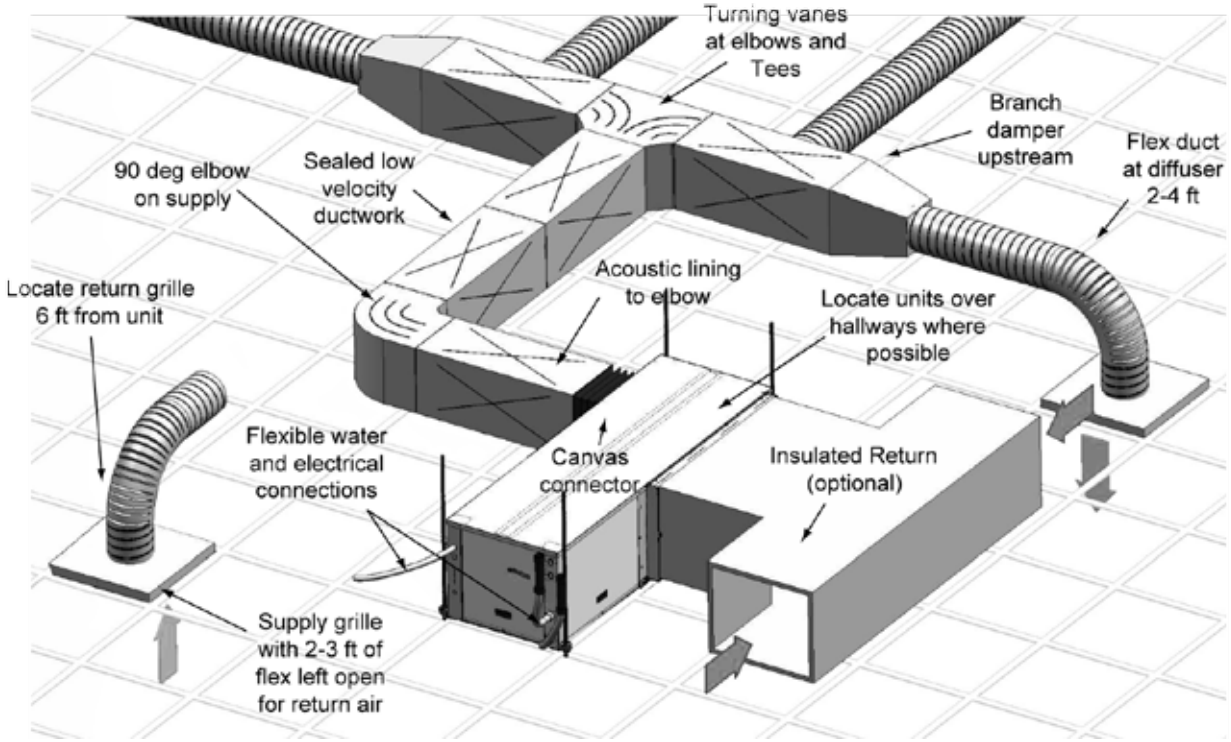
- Specify equipment with quietest sound power ratings
- Do not locate units above areas with a required NC 40 or less
- Space WSHP at least 10 ft (3m) apart to avoid noise summing of multiple units in a space.
- Maximize the height of the unit above the ceiling (horizontal).
- Suspend unit with isolation grommets that are appropriately rated to reduce vibrations (horizontal).

Vertical Unit Location

- Specify equipment with quietest sound power ratings
- Space WSHP at least 10 ft (3m) apart to avoid noise summing of multiple units in a space.
- Acoustic ceiling coatings can greatly reduce noise levels in mechanical rooms.
- Mount unit on a sound absorbing pad, extruded polystyrene, rubber or cork pad.

Ductwork

- Ensure return air grilles will not allow line of site noise to transfer to adjacent space. Use a sound barrier or some other material to isolate the grille from the unit. A supply grille, boot and short piece of flex duct pointed away from the unit can greatly attenuate equipment noise.
- Use a canvas isolation duct connector at the supply and return duct connection of the unit.
- Internally line the discharge and return duct within the first 4-8 feet of unit with acoustic insulation. Install an internally lined ‘L’ shaped return duct elbow at return grille. Face the elbow away from adjacent units.
- Always install at least one 90° elbow in the discharge duct to eliminate line of sight noise transmission of the blower.
- Use turning vanes at all elbows and tees to reduce turbulence.
- Limit supply duct velocities to less than 1,000 fpm
- Design and install ductwork as stiff as possible
- Allow 3 duct diameters both up and down stream of the unit before any fittings or transitions are installed.
- Use duct sealant on all duct joints.
- Install a short (2-4’) of flex duct on all branch ducts just prior to discharge boot or diffuser to reduce vibration and duct sound prior to delivery in the room.
- Locate the branch duct balancing damper as far away from the diffuser as possible.
- In ceiling plenum systems, install an internally lined ‘L’ shaped return duct elbow at unit. Face the elbow away from adjacent units (horizontal).



Performance Standard (AHRI/ISO/ASHRAE 13256-1)

The performance standard AHRI/ASHRAE/ISO 13256-1 became effective January 1, 2000 and replaces AHRI Standards 320, 325, and 330. This new standard has three major categories: Water Loop (comparable to ARI 320), Ground Water (ARI 325), and Ground Loop (ARI 330). Although these standards are similar there are some differences:

Unit of Measure: The Cooling COP

The cooling efficiency is measured in EER (US version measured in Btuh per Watt. The Metric version is measured in a cooling COP (Watt per Watt) similar to the traditional COP measurement.

Water Conditions Differences

Entering water temperatures have changed to reflect the centigrade temperature scale. For instance the water loop heating test is performed with 68°F (20°C) water rounded down from the old 70°F (21.1°C).

Air Conditions Differences

Entering air temperatures have also changed (rounded down) to reflect the centigrade temperature scale. For instance the cooling tests are performed with 80.6°F (27°C) dry bulb and 66.2°F (19°C) wet bulb entering air instead of the traditional 80°F (26.7°C) DB and 67°F (19.4°C) WB entering air temperatures. 80.6/66.2 data may be converted to 80/67 using the entering air correction table. This represents a significantly lower relative humidity than the old 80/67 of 50% and will result in lower latent capacities.

Pump Power Correction Calculation

Within each model, only one water flow rate is specified for all three groups and pumping Watts are calculated using the following formula. This additional power is added onto the existing power consumption.

• Pump power correction = (gpm x 0.0631) x (Press Drop x 2990) / 300

Where ‘gpm’ is waterflow in gpm and ‘Press Drop’ is the pressure drop through the unit heat exchanger at rated water flow in feet of head.

Fan Power Correction Calculation

Fan power is corrected to zero external static pressure using the following equation. The nominal airflow is rated at a specific external static pressure. This effectively reduces the power consumption of the unit and increases cooling capacity but decreases heating capacity. These Watts are significant enough in most cases to increase EER and COPs fairly dramatically over ARI 320, 325, and 330 ratings.

• Fan Power Correction = (cfm x 0.472) x (esp x 249) / 300

Where ‘cfm’ is airflow in cfm and ‘esp’ is the external static pressure at rated airflow in inches of water gauge.

ISO Capacity and Efficiency Calculations

The following equations illustrate cooling calculations:

• ISO Cooling Capacity = Cooling Capacity (Btuh) + (Fan Power Correction (Watts) x 3.412)

• ISO EER Efficiency (W/W) = ISO Cooling Capacity (Btuh) x 3.412 / [Power Input (Watts) - Fan Power Correction (Watts) + Pump Power Correction (Watt)]

The following equations illustrate heating calculations:

• ISO Heating Capacity = Heating Capacity (Btuh) - (Fan Power Correction (Watts) x 3.412)

• ISO COP Efficiency (W/W) = ISO Heating Capacity (Btuh) x 3.412 / [Power Input (Watts) - Fan Power Correction (Watts) + Pump Power Correction (Watt)]

Comparison of Test Conditions

	ARI 320	ISO/AHRI 13256-1 WLHP	ARI 325	ISO/AHRI 13256-1 GWHP	ARI 330	ISO/AHRI 13256-1 GLHP
Cooling						
Entering Air - DB/WB °F	80/67	80.6/66.2	80/67	80.6/66.2	80/67	80.6/66.2
Entering Water - °F	85	86	50/70	59	77	77
Fluid Flow Rate	*	**	**	**	**	**
Heating						
Entering Air - DB/WB °F	70	68	70	68	70	68
Entering Water - °F	70	68	50/70	50	32	32
Fluid Flow Rate	*	**	**	**	**	**

Note *: Flow rate is set by 10°F rise in standard cooling test Note **: Flow rate is specified by the manufacturer

Part load entering water conditions not shown.

WLHP = Water Loop Heat Pump; GWHP = Ground Water Heat Pump; GLHP = Ground Loop Heat Pump

Conversions:

Airflow (lps) = CFM x 0.472; Water Flow (lps) = GPM x 0.0631;

ESP (Pascals) = ESP (in wg) x 249; Press Drop (Pascals) = Press Drop (ft hd) x 2990

AHRI/ISO 13256-1 Performance Ratings

PSC Motor

AHRI/ASHRAE/ISO 13256-1
English (IP) Units

Model	Flow Rate		Water Loop Heat Pump				Ground Water Heat Pump				Ground Loop Heat Pump				Energy Star Rated
			Cooling EWT 86°F		Heating EWT 68°F		Cooling EWT 59°F		Heating EWT 50°F		Cooling EWT 77°F		Heating EWT 32°F		
	gpm	cfm	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	
009	3.0	350	8,500	12.0	11,500	4.4	10,500	18.2	9,600	3.7	9,100	13.5	7,600	3.0	no
012	3.5	400	10,900	12.7	14,700	4.4	12,500	18.2	12,000	3.8	11,500	14.7	9,600	3.2	no
015	4.0	500	14,000	15.0	16,500	4.8	16,000	24.0	15,000	4.1	14,700	17.2	11,500	3.5	yes
018	5.0	600	17,600	14.6	21,000	4.7	20,600	23.5	17,500	4.0	18,500	17.0	13,700	3.5	yes
023	6.0	800	23,000	14.5	26,000	4.5	25,400	22.5	21,900	3.9	23,900	16.8	17,000	3.4	yes
024	6.0	800	23,900	14.6	27,000	4.7	26,400	22.8	22,300	4.0	24,400	17.0	17,500	3.5	yes
030	8.0	1000	29,500	14.9	34,600	4.8	32,900	23.0	28,300	4.0	29,000	17.0	22,800	3.5	yes
036	9.0	1150	33,300	14.4	40,600	4.5	37,700	21.2	33,000	3.9	34,500	16.6	26,000	3.3	yes
041	11.0	1300	40,000	13.8	45,000	4.3	44,500	20.6	36,000	3.8	41,000	15.8	29,000	3.3	yes
042	11.0	1400	40,800	14.5	45,400	4.5	45,800	22.0	37,000	3.8	42,300	16.8	29,900	3.3	yes
048	12.0	1600	47,700	14.7	56,000	4.4	52,000	21.0	45,900	3.8	49,500	16.8	36,900	3.3	yes
060	15.0	1900	58,400	14.7	72,500	4.4	65,500	20.8	58,400	3.8	60,900	16.6	47,100	3.3	yes
070	18.0	2100	63,000	14.2	79,000	4.4	70,000	20.3	64,100	3.8	68,500	15.2	51,600	3.3	no

11/10/09

Cooling capacities based upon 80.6°F DB, 66.2°F WB entering air temperature
Heating capacities based upon 68°F DB, 59°F WB entering air temperature
All ratings based upon 208V operation

ECM2.3 Motor

AHRI/ASHRAE/ISO 13256-1
English (IP) Units

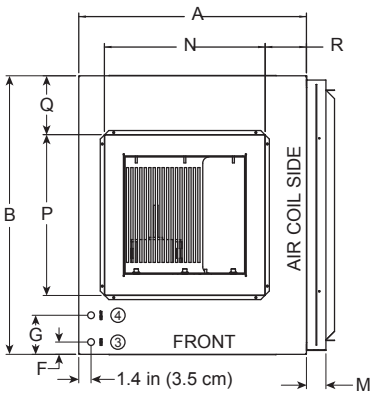
Model	Flow Rate		Water Loop Heat Pump				Ground Water Heat Pump				Ground Loop Heat Pump				Energy Star Rated
			Cooling EWT 86°F		Heating EWT 68°F		Cooling EWT 59°F		Heating EWT 50°F		Cooling EWT 77°F		Heating EWT 32°F		
	gpm	cfm	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	
015	4.0	500	14,000	15.3	16,500	4.9	16,000	24.3	15,000	4.4	14,700	17.5	11,500	3.7	yes
018	5.0	600	17,600	15.2	21,000	4.8	20,600	24.0	17,500	4.4	18,500	17.5	13,700	3.7	yes
023	6.0	800	23,000	15.0	26,000	4.7	25,400	23.0	21,900	4.3	23,900	17.0	17,000	3.6	yes
024	6.0	800	23,900	15.1	27,000	5.0	26,400	23.4	22,300	4.5	24,400	17.5	17,500	3.8	yes
030	8.0	900	29,500	15.7	34,600	5.1	32,900	23.9	28,300	4.4	29,000	18.3	22,800	3.8	yes
036	9.0	1150	33,300	15.0	40,600	4.8	37,700	23.0	33,000	4.3	34,500	17.3	26,000	3.5	yes
041	11.0	1300	40,000	14.5	45,000	4.5	44,500	22.0	36,000	4.0	41,000	16.5	29,000	3.4	yes
042	11.0	1400	40,800	15.6	45,400	5.0	45,800	23.5	37,000	4.3	42,300	18.5	29,900	3.7	yes
048	12.0	1600	47,700	15.5	56,000	4.8	52,000	23.4	45,900	4.2	49,500	18.1	36,900	3.6	yes
060	15.0	1900	58,400	15.3	72,500	4.7	65,500	23.0	58,400	4.0	60,900	17.9	47,100	3.6	yes
070	18.0	2100	63,000	14.3	79,000	4.7	70,000	21.0	64,100	4.0	68,500	16.1	51,600	3.5	yes

11/10/09

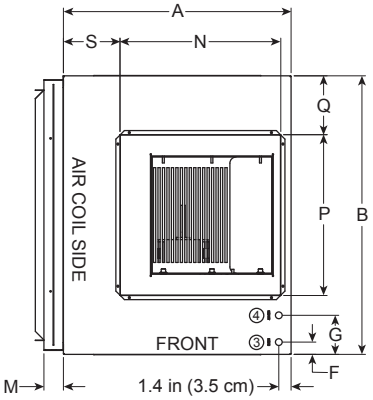
Cooling capacities based upon 80.6°F DB, 66.2°F WB entering air temperature
Heating capacities based upon 68°F DB, 59°F WB entering air temperature
All ratings based upon 208V operation

AHRI CERTIFIED™ www.ahridirectory.org
Water Source HP
ANSI/AHRI/ASHRAE/ISO13256-1

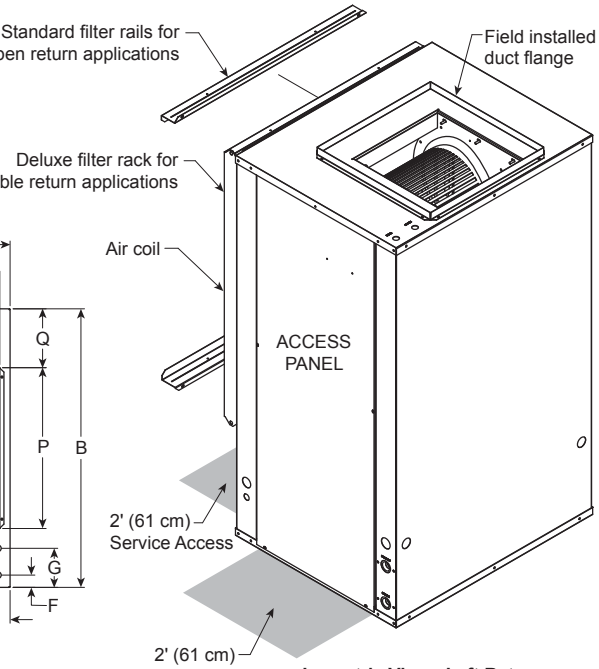
Vertical Dimensional Data



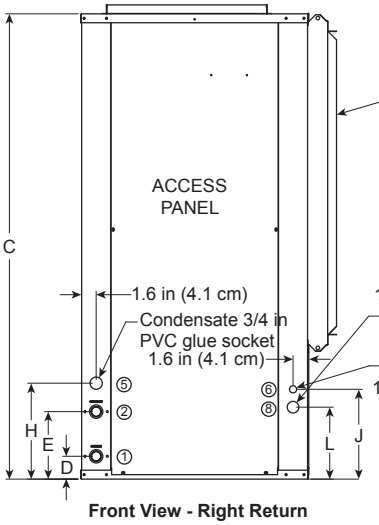
Top View - Right Return



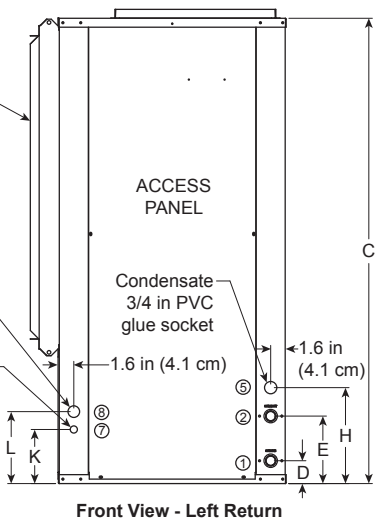
Top View - Left Return



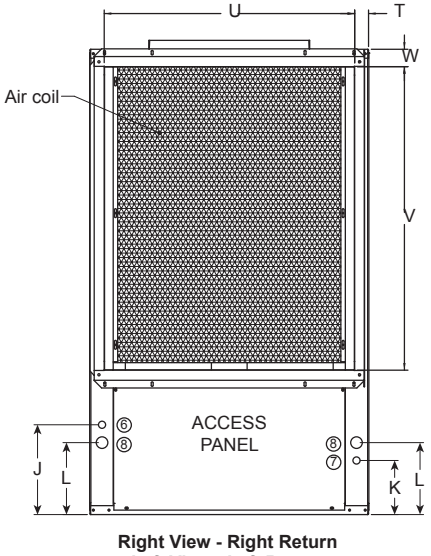
Isometric View - Left Return



Front View - Right Return



Front View - Left Return



Right View - Right Return
Left View - Left Return

Vertical Dimensional Data cont.

Vertical Models		Overall Cabinet			Water Connections							Electrical Knockouts		
					1	2	3	4	5			6	7	8
		A	B	C	D	E	F	G	H	Loop	Knock-out	J	K	L
		Width	Depth	Height**	In	Out	HWG In	HWG Out	Cond-ensate	Water FPT	HWG Pro-visions	1/2 in. cond	1/2 in. cond	1 in. cond
009-012	in.	22.5	22.2	23.7	2.6	5.6	N/A	N/A	8.8	1/2	N/A	7.4	3.4	5.4
	cm.	57.2	56.4	60.2	6.6	14.2	N/A	N/A	22.4	12.7 mm	N/A	18.8	8.6	13.7
015-018	in.	22.5	22.2	36.2	2.6	7.6	1.4	2.9	10.8	3/4	0.875	9.4	5.4	7.4
	cm.	57.2	56.4	91.9	6.6	19.3	3.6	7.4	27.4	19.1 mm	22.2 mm	23.9	13.7	18.8
024-030	in.	22.5	26.2	40.2	2.6	7.6	1.4	4.4	10.8	3/4	0.875	10.1	6.1	8.1
	cm.	57.2	66.5	102.1	6.6	19.3	3.6	11.2	27.4	19.1 mm	22.2 mm	25.7	15.5	20.6
036	in.	22.5	26.2	44.2	2.6	7.6	1.4	4.4	10.8	3/4	0.875	10.1	6.1	8.1
	cm.	57.2	66.5	112.3	6.6	19.3	3.6	11.2	27.4	19.1 mm	22.2 mm	25.7	15.5	20.6
041	in.	22.5	26.2	44.2	2.6	7.6	1.4	2.9	10.8	3/4	0.875	10.1	6.1	8.1
	cm.	57.2	66.5	112.3	6.6	19.3	3.6	7.4	27.4	19.1 mm	22.2 mm	25.7	15.5	20.6
042-048	in.	25.5	31.2	44.2	2.6	7.6	1.4	4.4	10.8	1	0.875	10.1	6.1	8.1
	cm.	64.8	79.2	112.3	6.6	19.3	3.6	11.2	27.4	25.4 mm	22.2 mm	25.7	15.5	20.6
060	in.	25.5	31.2	48.2	2.6	7.6	1.4	4.4	10.8	1	0.875	10.1	6.1	8.1
	cm.	64.8	79.2	122.4	6.6	19.3	3.6	11.2	27.4	25.4 mm	22.2 mm	25.7	15.5	20.6
070	in.	25.5	31.2	52.2	2.6	7.6	1.4	4.4	10.8	1	0.875	10.1	6.1	8.1
	cm.	64.8	79.2	132.6	6.6	19.3	3.6	11.2	27.4	25.4 mm	22.2 mm	25.7	15.5	20.6

Vertical Models			Discharge Connection duct flange installed (±0.10 in)					Return Connection* using deluxe filter rack (±0.10 in)			
		M	N	P	Q	R	S	T	U	V	W
		Filter Rack Width	Supply Width	Supply Depth					Return Depth	Return Height	
009-012	in.	2.2	10.0	10.0	6.1	9.4	9.4	2.1	18.1	10.0	1.9
	cm.	5.6	25.4	25.4	15.5	23.9	23.9	5.3	46.0	25.4	4.8
015-018	in.	2.2	14.0	14.0	4.1	4.3	7.7	2.1	18.1	20.0	1.9
	cm.	5.6	35.6	35.6	10.4	10.9	19.6	5.3	46.0	50.8	4.8
024-030	in.	2.2	14.0	14.0	6.1	4.5	7.7	2.1	22.1	22.1	1.9
	cm.	5.6	35.6	35.6	15.5	11.4	19.6	5.3	56.1	56.1	4.8
036	in.	2.2	14.0	14.0	6.1	4.5	7.7	2.1	22.1	26.1	1.9
	cm.	5.6	35.6	35.6	15.5	11.4	19.6	5.3	56.1	66.3	4.8
041	in.	2.2	18.0	18.0	4.1	3.9	3.9	2.1	22.1	26.1	1.9
	cm.	5.6	45.7	45.7	10.4	9.9	9.9	5.3	56.1	66.3	4.8
042-048	in.	2.2	18.0	18.0	6.6	4.6	6.3	1.6	28.1	26.0	2.0
	cm.	5.6	45.7	45.7	16.8	11.7	16.0	4.1	71.4	66.0	5.1
060	in.	2.2	18.0	18.0	6.6	4.6	6.3	1.6	28.1	30.0	2.0
	cm.	5.6	45.7	45.7	16.8	11.7	16.0	4.1	71.4	76.2	5.1
070	in.	2.2	18.0	18.0	6.6	4.6	6.3	1.6	28.1	34.0	2.0
	cm.	5.6	45.7	45.7	16.8	11.7	16.0	4.1	71.4	86.4	5.1

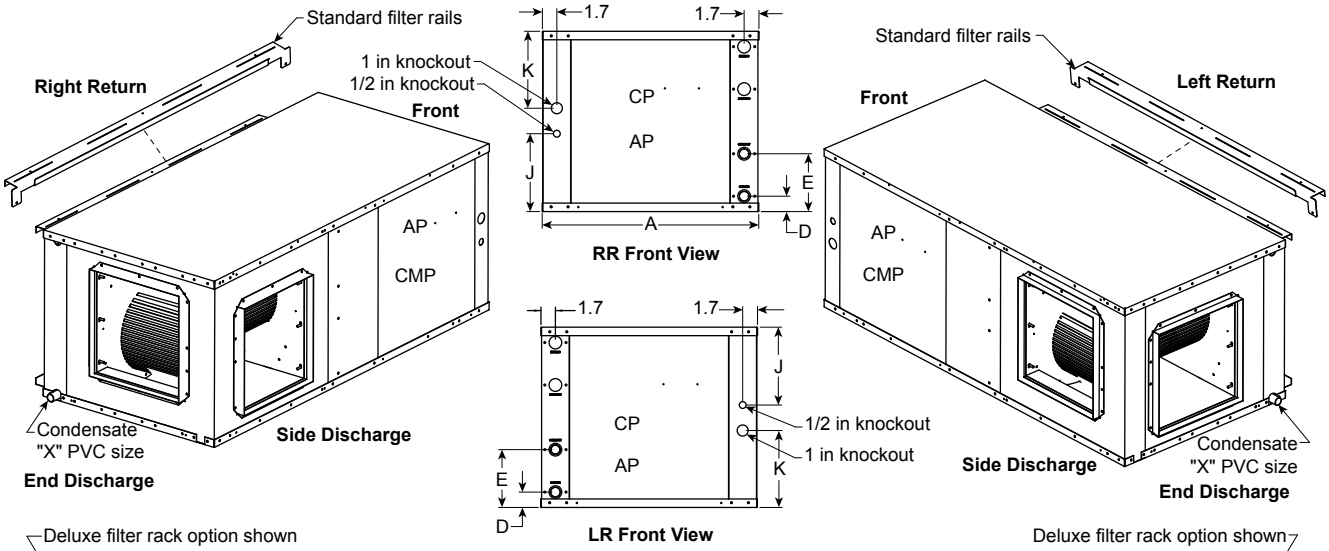
11/10/09

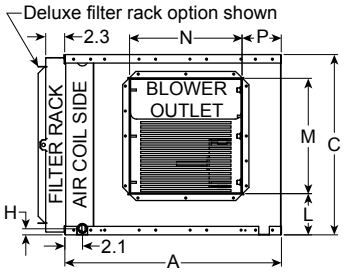
Condensate is 3/4 in. PVC female glue socket and is switchable from side to front.

***Dimensions for return connections are for the deluxe filter rack that is suitable for ducted return applications and extends 3.25 in. [8.26 cm] from the unit. The open filter rack, used in non-ducted returns, extends 2.2 in. [5.59 cm] from the unit.**

**Discharge flange is field installed and extends 1 in. (25.4 mm) from top of cabinet.

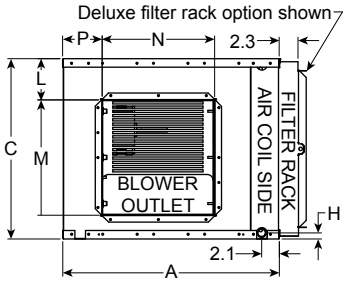
Horizontal Dimensional Data



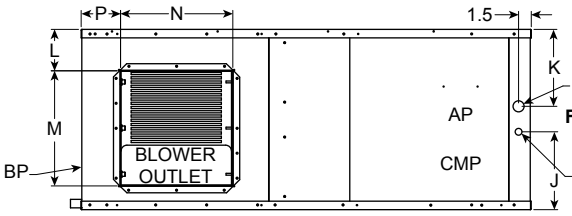


Right Return
End Discharge

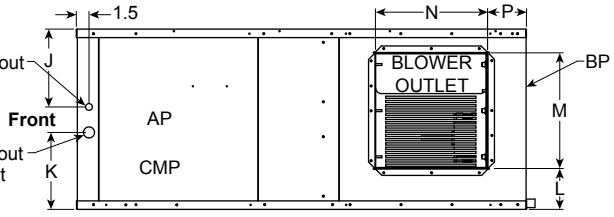
Legend	
AP	= Alternate Service Panel
BP	= Blower Service Panel
CP	= Control Access Panel
CMP	= Compressor Service Panel



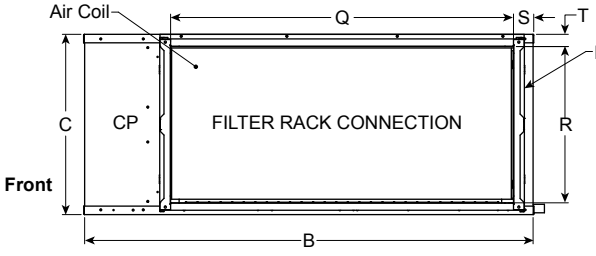
Left Return
End Discharge



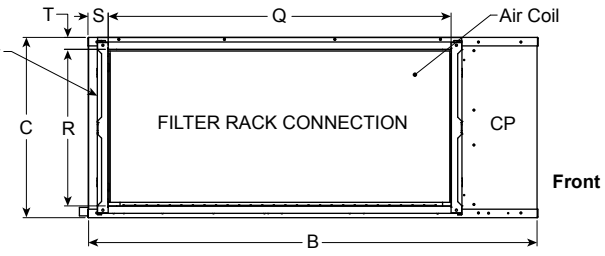
Right Return Side Discharge



Left Return Side Discharge



Right Return Side View



Left Return Side View

Horizontal Dimensional Data cont.

