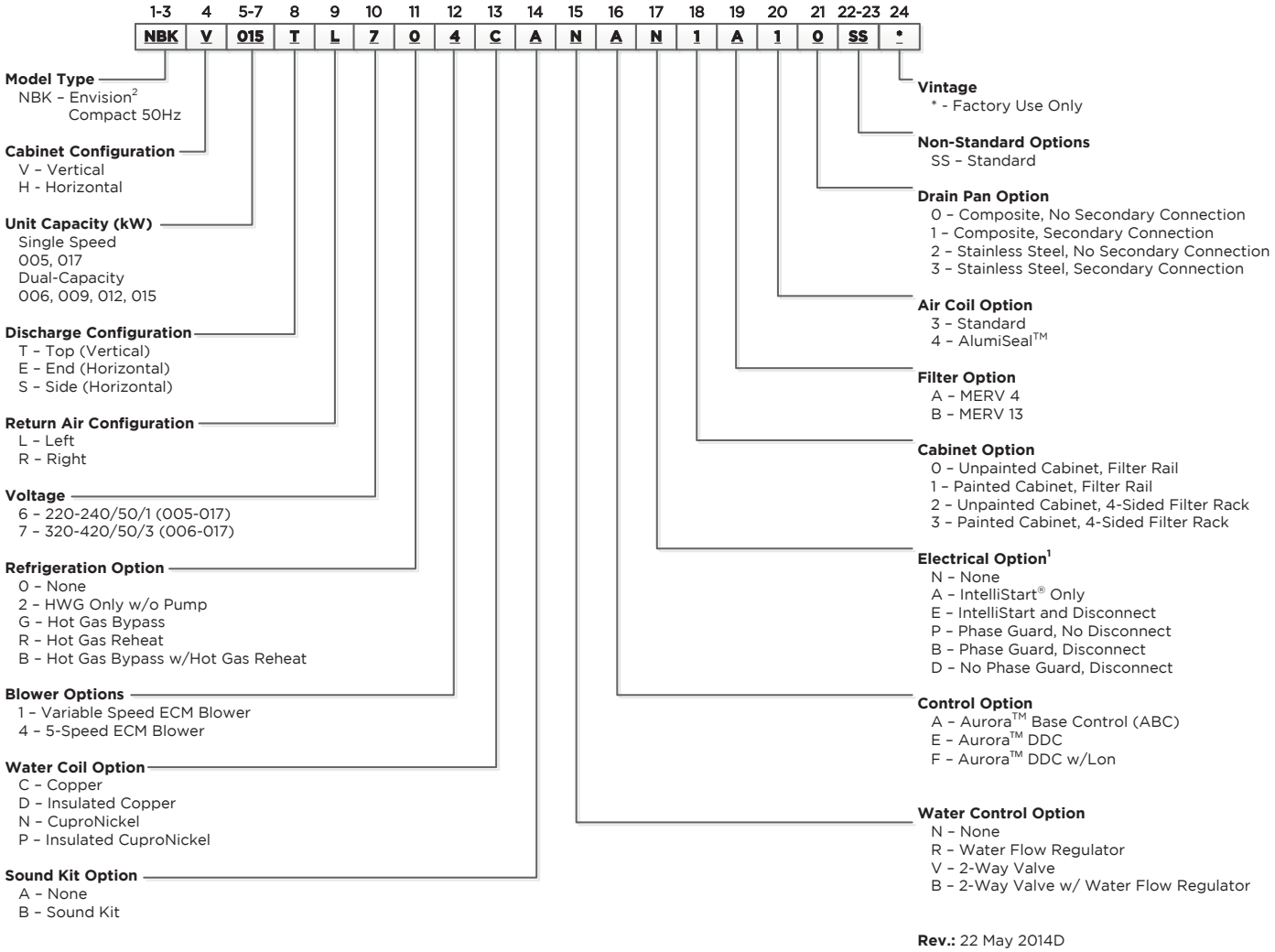
SPECIFICATION CATALOG

ENVISION™ 2
COMPACT
Commercial 005 to 017 kW
Water Source/Geothermal Heat Pump - 50 Hz

WaterFurnace®
Smarter from the Ground Up™

Table of Contents

Model Nomenclature



Rev.: 22 May 2014D

Note:
1 - Phase Guard Only Available on 380-420/50/3

CE

All Envision2 NBK 50Hz product is safety tested to CE standards and performance tested in accordance with standard EN 14511-2.