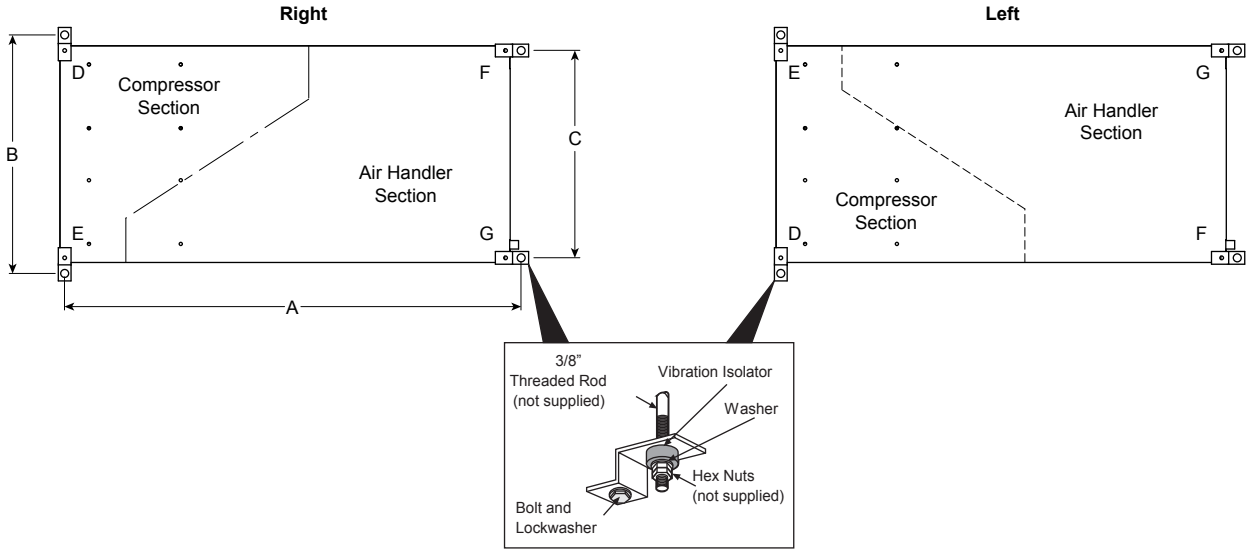
Horizontal Models		Overall Cabinet			Water Connections				Electrical Knockouts	
					1	2	3		J	K
		A	B	C	D	E	H	Loop	1/2 in. cond	1 in. cond
		Width	Depth	Height*	In	Out	Cond-ensate	Water FPT	Low Voltage	Power Supply
009-012	in.	19.2	29.0	12.1	1.8	4.8	0.8	1/2	4.5	4.5
	cm.	48.8	73.7	30.7	4.6	12.2	2.0	12.7 mm	11.4	11.4
015-018/023	in.	22.5	42.0	17.2	1.8	6.8	0.8	3/4	7.1	7.1
	cm.	57.2	106.7	43.7	4.6	17.3	2.0	19.05 mm	18.0	18.0
024-030	in.	22.5	42.0	19.2	1.8	6.8	0.8	3/4	9.2	7.1
	cm.	57.2	106.7	48.8	4.6	17.3	2.0	19.05 mm	23.4	18.0
036	in.	22.5	45.0	19.2	1.8	6.8	0.8	3/4	9.2	7.1
	cm.	57.2	114.3	48.8	4.6	17.3	2.0	19.05 mm	23.4	18.0
042-048	in.	25.5	48.0	21.2	1.8	6.8	0.8	1	9.2	9.1
	cm.	64.8	121.9	53.8	4.6	17.3	2.0	25.4 mm	23.4	23.1
060	in.	25.5	53.0	21.2	1.8	6.8	0.8	1	9.2	9.1
	cm.	64.8	134.6	53.8	4.6	17.3	2.0	25.4 mm	23.4	23.1
070	in.	25.5	61.0	21.2	1.8	6.8	0.8	1	9.2	9.1
	cm.	64.8	154.9	53.8	4.6	17.3	2.0	25.4 mm	23.4	23.1

Horizontal Models		Discharge Connection duct flange installed (±0.10 in)				Return Connection* using deluxe filter rack option (±0.10 in)				PVC Size
		L	M	N	P	Q	R	S	T	X
			Supply Width	Supply Depth		Return Depth	Return Height			
009-012	in.	2.3	8.0	10.0	2.3	15.4	9.4	3.0	1.4	1/2
	cm.	5.8	20.3	25.4	5.8	39.1	23.9	7.6	3.6	1.3
015-018/023	in.	5.7	10.5	9.4	4.9	23.4	14.5	2.0	1.4	3/4
	cm.	14.5	26.7	23.9	12.4	59.4	36.8	5.1	3.6	1.9
024-030	in.	6.7	10.5	9.4	4.9	27.4	16.4	2.0	1.5	3/4
	cm.	17.0	26.7	23.9	12.4	69.6	41.7	5.1	3.8	1.9
036	in.	6.7	10.5	9.4	4.9	30.4	16.4	2.1	1.5	3/4
	cm.	17.0	26.7	23.9	12.4	77.2	41.7	5.3	3.8	1.9
042-048	in.	4.9	13.6	13.2	4.6	35.4	18.6	2.4	1.5	3/4
	cm.	12.4	34.5	33.5	11.7	89.9	47.2	6.1	3.8	1.9
060	in.	4.9	13.6	13.2	4.6	40.4	18.4	2.4	1.5	3/4
	cm.	12.4	34.5	33.5	11.7	102.6	46.7	6.1	3.8	1.9
070	in.	4.9	13.6	13.2	4.6	45.6	18.6	2.3	1.5	3/4
	cm.	12.4	34.5	33.5	11.7	115.8	47.2	5.8	3.8	1.9

11/10/09

***Dimensions for return connections are for the deluxe filter rack that is suitable for ducted return applications and extends 3.25 in. [8.26 cm] from the unit. The open filter rack, used in non-ducted returns, extends 2.2 in. [5.59 cm] from the unit.**

Hanger Bracket Locations



Hanger Dimensions

Model		Hanger Kit Part Number	Unit Hanger Dimensions		
			A	B	C
009-012	in.	99S500A04	29.8	21.8	18.1
	cm.		75.7	55.4	46.0
015-023	in.	99S500A04	42.8	25.1	21.4
	cm.		108.6	63.8	54.4
024-030	in.	99S500A04	42.8	25.1	21.4
	cm.		108.7	63.8	54.4
036	in.	99S500A04	45.8	25.1	21.4
	cm.		116.3	63.8	54.4
042-048	in.	99S500A04	48.8	28.1	24.4
	cm.		124.0	71.4	62.0
060	in.	99S500A04	53.8	28.1	24.4
	cm.		136.7	71.4	62.0
070	in.	99S500A04	61.8	28.1	24.4
	cm.		157.0	71.4	62.0

11/10/09

Weight Distribution

Model	Vertical Shipping Weight	Horizontal Shipping Weight	Horizontal Weight Distribution			
			Front		Back	
			D	E	F	G
009	110	120	46	23	26	25
	[50]	[54]	[21]	[11]	[12]	[11]
012	115	125	48	24	27	26
	[52]	[57]	[22]	[11]	[12]	[12]
015	165	175	67	34	37	36
	[75]	[79]	[31]	[15]	[17]	[17]
018	170	180	69	35	38	38
	[77]	[82]	[31]	[16]	[17]	[17]
023	na	185	71	36	39	39
	na	[84]	[32]	[16]	[18]	[17]
024	230	245	94	47	52	51
	[104]	[111]	[43]	[22]	[24]	[23]
030	240	255	98	49	54	53
	[109]	[116]	[44]	[22]	[25]	[24]
036	265	285	110	55	61	59
	[120]	[129]	[50]	[25]	[28]	[27]
041	275	na	na	na	na	na
	[125]	na	na	na	na	na
042	285	300	115	58	64	63
	[129]	[136]	[52]	[26]	[29]	[28]
048	290	310	119	60	66	65
	[132]	[141]	[54]	[27]	[30]	[29]
060	335	360	138	70	77	75
	[152]	[163]	[63]	[32]	[35]	[34]
070	380	405	156	78	86	84
	[172]	[184]	[71]	[36]	[39]	[38]

11/10/09

Physical Data

Model		SINGLE SPEED												
		009	012	015	018	023	024	030	036	041	042	048	060	070
Compressor (1 each)		LG Rotary				Copeland Scroll			Danfoss Scroll					
Factory Charge R-410A, oz [kg]	Vertical	26 [0.74]	26 [0.74]	50 [1.42]	52 [1.47]	n/a	50 [1.42]	56 [1.58]	64 [1.81]	58 [1.64]	74 [2.10]	76 [2.15]	92 [2.61]	100 [2.83]
Factory Charge R-410A, oz [kg]	Horizontal	26 [0.74]	26 [0.74]	50 [1.42]	52 [1.47]	48 [1.36]	50 [1.42]	56 [1.58]	64 [1.81]	n/a	74 [2.10]	76 [2.15]	92 [2.61]	100 [2.83]
Blower motor & Blower														
Blower motor Type/Speeds	ECM2.3	Not Available		ECM2.3 Variable Speed										
	PSC	PSC 4 Speeds		PSC 3 Speeds										
Blower motor- hp [W]	ECM2.3	Not Available		1/2 [373]	1/2 [373]	1/2 [373]	1/2 [373]	1/2 [373]	1/2 [373]	1/2 [373]	1/2 [373]	1/2 [373]	1 [746]	1 [746]
	PSC	1/10 [75]	1/10 [75]	1/6 [134]	1/6 [134]	1/5 [149]	1/5 [149]	1/3 [249]	1/2 [373]	1/2 [373]	1/2 [373]	1/2 [373]	1 [746]	1 [746]
Optional - Oversized ECM2.3 Blower Motor - hp [W]	ECM2.3	Not Available									1 [746]	1 [746]	Not Available	
Optional - Oversized PSC Blower Motor - hp [W]	PSC	Not Available					1/3 [249]	1/2 [373]	Not Available		3/4 [560]	3/4 [560]	Not Available	
Blower Wheel Size (Dia x W), in. [mm]	ECM2.3	Not Available		9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	10 x 10 [254 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]
	PSC	6 x 8 [152 x 203]	6 x 8 [152 x 203]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	9 x 7 [229 x 178]	10 x 10 [254 x 254]	10 x 10 [254 x 254]	10 x 10 [254 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]
Coax and Water Piping														
Water Connection Size - FPT - in [mm]		1/2 [12.7]	1/2 [12.7]	3/4 [19.1]	3/4 [19.1]	3/4 [19.1]	3/4 [19.1]	3/4 [19.1]	3/4 [19.1]	3/4 [19.1]	1 [25.4]	1 [25.4]	1 [25.4]	1 [25.4]
HWG Connection Size - FPT - in [mm] (Vertical Only)		Not Available			1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]	1/2 [12.7]
Coax & Piping Water Volume - gal [l]		0.26 [0.98]	0.3 [1.12]	0.4 [1.49]	0.4 [1.49]	0.4 [1.49]	0.4 [1.49]	0.75 [2.83]	0.9 [3.41]	0.9 [3.41]	0.9 [3.41]	1.25 [4.72]	1.5 [5.68]	1.5 [5.68]
Vertical														
Air Coil Dimensions (H x W), in. [mm]		12 x 16 [305 x 406]	12 x 16 [305 x 406]	22 x 16 [559 x 406]	22 x 16 [559 x 406]	n/a	24 x 20 [610 x 508]	24 x 20 [610 x 508]	28 x 20 [711 x 508]	28 x 20 [711 x 508]	28 x 25 [711 x 635]	28 x 25 [711 x 635]	32 x 25 [813 x 635]	36 x 25 [914 x 635]
Air Coil Total Face Area, ft² [m²]		1.3 [0.121]	1.3 [0.121]	2.4 [0.220]	2.4 [0.220]	n/a	3.3 [0.310]	3.3 [0.310]	3.9 [0.362]	3.9 [0.362]	4.9 [0.452]	4.9 [0.452]	5.6 [0.516]	6.3 [0.581]
Air Coil Tube Size, in [mm]		3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	n/a	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]
Air Coil Number of rows		3	3	3	3	n/a	3	3	3	3	3	3	3	3
Filter Standard - 1 in. [25mm] MERV 4 Throwaway, in [mm]		12 x 20 [305 x 508]	12 x 20 [305 x 508]	22 x 20 [559 x 508]	22 x 20 [559 x 508]	n/a	24 x 24 [610 x 610]	24 x 24 [610 x 610]	28 x 24 [711 x 610]	28 x 24 [711 x 610]	28 x 30 [711 x 762]	28 x 30 [711 x 762]	32 x 30 [813 x 762]	36 x 30 [914 x 762]
Filter Standard - 2 in. [51mm] Pleated MERV 13 Throwaway, in [mm]		12 x 20 [305 x 508]	12 x 20 [305 x 508]	22 x 20 [559 x 508]	22 x 20 [559 x 508]	n/a	24 x 24 [610 x 610]	24 x 24 [610 x 610]	28 x 24 [711 x 610]	28 x 24 [711 x 610]	28 x 30 [711 x 762]	28 x 30 [711 x 762]	32 x 30 [813 x 762]	36 x 30 [914 x 762]
Horizontal														
Air Coil Dimensions (H x W), in. [mm]		10 x 16 [254 x 406]	10 x 16 [254 x 406]	16 x 23 [406 x 584]	16 x 23 [406 x 584]	16 x 23 [406 x 584]	18 x 27 [457 x 686]	18 x 27 [457 x 686]	18 x 30 [457 x 762]	n/a	20 x 35 [508 x 889]	20 x 35 [508 x 889]	20 x 40 [508 x 1016]	20 x 45 [508 x 1143]
Air Coil Total Face Area, ft2 [m2]		1.1 [0.103]	1.1 [0.103]	2.6 [0.238]	2.6 [0.238]	2.6 [0.238]	3.4 [0.316]	3.4 [0.316]	3.9 [0.362]	n/a	4.9 [0.452]	4.9 [0.452]	5.6 [0.516]	6.3 [0.581]
Air Coil Tube Size, in [mm]		3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	n/a	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]	3/8 [9.5]
Air Coil Number of rows		3	3	3	3	3	3	3	3	n/a	3	3	3	3
Filter Standard - 1 in. [25mm] MERV 4 Throwaway, in [mm]		10 x 19 [254 x 483]	10 x 19 [254 x 483]	16 x 25 [406 x 635]	16 x 25 [406 x 635]	16 x 25 [406 x 635]	2 - 18 x 14 [457 x 356]	2 - 18 x 14 [457 x 356]	1 - 18 x 14 [457 x 356] 1 - 18 x 18 [457 x 457]	n/a	2 - 18 x 20 [457 x 508]	2 - 18 x 20 [457 x 508]	1 - 20 x 20 [508 x 508] 1 - 20 x 22 [508 x 559]	1 - 20 x 25 [508 x 635] 1 - 20 x 22 [508 x 559]
Filter Standard - 2 in. [51mm] Pleated MERV 13 Throwaway, in [mm]		10 x 19 [254 x 483]	10 x 19 [254 x 483]	16 x 25 [406 x 635]	16 x 25 [406 x 635]	16 x 2 [406 x 635]	18 x 29 [457 x 737]	18 x 29 [457 x 737]	18 x 32 [457 x 813]	n/a	20 x 37 [686 x 940]	20 x 37 [686 x 940]	1 - 20 x 20 [508 x 508] 1 - 20 x 22 [508 x 559]	1 - 20 x 25 [508 x 635] 1 - 20 x 22 [508 x 559]

11/10/09

Electrical Availability

PSC

Voltage	Single Speed Models												
	009	012	015	018	023	024	030	036	041	042	048	060	070
208-230/60/1	x	x	x	x	x	x	x	x	x	x	x	x	x
208-230/60/1 w/GeoStart	n/a	n/a	n/a	n/a	x	x	x	x	x	x	x	x	x
265/60/1	x	x	x	x	x	x	x	n/a	n/a	n/a	n/a	n/a	n/a
208-230/60/3	n/a	n/a	n/a	n/a	x	x	x	x	x	x	x	x	x
460/60/3	n/a	n/a	n/a	n/a	x	x	x	x	x	x	x	x	x
575/60/3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	x	x	x	x	x

11/10/09

ECM2.3

Voltage	Single Speed Models										
	015	018	023	024	030	036	041	042	048	060	070
208-230/60/1	x	x	x	x	x	x	x	x	x	x	x
208-230/60/1 w/GeoStart	n/a	n/a	x	x	x	x	x	x	x	x	x
265/60/1	x	x	x	x	x	n/a	n/a	n/a	n/a	n/a	n/a
208-230/60/3	n/a	n/a	x	x	x	x	x	x	x	x	x
460/60/1	n/a	n/a	x	x	x	x	x	x	x	x	x
575/60/1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

11/10/09

Electrical Data

PSC Motor

Model	Rated Voltage	Voltage Min/Max	Compressor				Blower Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
			MCC	RLA	LRA	LRA**				
009	208-230/60/1	187/253	6.4	4.1	21.0	n/a	0.6	4.7	5.7	10
	265/60/1	238/292	6.7	4.3	22.0	n/a	0.6	4.9	6.0	10
012	208-230/60/1	187/253	7.7	4.9	25.0	n/a	0.6	5.5	6.7	10
	265/60/1	238/292	7.0	4.5	22.0	n/a	0.6	5.1	6.2	10
015	208-230/60/1	187/253	9.2	5.9	29.0	n/a	1.1	7.0	8.5	10
	265/60/1	238/292	7.8	5.0	28.0	n/a	1.0	6.0	7.2	10
018	208-230/60/1	187/253	10.4	6.7	33.5	n/a	1.1	7.8	9.5	15
	265/60/1	238/292	8.7	5.6	28.0	n/a	1.0	6.6	8.0	10
023	208-230/60/1	187/253	21.0	13.5	58.3	21.0	1.2	14.7	18.1	30
	265/60/1	238/292	14.0	9.0	54.0	n/a	1.1	10.1	12.4	20
	208-230/60/3	187/253	12.1	8.6	55.0	n/a	1.2	9.8	12.0	20
024	208-230/60/1	187/253	21.0	13.5	58.3	21.0	1.2	14.7	18.1	30
	265/60/1	238/292	14.0	9.0	54.0	n/a	1.1	10.1	12.4	20
	208-230/60/3	187/253	12.1	8.6	55.0	n/a	1.2	9.8	12.0	20
024*	208-230/60/1	187/253	21.0	13.5	58.3	21.0	1.5	15.0	18.4	30
	265/60/1	238/292	14.0	9.0	54.0	n/a	2.0	11.0	13.3	20
	208-230/60/3	187/253	12.1	8.6	55.0	n/a	1.5	10.1	12.3	20
030	208-230/60/1	187/253	22.0	14.1	73.0	26.0	1.5	15.6	19.1	30
	208-230/60/3	187/253	13.9	8.9	58.0	n/a	1.5	10.4	12.6	20
030*	208-230/60/1	187/253	22.0	14.1	73.0	26.0	2.2	16.3	19.8	30
	265/60/1	238/292	17.5	11.2	60.0	n/a	2.0	13.2	16.0	25
	208-230/60/3	187/253	13.9	8.9	58.0	n/a	2.2	11.1	13.3	20
	460/60/3	414/506	6.5	4.2	28.0	n/a	1.1	5.3	6.4	10
036	208-230/60/1	187/253	27.0	17.3	96.7	34.0	2.2	19.5	23.8	40
	208-230/60/3	187/253	20.0	12.8	95.0	n/a	2.2	15.0	18.2	30
	460/60/3	414/506	10.0	6.4	45.0	n/a	1.1	7.5	9.1	15
041	208-230/60/1	187/253	31.0	20.0	115.0	41.0	3.5	23.5	28.5	45
	208-230/60/3	187/253	20.0	12.8	95.0	n/a	3.5	16.3	19.5	30
	460/60/3	414/506	10.0	6.4	45.0	n/a	1.8	8.2	9.8	15
	575/60/3	517/633	8.5	5.4	38.0	n/a	1.4	6.8	8.2	10
042	208-230/60/1	187/253	31.0	20.0	115.0	41.0	3.5	23.5	28.5	45
	208-230/60/3	187/253	20.0	12.8	95.0	n/a	3.5	16.3	19.5	30
	460/60/3	414/506	10.0	6.4	45.0	n/a	1.8	8.2	9.8	15
	575/60/3	517/633	8.5	5.4	38.0	n/a	1.4	6.8	8.2	10
042*	208-230/60/1	187/253	31.0	20.0	115.0	41.0	4.6	24.6	29.6	45
	208-230/60/3	187/253	20.0	12.8	95.0	n/a	4.6	17.4	20.6	30
	460/60/3	414/506	10.0	6.4	45.0	n/a	2.3	8.7	10.3	15
	575/60/3	517/633	8.5	5.4	38.0	n/a	1.9	7.3	8.7	10
048	208-230/60/1	187/253	32.0	21.0	115.0	41.0	3.5	24.5	29.8	50
	208-230/60/3	187/253	25.0	16.0	115.0	n/a	3.5	19.5	23.5	35
	460/60/3	414/506	12.0	7.7	50.0	n/a	1.8	9.5	11.4	15
	575/60/3	517/633	10.0	6.4	40.0	n/a	1.4	7.8	9.4	15
048*	208-230/60/1	187/253	32.0	21.0	115.0	41.0	4.6	25.6	30.9	50
	208-230/60/3	187/253	25.0	16.0	115.0	n/a	4.6	20.6	24.6	40
	460/60/3	414/506	12.0	7.7	50.0	n/a	2.3	10.0	11.9	15
	575/60/3	517/633	10.0	6.4	40.0	n/a	1.9	8.3	9.9	15
060	208-230/60/1	187/253	41.0	26.3	150.0	53.0	5.9	32.3	38.8	60
	208-230/60/3	187/253	27.5	17.6	120.0	n/a	5.9	23.5	27.9	45
	460/60/3	414/506	13.0	8.3	70.0	n/a	3.0	11.3	13.4	20
	575/60/3	517/633	11.5	7.4	53.0	n/a	1.9	9.3	11.2	15
070	208-230/60/1	187/253	47.0	30.1	145.0	51.0	5.9	36.0	43.5	70
	208-230/60/3	187/253	28.0	17.3	120.0	n/a	5.9	23.2	27.5	40
	460/60/3	414/506	15.0	9.6	70.0	n/a	3.0	12.6	15.0	20
	575/60/3	517/633	12.5	8.0	53.0	n/a	1.9	9.9	11.9	15

11/10/09

HACR circuit breaker in USA only
* With optional high-static PSC motor
** With optional GeoStart™, only available on 208-230/60/1
NOTE: High-static option not available on all model sizes.

Electrical Data cont.

ECM2.3 Motor

Model	Rated Voltage	Voltage Min/Max	Compressor				Blower Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
			MCC	RLA	LRA	LRA**				
015	208-230/60/1	197/253	9.2	5.9	29.0	n/a	4.0	9.9	11.4	15
	265/60/1	238/292	7.8	5.0	28.0	n/a	4.1	9.1	10.3	15
018	208-230/60/1	197/253	10.4	6.7	33.5	n/a	4.0	10.7	12.4	15
	265/60/1	238/292	8.7	5.6	28.0	n/a	4.1	9.7	11.1	15
023	208-230/60/1	197/253	21.0	13.5	58.3	21.0	4.0	17.5	20.9	30
	265/60/1	238/292	14.0	9.0	54.0	n/a	4.1	13.1	15.4	20
	208-230/60/3	187/253	12.1	8.6	55.0	n/a	4.0	12.6	14.8	20
	460/60/3	414/506	6.2	4.4	22.4	n/a	4.1	8.5	9.6	10
024	208-230/60/1	197/253	21.0	13.5	58.3	21.0	4.0	17.5	20.9	30
	265/60/1	238/292	14.0	9.0	54.0	n/a	4.1	13.1	15.4	20
	208-230/60/3	187/253	12.1	8.6	55.0	n/a	4.0	12.6	14.8	20
	460/60/3	414/506	6.2	4.4	22.4	n/a	4.1	8.5	9.6	10
030	208-230/60/1	197/253	22.0	14.1	73.0	26.0	4.0	18.1	21.6	35
	265/60/1	238/292	17.5	11.2	60.0	n/a	4.1	15.3	18.1	25
	208-230/60/3	187/253	13.9	8.9	58.0	n/a	4.0	12.9	15.1	20
	460/60/3	414/506	6.5	4.2	28.0	n/a	4.1	8.3	9.4	10
036	208-230/60/1	197/253	27.0	17.3	96.7	34.0	4.0	21.3	25.6	40
	208-230/60/3	187/253	20.0	12.8	95.0	n/a	4.0	16.8	20.0	30
	460/60/3	414/506	10.0	6.4	45.0	n/a	4.1	10.5	12.1	15
041	208-230/60/1	197/253	31.0	20.0	115.0	41.0	4.0	24.0	29.0	45
	208-230/60/3	187/253	20.0	12.8	95.0	n/a	4.0	16.8	20.0	30
	460/60/3	414/506	10.0	6.4	45.0	n/a	4.1	10.5	12.1	15
042	208-230/60/1	197/253	31.0	20.0	115.0	41.0	4.0	24.0	29.0	45
	208-230/60/3	187/253	20.0	12.8	95.0	n/a	4.0	16.8	20.0	30
	460/60/3	414/506	10.0	6.4	45.0	n/a	4.1	10.5	12.1	15
042*	208-230/60/1	197/253	31.0	20.0	115.0	41.0	7.0	27.0	32.0	50
	208-230/60/3	187/253	20.0	12.8	95.0	n/a	7.0	19.8	23.0	35
	460/60/3	414/506	10.0	6.4	45.0	n/a	6.9	13.3	14.9	20
048	208-230/60/1	197/253	32.0	21.0	115.0	41.0	4.0	25.0	30.3	50
	208-230/60/3	187/253	25.0	16.0	115.0	n/a	4.0	20.0	24.0	40
	460/60/3	414/506	12.0	7.7	50.0	n/a	4.1	11.8	13.7	20
048*	208-230/60/1	197/253	32.0	21.0	115.0	41.0	7.0	28.0	33.3	50
	208-230/60/3	187/253	25.0	16.0	115.0	n/a	7.0	23.0	27.0	40
	460/60/3	414/506	12.0	7.7	50.0	n/a	6.9	14.6	16.5	20
060	208-230/60/1	197/253	41.0	26.3	150.0	53.0	7.0	33.3	39.9	60
	208-230/60/3	187/253	27.5	17.6	120.0	n/a	7.0	24.6	29.0	45
	460/60/3	414/506	13.0	8.3	70.0	n/a	6.9	15.2	17.3	25
070	208-230/60/1	197/253	47.0	30.1	145.0	51.0	7.0	37.1	44.6	70
	208-230/60/3	187/253	32.0	20.5	155.0	n/a	7.0	27.5	32.6	50
	460/60/3	414/506	15.0	9.6	75.0	n/a	6.9	16.5	18.9	25

11/10/09

HACR circuit breaker in USA only
* With optional 1 HP ECM2.3 motor
** With optional GeoStart™, only available on 208-230/60/1

CAUTION: When installing a unit with an ECM2.3 blower motor in 460/60/3 voltage, a neutral wire is required to allow proper unit operation.

Blower Performance Data

Standard PSC Motor

Model	Blower Spd	Blower Size	Motor HP	Airflow (cfm) at External Static Pressure (in. wg)															
				0	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.60	0.70	0.80	0.90	1.00
009	H	6 x 8	1/10	530	515	500	485	470	450	430	405	385	355	330	-	-	-	-	-
	MH			475	460	450	435	420	405	385	365	345	320	300	-	-	-	-	-
	ML*			435	420	410	395	380	365	345	325	300	-	-	-	-	-	-	-
	L			370	355	340	325	310	290	275	-	-	-	-	-	-	-	-	-
012	**H**	6 x 8	1/10	530	515	500	485	470	450	430	405	385	355	330	-	-	-	-	-
	MH*			475	460	450	435	420	405	385	365	345	320	300	-	-	-	-	-
	ML			435	420	410	395	380	365	345	325	300	-	-	-	-	-	-	-
	L			370	355	340	325	310	290	275	-	-	-	-	-	-	-	-	-
015	H	9 x 7	1/6	875	860	845	830	820	805	790	770	750	725	700	-	-	-	-	-
	M			760	750	740	730	720	710	700	680	660	640	620	-	-	-	-	-
	L			630	620	610	600	590	580	570	560	550	520	490	-	-	-	-	-
018	H	9 x 7	1/6	875	860	845	830	820	805	790	770	750	725	700	-	-	-	-	-
	M			760	750	740	730	720	710	700	680	660	640	620	-	-	-	-	-
	L			630	620	610	600	590	580	570	560	550	520	490	-	-	-	-	-
023	H	9 x 7	1/5	1065	1045	1030	1005	975	950	925	900	870	835	800	715	-	-	-	-
	M			880	865	850	830	815	795	775	750	725	700	670	-	-	-	-	-
	L			805	790	780	765	745	725	710	685	660	630	600	-	-	-	-	-
024	H	9 x 7	1/5	1020	990	960	930	900	870	850	830	800	770	690	-	-	-	-	-
	M			960	840	820	800	780	760	740	720	690	670	-	-	-	-	-	-
	L			720	700	680	650	640	620	600	580	570	550	-	-	-	-	-	-
030	H	9 x 7	1/3	1120	1100	1070	1050	1040	1030	1020	1010	1000	980	830	-	-	-	-	-
	M			1020	1000	980	960	920	880	860	840	820	790	-	-	-	-	-	-
	L			860	850	840	830	810	800	780	760	740	710	-	-	-	-	-	-
036	**H**	9 x 7	1/2	1360	1340	1320	1290	1260	1220	1185	1130	1080	1045	1010	910	855	-	-	-
	M			1205	1190	1170	1145	1120	1085	1050	1015	980	940	900	845	-	-	-	-
	L			1070	1060	1050	1035	1020	995	970	940	910	875	840	780	-	-	-	-
041	H	10x10	1/2	1655	1635	1615	1590	1570	1535	1500	1425	1350	1270	1185	1080	970	-	-	-
	M			1470	1455	1445	1425	1410	1380	1350	1285	1240	1205	1170	905	-	-	-	-
	L			1150	1140	1130	1110	1090	1050	1010	970	930	900	865	800	-	-	-	-
042	H	10 x 10	1/2	1705	1685	1665	1645	1625	1595	1565	1530	1500	1450	1405	1260	1140	-	-	-
	M			1485	1475	1465	1445	1430	1410	1390	1350	1315	1260	1210	1110	1010	-	-	-
	L			1180	1165	1150	1135	1120	1090	1060	1030	1000	965	920	855	-	-	-	-
048	**H**	10 x 10	1/2	1930	1910	1885	1860	1830	1790	1750	1710	1665	1620	1580	1280	1235	-	-	-
	M			1580	1565	1550	1535	1525	1505	1485	1445	1410	1310	1215	1130	1030	-	-	-
	L			1180	1170	1160	1140	1120	1100	1080	1050	1020	970	930	875	-	-	-	-
060	H	11 x 10	1	2360	2330	2300	2270	2240	2215	2190	2160	2130	2095	2060	1985	1920	1855	-	-
	M			2165	2130	2095	2070	2050	2030	2010	1985	1965	1930	1900	1850	1775	1700	-	-
	L			1965	1940	1920	1900	1885	1870	1855	1825	1800	1780	1760	1720	1625	1530	-	-
070	**H**	11 x 10	1	2450	2435	2420	2395	2370	2340	2310	2280	2250	2225	2200	2040	2000	1950	-	-
	M			2215	2190	2170	2155	2140	2120	2095	2070	2045	2015	1990	1940	1876	1795	-	-
	L			2005	1990	1975	1962	1950	1938	1925	1910	1890	1865	1845	1780	1710	1565	-	-

11/10/09

Factory settings are in Bold
Air flow values are with dry coil and standard filter
For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).
Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12in. wg. and 500 fpm by 0.16 in. wg.

Optional High Static PSC Motor

Model	Blower Spd	Blower Size	Motor HP	Airflow (cfm) at External Static Pressure (in. wg)															
				0	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.60	0.70	0.80	0.90	1.00
024	H	9 x 7	1/3	1120	1100	1070	1050	1040	1030	1020	1010	1000	980	830	-	-	-	-	-
	M			1020	1000	980	960	920	880	860	840	820	790	-	-	-	-	-	-
	L			860	850	840	830	810	800	780	760	740	710	-	-	-	-	-	-
030	H	9 x 7	1/2	1340	1320	1300	1270	1240	1200	1160	1115	1070	1025	985	880	-	-	-	-
	M			1185	1175	1165	1130	1095	1065	1035	1000	965	920	880	795	-	-	-	-
	L			1050	1040	1030	1015	1000	980	960	925	895	855	815	-	-	-	-	-
042	H	10 x 10	3/4	2095	2080	2060	2020	1980	1950	1920	1880	1840	1780	1725	1550	1335	1120	-	-
	M			1960	1940	1920	1890	1865	1830	1800	1760	1725	1670	1620	1435	1300	-	-	-
	L			1800	1780	1760	1740	1725	1695	1670	1625	1585	1525	1465	1300	1200	-	-	-
048	H	10 x 10	3/4	2095	2080	2060	2020	1980	1950	1920	1880	1840	1780	1725	1550	1335	1120	-	-
	M			1960	1940	1920	1890	1865	1830	1800	1760	1725	1670	1620	1435	1300	-	-	-
	L			1800	1780	1760	1740	1725	1695	1670	1625	1585	1525	1465	1300	1200	-	-	-

11/10/09

Factory settings are in Bold
Air flow values are with dry coil and standard filter
For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).
Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, 400 fpm by 0.12in. wg. and 500 fpm by 0.16 in. wg.
* Setting for 265 V operation.

Blower Performance Data cont.

ECM2.3 Motor

MODEL	MAX ESP	AIR FLOW DIP SWITCH SETTINGS											
		1	2	3	4	5	6	7	8	9	10	11	12
015	**0.50**	300 L	400	500 M	600 H	700							
018	**0.50**	300	400 L	500	600 M	700 H	800						
023	**0.50**		400	500 L	600 M	700	800 H	900	1000	1100	1200		
024	**0.50**		400	500 L	600 M	700	800 H	900	1000	1100	1200		
030	**0.50**		400	500 L	600	700 M	800	900 H	1000	1100	1200		
036	**0.50**				600	700 L	800	900 M	1000	1100 H	1150	1225	1300
041	**0.50**	650	750	850 L	950	1050 M	1150	1250	1325 H	1375	1475	1550	1600
042	**0.50**	650	750	850 L	950	1050 M	1150	1250	1325 H	1375	1475	1550	1600
042 w/1hp*	**0.75**	800 L	1000 M	1100	1300 H	1500	1600	1800					
048	**0.50**	650	750	850	950	1050 L	1150	1250 M	1325	1375	1475	1550 H	1600
048 w/1hp*	**0.75**	800	1000 L	1100	1300 M	1500 H	1600	1800					
060	**0.75**	750	900	1000	1200 L	1400 M	1600	1700	1850 H	2000	2200	2300	2400
070	**0.75**	800	950	1100 L	1300	1500	1750 M	1950	2100 H	2300			

11/10/09

Factory settings are at recommended L-M-H DIP switch locations
M-H settings MUST be located within boldface CFM range
Lowest and Highest DIP switch settings are assumed to be L and H respectively
CFM is controlled within ±5% up to the maximum ESP
Max ESP includes allowance for wet coil and standard filter

Selection Example

To achieve optimal performance, proper selection of each heat pump is essential. A building load program should be used to determine the heating and cooling load of each zone. Computer software selection program can then be used to develop an accurate and complete heat pump schedule.

Boiler/Tower Application

Typical boiler/tower application will result in entering water temperatures of 60-90°F with 70°F for heating and 90°F for cooling. Water to refrigerant insulation option would not be required. Flow rates are 2.5 to 3 gpm per ton with 2.5 gpm per ton often representing an economical design point.

Geothermal Application

Typical geothermal application can result in a wide entering water temperature range of 30-100°F. Typically minimum heating entering water temperatures can range from 30 to 50°F depending upon loop type and geographical location. Cooling performance should be calculated using a maximum loop temperature of 100°F in most loop applications. Water flow is typically 2.5 to 3 gpm per ton with 3 gpm per ton recommended with the more extreme loop temperatures. **PLEASE NOTE THAT WATER COIL INSULATION OPTION SHOULD BE SELECTED WHEN ENTERING WATER TEMPERATURES ARE EXPECTED TO BE BELOW 45-50°F.**

Geothermal Selection Example

Step 1: Determine the actual heating and cooling loads at the desired dry bulb and wet bulb conditions.

Step 2: Obtain the following design parameters: Entering water temperature, water flow rate in GPM, air flow in CFM, water flow pressure drop and design wet and dry bulb temperatures. Air flow CFM should be between 300 and 450 CFM per ton. Unit water pressure drop should be kept as close as possible to each other to make water balancing easier. Go to the appropriate tables and find the proper indicated water flow and water temperature.

Step 3: Select a unit based on total and sensible cooling conditions. Select a unit which is closest to, but no larger than, the actual cooling load.

Step 4: Enter tables at the design water flow and water temperature. Read the total and sensible cooling capacities (**NOTE:** interpolation is permissible, extrapolation is not).

Step 5: Read the heating capacity. If it exceeds the design criteria it is acceptable. It is quite normal for water source heat pumps to be selected on cooling capacity only since the heating output is usually greater than the cooling capacity.

Step 6: Determine the correction factors associated with the variable factors of dry bulb and wet bulb.
Corrected Total Cooling = tabulated total cooling x wet bulb correction.
Corrected Sensible Cooling = tabulated sensible cooling x wet/dry bulb correction.

Step 7: Compare the corrected capacities to the load requirements. Normally if the capacities are within 10% of the loads, the equipment is acceptable. It is better to undersize than oversize, as undersizing improves humidity control, reduces sound levels and extends the life of the equipment.

Step 8: When complete, calculate water temperature rise and assess the selection. If the units selected are not within 10% of the load calculations, then review what effect changing the GPM, water temperature and/or air flow and air temperature would have on the corrected capacities. If the desired capacity cannot be achieved, select the next larger or smaller unit and repeat the procedure. Remember, when in doubt, undersize slightly for best performance.

Example Equipment Selection - Cooling

1. Load Determination:
Assume we have determined that the appropriate cooling load at the desired dry bulb 80°F and wet bulb 65°F conditions is as follows:
Total Cooling..... 56,500 BTUH
Sensible Cooling..... 36,300 BTUH
Entering Air Temp .....75°F Dry Bulb / 60°F Wet Bulb

2. Design Conditions:
Similarly, we have also obtained the following design parameters:
Entering Water Temp .....90°F
Water Flow (Based upon 10°F rise in temp.) 15.0 GPM
Air Flow Required..... 1,850 CFM @ 0.2 in. wg.

3, 4 & 5. HP Selection:
After making our preliminary selection (ZS060 ECM2.3), we enter the tables at design water flow and water temperature and read Total Cooling, Sens. Cooling and Heat of Rej. capacities:
Total Cooling..... 60,500 BTUH
Sensible Cooling..... 45,000 BTUH
Heat of Rejection..... 75,500 BTUH

6 & 7. Entering Air and Airflow Corrections:
Next, we determine our correction factors. (Refer to Correction Factor Tables - Air Flow and Entering Air correction tables — using 1,850 cfm. or 1,850÷2,000 nom. = 92.5%).
Corrected Total Cooling = 60,500 x 0.990 x 0.967 = 57,918
Corrected Sens Cooling = 45,000 x 0.956 x 0.881 = 37,900
Corrected Heat of Reject = 75,500 x 0.987 x 0.972 = 72,432

$$HR = 500 \times GPM \times (T_{in} - T_{out})$$

$$\frac{HR}{500 \times GPM} = (Tin - Tout) \text{ or } \Delta T \text{ Rise}$$

$$\frac{72{,}432}{500 \times 15} = 9.65\ ^\circ F \text{ Rise}$$

Selection Example cont.

8. Water Temperature Rise Calculation & Assessment:
Note: 500 = parameters for water & 485 = parameters for antifreeze solutions to 30% weight.

When we compare the Corrected Total Cooling and Corrected Sensible Cooling figures with our load requirements stated in Step 1, we discover that our selection is within +10% of our sensible load requirement. Further more, we see that our Corrected Total Cooling figure is within 1,000 Btuh of the actual indicated load.

Antifreeze Corrections

Catalog performance can be corrected for antifreeze use. Please use the following table and note the example given.

Antifreeze Type	Antifreeze % by wt	Cooling Capacity	Heating Capacity	Pressure Drop
EWT - degF [DegC]		**90 [32.2]**	**30 [-1.1]**	**30 [-1.1]**
Water	0	1.000	1.000	1.000
Ethylene Glycol	10	0.991	0.973	1.075
	20	0.979	0.943	1.163
	30	0.965	0.917	1.225
	40	0.955	0.890	1.324
	50	0.943	0.865	1.419
Propylene Glycol	10	0.981	0.958	1.130
	20	0.969	0.913	1.270
	30	0.950	0.854	1.433
	40	0.937	0.813	1.614
	50	0.922	0.770	1.816
Ethanol	10	0.991	0.927	1.242
	20	0.972	0.887	1.343
	30	0.947	0.856	1.383
	40	0.930	0.815	1.523
	50	0.911	0.779	1.639
Methanol	10	0.986	0.957	1.127
	20	0.970	0.924	1.197
	30	0.951	0.895	1.235
	40	0.936	0.863	1.323
	50	0.920	0.833	1.399

***Warning**: Gray area represents antifreeze concentrations greater than 35% by weight and should be avoided due to the extreme performance penalty they represent.*

Antifreeze Correction Example

Antifreeze solution is Propylene Glycol 20% by weight. Determine the corrected heating and cooling performance at 30°F and 90°F respectively as well as pressure drop at 30°F for a ECO-Z ZS024-PSC.

The corrected cooling capacity at 90°F would be: 24,500 MBtuh x 0.969 = 23,740 MBtuh

The corrected heating capacity at 30°F would be: 19,000 MBtuh x 0.913 = 17,347 MBtuh

The corrected pressure drop at 30°F and 6 GPM would be: 10.5 feet of head x 1.270 = 13.34 feet of head

Reference Calculations

Heating Calculations:

$$LWT = EWT - \frac{HE}{GPM \times 500}$$

$$LAT = EAT + \frac{HC}{CFM \times 1.08}$$

$$TH = HC + HWC$$

Cooling Calculations:

$$LWT = EWT + \frac{HR}{GPM \times 500}$$

$$LAT\ (DB) = EAT\ (DB) - \frac{SC}{CFM \times 1.08}$$

$$LC = TC - SC$$

$$S/T = \frac{SC}{TC}$$

Legends and Notes

ABBREVIATIONS AND DEFINITIONS:

CFM = airflow, cubic feet/minute
EWT = entering water temperature, Fahrenheit
GPM = water flow in gallons/minute
WPD = water pressure drop, PSI and feet of water
EAT = entering air temperature, Fahrenheit (dry bulb/wet bulb)
HC = air heating capacity, MBTUH
TC = total cooling capacity, MBTUH
SC = sensible cooling capacity, MBTUH
KW = total power unit input, kilowatts
HR = total heat of rejection, MBTUH
HE = total heat of extraction, MBTUH
HWC = hot water generator capacity, MBTUH
EER = Energy Efficient Ratio = BTU output/Watt input
COP = Coefficient of Performance = BTU output/BTU input
LWT = leaving water temperature, °F
LAT = leaving air temperature, °F
TH = total heating capacity, MBTUH
LC = latent cooling capacity, MBTUH
S/T = sensible to total cooling ratio

Notes (Refer to Capacity Data tables)

- Capacity ratings are based on 80°F DB / 67°F WB EAT for cooling and 70°F DB EAT for heating.
- Three flow rates are shown for each unit. The lowest flow rate shown is used for geothermal open loop/well water systems with a minimum of 50°F EWT. The middle flow rate shown is the minimum geothermal closed loop flow rate. The highest flow rate shown is optimum for geothermal closed loop systems and the suggested flow rate for boiler/tower applications.
- The hot water generator numbers are based on a flow rate of 0.4 GPM/ton of rated capacity with an EWT of 90°F.
- Entering water temperatures below 40°F assumes 15% antifreeze solution.
- For non-standard EAT conditions, apply the appropriate correction factors on (Refer to Correction Factor Tables).
- Interpolation between EWT, GPM and CFM data is permissible.

Operating Limits

Operating Limits	Cooling		Heating	
	(°F)	(°C)	(°F)	(°C)
Air Limits				
Min. Ambient Air	45	7.2	45	7.2
Rated Ambient Air	80	26.7	70	21.1
Max. Ambient Air	100	37.8	85	29.4
Min. Entering Air	50	10.0	40	4.4
Rated Entering Air db/wb	80.6/66.2	27/19	68	20.0
Max. Entering Air db/wb	110/83	43/28.3	80	26.7
Water Limits				
Min. Entering Water	30	-1.1	20	-6.7
Normal Entering Water	50-110	10-43.3	30-70	-1.1
Max. Entering Water	120	48.9	90	32.2

NOTE: Minimum/maximum limits are only for start-up conditions, and are meant for bringing the space up to occupancy temperature. Units are not designed to operate at the minimum/maximum conditions on a regular basis. The operating limits are dependant upon three primary factors: 1) water temperature, 2) return air temperature, and 3) ambient temperature. When any of the factors are at the minimum or maximum levels, the other two factors must be at the normal level for proper and reliable unit operation.

Correction Factor Tables

Cooling Capacity Corrections

Entering Air WB ºF	Total Clg Cap	Sensible Cooling Capacity Multipliers - Entering DB ºF										Power Input	Heat of Rejection
		60	65	70	75	80	80.6	85	90	95	100		
55	0.898	0.723	0.866	1.048	1.185	*	*	*	*	*	*	0.985	0.913
60	0.912		0.632	0.880	1.078	1.244	1.260	*	*	*	*	0.994	0.927
65	0.967			0.694	0.881	1.079	1.085	1.270	*	*	*	0.997	0.972
66.2	0.983			0.655	0.842	1.040	1.060	1.232	*	*	*	0.999	0.986
67	**1.000**			0.616	0.806	**1.000**	1.023	1.193	1.330	*	*	**1.000**	**1.000**
70	1.053				0.693	0.879	0.900	1.075	1.250	1.404	*	1.003	1.044
75	1.168					0.687	0.715	0.875	1.040	1.261	1.476	1.007	1.141

11/10/09

NOTE: * Sensible capacity equals total capacity at conditions shown.

Heating Corrections

Ent Air DB °F	Htg Cap	Power	Heat of Ext
45	1.062	0.739	1.158
50	1.050	0.790	1.130
55	1.037	0.842	1.096
60	1.025	0.893	1.064
65	1.012	0.945	1.030
68	1.005	0.976	1.012
70	**1.000**	**1.000**	**1.000**
75	0.987	1.048	0.970
80	0.975	1.099	0.930

11/10/09

Air Flow Corrections

Airflow		Cooling				Heating		
CFM Per Ton of Clg	% of Nominal	Total Cap	Sens Cap	Power	Heat of Rej	Htg Cap	Power	Heat of Ext
240	60	0.922	0.786	0.910	0.920	0.943	1.150	0.893
275	69	0.944	0.827	0.924	0.940	0.958	1.105	0.922
300	75	0.959	0.860	0.937	0.955	0.968	1.078	0.942
325	81	0.971	0.894	0.950	0.967	0.977	1.053	0.959
350	88	0.982	0.929	0.964	0.978	0.985	1.031	0.973
375	94	0.992	0.965	0.982	0.990	0.993	1.014	0.988
400	**100**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
425	106	1.007	1.034	1.020	1.010	1.007	0.990	1.011
450	113	1.012	1.065	1.042	1.018	1.013	0.983	1.020
475	119	1.017	1.093	1.066	1.026	1.018	0.980	1.028
500	125	1.019	1.117	1.092	1.033	1.023	0.978	1.034
520	130	1.020	1.132	1.113	1.038	1.026	0.975	1.038

11/10/09

Pressure Drop

Model	GPM	Pressure Drop (psi)				
		30°F	50°F	70°F	90°F	110°F
009	1.5	2.0	1.7	1.4	1.3	1.0
	2.0	3.8	3.2	2.8	2.3	1.8
	3.0	7.2	6.0	5.1	4.5	4.0
	4.0	12.0	10.0	9.0	7.5	6.0
012	1.5	1.1	1.0	0.9	0.8	0.7
	2.5	2.5	2.3	2.1	1.8	1.5
	3.5	3.9	3.6	3.2	2.7	2.3
	4.5	5.3	4.9	4.5	3.8	3.5
015	2.0	0.6	0.5	0.5	0.4	0.4
	3.0	1.1	1.0	0.9	0.8	0.6
	4.0	1.9	1.8	1.6	1.5	1.3
	5.0	3.3	3.2	3.0	2.9	2.7
018	3.0	1.1	1.0	0.9	0.8	0.6
	4.0	1.9	1.8	1.6	1.5	1.3
	5.0	3.3	3.2	3.0	2.9	2.7
	6.0	4.5	4.4	4.3	4.1	4.0
023	3.0	1.1	1.0	0.9	0.8	0.6
	4.5	2.4	2.2	2.1	2.0	1.9
	6.0	4.5	4.4	4.3	4.1	4.0
	8.0	6.7	6.6	6.5	6.3	6.2
024	3.0	1.1	1.0	0.9	0.8	0.6
	4.5	2.4	2.2	2.1	2.0	1.9
	6.0	4.5	4.4	4.3	4.1	4.0
	8.0	6.7	6.6	6.5	6.3	6.2
030	4.0	0.9	0.8	0.7	0.6	0.5
	6.0	1.9	1.8	1.7	1.6	1.5
	8.0	3.7	3.6	3.5	3.4	3.3
	10.0	4.8	4.7	4.6	4.5	4.4
036	5.0	1.4	1.1	0.9	0.7	0.5
	7.0	2.5	2.3	2.1	1.8	1.6
	9.0	6.0	5.8	5.5	5.3	5.1
	12.0	6.6	6.4	6.2	6.0	5.7
041	5.0	1.5	1.2	0.9	0.5	0.4
	8.0	3.4	3.1	2.8	2.5	2.1
	11.0	7.9	7.5	7.2	6.9	6.6
	14.0	9.1	8.8	8.5	8.2	7.9
042	5.0	1.5	1.2	0.9	0.5	0.4
	8.0	3.4	3.1	2.8	2.5	2.1
	11.0	7.9	7.5	7.2	6.9	6.6
	14.0	9.1	8.8	8.5	8.2	7.9
048	6.0	2.8	2.6	2.4	2.2	2.0
	9.0	6.5	6.3	6.0	5.8	5.5
	12.0	10.2	9.9	9.6	9.3	9.0
	16.0	12.9	12.6	12.2	11.8	11.4
060	9.0	4.1	3.8	3.6	3.4	3.1
	12.0	7.1	6.7	6.3	5.9	5.6
	15.0	9.6	9.2	8.9	8.6	8.3
	20.0	15.5	14.5	13.3	12.0	10.7
070	12.0	4.0	3.6	3.2	3.0	2.7
	15.0	6.4	6.0	5.6	5.2	4.8
	18.0	8.8	8.4	7.9	7.5	7.1
	24.0	13.6	13.2	12.6	12.0	11.5

11/10/09

Valve	GPM	Cv	Pressure Drop (psi)
1/2 in.	1.5	9.6	0.02
	2.0	9.7	0.04
	3.0	9.9	0.09
	4.0	10.1	0.16
1/2 in.	1.5	9.6	0.02
	2.5	9.8	0.06
	3.5	10.0	0.12
	4.5	10.2	0.19
1/2 in.	2.0	9.7	0.04
	3.0	9.9	0.09
	4.0	10.1	0.16
	5.0	10.4	0.23
1/2 in.	3.0	9.9	0.09
	4.0	10.1	0.16
	5.0	10.4	0.23
	6.0	10.6	0.32
3/4 in.	3.0	9.9	0.09
	4.5	10.2	0.19
	6.0	10.6	0.32
	8.0	11.0	0.53
3/4 in.	3.0	9.9	0.09
	4.5	10.2	0.19
	6.0	10.6	0.32
	8.0	11.0	0.53
3/4 in.	4.0	10.1	0.16
	6.0	10.6	0.32
	8.0	11.0	0.53
	10.0	11.5	0.76
3/4 in.	5.0	10.4	0.23
	7.0	10.8	0.42
	9.0	11.2	0.64
	12.0	11.9	1.02
3/4 in.	5.0	10.4	0.23
	8.0	11.0	0.53
	11.0	11.7	0.89
	14.0	12.3	1.29
1 in.	5.0	15.9	0.10
	8.0	16.6	0.23
	11.0	17.2	0.41
	14.0	17.9	0.61
1 in.	6.0	16.1	0.14
	9.0	16.8	0.29
	12.0	17.4	0.47
	16.0	18.3	0.76
1 in.	9.0	16.8	0.29
	12.0	17.4	0.47
	15.0	18.1	0.69
	20.0	19.2	1.09
1 in.	12.0	17.4	0.47
	15.0	18.1	0.69
	18.0	18.7	0.92
	24.0	20.1	1.43

11/10/09

ZS009 - Performance Data

Single Speed PSC (350 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F					COOLING - EAT 80/67°F					
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER
20	1.5	2.2	5.1	Operation not recommended					Operation not recommended					
	2.0	4.2	9.7											
	3.0	7.5	17.3	6.0	0.65	3.8	83.9	2.71						
30	1.5	2.0	4.6	Operation not recommended					Operation not recommended					
	2.0	3.8	8.8	6.1	0.64	3.9	84.1	2.79	11.2	7.5	0.67	0.52	13.0	21.7
	3.0	7.2	16.6	6.9	0.67	4.6	86.2	3.01	11.4	7.7	0.67	0.49	13.0	23.4
40	1.5	1.9	4.4	Operation not recommended					Operation not recommended					
	2.0	3.5	8.1	6.9	0.67	4.6	86.3	3.03	11.1	7.6	0.68	0.55	13.0	20.3
	3.0	6.5	15.0	7.5	0.69	5.2	87.9	3.21	11.2	7.7	0.68	0.52	13.0	21.6
50	1.5	1.7	3.9	7.6	0.69	5.2	88.1	3.23	11.1	7.6	0.69	0.59	13.1	18.6
	2.0	3.2	7.4	7.8	0.69	5.4	88.6	3.29	11.1	7.6	0.69	0.58	13.1	19.0
	3.0	6.0	13.8	8.2	0.70	5.8	89.6	3.41	11.1	7.6	0.69	0.56	13.0	19.9
60	1.5	1.6	3.6	8.7	0.72	6.2	90.9	3.52	10.4	7.3	0.70	0.66	12.6	15.9
	2.0	3.0	6.9	8.9	0.72	6.4	91.5	3.59	10.5	7.3	0.70	0.64	12.6	16.3
	3.0	5.6	12.8	9.3	0.73	6.8	92.7	3.74	10.5	7.4	0.70	0.61	12.6	17.2
70	1.5	1.4	3.2	9.7	0.75	7.1	93.7	3.79	9.8	7.0	0.71	0.72	12.2	13.6
	2.0	2.8	6.5	10.0	0.75	7.4	94.4	3.88	9.8	7.0	0.71	0.70	12.2	14.0
	3.0	5.1	11.9	10.5	0.76	7.9	95.8	4.05	10.0	7.2	0.72	0.67	12.3	14.9
80	1.5	1.4	3.1	11.2	0.77	8.5	97.5	4.27	9.0	6.8	0.75	0.80	11.7	11.3
	2.0	2.6	5.9	11.4	0.77	8.8	98.1	4.32	9.1	6.8	0.75	0.76	11.7	12.0
	3.0	4.8	11.0	11.8	0.78	9.1	99.1	4.42	9.3	7.0	0.75	0.74	11.8	12.6
90	1.5	1.3	3.0	12.6	0.78	9.9	101.4	4.74	8.3	6.6	0.79	0.87	11.3	9.5
	2.0	2.3	5.3	12.8	0.79	10.1	101.9	4.75	8.4	6.7	0.79	0.83	11.3	10.2
	3.0	4.5	10.4	13.0	0.80	10.3	102.4	4.76	8.6	6.8	0.79	0.80	11.3	10.7
100	1.5	1.3	2.9	Operation not recommended					Operation not recommended					
	2.0	2.1	4.7						7.9	6.5	0.83	0.91	11.0	8.6
	3.0	4.3	9.8						8.0	6.6	0.82	0.88	11.0	9.1
110	1.5	1.0	2.3						Operation not recommended					
	2.0	1.8	4.2						7.2	6.2	0.86	0.99	10.6	7.3
	3.0	4.0	9.2						7.4	6.3	0.86	0.96	10.6	7.7
120	1.5	0.9	2.1						Operation not recommended					
	2.0	1.7	3.9						6.2	5.6	0.89	1.07	9.9	5.8
	3.0	3.8	8.8						6.4	5.6	0.89	1.04	9.9	6.1