BS EN 14511 Performance Ratings

Envision2 Compact 50 Hz Series EN 14511 Data
Variable Speed ECM & X13 ECM Motors

				Cooling Tower		Water-to Brine		Control Cabinet		Close Control		Water		Brine		Water Loop	
Model	**Capacity Modulation**	**Flow Rate**		**Cooling EWT 30°C**		**Cooling EWT 10°C**		**Cooling EWT 15°C**		**Cooling EWT 30°C**		**Heating EWT 10°C**		**Heating EWT 0°C**		**Heating EWT 20°C**	
		Water, l/s	**Air, l/s**	**Capacity Output, kW**	**EER (W/W)**	**Capacity Output, kW**	**EER (W/W)**	**Capacity Output, kW**	**EER (W/W)**	**Capacity Output, kW**	**EER (W/W)**	**Capacity Output, kW**	**COP**	**Capacity Output, kW**	**COP**	**Capacity Output, kW**	**COP**
005	**Single**	0.32	283	4.59	5.0	5.69	10.3	6.55	11.3	4.24	4.6	4.67	5.0	3.60	4.0	5.63	5.8
006	**Full**	0.50	448	6.68	5.1	7.85	14.8	8.95	9.2	6.14	4.7	6.30	5.0	4.81	4.2	7.89	6.1
	Part	0.44	354	4.87	5.6	5.96	11.5	6.74	11.9	4.39	4.8	4.59	5.2	3.38	4.0	5.73	6.7
009	**Full**	0.57	614	9.99	5.6	9.75	8.7	10.85	8.8	9.40	5.3	9.14	5.0	7.16	4.4	11.11	5.9
	Part	0.50	543	7.08	6.1	8.43	12.2	9.35	12.3	6.64	5.5	6.28	5.4	4.76	4.3	7.73	6.8
012	**Full**	0.76	733	12.27	5.1	14.44	8.9	15.94	8.8	11.38	4.8	12.06	5.1	9.32	4.2	14.29	5.8
	Part	0.69	637	8.92	5.5	14.37	9.0	12.18	11.8	8.28	4.9	8.59	5.3	6.46	4.1	10.28	6.5
015	**Full**	1.01	850	16.42	5.1	19.12	8.3	21.79	8.7	15.17	4.7	14.61	4.5	11.44	3.9	18.94	5.7
	Part	0.88	708	11.35	5.3	13.40	10.2	15.88	12.5	10.48	4.7	9.46	4.3	7.28	3.5	12.57	6.0
017	**Single**	1.14	1038	16.97	4.3	20.17	7.5	22.65	7.7	15.78	3.9	18.36	4.6	14.20	3.8	22.56	5.3

9/5/2014

Legend

ABBREVIATIONS AND DEFINITIONS:

COP = coefficient of performance
EER = cooling energy efficiency (TC/kW)
ELT = entering load fluid temperature
EST = entering source fluid temperature to heat pump
FLA = full load amps
FtHd = pressure drop in feet of head
gpm = US gallon per minute
HC = heating capacity in kW
HE = heat of extraction in kW
HR = heat rejected in kW
kPa = kilopascal
kW = kilowatt
L/s = liters per second
LLT = leaving load fluid temperature from heat pump
LRA = locked rotor amps (starting current)
LST = leaving source fluid temperature from heat pump
LWPD= load heat exchanger water pressure drop
MCC = maximum continuous current
PD = pressure drop
psi = pressure drop in pounds per square inch
P/T = Pressure/Temperature
RLA = run load amps
TC = total cooling capacity in kW
W = Watt