11/10/09

ZS012 - Performance Data

Single Speed PSC (400 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F					COOLING - EAT 80/67°F					
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER
20	1.5	1.2	2.8	Operation not recommended					Operation not recommended					
	2.5	2.6	6.0											
	3.5	4.1	9.5	7.2	0.81	4.4	84.7	2.61						
30	1.5	1.1	2.5	Operation not recommended					Operation not recommended					
	2.5	2.5	5.8	8.6	0.81	5.9	88.0	3.13	15.7	10.0	0.64	0.47	17.3	33.5
	3.5	3.9	9.0	8.9	0.83	6.1	88.6	3.14	15.9	10.2	0.64	0.44	17.4	36.1
40	1.5	1.1	2.4	Operation not recommended					Operation not recommended					
	2.5	2.4	5.5	9.6	0.83	6.8	90.2	3.39	15.3	10.0	0.65	0.53	17.1	28.6
	3.5	3.8	8.7	10.0	0.85	7.1	91.0	3.45	15.5	10.1	0.65	0.50	17.1	31.2
50	1.5	1.0	2.3	10.3	0.85	7.4	91.8	3.55	14.7	10.0	0.68	0.65	16.9	22.6
	2.5	2.3	5.3	10.7	0.86	7.7	92.7	3.65	14.9	10.0	0.67	0.60	16.9	24.8
	3.5	3.6	8.3	11.0	0.86	8.1	93.5	3.75	15.0	9.9	0.66	0.55	16.9	27.3
60	1.5	1.0	2.2	11.5	0.87	8.5	94.5	3.86	14.2	9.7	0.68	0.73	16.7	19.5
	2.5	2.2	5.1	11.9	0.88	8.9	95.5	3.96	14.4	9.7	0.68	0.68	16.7	21.1
	3.5	3.4	7.9	12.4	0.89	9.3	96.6	4.07	14.5	9.8	0.67	0.63	16.6	23.0
70	1.5	0.9	2.1	12.6	0.89	9.6	97.2	4.15	13.7	9.4	0.69	0.81	16.5	16.9
	2.5	2.1	4.9	13.2	0.91	10.1	98.4	4.26	13.9	9.5	0.69	0.76	16.4	18.2
	3.5	3.2	7.4	13.7	0.92	10.6	99.7	4.36	14.0	9.6	0.69	0.71	16.4	19.7
80	1.5	0.9	2.0	14.2	0.91	11.0	100.8	4.54	13.0	9.2	0.70	0.89	16.1	14.6
	2.5	2.0	4.5	14.6	0.93	11.4	101.7	4.60	13.2	9.3	0.70	0.85	16.1	15.5
	3.5	2.9	6.7	15.0	0.94	11.7	102.6	4.66	13.4	9.4	0.70	0.83	16.2	16.2
90	1.5	0.8	1.8	15.7	0.94	12.5	104.4	4.92	12.4	8.9	0.72	1.02	15.8	12.1
	2.5	1.8	4.2	16.0	0.95	12.7	104.9	4.93	12.5	9.0	0.72	0.97	15.9	12.9
	3.5	2.7	6.2	16.2	0.96	12.9	105.5	4.95	12.8	9.2	0.71	0.94	16.0	13.6
100	1.5	0.8	1.7	Operation not recommended					Operation not recommended					
	2.5	1.7	3.8						12.2	9.0	0.73	1.11	16.0	11.0
	3.5	2.5	5.8						12.4	9.0	0.73	1.07	16.1	11.6
110	1.5	0.7	1.6						Operation not recommended					
	2.5	1.5	3.5						11.8	8.8	0.75	1.23	16.0	9.5
	3.5	2.3	5.3						12.0	8.9	0.74	1.20	16.1	10.0
120	1.5	0.7	1.5						Operation not recommended					
	2.5	1.4	3.1						11.3	8.6	0.76	1.34	15.8	8.4
	3.5	2.1	4.9						11.5	8.7	0.76	1.30	15.9	8.8

11/10/09

ZS015 - Performance Data

Single Speed PSC (500 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	2.0	0.6	1.4	Operation not recommended						Operation not recommended						
	3.0	1.2	2.8													
	4.0	2.0	4.6	10.0	1.00	6.6	86.5	2.93	1.2							
30	2.0	0.6	1.4	Operation not recommended						Operation not recommended						
	3.0	1.1	2.6	11.0	1.04	7.4	88.3	3.09	1.3	14.5	9.8	0.68	0.71	16.9	20.3	---
	4.0	1.9	4.4	11.0	1.00	7.6	88.4	3.22	1.3	14.7	10.0	0.68	0.67	17.0	21.9	---
40	2.0	0.6	1.3	Operation not recommended						Operation not recommended						
	3.0	1.1	2.5	12.1	1.05	8.5	90.4	3.37	1.3	15.6	10.6	0.68	0.77	18.3	20.2	---
	4.0	1.8	4.3	12.4	1.04	8.8	90.9	3.50	1.3	15.9	10.8	0.68	0.74	18.4	21.4	---
50	2.0	0.5	1.2	13.0	1.06	9.4	92.1	3.59	1.4	16.5	11.3	0.68	0.85	19.4	19.4	0.8
	3.0	1.0	2.3	13.4	1.07	9.7	92.7	3.67	1.4	16.8	11.4	0.68	0.83	19.6	20.2	0.8
	4.0	1.8	4.1	13.7	1.07	10.1	93.4	3.75	1.5	17.0	11.5	0.68	0.81	19.8	21.0	0.8
60	2.0	0.5	1.2	14.4	1.07	10.7	94.6	3.93	1.6	15.7	10.9	0.69	0.92	18.8	17.2	0.9
	3.0	0.9	2.1	14.8	1.08	11.1	95.4	4.03	1.6	16.0	11.0	0.69	0.89	19.0	18.0	0.9
	4.0	1.7	3.9	15.3	1.09	11.5	96.2	4.12	1.7	16.2	11.1	0.68	0.86	19.1	18.9	0.8
70	2.0	0.5	1.1	15.7	1.08	12.0	97.1	4.26	1.8	14.9	10.5	0.70	0.98	18.2	15.2	1.1
	3.0	0.8	1.9	16.3	1.09	12.5	98.1	4.37	1.8	15.2	10.6	0.70	0.94	18.4	16.1	1.1
	4.0	1.6	3.7	16.8	1.10	13.1	99.1	4.48	1.8	15.4	10.6	0.69	0.90	18.5	17.1	1.0
80	2.0	0.5	1.1	17.6	1.10	13.8	100.5	4.69	2.0	14.2	10.2	0.72	1.03	17.7	13.7	1.4
	3.0	0.8	1.8	18.0	1.11	14.2	101.3	4.75	2.0	14.4	10.3	0.71	0.99	17.8	14.6	1.3
	4.0	1.5	3.6	18.4	1.12	14.6	102.1	4.81	2.1	14.7	10.4	0.71	0.96	17.9	15.3	1.3
90	2.0	0.4	1.0	19.4	1.11	15.6	103.9	5.12	2.3	13.4	9.9	0.74	1.09	17.1	12.3	1.8
	3.0	0.7	1.6	19.7	1.13	15.9	104.5	5.13	2.3	13.6	10.0	0.73	1.04	17.2	13.1	1.7
	4.0	1.5	3.4	20.0	1.14	16.1	105.0	5.14	2.3	13.9	10.1	0.73	1.01	17.3	13.8	1.6
100	2.0	0.4	0.9	Operation not recommended						Operation not recommended						
	3.0	0.6	1.4							12.8	9.7	0.76	1.16	16.7	11.0	2.1
	4.0	1.4	3.2							13.0	9.8	0.76	1.13	16.8	11.5	1.9
110	2.0	0.4	0.9							Operation not recommended						
	3.0	0.5	1.2							11.8	9.4	0.80	1.27	16.1	9.2	2.7
	4.0	1.3	3.0							12.0	9.5	0.79	1.24	16.2	9.7	2.5
120	2.0	0.4	0.9							Operation not recommended						
	3.0	0.5	1.1							10.8	9.1	0.84	1.41	15.6	7.6	3.3
	4.0	1.2	2.9							11.0	9.2	0.84	1.37	15.7	8.0	3.0

11/10/09

ZS018 - Performance Data

Single Speed PSC (600 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	3.0	1.2	2.8	Operation not recommended						Operation not recommended						
	4.0	2.0	4.6													
	5.0	3.4	7.8	13.0	1.21	8.9	88.1	3.15	1.4							
30	3.0	1.1	2.6	Operation not recommended						Operation not recommended						
	4.0	1.9	4.4	14.5	1.29	10.1	90.3	3.29	1.5	18.2	11.8	0.65	0.86	21.1	21.0	---
	5.0	3.3	7.6	14.9	1.31	10.4	91.0	3.33	1.5	18.4	12.0	0.65	0.81	21.2	22.7	---
40	3.0	1.1	2.5	Operation not recommended						Operation not recommended						
	4.0	1.8	4.3	15.7	1.34	11.1	92.2	3.43	1.6	19.1	12.4	0.65	0.92	22.2	20.8	---
	5.0	3.2	7.5	16.5	1.37	11.8	93.4	3.52	1.6	19.4	12.6	0.65	0.89	22.4	21.9	---
50	3.0	1.0	2.3	16.0	1.36	11.4	92.7	3.45	1.7	19.7	12.8	0.65	0.98	23.0	20.1	0.9
	4.0	1.8	4.1	17.0	1.40	12.2	94.2	3.57	1.7	20.0	13.0	0.65	0.97	23.3	20.6	0.9
	5.0	3.2	7.3	18.0	1.43	13.1	95.8	3.69	1.8	20.3	13.1	0.65	0.96	23.6	21.1	0.9
60	3.0	0.9	2.1	17.5	1.43	12.6	95.0	3.60	1.9	18.7	12.4	0.66	1.07	22.3	17.6	1.1
	4.0	1.7	3.9	18.5	1.45	13.5	96.5	3.73	1.9	18.9	12.6	0.67	1.06	22.5	17.9	1.1
	5.0	3.1	7.1	19.5	1.48	14.5	98.1	3.86	2.0	19.2	12.8	0.67	1.05	22.7	18.3	1.0
70	3.0	0.8	1.9	19.0	1.49	13.9	97.3	3.74	2.1	17.7	12.0	0.68	1.15	21.6	15.4	1.3
	4.0	1.6	3.7	20.0	1.51	14.8	98.9	3.88	2.1	17.9	12.3	0.69	1.14	21.7	15.7	1.3
	5.0	3.0	6.9	21.0	1.53	15.8	100.4	4.02	2.2	18.0	12.5	0.69	1.13	21.9	15.9	1.2
80	3.0	0.8	1.8	21.9	1.56	16.5	101.7	4.10	2.4	16.6	11.4	0.69	1.36	21.2	12.2	1.7
	4.0	1.5	3.6	22.6	1.58	17.2	102.8	4.17	2.4	16.8	11.7	0.70	1.30	21.2	12.9	1.6
	5.0	2.9	6.8	23.3	1.61	17.8	103.9	4.25	2.5	17.0	12.0	0.70	1.26	21.3	13.5	1.5
90	3.0	0.7	1.6	24.7	1.64	19.1	106.2	4.43	2.8	15.4	10.8	0.70	1.49	20.5	10.3	2.2
	4.0	1.5	3.4	25.1	1.66	19.5	106.8	4.44	2.8	15.7	11.1	0.71	1.43	20.5	11.0	2.0
	5.0	2.9	6.6	25.5	1.68	19.8	107.4	4.45	2.8	16.0	11.4	0.71	1.38	20.7	11.6	1.9
100	3.0	0.6	1.4	Operation not recommended						Operation not recommended						
	4.0	1.4	3.2							14.9	11.0	0.74	1.52	20.1	9.8	2.5
	5.0	2.8	6.4							15.1	11.1	0.73	1.47	20.1	10.3	2.3
110	3.0	0.5	1.2							Operation not recommended						
	4.0	1.3	3.0							13.9	10.5	0.76	1.60	19.4	8.7	3.2
	5.0	2.7	6.2							14.2	10.7	0.75	1.56	19.5	9.1	3.0
120	3.0	0.5	1.1							Operation not recommended						
	4.0	1.2	2.9							13.2	10.1	0.76	1.76	19.2	7.5	4.0
	5.0	2.6	6.1							13.5	10.2	0.76	1.71	19.3	7.9	3.6

11/10/09

ZS023 - Performance Data

Single Speed PSC (700 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F					COOLING - EAT 80/67°F					
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER
20	3.0	1.2	2.8	Operation not recommended					Operation not recommended					
	4.5	2.4	5.6											
	6.0	4.6	10.6	15.0	1.68	9.2	85.3	2.61						
30	3.0	1.1	2.6	Operation not recommended					Operation not recommended					
	4.5	2.4	5.5	17.9	1.74	11.9	88.7	3.01	26.3	16.7	0.63	1.11	30.1	23.8
	6.0	4.5	10.5	18.2	1.76	12.2	89.1	3.04	26.7	17.0	0.64	1.04	30.2	25.7
40	3.0	1.1	2.5	Operation not recommended					Operation not recommended					
	4.5	2.3	5.3	19.6	1.78	13.6	90.7	3.24	26.5	17.0	0.64	1.20	30.6	22.0
	6.0	4.5	10.3	20.3	1.80	14.1	91.4	3.30	26.8	17.3	0.64	1.14	30.7	23.6
50	3.0	1.0	2.3	20.8	1.79	14.7	92.1	3.41	26.4	17.3	0.66	1.37	31.1	19.3
	4.5	2.2	5.2	21.6	1.82	15.4	92.9	3.48	26.6	17.4	0.65	1.30	31.1	20.5
	6.0	4.4	10.2	22.3	1.84	16.0	93.8	3.55	26.9	17.5	0.65	1.23	31.1	21.9
60	3.0	1.0	2.2	23.0	1.83	16.7	94.6	3.68	25.7	17.0	0.66	1.52	30.9	16.9
	4.5	2.2	5.0	23.8	1.85	17.5	95.5	3.76	25.9	17.1	0.66	1.44	30.9	18.0
	6.0	4.3	10.0	24.6	1.88	18.2	96.4	3.84	26.2	17.2	0.66	1.36	30.8	19.3
70	3.0	0.9	2.0	25.2	1.87	18.8	97.1	3.94	25.0	16.7	0.67	1.67	30.7	15.0
	4.5	2.1	4.9	26.0	1.89	19.6	98.1	4.03	25.3	16.8	0.67	1.58	30.6	16.0
	6.0	4.3	9.9	26.9	1.91	20.4	99.1	4.12	25.5	16.9	0.66	1.49	30.6	17.1
80	3.0	0.8	1.9	27.9	1.88	21.5	100.2	4.35	23.8	16.1	0.68	1.81	30.0	13.1
	4.5	2.1	4.7	28.5	1.90	22.0	101.0	4.40	24.1	16.3	0.68	1.73	30.0	13.9
	6.0	4.2	9.7	29.2	1.92	22.6	101.8	4.46	24.5	16.5	0.67	1.68	30.2	14.6
90	3.0	0.8	1.7	30.6	1.88	24.1	103.4	4.76	22.7	15.6	0.69	2.01	29.6	11.3
	4.5	2.0	4.6	31.0	1.91	24.5	103.9	4.77	23.0	15.8	0.69	1.92	29.6	12.0
	6.0	4.1	9.6	31.5	1.93	24.9	104.5	4.78	23.5	16.0	0.68	1.86	29.8	12.6
100	3.0	0.7	1.6	Operation not recommended					Operation not recommended					
	4.5	1.9	4.4						21.7	15.1	0.69	2.20	29.2	9.9
	6.0	4.1	9.4						22.1	15.2	0.69	2.13	29.3	10.4
110	3.0	0.6	1.4						Operation not recommended					
	4.5	1.9	4.3						20.2	14.2	0.70	2.46	28.6	8.2
	6.0	4.0	9.3						20.6	14.4	0.70	2.39	28.8	8.6
120	3.0	0.6	1.3						Operation not recommended					
	4.5	1.8	4.1						18.4	14.2	0.77	2.85	28.2	6.5
	6.0	3.9	9.1						18.8	14.4	0.77	2.77	28.3	6.8

11/10/09

ZS024 - Performance Data

Single Speed PSC (800 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	3.0	1.2	2.8	Operation not recommended						Operation not recommended						
	4.5	2.4	5.6													
	6.0	4.6	10.6	15.6	1.68	9.8	86.0	2.72	1.6							
30	3.0	1.1	2.6	Operation not recommended						Operation not recommended						
	4.5	2.4	5.5	18.7	1.74	12.7	89.6	3.14	1.7	27.5	17.4	0.63	1.11	31.2	24.8	---
	6.0	4.5	10.5	19.0	1.76	13.0	90.0	3.16	1.7	27.8	17.7	0.64	1.04	31.4	26.8	---
40	3.0	1.1	2.5	Operation not recommended						Operation not recommended						
	4.5	2.3	5.3	20.5	1.78	14.4	91.7	3.38	1.9	27.6	17.7	0.64	1.20	31.7	22.9	---
	6.0	4.5	10.3	21.1	1.80	15.0	92.4	3.44	1.9	27.9	18.0	0.64	1.14	31.8	24.6	---
50	3.0	1.0	2.3	21.7	1.79	15.6	93.2	3.56	2.1	27.5	18.0	0.65	1.37	32.2	20.1	1.3
	4.5	2.2	5.2	22.5	1.82	16.3	94.0	3.63	2.1	27.8	18.1	0.65	1.30	32.2	21.4	1.2
	6.0	4.4	10.2	23.2	1.84	16.9	94.9	3.70	2.2	28.0	18.2	0.65	1.23	32.2	22.7	1.2
60	3.0	1.0	2.2	24.0	1.83	17.7	95.7	3.84	2.3	26.8	17.7	0.66	1.52	32.0	17.6	1.5
	4.5	2.2	5.0	24.8	1.85	18.5	96.7	3.92	2.4	27.0	17.8	0.66	1.44	32.0	18.8	1.4
	6.0	4.3	10.0	25.6	1.88	19.2	97.6	4.00	2.4	27.3	17.9	0.66	1.36	31.9	20.1	1.4
70	3.0	0.9	2.0	26.2	1.87	19.8	98.3	4.10	2.6	26.1	17.4	0.67	1.67	31.8	15.6	1.8
	4.5	2.1	4.9	27.1	1.89	20.6	99.4	4.20	2.6	26.3	17.5	0.66	1.58	31.7	16.7	1.8
	6.0	4.3	9.9	28.0	1.91	21.5	100.4	4.30	2.7	26.6	17.6	0.66	1.49	31.6	17.8	1.7
80	3.0	0.8	1.9	29.0	1.88	22.6	101.5	4.53	2.9	24.9	16.8	0.68	1.81	31.1	13.7	2.3
	4.5	2.1	4.7	29.7	1.90	23.2	102.4	4.58	2.9	25.2	17.0	0.68	1.73	31.1	14.5	2.2
	6.0	4.2	9.7	30.4	1.92	23.8	103.2	4.64	3.0	25.5	17.1	0.67	1.68	31.2	15.2	2.1
90	3.0	0.8	1.7	31.8	1.88	25.4	104.8	4.95	3.3	23.6	16.2	0.69	2.01	30.5	11.7	2.8
	4.5	2.0	4.6	32.3	1.91	25.8	105.4	4.96	3.4	24.0	16.5	0.69	1.92	30.6	12.5	2.7
	6.0	4.1	9.6	32.8	1.93	26.2	105.9	4.98	3.5	24.5	16.7	0.68	1.86	30.8	13.2	2.5
100	3.0	0.7	1.6	Operation not recommended						Operation not recommended						
	4.5	1.9	4.4							22.7	16.0	0.71	2.20	30.2	10.3	3.4
	6.0	4.1	9.4							23.0	16.2	0.70	2.13	30.3	10.8	3.2
110	3.0	0.6	1.4							Operation not recommended						
	4.5	1.9	4.3							21.1	15.4	0.73	2.46	29.5	8.6	4.1
	6.0	4.0	9.3							21.5	15.6	0.73	2.39	29.7	9.0	3.9
120	3.0	0.6	1.3							Operation not recommended						
	4.5	1.8	4.1							19.1	14.8	0.77	2.85	28.9	6.7	4.9
	6.0	3.9	9.1							19.6	15.0	0.77	2.77	29.0	7.1	4.6

11/10/09

ZS030 - Performance Data

Single Speed PSC (1000 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	4.0	1.0	2.2	Operation not recommended						Operation not recommended						
	6.0	1.9	4.5													
	8.0	3.8	8.7	20.0	1.90	13.5	86.5	3.09	1.9							
30	4.0	0.9	2.1	Operation not recommended						Operation not recommended						
	6.0	1.9	4.4	21.2	1.96	14.5	87.6	3.16	2.1	30.4	19.3	0.64	1.38	35.1	21.9	---
	8.0	3.7	8.5	22.0	1.98	15.2	88.4	3.26	2.1	30.8	19.7	0.64	1.30	35.2	23.7	---
40	4.0	0.9	2.0	Operation not recommended						Operation not recommended						
	6.0	1.8	4.3	23.9	2.00	17.1	90.1	3.50	2.3	31.3	20.2	0.64	1.41	36.1	22.1	---
	8.0	3.7	8.4	25.0	2.02	18.1	91.1	3.62	2.4	32.4	20.9	0.65	1.40	37.2	23.1	---
50	4.0	0.8	1.9	25.8	2.01	18.9	91.9	3.76	2.5	30.5	19.9	0.65	1.39	35.2	21.9	1.4
	6.0	1.8	4.1	26.9	2.04	19.9	92.9	3.87	2.6	32.3	21.0	0.65	1.45	37.2	22.3	1.3
	8.0	3.6	8.3	27.9	2.06	20.9	93.8	3.97	2.7	34.0	22.1	0.65	1.50	39.1	22.7	1.3
60	4.0	0.8	1.8	29.4	2.05	22.4	95.2	4.20	2.9	30.1	19.7	0.66	1.54	35.3	19.5	1.6
	6.0	1.7	4.0	30.5	2.07	23.4	96.2	4.31	2.9	31.9	20.9	0.66	1.60	37.4	20.0	1.5
	8.0	3.6	8.2	31.6	2.10	24.5	97.3	4.42	3.0	33.8	22.1	0.66	1.65	39.4	20.5	1.4
70	4.0	0.7	1.6	33.0	2.09	25.9	98.6	4.63	3.2	29.6	19.5	0.66	1.69	35.4	17.5	2.0
	6.0	1.7	3.9	34.2	2.11	27.0	99.6	4.74	3.3	31.6	20.8	0.66	1.75	37.6	18.1	1.9
	8.0	3.5	8.1	35.3	2.13	28.0	100.7	4.86	3.4	33.6	22.2	0.66	1.80	39.7	18.7	1.8
80	4.0	0.7	1.5	36.9	2.19	29.4	102.1	4.93	3.6	29.3	19.3	0.66	2.16	36.6	13.6	2.5
	6.0	1.6	3.8	37.8	2.22	30.2	103.0	4.99	3.7	30.7	20.4	0.66	2.06	37.8	15.0	2.4
	8.0	3.5	8.0	38.7	2.24	31.0	103.8	5.06	3.8	32.1	21.5	0.67	1.99	38.8	16.1	2.3
90	4.0	0.6	1.4	40.7	2.29	32.9	105.7	5.21	4.1	29.0	19.0	0.66	2.36	37.0	12.3	3.3
	6.0	1.6	3.7	41.4	2.32	33.4	106.3	5.22	4.2	29.9	20.0	0.67	2.25	37.6	13.3	3.1
	8.0	3.4	7.9	42.0	2.35	34.0	106.9	5.24	4.3	30.5	20.7	0.68	2.18	37.9	14.0	3.0
100	4.0	0.6	1.3	Operation not recommended						Operation not recommended						
	6.0	1.6	3.6							27.5	19.7	0.72	2.58	36.3	10.7	3.9
	8.0	3.4	7.8							28.0	19.9	0.71	2.50	36.5	11.2	3.7
110	4.0	0.5	1.2							Operation not recommended						
	6.0	1.5	3.5							24.9	18.7	0.75	2.89	34.7	8.6	4.9
	8.0	3.3	7.6							25.4	19.0	0.75	2.81	35.0	9.0	4.5
120	4.0	0.5	1.1							Operation not recommended						
	6.0	1.5	3.3							21.1	17.2	0.82	3.09	31.7	6.8	5.7
	8.0	3.3	7.5							21.6	17.5	0.81	3.00	31.8	7.2	5.4

11/10/09

ZS036 - Performance Data

Single Speed PSC (1250 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	5.0	1.5	3.4	Operation not recommended						Operation not recommended						
	7.0	2.6	6.0													
	9.0	6.1	14.1	23.4	2.43	15.1	86.9	2.83	2.3							
30	5.0	1.4	3.1	Operation not recommended						Operation not recommended						
	7.0	2.5	5.8	27.4	2.46	19.0	90.1	3.27	2.5	35.9	25.1	0.70	1.64	41.5	21.9	---
	9.0	6.0	13.8	28.2	2.51	19.6	90.7	3.29	2.6	36.4	25.6	0.70	1.54	41.7	23.6	---
40	5.0	1.3	2.9	Operation not recommended						Operation not recommended						
	7.0	2.4	5.5	30.8	2.52	22.2	92.8	3.58	2.9	38.7	27.2	0.70	1.74	44.6	22.2	---
	9.0	5.9	13.6	31.9	2.57	23.2	93.7	3.65	2.9	39.2	27.5	0.70	1.66	44.9	23.6	---
50	5.0	1.1	2.6	33.3	2.53	24.6	94.8	3.85	3.1	40.9	29.1	0.71	1.90	47.4	21.5	1.6
	7.0	2.3	5.2	34.5	2.58	25.7	95.8	3.92	3.2	41.5	29.2	0.70	1.84	47.7	22.5	1.5
	9.0	5.8	13.3	35.7	2.62	26.8	96.7	3.99	3.3	42.0	29.4	0.70	1.78	48.1	23.6	1.5
60	5.0	1.0	2.4	37.7	2.60	28.8	98.3	4.25	3.5	39.2	28.5	0.73	2.09	46.4	18.8	2.0
	7.0	2.2	5.0	39.0	2.64	30.0	99.4	4.33	3.6	39.9	28.7	0.72	2.02	46.8	19.7	1.9
	9.0	5.7	13.1	40.2	2.67	31.1	100.4	4.42	3.6	40.5	28.9	0.71	1.96	47.2	20.7	1.8
70	5.0	0.9	2.1	42.1	2.67	33.0	101.9	4.62	3.9	37.6	27.9	0.74	2.28	45.3	16.5	2.5
	7.0	2.1	4.7	43.5	2.70	34.3	103.0	4.73	4.0	38.3	28.2	0.74	2.21	45.8	17.4	2.4
	9.0	5.5	12.8	44.8	2.72	35.5	104.1	4.83	4.1	39.0	28.5	0.73	2.13	46.3	18.3	2.3
80	5.0	0.8	1.8	46.7	2.73	37.4	105.6	5.01	4.4	36.1	27.1	0.75	2.55	44.8	14.1	3.2
	7.0	1.9	4.5	47.7	2.76	38.3	106.4	5.07	4.5	36.7	27.6	0.75	2.43	45.0	15.1	3.0
	9.0	5.4	12.5	48.8	2.79	39.3	107.3	5.13	4.6	37.4	28.0	0.75	2.36	45.4	15.9	2.9
90	5.0	0.7	1.6	51.2	2.79	41.7	109.3	5.39	4.9	34.5	26.3	0.76	2.79	44.1	12.4	3.9
	7.0	1.8	4.2	52.0	2.83	42.4	109.9	5.40	5.1	35.1	27.0	0.77	2.67	44.2	13.2	3.7
	9.0	5.3	12.3	52.8	2.86	43.1	110.5	5.41	5.2	35.8	27.5	0.77	2.58	44.6	13.9	3.6
100	5.0	0.6	1.3	Operation not recommended						Operation not recommended						
	7.0	1.7	4.0							33.3	26.4	0.79	2.98	43.5	11.2	4.6
	9.0	5.2	12.0							33.8	26.6	0.79	2.89	43.6	11.7	4.4
110	5.0	0.5	1.1							Operation not recommended						
	7.0	1.6	3.7							31.2	25.3	0.81	3.28	42.4	9.5	5.7
	9.0	5.1	11.8							31.8	25.7	0.81	3.19	42.7	10.0	5.4
120	5.0	0.4	0.8							Operation not recommended						
	7.0	1.5	3.5							26.5	22.7	0.85	3.61	38.8	7.4	6.8
	9.0	5.0	11.5							27.1	23.0	0.85	3.50	39.0	7.7	6.4

11/10/09

ZS041 - Performance Data

Single Speed PSC (1300 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	5.0	1.6	3.8	Operation not recommended						Operation not recommended						
	8.0	3.6	8.2													
	11.0	8.0	18.5	25.7	2.81	16.1	85.0	2.68	3.5							
30	5.0	1.5	3.4	Operation not recommended						Operation not recommended						
	8.0	3.4	7.8	28.5	2.82	18.9	86.9	2.97	3.7	41.9	30.4	0.73	1.93	48.4	21.7	---
	11.0	7.9	18.1	29.5	2.86	19.7	87.5	3.02	3.8	42.4	31.0	0.73	1.81	48.6	23.4	---
40	5.0	1.3	3.0	Operation not recommended						Operation not recommended						
	8.0	3.2	7.5	31.7	2.88	21.9	89.0	3.23	4.0	43.8	31.4	0.72	2.06	50.9	21.2	---
	11.0	7.7	17.8	33.0	2.91	23.1	89.8	3.33	4.1	44.4	31.9	0.72	1.95	51.1	22.8	---
50	5.0	1.2	2.7	33.7	2.92	23.7	90.3	3.38	4.4	45.2	32.0	0.71	2.31	53.1	19.6	2.4
	8.0	3.1	7.1	35.2	2.94	25.1	91.2	3.50	4.5	45.8	32.4	0.71	2.20	53.3	20.8	2.4
	11.0	7.5	17.4	36.6	2.96	26.5	92.2	3.62	4.7	46.5	32.7	0.70	2.09	53.6	22.2	2.3
60	5.0	1.0	2.3	37.8	2.99	27.7	93.0	3.72	5.0	44.2	31.5	0.71	2.57	52.9	17.2	3.0
	8.0	2.9	6.7	39.3	3.01	29.0	94.0	3.83	5.1	45.1	31.8	0.70	2.43	53.4	18.6	2.8
	11.0	7.4	17.0	40.7	3.03	30.4	94.9	3.95	5.3	46.1	32.1	0.70	2.30	53.9	20.1	2.7
70	5.0	0.9	2.0	42.0	3.05	31.6	95.8	4.03	5.6	43.1	30.9	0.72	2.82	52.7	15.3	3.8
	8.0	2.8	6.4	43.4	3.07	32.9	96.7	4.14	5.7	44.4	31.2	0.70	2.66	53.5	16.7	3.6
	11.0	7.2	16.7	44.8	3.09	34.3	97.7	4.25	5.9	45.7	31.5	0.69	2.50	54.2	18.3	3.4
80	5.0	0.7	1.6	46.9	3.11	36.3	99.0	4.42	6.3	41.7	30.4	0.73	3.02	52.0	13.8	4.8
	8.0	2.6	6.0	48.0	3.15	37.3	99.8	4.48	6.5	42.6	30.6	0.72	2.88	52.5	14.8	4.5
	11.0	7.1	16.3	49.2	3.18	38.3	100.5	4.54	6.7	43.7	30.8	0.71	2.79	53.2	15.7	4.3
90	5.0	0.5	1.2	51.9	3.18	41.0	102.3	4.78	7.1	40.2	29.8	0.74	3.34	51.6	12.1	6.0
	8.0	2.5	5.7	52.7	3.22	41.7	102.8	4.79	7.3	40.9	30.0	0.73	3.18	51.7	12.8	5.7
	11.0	6.9	16.0	53.5	3.26	42.4	103.4	4.81	7.5	41.7	30.1	0.72	3.08	52.2	13.5	5.5
100	5.0	0.4	0.9	Operation not recommended						Operation not recommended						
	8.0	2.3	5.3							38.2	29.0	0.76	3.55	50.3	10.8	7.1
	11.0	6.8	15.6							38.8	29.2	0.75	3.44	50.5	11.3	6.8
110	5.0	0.4	0.9							Operation not recommended						
	8.0	2.1	4.9							35.2	27.9	0.79	3.91	48.5	9.0	8.6
	11.0	6.6	15.2							35.9	28.3	0.79	3.80	48.9	9.4	8.3
120	5.0	0.4	0.9							Operation not recommended						
	8.0	2.0	4.6							31.8	27.1	0.85	4.55	47.4	7.0	10.4
	11.0	6.5	14.9							32.5	27.5	0.84	4.42	47.6	7.4	10.0

11/10/09

ZS042 - Performance Data

Single Speed PSC (1400 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	5.0	1.6	3.8	Operation not recommended						Operation not recommended						
	8.0	3.6	8.2													
	11.0	8.0	18.5	27.0	2.81	17.4	85.9	2.82	3.5							
30	5.0	1.5	3.4	Operation not recommended						Operation not recommended						
	8.0	3.4	7.8	30.0	2.82	20.4	87.8	3.12	3.7	43.6	31.7	0.73	1.93	50.2	22.6	---
	11.0	7.9	18.1	31.0	2.86	21.2	88.5	3.18	3.8	44.2	32.3	0.73	1.81	50.4	24.4	---
40	5.0	1.3	3.0	Operation not recommended						Operation not recommended						
	8.0	3.2	7.5	33.4	2.88	23.5	90.1	3.40	4.0	45.7	32.7	0.72	2.06	52.7	22.1	---
	11.0	7.7	17.8	34.8	2.91	24.8	91.0	3.50	4.1	46.3	33.2	0.72	1.95	53.0	23.7	---
50	5.0	1.2	2.7	35.5	2.92	25.5	91.5	3.56	4.4	47.1	33.4	0.71	2.31	55.0	20.4	2.4
	8.0	3.1	7.1	37.0	2.94	27.0	92.5	3.69	4.5	47.8	33.8	0.71	2.20	55.3	21.7	2.4
	11.0	7.5	17.4	38.5	2.96	28.4	93.5	3.81	4.7	48.4	34.1	0.70	2.09	55.5	23.2	2.3
60	5.0	1.0	2.3	39.9	2.99	29.7	94.4	3.91	5.0	46.0	32.8	0.71	2.57	54.8	17.9	3.0
	8.0	2.9	6.7	41.4	3.01	31.1	95.3	4.03	5.1	47.0	33.1	0.70	2.43	55.3	19.3	2.8
	11.0	7.4	17.0	42.9	3.03	32.5	96.3	4.15	5.3	48.0	33.5	0.70	2.30	55.8	20.9	2.7
70	5.0	0.9	2.0	44.2	3.05	33.8	97.2	4.25	5.6	44.9	32.2	0.72	2.82	54.5	15.9	3.8
	8.0	2.8	6.4	45.7	3.07	35.2	98.2	4.36	5.7	46.3	32.5	0.70	2.66	55.3	17.4	3.6
	11.0	7.2	16.7	47.2	3.09	36.7	99.2	4.48	5.9	47.6	32.8	0.69	2.50	56.1	19.0	3.4
80	5.0	0.7	1.6	49.4	3.11	38.8	100.7	4.65	6.3	43.4	31.6	0.73	3.02	53.8	14.4	4.8
	8.0	2.6	6.0	50.6	3.15	39.8	101.5	4.71	6.5	44.4	31.9	0.72	2.88	54.3	15.4	4.5
	11.0	7.1	16.3	51.8	3.18	40.9	102.2	4.78	6.7	45.6	32.1	0.70	2.79	55.1	16.3	4.3
90	5.0	0.5	1.2	54.6	3.18	43.8	104.1	5.04	7.1	42.0	31.0	0.74	3.34	53.4	12.6	6.0
	8.0	2.5	5.7	55.5	3.22	44.5	104.7	5.05	7.3	42.6	31.2	0.73	3.18	53.5	13.4	5.7
	11.0	6.9	16.0	56.3	3.26	45.2	105.2	5.06	7.5	43.5	31.4	0.72	3.08	54.0	14.1	5.5
100	5.0	0.4	0.9	Operation not recommended						Operation not recommended						
	8.0	2.3	5.3							39.8	30.2	0.76	3.55	52.0	11.2	7.1
	11.0	6.8	15.6							40.5	30.5	0.75	3.44	52.2	11.8	6.8
110	5.0	0.4	0.9							Operation not recommended						
	8.0	2.1	4.9							36.7	29.1	0.79	3.91	50.0	9.4	8.6
	11.0	6.6	15.2							37.4	29.5	0.79	3.80	50.4	9.8	8.3
120	5.0	0.4	0.9							Operation not recommended						
	8.0	2.0	4.6							33.2	28.2	0.85	4.55	48.7	7.3	10.4
	11.0	6.5	14.9							33.9	28.6	0.84	4.42	49.0	7.7	10.0

11/10/09

ZS048 - Performance Data

Single Speed PSC (1600 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	6.0	2.1	4.8	Operation not recommended						Operation not recommended						
	9.0	4.1	9.4													
	12.0	6.5	15.0	30.8	3.32	19.5	87.0	2.72	4.6							
30	6.0	1.9	4.3	Operation not recommended						Operation not recommended						
	9.0	3.9	8.9	35.3	3.31	24.0	89.8	3.12	4.9	50.3	31.3	0.62	2.33	58.3	21.6	---
	12.0	6.5	14.9	35.8	3.35	24.4	90.1	3.13	5.0	51.0	31.9	0.63	2.19	58.5	23.3	---
40	6.0	1.7	3.9	Operation not recommended						Operation not recommended						
	9.0	3.7	8.5	40.1	3.44	28.4	92.8	3.41	5.4	53.1	34.8	0.65	2.52	61.7	21.1	---
	12.0	6.1	14.1	41.9	3.51	30.0	93.9	3.51	5.5	54.0	35.5	0.66	2.39	62.2	22.6	---
50	6.0	1.5	3.4	42.9	3.50	31.0	94.5	3.60	5.9	54.9	37.4	0.68	2.84	64.6	19.3	2.9
	9.0	3.5	8.0	45.5	3.58	33.3	96.1	3.73	6.1	56.0	38.3	0.68	2.72	65.2	20.6	2.8
	12.0	5.9	13.7	48.1	3.66	35.6	97.7	3.85	6.2	57.0	39.1	0.69	2.59	65.8	22.0	2.7
60	6.0	1.3	3.0	49.5	3.67	37.0	98.6	3.96	6.7	54.5	37.4	0.69	3.14	65.2	17.4	3.5
	9.0	3.3	7.6	52.2	3.73	39.5	100.2	4.11	6.8	55.4	38.0	0.69	2.99	65.6	18.5	3.4
	12.0	5.7	13.2	54.9	3.79	42.0	101.9	4.25	7.0	56.2	38.6	0.69	2.85	65.9	19.8	3.2
70	6.0	1.1	2.5	56.1	3.83	43.0	102.6	4.29	7.5	54.1	37.3	0.69	3.43	65.8	15.8	4.5
	9.0	3.1	7.1	58.9	3.87	45.7	104.4	4.46	7.7	54.8	37.7	0.69	3.27	65.9	16.8	4.3
	12.0	5.5	12.8	61.7	3.91	48.4	106.1	4.63	7.9	55.4	38.2	0.69	3.10	66.0	17.9	4.0
80	6.0	0.9	2.1	61.3	3.91	47.9	105.8	4.59	8.4	51.4	35.8	0.70	3.71	64.0	13.9	5.6
	9.0	2.9	6.7	63.2	3.96	49.7	107.0	4.68	8.6	52.1	36.4	0.70	3.54	64.2	14.7	5.3
	12.0	5.3	12.3	65.2	4.01	51.5	108.2	4.77	8.9	52.9	36.9	0.70	3.43	64.6	15.5	5.1
90	6.0	0.7	1.6	66.5	4.00	52.9	109.1	4.88	9.4	48.7	34.3	0.70	4.06	62.5	12.0	7.0
	9.0	2.7	6.2	67.5	4.05	53.7	109.7	4.89	9.7	49.4	35.0	0.71	3.87	62.7	12.8	6.7
	12.0	5.1	11.9	68.6	4.10	54.6	110.3	4.90	10.1	50.4	35.6	0.70	3.75	63.2	13.5	6.4
100	6.0	0.5	1.2	Operation not recommended						Operation not recommended						
	9.0	2.5	5.8							46.7	34.3	0.74	4.37	61.6	10.7	8.4
	12.0	5.0	11.4							47.4	34.6	0.73	4.23	61.8	11.2	8.0
110	6.0	0.3	0.7							Operation not recommended						
	9.0	2.3	5.3							43.4	33.2	0.76	4.83	59.9	9.0	10.3
	12.0	4.8	11.0							44.3	33.7	0.76	4.70	60.4	9.4	9.7
120	6.0	0.1	0.3							Operation not recommended						
	9.0	2.1	4.9							40.1	32.0	0.80	5.40	58.5	7.4	12.4
	12.0	4.6	10.5							41.0	32.5	0.79	5.24	58.8	7.8	11.8

11/10/09

ZS060 - Performance Data

Single Speed PSC (2000 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	9.0	4.2	9.7	Operation not recommended						Operation not recommended						
	12.0	6.9	16.0													
	15.0	9.8	22.6	41.9	4.06	28.0	87.4	3.02	5.5							
30	9.0	4.1	9.4	Operation not recommended						Operation not recommended						
	12.0	6.8	15.7	43.8	3.99	30.2	88.3	3.22	5.9	72.0	49.1	0.68	2.96	82.1	24.3	---
	15.0	9.6	22.2	46.5	4.11	32.5	89.5	3.31	6.1	73.0	50.0	0.68	2.78	82.5	26.3	---
40	9.0	3.9	9.1	Operation not recommended						Operation not recommended						
	12.0	6.6	15.4	49.7	4.12	35.6	91.0	3.53	6.6	70.8	48.8	0.69	3.11	81.4	22.8	---
	15.0	9.4	21.7	52.2	4.22	37.8	92.2	3.63	6.7	71.8	49.5	0.69	2.97	81.9	24.2	---
50	9.0	3.8	8.8	54.6	4.20	40.3	93.3	3.81	7.1	68.5	48.0	0.70	3.34	79.9	20.5	3.9
	12.0	6.5	15.0	56.2	4.26	41.7	94.0	3.87	7.3	69.5	48.5	0.70	3.25	80.6	21.4	3.7
	15.0	9.2	21.3	57.8	4.32	43.1	94.8	3.92	7.5	70.5	48.9	0.69	3.16	81.3	22.3	3.5
60	9.0	3.7	8.5	62.2	4.35	47.3	96.8	4.19	8.0	67.3	47.0	0.70	3.64	79.7	18.5	4.8
	12.0	6.4	14.7	64.3	4.41	49.3	97.8	4.28	8.3	68.2	47.6	0.70	3.54	80.3	19.3	4.6
	15.0	9.1	20.9	66.4	4.46	51.2	98.8	4.36	8.5	69.1	48.3	0.70	3.45	80.9	20.1	4.4
70	9.0	3.6	8.3	69.8	4.50	54.4	100.3	4.54	9.0	66.0	46.0	0.70	3.93	79.4	16.8	6.0
	12.0	6.2	14.4	72.4	4.55	56.9	101.5	4.66	9.3	66.9	46.8	0.70	3.83	79.9	17.5	5.7
	15.0	8.9	20.6	75.0	4.60	59.3	102.7	4.78	9.5	67.7	47.6	0.70	3.73	80.4	18.2	5.4
80	9.0	3.5	8.0	76.2	4.59	60.6	103.3	4.87	10.2	62.2	45.0	0.72	4.45	77.4	14.0	7.6
	12.0	6.1	14.1	78.2	4.65	62.3	104.2	4.93	10.5	63.1	45.7	0.72	4.25	77.6	14.9	7.2
	15.0	8.8	20.2	80.1	4.70	64.1	105.1	5.00	10.7	64.1	46.3	0.72	4.11	78.1	15.6	6.8
90	9.0	3.4	7.8	82.7	4.68	66.8	106.3	5.18	11.4	58.4	43.9	0.75	4.86	75.0	12.0	9.5
	12.0	6.0	13.8	84.0	4.74	67.8	106.9	5.19	11.8	59.3	44.6	0.75	4.64	75.2	12.8	9.0
	15.0	8.6	19.9	85.3	4.80	68.9	107.5	5.21	12.2	60.5	45.0	0.74	4.49	75.9	13.5	8.6
100	9.0	3.2	7.5	Operation not recommended						Operation not recommended						
	12.0	5.9	13.5							56.1	43.4	0.77	5.15	73.7	10.9	11.2
	15.0	8.5	19.5							57.0	43.7	0.77	4.99	74.0	11.4	10.6
110	9.0	3.1	7.3							Operation not recommended						
	12.0	5.7	13.2							52.3	41.8	0.80	5.63	71.6	9.3	13.8
	15.0	8.3	19.2							53.4	42.4	0.79	5.48	72.1	9.7	13.1
120	9.0	3.0	7.0							Operation not recommended						
	12.0	5.6	13.0							48.0	39.9	0.83	6.25	69.3	7.7	16.6
	15.0	8.0	18.5							49.0	40.5	0.83	6.07	69.7	8.1	15.9

11/10/09

ZS070 - Performance Data

Single Speed PSC (2200 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	12.0	4.5	10.5	Operation not recommended						Operation not recommended						
	15.0	7.4	17.0													
	18.0	10.1	23.3	46.0	4.98	29.0	87.4	2.71	6.5							
30	12.0	4.5	10.3	Operation not recommended						Operation not recommended						
	15.0	7.2	16.6	52.0	4.92	35.2	89.9	3.09	7.0	73.0	46.1	0.63	3.30	84.3	22.1	---
	18.0	9.8	22.6	53.7	5.06	36.4	90.6	3.11	7.3	74.0	47.0	0.64	3.10	84.6	23.9	---
40	12.0	4.4	10.2	Operation not recommended						Operation not recommended						
	15.0	7.0	16.2	58.4	5.10	41.0	92.6	3.35	7.8	74.6	49.3	0.66	3.49	86.5	21.4	---
	18.0	9.6	22.2	60.9	5.20	43.1	93.6	3.43	8.0	76.1	50.5	0.66	3.36	87.5	22.7	---
50	12.0	4.4	10.1	62.8	5.25	44.9	94.4	3.51	8.5	74.2	51.0	0.69	3.74	87.0	19.8	4.3
	15.0	6.9	15.9	65.4	5.29	47.4	95.5	3.62	8.7	76.2	52.5	0.69	3.68	88.7	20.7	4.1
	18.0	9.4	21.7	68.0	5.33	49.8	96.6	3.74	8.9	78.2	54.0	0.69	3.61	90.5	21.7	3.9
60	12.0	4.3	9.9	71.9	5.46	53.3	98.3	3.86	9.5	71.6	50.0	0.70	4.08	85.5	17.6	5.2
	15.0	6.7	15.5	73.9	5.49	55.2	99.1	3.95	9.8	73.3	51.3	0.70	4.00	87.0	18.3	4.9
	18.0	9.1	21.1	76.0	5.52	57.2	100.0	4.03	10.1	75.1	52.5	0.70	3.92	88.4	19.1	4.8
70	12.0	4.3	9.8	81.0	5.66	61.7	102.1	4.19	10.7	69.0	49.0	0.71	4.41	84.0	15.6	6.6
	15.0	6.6	15.2	82.5	5.69	63.1	102.7	4.25	11.0	70.5	50.0	0.71	4.32	85.2	16.3	6.3
	18.0	8.9	20.5	84.0	5.71	64.5	103.3	4.31	11.3	71.9	51.0	0.71	4.23	86.4	17.0	6.0
80	12.0	4.2	9.7	89.7	5.82	69.8	105.8	4.52	12.1	65.3	47.4	0.73	5.04	82.5	12.9	8.3
	15.0	6.4	14.8	91.2	5.88	71.2	106.4	4.55	12.4	66.5	48.3	0.73	4.81	82.9	13.8	7.9
	18.0	8.7	20.1	92.7	5.93	72.5	107.0	4.59	12.8	67.9	49.0	0.72	4.66	83.8	14.6	7.5
90	12.0	4.1	9.6	98.4	5.99	78.0	109.4	4.82	13.6	61.6	45.8	0.74	5.50	80.4	11.2	10.4
	15.0	6.3	14.5	99.9	6.07	79.2	110.1	4.83	14.0	62.5	46.6	0.75	5.25	80.4	11.9	9.9
	18.0	8.5	19.6	101.5	6.14	80.5	110.7	4.84	14.4	63.8	47.0	0.74	5.08	81.1	12.6	9.4
100	12.0	4.1	9.4	Operation not recommended						Operation not recommended						
	15.0	6.1	14.1							59.7	44.9	0.75	5.83	79.6	10.2	12.4
	18.0	8.1	18.7							60.6	45.3	0.75	5.65	79.8	10.7	11.7
110	12.0	4.0	9.3							Operation not recommended						
	15.0	6.0	13.8							56.2	42.9	0.76	6.38	78.0	8.8	15.1
	18.0	7.8	17.9							57.4	43.5	0.76	6.21	78.5	9.2	14.3
120	12.0	4.0	9.2							Operation not recommended						
	15.0	5.8	13.5							51.9	41.4	0.80	7.09	76.0	7.3	18.2
	18.0	7.5	17.3							53.0	42.0	0.79	6.88	76.4	7.7	17.3

11/10/09

ZS015 - Performance Data

Single Speed ECM2.3 (500 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	2.0	0.6	1.4	Operation not recommended						Operation not recommended						
	3.0	1.2	2.8													
	4.0	2.0	4.6	10.0	0.95	6.8	86.5	3.09	1.2							
30	2.0	0.6	1.4	Operation not recommended						Operation not recommended						
	3.0	1.1	2.6	11.0	0.99	7.6	88.3	3.25	1.3	14.5	9.8	0.68	0.66	16.8	22.0	---
	4.0	1.9	4.4	11.0	0.95	7.8	88.4	3.39	1.3	14.7	10.0	0.68	0.62	16.8	23.7	---
40	2.0	0.6	1.3	Operation not recommended						Operation not recommended						
	3.0	1.1	2.5	12.1	1.00	8.7	90.4	3.54	1.3	15.6	10.6	0.68	0.72	18.1	21.7	---
	4.0	1.8	4.3	12.4	0.99	9.0	90.9	3.67	1.3	15.9	10.8	0.68	0.69	18.2	23.0	---
50	2.0	0.5	1.2	13.0	1.01	9.6	92.1	3.77	1.4	16.5	11.3	0.68	0.80	19.2	20.6	0.8
	3.0	1.0	2.3	13.4	1.02	9.9	92.7	3.85	1.4	16.8	11.4	0.68	0.78	19.4	21.5	0.8
	4.0	1.8	4.1	13.7	1.02	10.2	93.4	3.94	1.5	17.0	11.5	0.68	0.76	19.6	22.4	0.8
60	2.0	0.5	1.2	14.4	1.02	10.9	94.6	4.12	1.6	15.7	10.9	0.69	0.87	18.7	18.2	0.9
	3.0	0.9	2.1	14.8	1.03	11.3	95.4	4.22	1.6	16.0	11.0	0.69	0.84	18.8	19.1	0.9
	4.0	1.7	3.9	15.3	1.04	11.7	96.2	4.32	1.7	16.2	11.1	0.68	0.81	18.9	20.1	0.8
70	2.0	0.5	1.1	15.7	1.03	12.2	97.1	4.47	1.8	14.9	10.5	0.70	0.93	18.1	16.0	1.1
	3.0	0.8	1.9	16.3	1.04	12.7	98.1	4.58	1.8	15.2	10.6	0.70	0.89	18.2	17.0	1.1
	4.0	1.6	3.7	16.8	1.05	13.2	99.1	4.69	1.8	15.4	10.6	0.69	0.85	18.3	18.1	1.0
80	2.0	0.5	1.1	17.6	1.05	14.0	100.5	4.92	2.0	14.2	10.2	0.72	0.98	17.5	14.4	1.4
	3.0	0.8	1.8	18.0	1.06	14.4	101.3	4.98	2.0	14.4	10.3	0.71	0.94	17.6	15.4	1.3
	4.0	1.5	3.6	18.4	1.07	14.7	102.1	5.04	2.1	14.7	10.4	0.71	0.91	17.7	16.2	1.3
90	2.0	0.4	1.0	19.4	1.06	15.8	103.9	5.35	2.3	13.4	9.9	0.74	1.04	17.0	12.9	1.8
	3.0	0.7	1.6	19.7	1.08	16.0	104.5	5.36	2.3	13.6	10.0	0.73	0.99	17.0	13.7	1.7
	4.0	1.5	3.4	20.0	1.09	16.3	105.0	5.38	2.3	13.9	10.1	0.73	0.96	17.2	14.5	1.6
100	2.0	0.4	0.9	Operation not recommended						Operation not recommended						
	3.0	0.6	1.4							12.8	9.7	0.76	1.11	16.5	11.5	2.1
	4.0	1.4	3.2							13.0	9.8	0.76	1.08	16.6	12.0	1.9
110	2.0	0.4	0.9							Operation not recommended						
	3.0	0.5	1.2							11.8	9.4	0.80	1.22	15.9	9.6	2.7
	4.0	1.3	3.0							12.0	9.5	0.79	1.19	16.1	10.1	2.5
120	2.0	0.4	0.9							Operation not recommended						
	3.0	0.5	1.1							10.8	9.1	0.84	1.36	15.4	7.9	3.3
	4.0	1.2	2.9							11.0	9.2	0.84	1.32	15.5	8.3	3.0