CONVERSIONS:

x°F = (*x* - 32)/1.8°C
1 bar = 100 kPa
1 gpm = 0.0631 L/s
1 US Gallon = 3.785412 L
1 Btu/h = 0.29037 W

The Envision² Compact

WaterFurnace is proud to announce the Envision² Compact that boasts premium efficiency in a cabinet footprint that rivals lower efficiency commercial water source heat pumps. The Envision² Compact comes with single-stage compressors or two-stage Copeland UtlraTech™ scrolls for added comfort and efficiency. Other advantages of specifying this premium product is the broad range of factory installed features such as hot gas reheat, internal 2-way valves, electrical disconnects, and many other valuable features that make this product stand in a class of its own.

Envision² Compact Highlights

- Capacities ranging from 05-17 kW output
- Complete commercial voltage selection of 220-240/50/1, 380-420/50/3
- Industry leading quality through engineering and manufacturing using quality components
  - — Premium Efficiency with rotary compressors for model size 005
  - — Premium Efficiency with single stage scroll compressors for model size 017
  - — Premium Efficiency with two-stage Copeland UltraTech™ scroll compressors for model sizes 006-017
  - — Premium Efficiency 5-speed ECM or optional variable speed ECM blower motors
- 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
  - — 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 25.4 mm MERV 4 or optional 50.8 mm MERV 13 factory installed with either filter rails or optional deluxe filter rack both field switchable between 25.4 mm and 50.8 mm.
  - — Aurora Base Control or Aurora UPC with N2, BACnet, or optional LonWorks card.
  - — 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, painted cabinet

Vertical Envision² Compact

Models NBKV005 and NBKV017 Single Speed
Models NBKV006-015 Dual Capacity

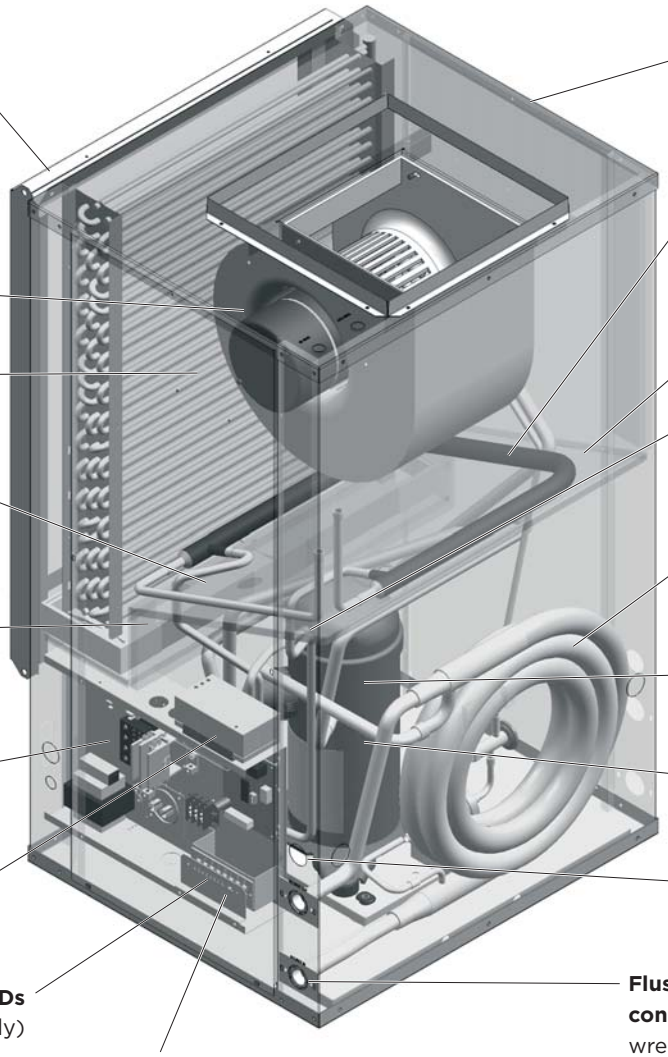
Horizontal Envision² Compact

Models NBKH005-017 Single Speed
Models NBKH006-015 Dual Capacity

The Envision² Compact cont.