11/10/09

ZS018 - Performance Data

Single Speed ECM2.3 (600 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	3.0	1.2	2.8	Operation not recommended						Operation not recommended						
	4.0	2.0	4.6													
	5.0	3.4	7.8	13.0	1.15	9.1	88.1	3.31	1.4							
30	3.0	1.1	2.6	Operation not recommended						Operation not recommended						
	4.0	1.9	4.4	14.5	1.23	10.3	90.3	3.45	1.5	18.2	11.8	0.65	0.80	20.9	22.7	---
	5.0	3.3	7.6	14.9	1.25	10.6	91.0	3.49	1.5	18.4	12.0	0.65	0.75	21.0	24.5	---
40	3.0	1.1	2.5	Operation not recommended						Operation not recommended						
	4.0	1.8	4.3	15.7	1.28	11.3	92.2	3.59	1.6	19.1	12.4	0.65	0.85	22.0	22.3	---
	5.0	3.2	7.5	16.5	1.31	12.0	93.4	3.68	1.6	19.4	12.6	0.65	0.83	22.2	23.5	---
50	3.0	1.0	2.3	16.0	1.30	11.6	92.7	3.61	1.7	19.7	12.8	0.65	0.92	22.8	21.4	0.9
	4.0	1.8	4.1	17.0	1.34	12.4	94.2	3.73	1.7	20.0	13.0	0.65	0.91	23.1	22.0	0.9
	5.0	3.2	7.3	18.0	1.37	13.3	95.8	3.85	1.8	20.3	13.1	0.65	0.90	23.4	22.6	0.9
60	3.0	0.9	2.1	17.5	1.37	12.8	95.0	3.76	1.9	18.7	12.4	0.66	1.01	22.1	18.6	1.1
	4.0	1.7	3.9	18.5	1.39	13.7	96.5	3.89	1.9	18.9	12.6	0.67	1.00	22.3	19.0	1.1
	5.0	3.1	7.1	19.5	1.42	14.7	98.1	4.02	2.0	19.2	12.8	0.67	0.99	22.5	19.4	1.0
70	3.0	0.8	1.9	19.0	1.43	14.1	97.3	3.89	2.1	17.7	12.0	0.68	1.09	21.4	16.2	1.3
	4.0	1.6	3.7	20.0	1.45	15.1	98.9	4.04	2.1	17.9	12.3	0.69	1.08	21.5	16.5	1.3
	5.0	3.0	6.9	21.0	1.47	16.0	100.4	4.19	2.2	18.0	12.5	0.69	1.07	21.7	16.8	1.2
80	3.0	0.8	1.8	21.9	1.50	16.7	101.7	4.26	2.4	16.6	11.4	0.69	1.29	21.0	12.8	1.7
	4.0	1.5	3.6	22.6	1.53	17.4	102.8	4.33	2.4	16.8	11.7	0.70	1.23	21.0	13.6	1.6
	5.0	2.9	6.8	23.3	1.55	18.0	103.9	4.41	2.5	17.0	12.0	0.70	1.20	21.1	14.2	1.5
90	3.0	0.7	1.6	24.7	1.58	19.3	106.2	4.59	2.8	15.4	10.8	0.70	1.43	20.3	10.8	2.2
	4.0	1.5	3.4	25.1	1.60	19.7	106.8	4.60	2.8	15.7	11.1	0.71	1.36	20.3	11.5	2.0
	5.0	2.9	6.6	25.5	1.62	20.0	107.4	4.61	2.8	16.0	11.4	0.71	1.32	20.5	12.1	1.9
100	3.0	0.6	1.4	Operation not recommended						Operation not recommended						
	4.0	1.4	3.2							14.9	11.0	0.74	1.46	19.8	10.2	2.5
	5.0	2.8	6.4							15.1	11.1	0.73	1.41	19.9	10.7	2.3
110	3.0	0.5	1.2							Operation not recommended						
	4.0	1.3	3.0							13.9	10.5	0.76	1.54	19.2	9.0	3.2
	5.0	2.7	6.2							14.2	10.7	0.75	1.50	19.3	9.5	3.0
120	3.0	0.5	1.1							Operation not recommended						
	4.0	1.2	2.9							13.2	10.1	0.76	1.70	19.0	7.8	4.0
	5.0	2.6	6.1							13.5	10.2	0.76	1.65	19.1	8.2	3.6

11/10/09

ZS023 - Performance Data

Single Speed ECM2.3 (800 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F					COOLING - EAT 80/67°F					
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER
20	3.0	1.2	2.8	Operation not recommended					Operation not recommended					
	4.5	2.4	5.6											
	6.0	4.6	10.6	15.0	1.53	9.8	85.4	2.87						
30	3.0	1.1	2.6	Operation not recommended					Operation not recommended					
	4.5	2.4	5.5	17.9	1.59	12.4	88.7	3.29	26.3	16.7	0.63	0.94	29.6	27.9
	6.0	4.5	10.5	18.2	1.61	12.7	89.1	3.31	26.7	17.0	0.64	0.89	29.7	30.2
40	3.0	1.1	2.5	Operation not recommended					Operation not recommended					
	4.5	2.3	5.3	19.6	1.63	14.1	90.7	3.54	26.5	17.0	0.64	1.04	30.1	25.4
	6.0	4.5	10.3	20.3	1.65	14.6	91.4	3.60	26.8	17.3	0.64	0.98	30.1	27.3
50	3.0	1.0	2.3	20.8	1.64	15.2	92.1	3.71	26.4	17.3	0.66	1.22	30.6	21.7
	4.5	2.2	5.2	21.6	1.66	15.9	92.9	3.79	26.7	17.4	0.65	1.15	30.6	23.2
	6.0	4.4	10.2	22.3	1.69	16.5	93.8	3.87	26.9	17.5	0.65	1.08	30.6	25.0
60	3.0	1.0	2.2	23.0	1.68	17.3	94.6	4.01	25.7	17.0	0.66	1.37	30.4	18.8
	4.5	2.2	5.0	23.8	1.70	18.0	95.5	4.09	26.0	17.1	0.66	1.29	30.3	20.2
	6.0	4.3	10.0	24.6	1.72	18.7	96.5	4.18	26.2	17.2	0.66	1.21	30.3	21.7
70	3.0	0.9	2.0	25.2	1.72	19.3	97.2	4.28	25.0	16.7	0.67	1.52	30.2	16.5
	4.5	2.1	4.9	26.1	1.74	20.1	98.2	4.38	25.3	16.8	0.67	1.43	30.1	17.7
	6.0	4.3	9.9	26.9	1.76	20.9	99.1	4.48	25.5	16.9	0.66	1.34	30.1	19.0
80	3.0	0.8	1.9	27.9	1.73	22.0	100.3	4.72	23.8	16.2	0.68	1.65	29.5	14.4
	4.5	2.1	4.7	28.5	1.75	22.6	101.0	4.78	24.1	16.3	0.68	1.58	29.5	15.3
	6.0	4.2	9.7	29.2	1.77	23.2	101.8	4.83	24.5	16.5	0.67	1.53	29.7	16.1
90	3.0	0.8	1.7	30.6	1.74	24.6	103.4	5.16	22.7	15.6	0.69	1.85	29.0	12.2
	4.5	2.0	4.6	31.0	1.76	25.0	103.9	5.17	23.0	15.8	0.69	1.77	29.1	13.0
	6.0	4.1	9.6	31.5	1.78	25.4	104.5	5.19	23.5	16.0	0.68	1.71	29.3	13.7
100	3.0	0.7	1.6	Operation not recommended					Operation not recommended					
	4.5	1.9	4.4						21.7	15.1	0.69	2.04	28.7	10.7
	6.0	4.1	9.4						22.1	15.2	0.69	1.97	28.8	11.2
110	3.0	0.6	1.4						Operation not recommended					
	4.5	1.9	4.3						20.2	14.2	0.70	2.30	28.0	8.8
	6.0	4.0	9.3						20.6	14.4	0.70	2.24	28.2	9.2
120	3.0	0.6	1.3						Operation not recommended					
	4.5	1.8	4.1						18.4	14.2	0.77	2.70	27.6	6.8
	6.0	3.9	9.1						18.8	14.4	0.77	2.63	27.8	7.2

11/10/09

ZS024 - Performance Data

Single Speed ECM2.3 (800 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	3.0	1.2	2.8	Operation not recommended						Operation not recommended						
	4.5	2.4	5.6													
	6.0	4.6	10.6	15.6	1.53	10.3	86.0	2.98	1.6							
30	3.0	1.1	2.6	Operation not recommended						Operation not recommended						
	4.5	2.4	5.5	18.7	1.59	13.2	89.6	3.44	1.7	27.5	17.4	0.63	0.94	30.7	29.1	---
	6.0	4.5	10.5	19.0	1.61	13.5	90.0	3.46	1.7	27.8	17.7	0.64	0.89	30.9	31.5	---
40	3.0	1.1	2.5	Operation not recommended						Operation not recommended						
	4.5	2.3	5.3	20.5	1.63	14.9	91.7	3.69	1.9	27.6	17.7	0.64	1.04	31.2	26.4	---
	6.0	4.5	10.3	21.1	1.65	15.5	92.4	3.75	1.9	27.9	18.0	0.64	0.98	31.3	28.5	---
50	3.0	1.0	2.3	21.7	1.64	16.1	93.2	3.88	2.1	27.5	18.0	0.65	1.22	31.7	22.6	1.3
	4.5	2.2	5.2	22.5	1.66	16.8	94.0	3.96	2.1	27.8	18.1	0.65	1.15	31.7	24.2	1.2
	6.0	4.4	10.2	23.2	1.69	17.4	94.9	4.03	2.2	28.0	18.2	0.65	1.08	31.6	26.0	1.2
60	3.0	1.0	2.2	24.0	1.68	18.2	95.7	4.17	2.3	26.8	17.7	0.66	1.37	31.5	19.6	1.5
	4.5	2.2	5.0	24.8	1.70	19.0	96.7	4.26	2.4	27.0	17.8	0.66	1.29	31.4	21.0	1.4
	6.0	4.3	10.0	25.6	1.72	19.7	97.6	4.35	2.4	27.3	17.9	0.66	1.21	31.4	22.6	1.4
70	3.0	0.9	2.0	26.2	1.72	20.3	98.3	4.45	2.6	26.1	17.4	0.67	1.52	31.3	17.2	1.8
	4.5	2.1	4.9	27.1	1.74	21.1	99.4	4.56	2.6	26.3	17.5	0.66	1.43	31.2	18.4	1.8
	6.0	4.3	9.9	28.0	1.76	22.0	100.4	4.66	2.7	26.6	17.6	0.66	1.34	31.1	19.8	1.7
80	3.0	0.8	1.9	29.0	1.73	23.1	101.5	4.91	2.9	24.9	16.8	0.68	1.65	30.5	15.0	2.3
	4.5	2.1	4.7	29.7	1.75	23.7	102.4	4.97	2.9	25.2	17.0	0.68	1.58	30.5	16.0	2.2
	6.0	4.2	9.7	30.4	1.77	24.3	103.2	5.03	3.0	25.5	17.1	0.67	1.53	30.7	16.7	2.1
90	3.0	0.8	1.7	31.8	1.74	25.9	104.8	5.37	3.3	23.6	16.2	0.69	1.85	29.9	12.8	2.8
	4.5	2.0	4.6	32.3	1.76	26.3	105.4	5.38	3.4	24.0	16.5	0.69	1.77	30.0	13.6	2.7
	6.0	4.1	9.6	32.8	1.78	26.7	105.9	5.40	3.5	24.5	16.7	0.68	1.71	30.3	14.3	2.5
100	3.0	0.7	1.6	Operation not recommended						Operation not recommended						
	4.5	1.9	4.4							22.7	16.0	0.71	2.04	29.6	11.1	3.4
	6.0	4.1	9.4							23.0	16.2	0.70	1.97	29.7	11.7	3.2
110	3.0	0.6	1.4							Operation not recommended						
	4.5	1.9	4.3							21.1	15.4	0.73	2.30	29.0	9.2	4.1
	6.0	4.0	9.3							21.5	15.6	0.73	2.24	29.2	9.6	3.9
120	3.0	0.6	1.3							Operation not recommended						
	4.5	1.8	4.1							19.1	14.8	0.77	2.70	28.4	7.1	4.9
	6.0	3.9	9.1							19.6	15.0	0.77	2.63	28.5	7.4	4.6

11/10/09

ZS030 - Performance Data

Single Speed ECM2.3 (1000 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	4.0	1.0	2.2	Operation not recommended						Operation not recommended						
	6.0	1.9	4.5													
	8.0	3.8	8.7	20.0	1.70	14.2	86.5	3.45	1.9							
30	4.0	0.9	2.1	Operation not recommended						Operation not recommended						
	6.0	1.9	4.4	21.2	1.76	15.1	87.6	3.52	2.1	30.4	19.3	0.64	1.17	34.4	25.9	---
	8.0	3.7	8.5	22.0	1.78	15.9	88.4	3.62	2.1	30.8	19.7	0.64	1.10	34.6	28.0	---
40	4.0	0.9	2.0	Operation not recommended						Operation not recommended						
	6.0	1.8	4.3	23.9	1.80	17.7	90.1	3.89	2.3	31.3	20.2	0.64	1.21	35.4	25.9	---
	8.0	3.7	8.4	25.0	1.82	18.7	91.1	4.02	2.4	32.4	20.9	0.65	1.20	36.5	27.0	---
50	4.0	0.8	1.9	25.8	1.81	19.6	91.9	4.18	2.5	30.5	19.9	0.65	1.19	34.6	25.6	1.4
	6.0	1.8	4.1	26.9	1.84	20.6	92.9	4.29	2.6	32.3	21.0	0.65	1.25	36.5	25.9	1.3
	8.0	3.6	8.3	27.9	1.86	21.6	93.8	4.40	2.7	34.0	22.1	0.65	1.30	38.4	26.2	1.3
60	4.0	0.8	1.8	29.4	1.85	23.1	95.2	4.66	2.9	30.1	19.7	0.66	1.34	34.6	22.4	1.6
	6.0	1.7	4.0	30.5	1.87	24.1	96.2	4.77	2.9	31.9	20.9	0.66	1.40	36.7	22.9	1.5
	8.0	3.6	8.2	31.6	1.90	25.1	97.3	4.89	3.0	33.8	22.1	0.66	1.45	38.7	23.3	1.4
70	4.0	0.7	1.6	33.0	1.89	26.6	98.6	5.12	3.2	29.6	19.5	0.66	1.49	34.7	19.9	2.0
	6.0	1.7	3.9	34.2	1.91	27.6	99.6	5.24	3.3	31.6	20.8	0.66	1.55	36.9	20.5	1.9
	8.0	3.5	8.1	35.3	1.93	28.7	100.7	5.36	3.4	33.6	22.2	0.66	1.60	39.1	21.0	1.8
80	4.0	0.7	1.5	36.9	1.99	30.1	102.1	5.42	3.6	29.3	19.3	0.66	1.94	35.9	15.1	2.5
	6.0	1.6	3.8	37.8	2.02	30.9	103.0	5.49	3.7	30.7	20.4	0.66	1.85	37.1	16.6	2.4
	8.0	3.5	8.0	38.7	2.04	31.7	103.8	5.55	3.8	32.1	21.5	0.67	1.79	38.2	17.9	2.3
90	4.0	0.6	1.4	40.7	2.10	33.6	105.7	5.70	4.1	29.0	19.0	0.66	2.14	36.3	13.5	3.3
	6.0	1.6	3.7	41.4	2.12	34.1	106.3	5.71	4.2	29.9	20.0	0.67	2.05	36.9	14.6	3.1
	8.0	3.4	7.9	42.0	2.15	34.7	106.9	5.73	4.3	30.5	20.7	0.68	1.98	37.3	15.4	3.0
100	4.0	0.6	1.3	Operation not recommended						Operation not recommended						
	6.0	1.6	3.6							27.5	19.7	0.72	2.37	35.6	11.6	3.9
	8.0	3.4	7.8							28.0	19.9	0.71	2.30	35.8	12.2	3.7
110	4.0	0.5	1.2							Operation not recommended						
	6.0	1.5	3.5							24.9	18.7	0.75	2.68	34.0	9.3	4.9
	8.0	3.3	7.6							25.4	19.0	0.75	2.61	34.3	9.7	4.5
120	4.0	0.5	1.1							Operation not recommended						
	6.0	1.5	3.3							21.1	17.2	0.82	2.88	31.0	7.3	5.7
	8.0	3.3	7.5							21.6	17.5	0.81	2.80	31.2	7.7	5.4

11/10/09

ZS036 - Performance Data

Single Speed ECM2.3 (1150 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	5.0	1.5	3.4	Operation not recommended						Operation not recommended						
	7.0	2.6	6.0													
	9.0	6.1	14.1	23.4	2.31	15.6	86.9	2.97	2.3							
30	5.0	1.4	3.1	Operation not recommended						Operation not recommended						
	7.0	2.5	5.8	27.4	2.34	19.4	90.1	3.43	2.5	35.9	25.1	0.70	1.51	41.1	23.7	---
	9.0	6.0	13.8	28.2	2.38	20.1	90.7	3.47	2.6	36.4	25.6	0.70	1.42	41.2	25.6	---
40	5.0	1.3	2.9	Operation not recommended						Operation not recommended						
	7.0	2.4	5.5	30.8	2.40	22.6	92.8	3.76	2.9	38.7	27.2	0.70	1.62	44.2	23.9	---
	9.0	5.9	13.6	31.9	2.44	23.6	93.7	3.84	2.9	39.2	27.5	0.70	1.54	44.5	25.5	---
50	5.0	1.1	2.6	33.3	2.41	25.0	94.8	4.05	3.1	40.9	29.1	0.71	1.78	47.0	23.0	1.6
	7.0	2.3	5.2	34.5	2.46	26.1	95.8	4.12	3.2	41.5	29.2	0.70	1.72	47.3	24.1	1.5
	9.0	5.8	13.3	35.7	2.50	27.2	96.7	4.18	3.3	42.0	29.4	0.70	1.66	47.7	25.3	1.5
60	5.0	1.0	2.4	37.7	2.48	29.2	98.3	4.45	3.5	39.2	28.5	0.73	1.97	46.0	19.9	2.0
	7.0	2.2	5.0	39.0	2.52	30.4	99.4	4.54	3.6	39.9	28.7	0.72	1.90	46.4	21.0	1.9
	9.0	5.7	13.1	40.2	2.55	31.5	100.4	4.62	3.6	40.5	28.9	0.71	1.84	46.8	22.1	1.8
70	5.0	0.9	2.1	42.1	2.55	33.4	101.9	4.84	3.9	37.6	27.9	0.74	2.16	44.9	17.4	2.5
	7.0	2.1	4.7	43.5	2.58	34.7	103.0	4.95	4.0	38.3	28.2	0.74	2.09	45.4	18.4	2.4
	9.0	5.5	12.8	44.8	2.60	35.9	104.1	5.05	4.1	39.0	28.5	0.73	2.01	45.9	19.4	2.3
80	5.0	0.8	1.8	46.7	2.62	37.8	105.6	5.23	4.4	36.1	27.1	0.75	2.42	44.3	14.9	3.2
	7.0	1.9	4.5	47.7	2.65	38.7	106.4	5.29	4.5	36.7	27.6	0.75	2.31	44.6	15.9	3.0
	9.0	5.4	12.5	48.8	2.68	39.7	107.3	5.35	4.6	37.4	28.0	0.75	2.24	45.0	16.7	2.9
90	5.0	0.7	1.6	51.2	2.68	42.1	109.3	5.60	4.9	34.5	26.3	0.76	2.66	43.6	13.0	3.9
	7.0	1.8	4.2	52.0	2.72	42.8	109.9	5.61	5.1	35.1	27.0	0.77	2.54	43.8	13.8	3.7
	9.0	5.3	12.3	52.8	2.75	43.5	110.5	5.63	5.2	35.8	27.5	0.77	2.46	44.2	14.6	3.6
100	5.0	0.6	1.3	Operation not recommended						Operation not recommended						
	7.0	1.7	4.0							33.3	26.4	0.79	2.86	43.0	11.7	4.6
	9.0	5.2	12.0							33.8	26.6	0.79	2.77	43.2	12.2	4.4
110	5.0	0.5	1.1							Operation not recommended						
	7.0	1.6	3.7							31.2	25.3	0.81	3.16	41.9	9.9	5.7
	9.0	5.1	11.8							31.8	25.7	0.81	3.07	42.3	10.4	5.4
120	5.0	0.4	0.8							Operation not recommended						
	7.0	1.5	3.5							26.5	22.7	0.85	3.53	38.6	7.5	6.8
	9.0	5.0	11.5							27.1	23.0	0.85	3.43	38.8	7.9	6.4

11/10/09

ZS041 - Performance Data

Single Speed ECM2.3 (1300 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	5.0	1.6	3.8	Operation not recommended						Operation not recommended						
	8.0	3.6	8.2													
	11.0	8.0	18.5	25.7	2.61	16.8	85.0	2.89	3.5							
30	5.0	1.5	3.4	Operation not recommended						Operation not recommended						
	8.0	3.4	7.8	28.5	2.61	19.6	86.9	3.20	3.7	41.8	30.4	0.73	1.71	47.7	24.5	---
	11.0	7.9	18.1	29.5	2.66	20.4	87.5	3.26	3.8	42.4	31.0	0.73	1.61	47.9	26.4	---
40	5.0	1.3	3.0	Operation not recommended						Operation not recommended						
	8.0	3.2	7.5	31.7	2.67	22.6	89.0	3.48	4.0	43.8	31.4	0.72	1.85	50.2	23.7	---
	11.0	7.7	17.8	33.1	2.71	23.8	89.9	3.58	4.1	44.5	31.9	0.72	1.75	50.4	25.5	---
50	5.0	1.2	2.7	33.7	2.72	24.4	90.3	3.64	4.4	45.2	32.0	0.71	2.11	52.4	21.5	2.4
	8.0	3.1	7.1	35.2	2.74	25.8	91.2	3.77	4.5	45.9	32.4	0.71	2.00	52.7	23.0	2.4
	11.0	7.5	17.4	36.6	2.76	27.2	92.2	3.89	4.7	46.5	32.7	0.70	1.89	52.9	24.7	2.3
60	5.0	1.0	2.3	37.9	2.78	28.4	93.0	3.99	5.0	44.2	31.5	0.71	2.36	52.2	18.7	3.0
	8.0	2.9	6.7	39.3	2.80	29.7	94.0	4.11	5.1	45.1	31.8	0.70	2.23	52.7	20.3	2.8
	11.0	7.4	17.0	40.7	2.82	31.1	94.9	4.23	5.3	46.1	32.1	0.70	2.09	53.2	22.1	2.7
70	5.0	0.9	2.0	42.0	2.85	32.3	95.8	4.33	5.6	43.1	30.9	0.72	2.62	52.0	16.5	3.8
	8.0	2.8	6.4	43.4	2.87	33.6	96.7	4.44	5.7	44.4	31.2	0.70	2.46	52.8	18.1	3.6
	11.0	7.2	16.7	44.8	2.89	35.0	97.6	4.55	5.9	45.7	31.5	0.69	2.30	53.5	19.9	3.4
80	5.0	0.7	1.6	46.9	2.91	37.0	99.0	4.73	6.3	41.7	30.4	0.73	2.80	51.2	14.9	4.8
	8.0	2.6	6.0	48.0	2.94	38.0	99.8	4.79	6.5	42.6	30.6	0.72	2.67	51.7	16.0	4.5
	11.0	7.1	16.3	49.2	2.97	39.0	100.5	4.85	6.7	43.7	30.8	0.70	2.59	52.5	16.9	4.3
90	5.0	0.5	1.2	51.9	2.98	41.7	102.3	5.11	7.1	40.2	29.8	0.74	3.11	50.9	12.9	6.0
	8.0	2.5	5.7	52.7	3.02	42.4	102.9	5.12	7.3	40.9	30.0	0.73	2.97	51.0	13.8	5.7
	11.0	6.9	16.0	53.5	3.06	43.1	103.4	5.13	7.5	41.7	30.1	0.72	2.88	51.5	14.5	5.5
100	5.0	0.4	0.9							Operation not recommended						
	8.0	2.3	5.3							38.2	29.0	0.76	3.34	49.6	11.4	7.1
	11.0	6.8	15.6							38.8	29.2	0.75	3.24	49.8	12.0	6.8
110	5.0	0.4	0.9							Operation not recommended						
	8.0	2.1	4.9	Operation not recommended						35.2	27.9	0.79	3.70	47.8	9.5	8.6
	11.0	6.6	15.2							35.9	28.3	0.79	3.60	48.2	10.0	8.3
120	5.0	0.4	0.9							Operation not recommended						
	8.0	2.0	4.6							31.8	27.1	0.85	4.34	46.6	7.3	10.4
	11.0	6.5	14.9							32.5	27.5	0.85	4.22	46.9	7.7	10.0

11/10/09

ZS042 - Performance Data

Single Speed ECM2.3 (1400 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	5.0	1.6	3.8	Operation not recommended						Operation not recommended						
	8.0	3.6	8.2													
	11.0	8.0	18.5	27.0	2.61	18.1	85.9	3.04	3.5							
30	5.0	1.5	3.4	Operation not recommended						Operation not recommended						
	8.0	3.4	7.8	30.0	2.61	21.1	87.8	3.37	3.7	43.6	31.7	0.73	1.71	49.4	25.5	---
	11.0	7.9	18.1	31.0	2.66	21.9	88.5	3.42	3.8	44.2	32.3	0.73	1.61	49.7	27.5	---
40	5.0	1.3	3.0	Operation not recommended						Operation not recommended						
	8.0	3.2	7.5	33.4	2.67	24.2	90.1	3.66	4.0	45.7	32.7	0.72	1.85	52.0	24.7	---
	11.0	7.7	17.8	34.8	2.71	25.5	91.0	3.77	4.1	46.3	33.2	0.72	1.75	52.3	26.5	---
50	5.0	1.2	2.7	35.5	2.72	26.2	91.5	3.83	4.4	47.1	33.4	0.71	2.11	54.3	22.4	2.4
	8.0	3.1	7.1	37.0	2.74	27.7	92.5	3.96	4.5	47.8	33.8	0.71	2.00	54.6	23.9	2.4
	11.0	7.5	17.4	38.5	2.76	29.1	93.5	4.10	4.7	48.4	34.1	0.70	1.89	54.8	25.7	2.3
60	5.0	1.0	2.3	39.9	2.78	30.4	94.4	4.20	5.0	46.0	32.8	0.71	2.36	54.1	19.5	3.0
	8.0	2.9	6.7	41.4	2.80	31.8	95.3	4.33	5.1	47.0	33.1	0.70	2.23	54.6	21.1	2.8
	11.0	7.4	17.0	42.9	2.82	33.2	96.3	4.45	5.3	48.0	33.5	0.70	2.09	55.1	23.0	2.7
70	5.0	0.9	2.0	44.2	2.85	34.5	97.2	4.55	5.6	44.9	32.2	0.72	2.62	53.8	17.2	3.8
	8.0	2.8	6.4	45.7	2.87	35.9	98.2	4.68	5.7	46.3	32.5	0.70	2.46	54.6	18.8	3.6
	11.0	7.2	16.7	47.2	2.89	37.4	99.2	4.79	5.9	47.6	32.8	0.69	2.30	55.4	20.7	3.4
80	5.0	0.7	1.6	49.4	2.91	39.5	100.7	4.97	6.3	43.4	31.6	0.73	2.80	53.0	15.5	4.8
	8.0	2.6	6.0	50.6	2.94	40.5	101.5	5.04	6.5	44.4	31.9	0.72	2.67	53.6	16.6	4.5
	11.0	7.1	16.3	51.8	2.97	41.6	102.2	5.11	6.7	45.6	32.1	0.70	2.59	54.4	17.6	4.3
90	5.0	0.5	1.2	54.6	2.98	44.4	104.1	5.37	7.1	42.0	31.0	0.74	3.11	52.6	13.5	6.0
	8.0	2.5	5.7	55.5	3.02	45.2	104.7	5.39	7.3	42.6	31.2	0.73	2.97	52.8	14.3	5.7
	11.0	6.9	16.0	56.3	3.06	45.9	105.2	5.40	7.5	43.5	31.4	0.72	2.88	53.3	15.1	5.5
100	5.0	0.4	0.9	Operation not recommended						Operation not recommended						
	8.0	2.3	5.3							39.8	30.2	0.76	3.34	51.2	11.9	7.1
	11.0	6.8	15.6							40.5	30.5	0.75	3.24	51.5	12.5	6.8
110	5.0	0.4	0.9							Operation not recommended						
	8.0	2.1	4.9							36.7	29.1	0.79	3.70	49.3	9.9	8.6
	11.0	6.6	15.2							37.4	29.5	0.79	3.60	49.7	10.4	8.3
120	5.0	0.4	0.9							Operation not recommended						
	8.0	2.0	4.6							33.2	28.2	0.85	4.34	48.0	7.6	10.4
	11.0	6.5	14.9							33.9	28.6	0.84	4.22	48.3	8.0	10.0

11/10/09

ZS048 - Performance Data

Single Speed ECM2.3 (1600 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	6.0	2.1	4.8	Operation not recommended						Operation not recommended						
	9.0	4.1	9.4													
	12.0	6.5	15.0	30.8	3.09	20.2	87.0	2.92	4.6							
30	6.0	1.9	4.3	Operation not recommended						Operation not recommended						
	9.0	3.9	8.9	35.3	3.12	24.6	89.8	3.31	4.9	50.3	31.3	0.62	2.09	57.4	24.1	---
	12.0	6.5	14.9	35.8	3.15	25.1	90.1	3.33	5.0	51.0	31.9	0.63	1.96	57.7	26.0	---
40	6.0	1.7	3.9	Operation not recommended						Operation not recommended						
	9.0	3.7	8.5	40.1	3.25	29.0	92.8	3.62	5.4	53.1	34.8	0.65	2.29	60.9	23.2	---
	12.0	6.1	14.1	41.9	3.29	30.7	93.9	3.74	5.5	54.0	35.5	0.66	2.16	61.4	25.0	---
50	6.0	1.5	3.4	42.9	3.32	31.6	94.5	3.79	5.9	54.9	37.4	0.68	2.61	63.8	21.0	2.9
	9.0	3.5	8.0	45.5	3.38	34.0	96.1	3.95	6.1	56.0	38.3	0.68	2.49	64.4	22.5	2.8
	12.0	5.9	13.7	48.1	3.43	36.4	97.7	4.11	6.2	57.0	39.1	0.69	2.36	65.1	24.1	2.7
60	6.0	1.3	3.0	49.5	3.47	37.7	98.6	4.18	6.7	54.5	37.4	0.69	2.91	64.4	18.7	3.5
	9.0	3.3	7.6	52.2	3.52	40.2	100.2	4.35	6.8	55.4	38.0	0.69	2.76	64.8	20.0	3.4
	12.0	5.7	13.2	54.9	3.56	42.8	101.9	4.52	7.0	56.2	38.6	0.69	2.62	65.1	21.5	3.2
70	6.0	1.1	2.5	56.1	3.62	43.7	102.6	4.54	7.5	54.1	37.3	0.69	3.20	65.0	16.9	4.5
	9.0	3.1	7.1	58.9	3.65	46.5	104.4	4.73	7.7	54.8	37.7	0.69	3.04	65.1	18.0	4.3
	12.0	5.5	12.8	61.7	3.68	49.2	106.1	4.91	7.9	55.4	38.2	0.69	2.87	65.2	19.3	4.0
80	6.0	0.9	2.1	61.3	3.70	48.7	105.8	4.86	8.4	51.4	35.8	0.70	3.48	63.2	14.8	5.6
	9.0	2.9	6.7	63.2	3.74	50.5	107.0	4.96	8.6	52.1	36.4	0.70	3.31	63.4	15.7	5.3
	12.0	5.3	12.3	65.2	3.78	52.3	108.2	5.05	8.9	52.9	36.9	0.70	3.21	63.9	16.5	5.1
90	6.0	0.7	1.6	66.5	3.78	53.6	109.1	5.16	9.4	48.7	34.3	0.70	3.84	61.8	12.7	7.0
	9.0	2.7	6.2	67.5	3.83	54.5	109.7	5.17	9.7	49.4	35.0	0.71	3.66	61.9	13.5	6.7
	12.0	5.1	11.9	68.6	3.87	55.4	110.3	5.19	10.1	50.4	35.6	0.70	3.54	62.5	14.2	6.4
100	6.0	0.5	1.2	Operation not recommended						Operation not recommended						
	9.0	2.5	5.8							46.7	34.3	0.74	4.14	60.8	11.3	8.4
	12.0	5.0	11.4							47.4	34.6	0.73	4.00	61.0	11.8	8.0
110	6.0	0.3	0.7							Operation not recommended						
	9.0	2.3	5.3							43.4	33.2	0.76	4.59	59.1	9.5	10.3
	12.0	4.8	11.0							44.3	33.7	0.76	4.46	59.5	9.9	9.7
120	6.0	0.1	0.3							Operation not recommended						
	9.0	2.1	4.9							40.1	32.0	0.80	5.16	57.7	7.8	12.4
	12.0	4.6	10.5							41.0	32.5	0.79	5.01	58.1	8.2	11.8

11/10/09

ZS060 - Performance Data

Single Speed ECM2.3 (2000 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	9.0	4.2	9.7	Operation not recommended						Operation not recommended						
	12.0	6.9	16.0													
	15.0	9.8	22.6	41.9	3.96	28.4	87.4	3.10	5.5							
30	9.0	4.1	9.4	Operation not recommended						Operation not recommended						
	12.0	6.8	15.7	43.8	3.89	30.5	88.3	3.30	5.9	72.0	49.1	0.68	2.86	81.8	25.2	---
	15.0	9.6	22.2	46.5	4.01	32.8	89.5	3.39	6.1	73.0	50.0	0.68	2.68	82.2	27.2	---
40	9.0	3.9	9.1	Operation not recommended						Operation not recommended						
	12.0	6.6	15.4	49.7	4.03	35.9	91.0	3.62	6.6	70.8	48.8	0.69	3.01	81.0	23.5	---
	15.0	9.4	21.7	52.2	4.12	38.1	92.2	3.71	6.7	71.8	49.5	0.69	2.87	81.6	25.0	---
50	9.0	3.8	8.8	54.6	4.10	40.6	93.3	3.90	7.1	68.5	48.0	0.70	3.24	79.6	21.1	3.9
	12.0	6.5	15.0	56.2	4.16	42.0	94.0	3.96	7.3	69.5	48.5	0.70	3.15	80.3	22.0	3.7
	15.0	9.2	21.3	57.8	4.22	43.4	94.8	4.01	7.5	70.5	48.9	0.69	3.06	81.0	23.0	3.5
60	9.0	3.7	8.5	62.2	4.25	47.7	96.8	4.28	8.0	67.3	47.0	0.70	3.54	79.3	19.0	4.8
	12.0	6.4	14.7	64.3	4.31	49.6	97.8	4.37	8.3	68.2	47.6	0.70	3.44	79.9	19.8	4.6
	15.0	9.1	20.9	66.4	4.36	51.5	98.8	4.46	8.5	69.1	48.3	0.70	3.35	80.5	20.6	4.4
70	9.0	3.6	8.3	69.8	4.40	54.8	100.3	4.64	9.0	66.0	46.0	0.70	3.83	79.1	17.2	6.0
	12.0	6.2	14.4	72.4	4.45	57.2	101.5	4.76	9.3	66.9	46.8	0.70	3.73	79.6	17.9	5.7
	15.0	8.9	20.6	75.0	4.50	59.6	102.7	4.88	9.5	67.7	47.6	0.70	3.63	80.1	18.6	5.4
80	9.0	3.5	8.0	76.2	4.50	60.9	103.3	4.97	10.2	62.2	45.0	0.72	4.35	77.0	14.3	7.6
	12.0	6.1	14.1	78.2	4.55	62.7	104.2	5.04	10.5	63.1	45.7	0.72	4.15	77.2	15.2	7.2
	15.0	8.8	20.2	80.1	4.60	64.4	105.1	5.10	10.7	64.1	46.3	0.72	4.01	77.8	16.0	6.8
90	9.0	3.4	7.8	82.7	4.59	67.1	106.3	5.29	11.4	58.4	43.9	0.75	4.76	74.7	12.3	9.5
	12.0	6.0	13.8	84.0	4.65	68.1	106.9	5.30	11.8	59.3	44.6	0.75	4.54	74.8	13.1	9.0
	15.0	8.6	19.9	85.3	4.70	69.2	107.5	5.31	12.2	60.5	45.0	0.74	4.39	75.5	13.8	8.6
100	9.0	3.2	7.5	Operation not recommended						Operation not recommended						
	12.0	5.9	13.5							56.1	43.4	0.77	5.05	73.4	11.1	11.2
	15.0	8.5	19.5							57.0	43.7	0.77	4.89	73.7	11.7	10.6
110	9.0	3.1	7.3							Operation not recommended						
	12.0	5.7	13.2							52.3	41.8	0.80	5.53	71.2	9.5	13.8
	15.0	8.3	19.2							53.4	42.4	0.79	5.38	71.8	9.9	13.1
120	9.0	3.0	7.0							Operation not recommended						
	12.0	5.6	13.0							48.0	39.9	0.83	6.15	69.0	7.8	16.6
	15.0	8.0	18.5							49.0	40.5	0.83	5.97	69.4	8.2	15.9

11/10/09

ZS070 - Performance Data

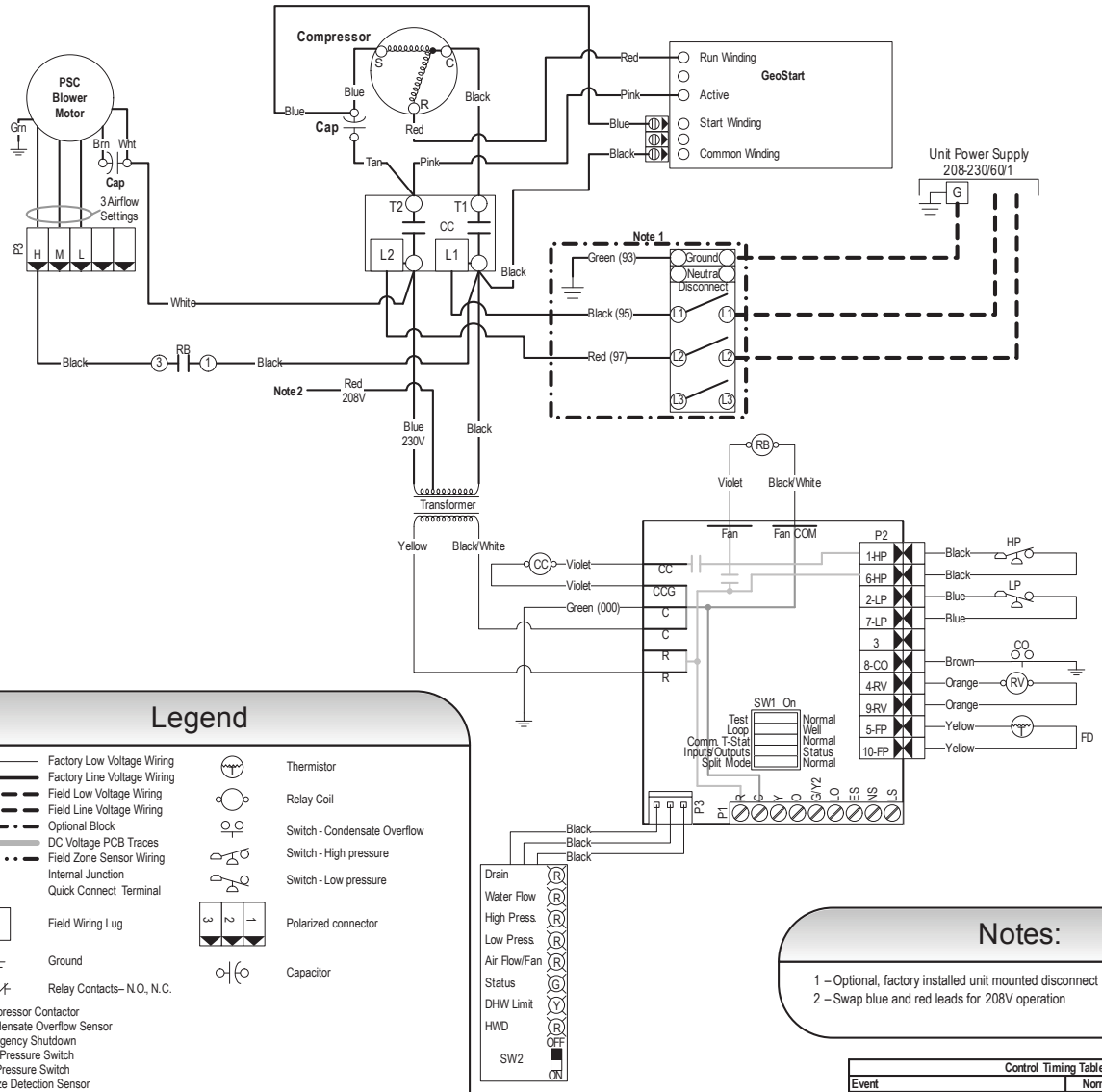
Single Speed ECM2.3 (2200 CFM)

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F						COOLING - EAT 80/67°F						
		PSI	FT	HC kBtuh	Power kW	HE kBtuh	LAT °F	COP	HWC kBtuh	TC kBtuh	SC kBtuh	S/T Ratio	Power kW	HR kBtuh	EER	HWC kBtuh
20	12.0	4.5	10.5	Operation not recommended						Operation not recommended						
	15.0	7.4	17.0													
	18.0	10.1	23.3	46.0	4.88	29.3	87.4	2.76	6.5							
30	12.0	4.5	10.3	Operation not recommended						Operation not recommended						
	15.0	7.2	16.6	52.0	4.82	35.5	89.9	3.16	7.0	73.0	46.1	0.63	3.18	83.9	22.9	---
	18.0	9.8	22.6	53.7	4.96	36.8	90.6	3.17	7.3	74.0	47.0	0.64	2.99	84.2	24.7	---
40	12.0	4.4	10.2	Operation not recommended						Operation not recommended						
	15.0	7.0	16.2	58.4	5.00	41.3	92.6	3.42	7.8	74.6	49.3	0.66	3.38	86.1	22.1	---
	18.0	9.6	22.2	60.9	5.10	43.5	93.6	3.50	8.0	76.1	50.5	0.66	3.25	87.2	23.4	---
50	12.0	4.4	10.1	62.8	5.15	45.2	94.4	3.57	8.5	74.2	51.0	0.69	3.64	86.6	20.4	4.3
	15.0	6.9	15.9	65.4	5.19	47.7	95.5	3.69	8.7	76.2	52.5	0.69	3.58	88.4	21.3	4.1
	18.0	9.4	21.7	68.0	5.23	50.2	96.6	3.81	8.9	78.2	54.0	0.69	3.51	90.2	22.3	3.9
60	12.0	4.3	9.9	71.9	5.36	53.6	98.3	3.94	9.5	71.6	50.0	0.70	3.98	85.2	18.0	5.2
	15.0	6.7	15.5	73.9	5.39	55.6	99.1	4.02	9.8	73.3	51.3	0.70	3.90	86.6	18.8	4.9
	18.0	9.1	21.1	76.0	5.42	57.5	100.0	4.11	10.1	75.1	52.5	0.70	3.82	88.1	19.7	4.8
70	12.0	4.3	9.8	81.0	5.56	62.0	102.1	4.27	10.7	69.0	49.0	0.71	4.31	83.7	16.0	6.6
	15.0	6.6	15.2	82.5	5.59	63.4	102.7	4.33	11.0	70.5	50.0	0.71	4.22	84.9	16.7	6.3
	18.0	8.9	20.5	84.0	5.61	64.8	103.3	4.39	11.3	71.9	51.0	0.71	4.13	86.0	17.4	6.0
80	12.0	4.2	9.7	89.7	5.72	70.2	105.8	4.59	12.1	65.3	47.4	0.73	4.93	82.1	13.2	8.3
	15.0	6.4	14.8	91.2	5.78	71.5	106.4	4.63	12.4	66.5	48.3	0.73	4.71	82.6	14.1	7.9
	18.0	8.7	20.1	92.7	5.83	72.9	107.0	4.67	12.8	67.9	49.0	0.72	4.56	83.4	14.9	7.5
90	12.0	4.1	9.6	98.4	5.89	78.3	109.4	4.90	13.6	61.6	45.8	0.74	5.39	80.0	11.4	10.4
	15.0	6.3	14.5	99.9	5.97	79.6	110.1	4.91	14.0	62.5	46.6	0.75	5.15	80.1	12.2	9.9
	18.0	8.5	19.6	101.5	6.04	80.9	110.7	4.92	14.4	63.8	47.0	0.74	4.98	80.8	12.8	9.4
100	12.0	4.1	9.4	Operation not recommended						Operation not recommended						
	15.0	6.1	14.1							59.7	44.9	0.75	5.73	79.2	10.4	12.4
	18.0	8.1	18.7							60.6	45.3	0.75	5.55	79.5	10.9	11.7
110	12.0	4.0	9.3							Operation not recommended						
	15.0	6.0	13.8							56.2	42.9	0.76	6.28	77.6	8.9	15.1
	18.0	7.8	17.9							57.4	43.5	0.76	6.11	78.2	9.4	14.3
120	12.0	4.0	9.2							Operation not recommended						
	15.0	5.8	13.5							51.9	41.4	0.80	6.98	75.7	7.4	18.2
	18.0	7.5	17.3							53.0	42.0	0.79	6.78	76.1	7.8	17.3

11/10/09

Wiring Schematics

Versatec Microprocessor 208-230/60/1 PSC with GeoStart



Legend

- Factory Low Voltage Wiring
- Factory Line Voltage Wiring
- Field Low Voltage Wiring
- Field Line Voltage Wiring
- Optional Block
- DC Voltage PCB Traces
- Field Zone Sensor Wiring
- Internal Junction
- Quick Connect Terminal
- L1 — Field Wiring Lug
- Ground
- Relay Contacts– N.O., N.C.
- Thermistor
- Relay Coil
- Switch - Condensate Overflow
- Switch - High pressure
- Switch - Low pressure
- Polarized connector
- Capacitor

CC – Compressor Contactor
CO – Condensate Overflow Sensor
ES – Emergency Shutdown
HP – High Pressure Switch
LP – Low Pressure Switch
FD – Freeze Detection Sensor
RB – Blower Relay
RV – Reversing Valve Coil

Notes:

1 – Optional, factory installed unit mounted disconnect
2 – Swap blue and red leads for 208V operation

Control Timing Table		
Event	**Normal Mode**	**Test Mode**
Power On Delay	5 minutes	15 seconds
Compressor On Delay	10 seconds	2 seconds
Compressor Minimum On Time	2 minutes	5 seconds
Compressor Short Cycle Delay	5 minutes	15 seconds
Blower Off Delay	30 seconds	5 seconds
Fault Recognition Delay – High Pressure	Less than1 second	Less than1 second
StartUp Bypass– Low Pressure	2 minutes	0 seconds
Fault Recognition Delay – Low Pressure	30 seconds	30 seconds
StartUp Bypass– Freeze Detection	2 minutes	0 seconds
Fault Recognition Delay – Freeze Detection	30 seconds	30 seconds
Fault Recognition Delay – Condensate Overflow	30 seconds	30 seconds

Operational Logic Table				
Single-Speed				
Mode	**Inputs**	**Fan**	**Comp**	**RV**
Htg	Y	Auto	ON	OFF
Clg	Y,O	Auto	ON	ON
Blower Only	G	ON	OFF	OFF

LED Display Mode Table			
Status Display Mode			
LED	SW1-4 On, SW2 Off		
Drain	Drain Pan Overflow Lockout		
Water Flow	Freeze Detection Lockout (Loop <= 15°F, Well <=30°F)		
High Press.	High Pressure Lockout		
Low Press	Low Pressure Lockout		
Air Flow	Not Used		
Status	Microprocessor Malfunction*		
DHW Limit	Not Used		
DHW	SW2 Status(Off=Down Position, On= Up Position)		
Diagnostic Display Modes			
	Current Fault Display Mode	**Inputs Display Mode**	**Outputs Display Mode**
LED	SW1-4 On, SW2 On	SW1-4 Off, SW2 Off	SW1-4 Off, SW2 On
Drain	Drain Pan Overflow Lockout	Y	Compressor
Water Flow	Freeze Detection Lockout	G	Fan
High Press.	High Pressure Lockout	O	Reversing Valve
Low Press	Low Pressure Lockout	ES	ES
Air Flow	Not Used	NS	NS
Status	Not Used	LS	LS
DHW Limit	Not Used	Not Used	Not Used
HWD	SW2 = On	SW2 = Off	SW2 = On

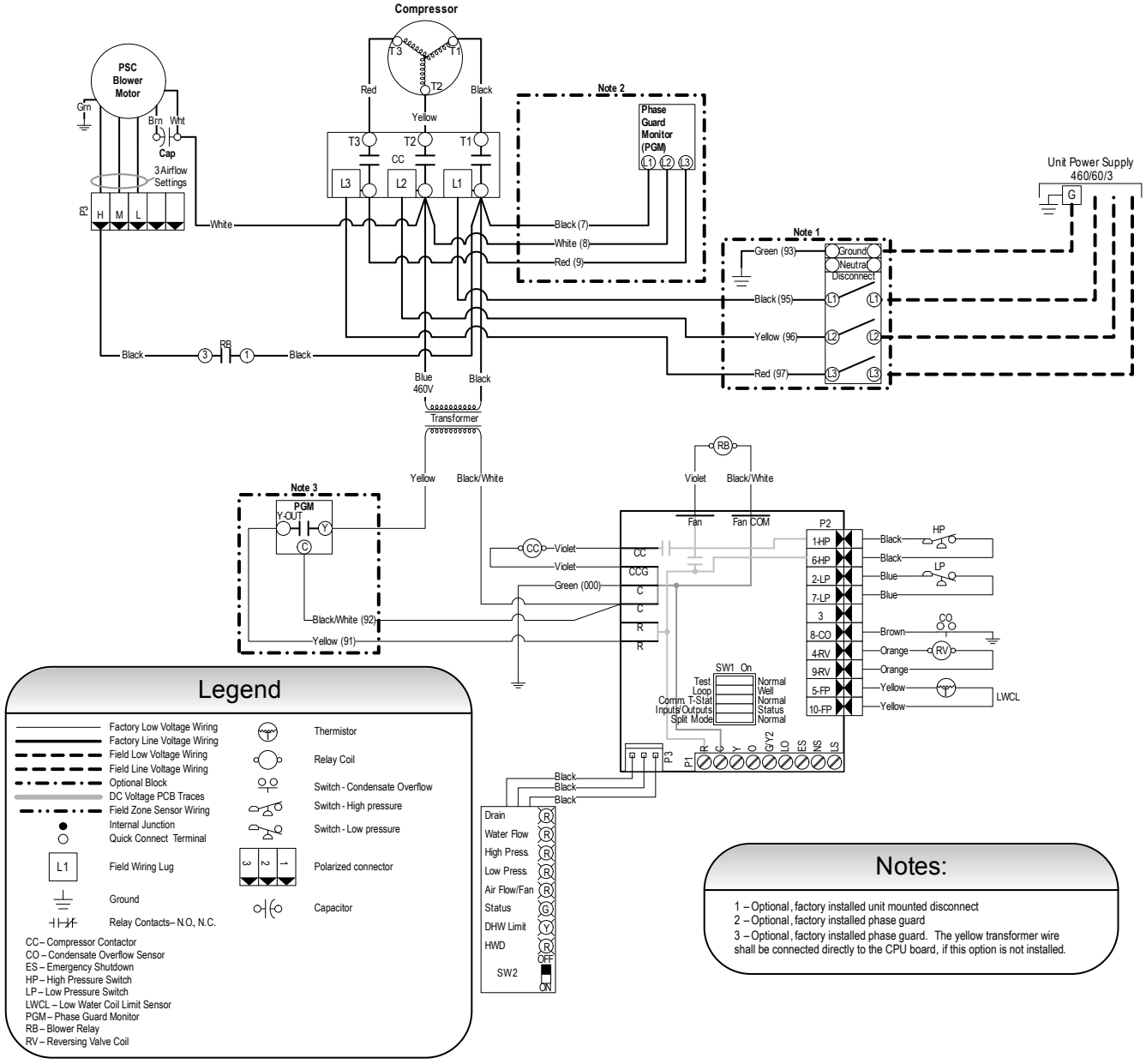
* Flashing Status Light Indicates the Board is Functioning Properly
A Solid "On" Indicates a Board Malfunction

Factory Setup DIP Switches (SW1)				
DIP Switch Number		**Description**	**"OFF" Position**	**"ON" Position**
SW1-	**1**	**Service Test Mode** On the control,allows field selection of "NORMAL" or "TEST" operational modes, Test mode accelerates most timing functions 16 times to allow faster troubleshooting. Test mode also allows viewing the"CURRENT"status of the fault inputs on the LED display.	Test Mode	Normal Speed Operation
SW1-	**2**	**Freeze Detection Setting** This DIP switch allows field selection of low source water thermistor fault sensing for "WELL" water (30 °F) or "LOOP" (15°F)for anti-freeze protected earth loops	"LOOP" (15° F)	"WELL" (30° F)
SW1-	**3**	**Not Available**	N/A	Normal Operation
SW1-	**4**	**I/O Display Mode** This DIP switch enables Input/Output Display or Status/Current Fault on LED Board Refer to SW2 for operation and positioning	Input/Output Display Mode	Status/Current Fault Display Mode
SW1-	**5**	**Not Available**	N/A	Normal Operation
SW2		**LED Display (On LED Board)** This DIP switch enables Normal Status or Input display mode in the "OFF" position and Current Fault or Output display mode in the "ON" position.	Status or Inputs Display Mode	Current Fault or Output Display Mode

97P800-03 11/13/09

Wiring Schematics cont.

Versatec Microprocessor 460/60/3 PSC



Legend

- Factory Low Voltage Wiring
- Factory Line Voltage Wiring
- Field Low Voltage Wiring
- Field Line Voltage Wiring
- Optional Block
- DC Voltage PCB Traces
- Field Zone Sensor Wiring
- Internal Junction
- Quick Connect Terminal
- L1 — Field Wiring Lug
- Ground
- Relay Contacts– N.O, N.C.
- Thermistor
- Relay Coil
- Switch - Condensate Overflow
- Switch - High pressure
- Switch - Low pressure
- 3 2 1 — Polarized connector
- Capacitor

CC – Compressor Contactor
CO – Condensate Overflow Sensor
ES – Emergency Shutdown
HP – High Pressure Switch
LP – Low Pressure Switch
LWCL – Low Water Coil Limit Sensor
PGM – Phase Guard Monitor
RB – Blower Relay
RV – Reversing Valve Coil

Notes:

1 – Optional, factory installed unit mounted disconnect
2 – Optional, factory installed phase guard
3 – Optional, factory installed phase guard. The yellow transformer wire shall be connected directly to the CPU board, if this option is not installed.