Product Features: Vertical Cabinet

Vertical units are designed for high efficiency, maximum flexibility, and primary servicing from the front.



Standard filter rail, field switchable for 25.4 mm or 50.8 mm filters
Optional factory mounted deluxe filter rack (shown), field switchable for 25.4 mm or 50.8 mm filters

Removable inlet rings for easy blower removal

All-Aluminum Oversized rifled tube/lanced fin air coil (optional AlumiSeal 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
ABC - Standard
UPC - Optional

Optional IntelliStart reduces starting current by 60%

Fault and status LEDs (Aurora Base Control only)

AID Tool for diagnosing and controlling the Aurora control

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 factory installed, non-fused electrical disconnect

Optional ThermaShield coated coaxial heat exchanger

High efficiency rotary or scroll compressor

Copeland UltraTech™ scroll compressor (dual capacity)

Internally trapped condensate line

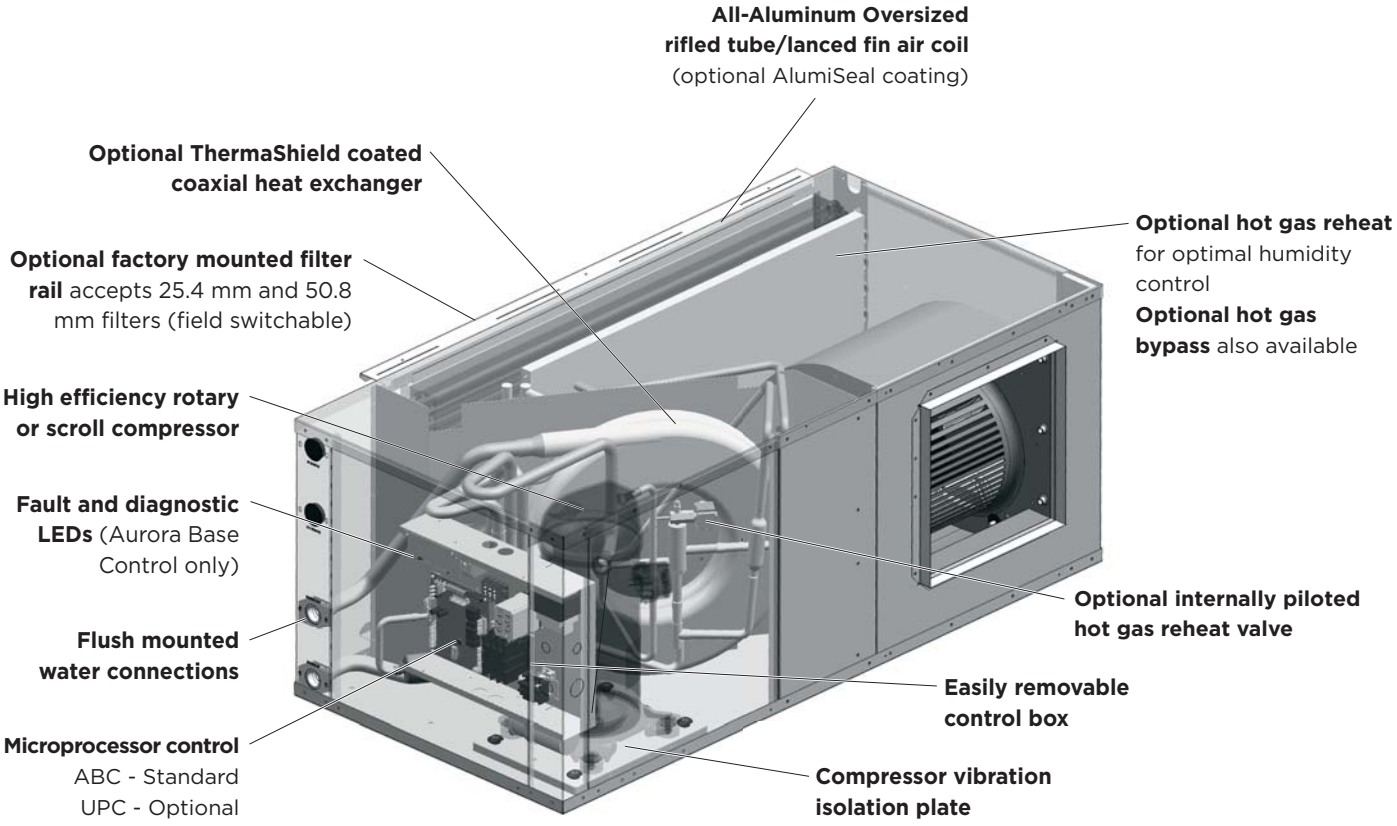
Flush mounted water connections (no backup wrenches needed)