Logic Board DIP Switch Settings		
DIP	**OFF**	**ON**
SW1-1	Test Mode – Speedup Mode	Normal Mode – Standard Timings
SW1-2	Loop - 15°F Low Water Coil Limit	Well - 30°F Low Water Coil Limit
SW1-3	Commercial TA32U02 T-Stat	Normal – Standard Thermostat Operation
SW1-4	*IO Display– Enables Input/Output Display on LED Board	*Normal - Unit Status Display Mode
SW1-5	Split Mode – Dual-Speed Compressor without Fan	Normal – Single-Speed Compressor with Fan
SW2	*OFF - Status or Inputs Display Mode	*ON - Current Fault or Output Display Mode

* Refer to LED Display Mode Table for Operation and Positioning of SW1-4 and SW2

LED Display Mode Table	
Status Display Mode	
LED	SW1-4 On, SW2 Off
Drain	Drain Pan Overflow Lockout
Water Flow	Low Water Coil Limit Lockout(Loop <= 15°F, Well <= 30°F)
High Press.	High Pressure Lockout
Low Press	Low Pressure Lockout
Air Flow	Not Used
Status	Microprocessor Malfunction*
DHW Limit	Not Used
HWD	SW2 Status(Off=Down Position,On=Up Position)

Diagnostic Display Modes			
	Current Fault Display Mode	**Inputs Display Mode**	**Outputs Display Mode**
LED	SW1-4 On, SW2 On	SW1-4 Off, SW2 Off	SW1-4 Off, SW2 On
Drain	Drain Pan Overflow Lockout	Y	Compressor
Water Flow	Low Water Coil Limit Lockout	G	Fan
High Press.	High Pressure Lockout	O	Reversing Valve
Low Press	Low Pressure Lockout	ES	ES
Air Flow	Not Used	NS	NS
Status	Not Used	LS	LS
DHW Limit	Not Used	Not Used	Not Used
HWD	SW2 = On	SW2 = Off	SW2 = On

* Flashing Status Light Indicates the Board is Functioning Properly A Solid "On" Indicates a Board Malfunction

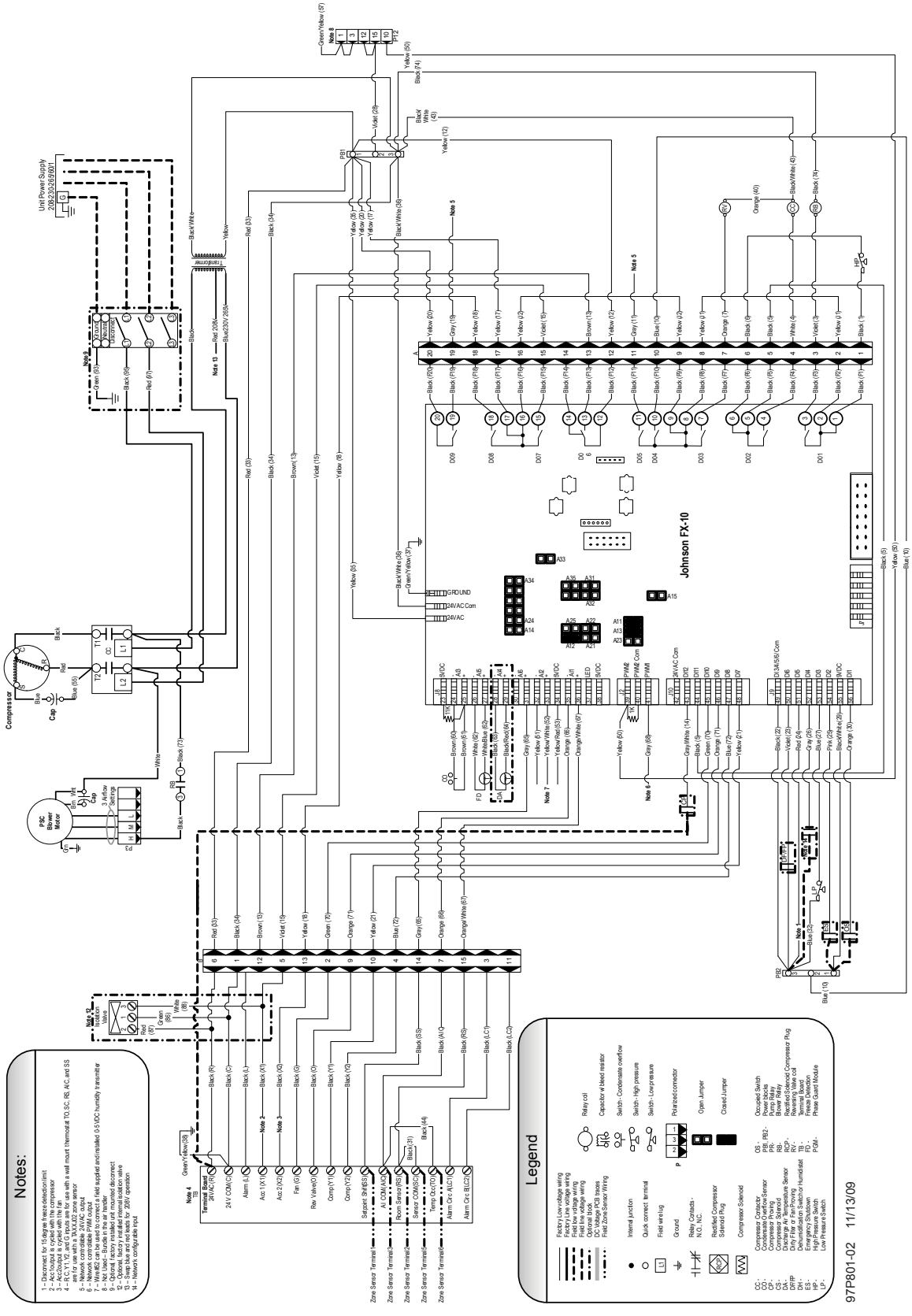
Operational Logic Table				
Single-Speed				
Mode	**Inputs**	**Fan**	**Comp**	**RV**
Htg	Y	ON	ON	OFF
Clg	Y,O	ON	ON	ON
Blower Only	G	ON	OFF	OFF
Dual-Speed				
Mode	**Inputs**	**Comp Low**	**Comp High**	**RV**
Low Speed Htg	Y	ON	OFF	OFF
High Speed Htg	Y,G	ON	ON	OFF
Low Speed Clg	Y,O	ON	OFF	ON
High Speed Clg	Y,G,O	ON	ON	ON

Normal Mode Control Timing Table		
Event	**Normal Mode**	**Test Mode**
Power On Delay	5 minutes	15 seconds
Compressor On Delay	10 seconds	2 seconds
Compressor Minimum On Time	2 minutes	5 seconds
Compressor Short Cycle Delay	5 minutes	15 seconds
Blower Off Delay	30 seconds	5 seconds
Fault Recognition Delay – High Pressure	Less than1 second	Less than1 second
Start Up Bypass– Low Pressure	2 minutes	0 seconds
Fault Recognition Delay – Low Pressure	30 seconds	30 seconds
StartUp Bypass– Low Water Coil Limit	2 minutes	0 seconds
Fault Recognition Delay – Low Water Coil Limit	30 seconds	30 seconds
Fault Recognition Delay – Condensate Overflow	30 seconds	30 seconds

97P800-05 11/13/09

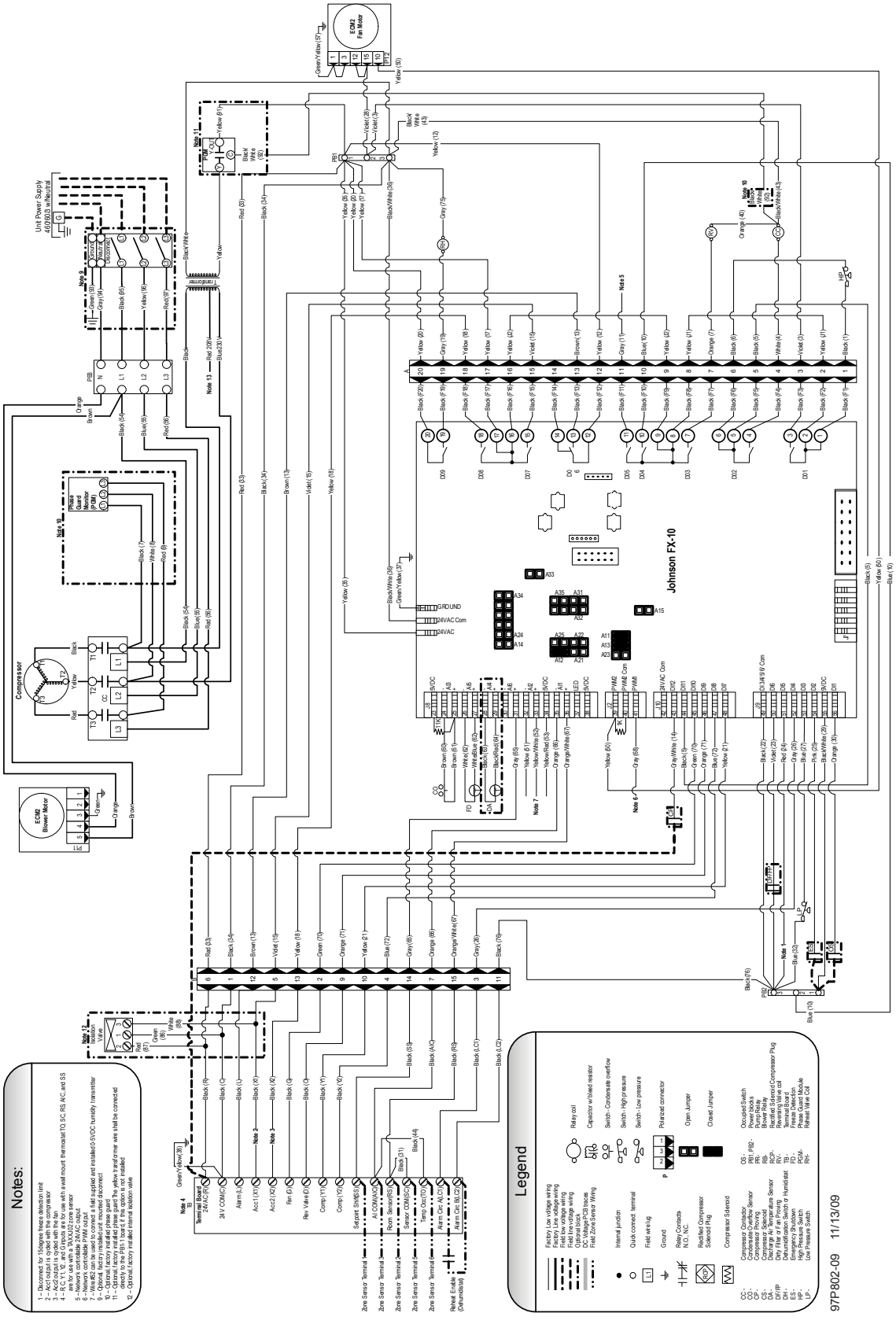
Wiring Schematics cont.

FX10 Control 208-230-265/60/1 PSC



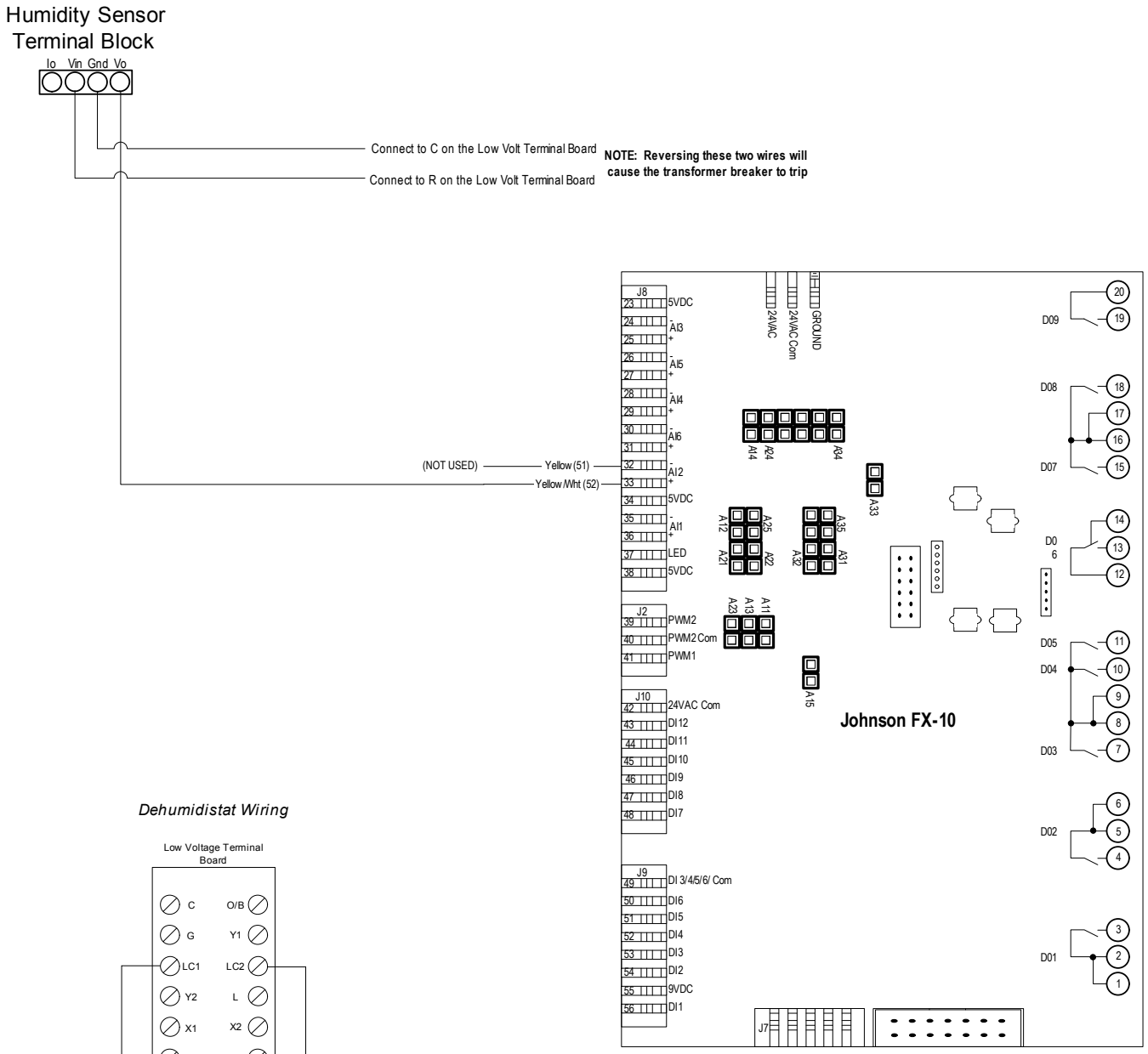
Wiring Schematics cont.

FX10 Control 460/60/3 ECM2.3

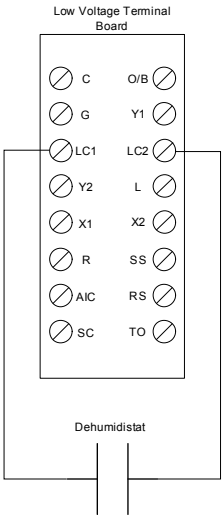


Wiring Schematics cont.

Hot Gas Reheat



Dehumidistat Wiring



Engineering Guide Specifications

General
Furnish and install water source heat pumps as indicated on the plans. Equipment shall be completely assembled, piped and internally wired. Capacities and characteristics as listed in the schedule and the specifications that follow. The reverse cycle heating/cooling units shall be either suspended type with horizontal air inlet and discharge or floor mounted type with horizontal air inlet and vertical upflow air discharge. Units shall be AHRI/ISO 13256-1 certified and listed by a nationally recognized safety-testing laboratory or agency, such as ETL Testing Laboratory. Each unit shall be computer run-tested at the factory with conditioned water and operation verified to catalog data. Each unit shall be mounted on a pallet and shipped in a corrugated box or stretch-wrapped. The units shall be designed to operate with entering liquid temperature between 20°F and 120°F [-6.7°C and 48.9°C].

Casing and Cabinet
The cabinet shall be fabricated from heavy-gauge galvanized steel and finished with optional corrosion-resistant powder coating. This corrosion protection system shall meet the stringent 1000 hour salt spray test per ASTM B117. The interior shall be insulated with 1/2″ thick, multi-density, cleanable aluminum foil coated glass fiber with edges sealed or tucked under flanges to prevent the introduction of glass fibers into the discharge air. Standard cabinet panel insulation must meet NFPA 90A requirements, air erosion and mold growth limits of UL-181, stringent fungal resistance test per ASTM-C1071 and ASTM G21, and shall meet zero level bacteria growth per ASTM G22. Unit insulation must meet these stringent requirements or unit(s) will not be accepted.

One (horizontal) to two (vertical) blower and two compressor compartment access panels shall be 'lift-out' removable with supply and return ductwork in place.

A duct collar shall be provided on the supply air opening. Standard size 1 in. [2.54 cm] MERV 4 filters shall be provided with each unit. Units shall have a return air filter rack that is field convertible from 1 in. [2.54 cm] to 2 in. [5.1 cm]. The upflow vertical units shall have a removable insulated divider panel between the air handling section and the compressor section to minimize the transmission of compressor noise and to permit operational service testing without air bypass. Vertical units shall be supplied with left or right horizontal air inlet and top vertical air discharge. Horizontal units shall be supplied with left or right air inlet and side or end air discharge.

The compressor shall be double isolation mounted using selected durometer grommets to provide vibration free compressor mounting. The compressor mounting bracket shall be acoustically deadened galvanized steel to prevent vibration transmission to the cabinet.

Option: AlpinePure MERV 13 Filter - A 2″ thick [51 mm] MERV 13 filter can help fulfill a credit under the LEED Rating System. Its low initial resistance promotes low energy consumption (0.21 in. w.g. @ 300 fpm) and provides nearly twice the life of a standard filter (300 fpm vs. standard 500 fpm application).

Option: A Super Quiet Sound package shall include multi-density full coverage compressor blanket and sound deadening multi-density laminated metal plate under the compressor.

Option: An internally mounted low pressure drop (high Cv) water solenoid valve shall be factory installed for use in variable speed pumping applications.
Option: An internally mounted automatic flow regulator shall be set to 3 gpm/ton to deliver optimal flow to the unit.

Refrigerant Circuit
All units shall utilize the non-ozone depleting and low global warming potential refrigerant R410A. All units shall contain a sealed refrigerant circuit including a hermetic motor-compressor, bidirectional thermostatic expansion valve, finned tube air-to-refrigerant heat exchanger, reversing valve, coaxial tube water-to-refrigerant heat exchanger, optional hot water generator coil, and service ports.

Compressors shall be high-efficiency single speed rotary or scroll type designed for heat pump duty and mounted on vibration isolators. The compressor shall be double isolation mounted using selected durometer grommets to provide vibration free compressor mounting. The compressor mounting bracket shall be acoustically deadened galvanized steel to prevent vibration transmission to the cabinet. Compressor motors shall be single-phase PSC with overload protection.

The air coil shall be sized for low-face velocity and constructed of lanced aluminum fins bonded to rifled copper tubes in a staggered pattern not less than three rows deep for enhanced performance.

Option: FormiShield electro-coated air coil for maximum protection against formicary corrosion.

The coaxial water-to-refrigerant heat exchanger shall be designed for low water pressure drop and constructed of a convoluted copper (cupronickel option) inner tube and a steel outer tube. Refrigerant to air heat exchangers shall utilize enhanced corrugated lanced aluminum fins and rifled copper tube construction rated to withstand 600 PSIG (4135 kPa) refrigerant working pressure. Refrigerant to water heat exchangers shall be of copper inner water tube and steel refrigerant outer tube design, rated to withstand 600 PSIG (4135 kPa) working refrigerant pressure and 450 PSIG (3101 kPa) working water pressure. The thermostatic expansion valve shall provide proper superheat over the entire liquid temperature range with minimal "hunting." The valve shall operate bidirectionally without the use of check valves.

Option: Cupronickel refrigerant to water heat exchanger shall be of copper-nickel inner water tube and steel refrigerant outer tube design, rated to withstand 600 PSIG (4135 kPa) working refrigerant pressure and 450 PSIG (3101 kPa) working water pressure. Water lines shall also be of cupronickel construction.

Option: Hot water generator - An optional heat reclaiming hot water generator coil of vented double-wall copper construction suitable for potable water shall be provided (vertical only). The coil shall be factory

Engineering Guide Specifications cont.

mounted inside the unit. An internal pump is not included. Order DPK5 for field installed pump and temperature limit.

Option: ThermaShield coated water-to-refrigerant heat exchanger shall be insulated to prevent condensation at low liquid temperatures below 50°F.

Option: AlpinePure Hot Gas Bypass
The hot gas bypass (HGB) option is designed to limit the minimum evaporating pressure in the cooling mode to prevent the air coil from icing. The option shall consist of a hot gas bypass valve installed in the discharge side of the compressor. The refrigerant control shall proportionately bypass hot gas refrigerant to the air coil when suction pressure falls below 115 psig thus limiting air coil freeze-up.

Optional AlpinePure Hot Gas Reheat
An optional hot gas reheat coil shall be available to allow dehumidification-only operation. The internal reheat system shall be factory installed and include a high efficiency reheat coil located downstream of the evaporator coil, a reclaim valve and integral controls to allow heating, cooling and reheat/dehumidification modes. The reheat coil shall be sized so that during reheat/dehumidification mode the unit will produce neutral air (78 ±3°F DB @ 50-58% relative humidity) with typical 80 DB/67 WB °F entering air and 90°F entering water temperature. The reheat coil shall be sized to restrict airflow by no more than 0.17 in wg at 350 feet per minute airflow velocity.

The FX10 control shall have three control options available:

Room wall dehumidistat – An optional room wall dehumidistat shall control the reheat mode thru a 24VAC 'Hum' input (On or Off). Setpoint and deadband shall be determined by the dehumidistat.

Duct humidity sensor – An optional duct humidity sensor shall be installed. The FX10 control reads the humidity from the sensor and determines operation mode. Setpoint and deadband are internally set by the FX10 control and shall be are adjustable. Continuous blower operation is a requirement for this mode to accurately measure relative humidity during the off cycle.

Room wall humidity sensor - An optional wall humidity sensor is installed. The FX10 control reads the humidity from the sensor and determines operation mode. Setpoint and dead band are internally set by the FX10 control and are adjustable. Continuous blower operation is NOT requirement for this mode.

Dehumidification Set Point (used only with a humidity sensor) - The factory default set point for dehumidification is 52% this is field adjustable from 30% to 60%. In addition there shall be a factory default differential of 5% field adjustable from 5% to 15%. The control will enable re-heat when the space humidity rises above the set point plus the differential.
Reheat operation during periods of vacancy - The control logic contains an unoccupied set point that can be used for periods of un-occupancy if desired. The factory default for the set point is 60% and is adjustable from 30% to 60%. The unoccupied setback must be enabled either through a building automation system or with a user interface. Factory default for unoccupied setback is off.

Space Humidity High and Low Alarm Limits (building automation system only) - The control has a high and low alarm limit that can be enumerated over a building automation system. The factory default set point for these alarm limits is 0% for the low alarm and 100% for the high alarm limit. These limits can be adjusted through a building automation system.

Blower motor and Assembly
The blower shall be a direct drive centrifugal type with a dynamically balanced wheel. The housing and wheel shall be designed for quiet low outlet velocity operation. The blower housing shall be removable from the unit without disconnecting the supply air ductwork for servicing of the blower motor. The blower motor shall be isolated from the housing by rubber grommets. The motor shall be permanently lubricated and have thermostatic overload protection.

Option: PSC blower motor shall be a three-speed PSC type.

Option: ECM2.3 blower motor shall be a variable-speed ECM2.3 type. The ECM2.3 blower motor shall be soft starting, shall maintain constant CFM over its operating static range, and shall provide 12 CFM settings. ECM2.3 motors shall be long-life ball bearing type.

Option: High static blower motors shall be available on certain PSC and ECM2.3 models.

Electrical
A control box shall be located within the unit compressor compartment and shall contain a 75VA transformer, 24 volt activated, 2 pole compressor contactor, terminal block for thermostat wiring and solid-state controller for complete unit operation. Electromechanical operation WILL NOT be accepted. Units shall be name-plated for use with time delay fuses or HACR circuit breakers. Unit controls shall be 24 volt and provide heating or cooling as required by the remote thermostat/sensor.

A Versatec microprocessor-based controller that interfaces with a multi-stage electronic thermostat to monitor and control unit operation shall be provided. The control shall provide operational sequencing, blower speed control, high and low pressure switch monitoring, freeze detection, condensate overflow sensing, lockout mode control, LED status and fault indicators, fault memory, field selectable options and accessory output. The control shall provide fault retry three times before locking out to limit nuisance trips.

A detachable terminal block with screw terminals will be provided for field control wiring. All units shall have knockouts for entrance of low and line voltage wiring. The blower motor and control box shall be harness plug wired for easy removal.

Engineering Guide Specifications cont.

Option: A FX10 microprocessor-based controller that interfaces with a multi-stage electronic thermostat to monitor and control unit operation. The control shall provide operational sequencing, blower speed control, high, low and loss of charge pressure monitoring, freeze detection, condensate overflow sensing, lockout mode control, hot water and loop pump control, LED status and fault indicators, fault memory, field selectable options and accessory output. The control shall communicate all mode, status, fault and lockout codes to the front end system for fast and accurate equipment diagnosis. The control shall provide fault retry three times before locking out to limit nuisance trips.

Optional FX10 microprocessor control communication protocols: N2, LonWorks, BACnet

Optional GeoStart™ (compressor Soft Starter) shall be factory installed for use in applications that require low starting amps, reduced compressor start-up noise, off-grid, and improved start-up behavior. GeoStart shall reduce normal starting current by 60% on 208/60/1 units.

Piping
Supply and return water connections shall be FPT copper fittings fixed to the corner post, which eliminate the need for backup pipe wrenches.

With vertical units, the condensate connection shall be a 3/4 in. [19.1 mm] PVC socket with internally-trapped hose that can be routed to front or side corner post locations.

Hanger Kit
(included with horizontal units only - field installed)
The hanger kit shall consist of galvanized steel brackets, bolts, lock washers, and isolators and shall be designed to fasten to the unit bottom panel for suspension from 3/8″ threaded rods. Unit sizes 009-070 shall include four brackets. Brackets shall not inhibit filter removal in any way.

Accessories

Thermostat (field-installed)
A multi-stage auto-changeover electronic digital thermostat shall be provided. The thermostat shall offer two heating stages and one cooling stage with precise temperature control. An OFF-HEAT-AUTO-COOL-EMERG system switch, OFF-AUTO blower switch, and indicating LEDs shall be provided. The thermostat shall display in °F or °C.

Hose Kits – Ball Valves (field-installed)
A flexible steel braid hose featuring Kevlar® reinforced EPDM core with ANSI 302/304 stainless steel outer braid and fire rated materials per ASTM E 84-00 (NFPA 255, ANSI/UL 723 & UBC 8-1). Ball valve at one end; swivel connector with adapter at the other end (swivel to adapter connection via fiber or EPDM gasket). Swivel connection provides union between heat pump and piping system. The hoses feature brass fittings, stainless steel ferrules. A full port ball valve shall be provided with integral P/T (pressure/temperature) port on supply hose.

Specifications:
- Temperature range of 35°F [2°C] to 180°F [82°C].
- Max. working pressure of 400 psi [2757 kPa] for 1/2″ and 3/4″ hose kits; max. working pressure of 350 psi [kPa] for 1″ and 1-1/4″ hose kits.

Hose Kits – Automatic Balancing and Ball Valves (field-installed)
A flexible steel braid hose featuring Kevlar® reinforced EPDM core with ANSI 302/304 stainless steel outer braid and fire rated materials per ASTM E 84-00 (NFPA 255, ANSI/UL 723 & UBC 8-1). Ball valve at one end; swivel connector with adapter at the other end (swivel to adapter connection via fiber or EPDM gasket). Swivel connection provides union between heat pump and piping system. The hoses feature brass fittings, stainless steel ferrules. A full port ball valve shall be provided with integral P/T (pressure/temperature) port on supply hose and automatic balancing valve with integral P/T ports and full port ball valve on return hose.

Specifications:
- Temperature range of 35°F [2°C] to 180°F [82°C]
- Max. working pressure of 400 psi [2757 kPa] for 1/2 in. and 3/4 in. hose kits; max. working pressure of 350 psi [2413 kPa] for 1 in. and 1-1/4 in. hose kits
- Minimum burst pressure of four times working pressure

Hose Kits – Automatic Balancing and Ball Valves with 'Y' strainer (field-installed)
A flexible steel braid hose featuring Kevlar® reinforced EPDM core with ANSI 302/304 stainless steel outer braid and fire rated materials per ASTM E 84-00 (NFPA 255, ANSI/UL 723 & UBC 8-1). Ball valve at one end; swivel connector with adapter at the other end (swivel to adapter connection via fiber or EPDM gasket). Swivel connection provides union between heat pump and piping system. The hoses feature brass fittings, stainless steel ferrules. A "y" strainer is provided on one end for fluid straining and integral "blowdown" valve. A full port ball valve shall be provided with integral P/T (pressure/temperature) port on supply hose and automatic balancing valve with integral P/T ports and full port ball valve on return hose.

Specifications:
- Temperature range of 35°F [2°C] to 180°F [82°C]
- Max. working pressure of 400 psi [2756 kPa] for 1/2 in. and 3/4 in. hose kits; max. working pressure of 350 psi [2413 kPa] for 1 in. and 1-1/4 in. hose kits
- Minimum burst pressure of four times working pressure

GEOSMART ENERGY

290 Pinebush Road, Cambridge, Ontario N1T 1Z6 | o: 1.866.310.6690 | f: 1.866.533.3889
GEOSMARTENERGY.COM

Product:	**ECO-Z Series**
Type:	Geothermal/Water Source Heat Pump
Size:	0.75-6 Ton

Document Type:	Specification Catalog
Ref. Number:	SC1200AZ1
Revision Date:	02/10
Revision Number:	1
Document Name:	TEC-SPC-Z-0210v1