A true left and right return option is available.

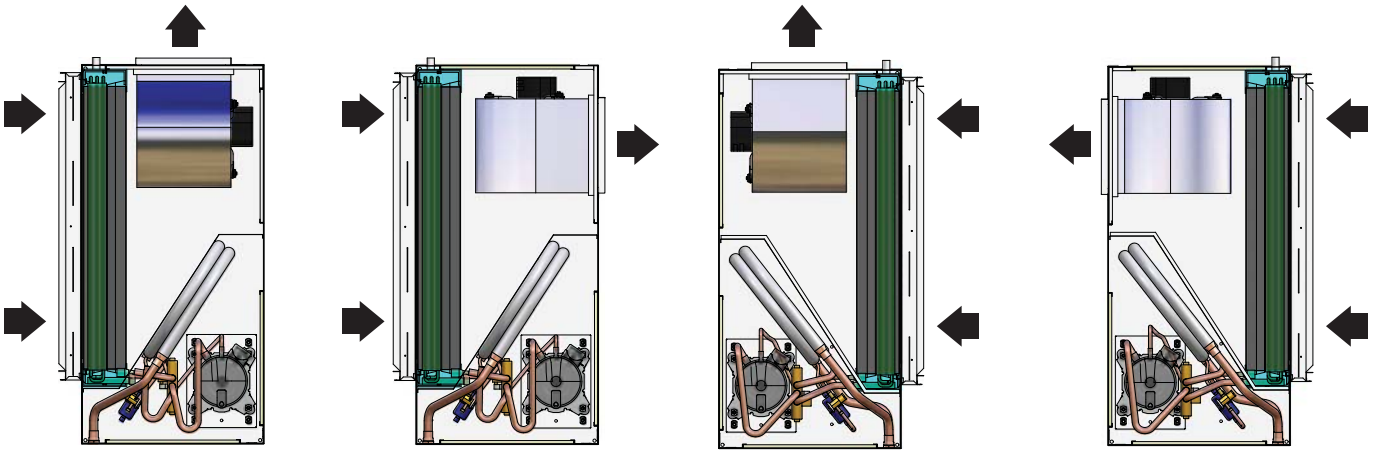
The Envision² Compact cont.

Product Features: Horizontal Cabinet

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 Envision² Compact 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 005 and 017 kW for single speed models
- Capacities of 006 through 015 kW for dual capacity models
- All commercial voltages including 220-240/50/1 and 380-420/50/3.
- Hot water generation (hot water generator - vertical only)
- 5-speed ECM or optional variable speed ECM blower motors
- All-Aluminum air coils with optional AlumiSeal coating
- 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
- Heavy gauge cabinet and vibration isolating hanger brackets
- Hot Gas Bypass and Reheat
- Internally mounted water flow regulator and/or water solenoid valve for variable speed pumping systems
- Standard Aurora Base Control or UPC DDC Control with standard N2, BACnet or optional LonWorks card.
- Phase guard with optional 'dial' disconnect
- Optional painted cabinet
- Polymer composite drain pan or stainless steel drain pan with optional secondary drain connection
- 25.4 mm MERV 4 or 50.8 mm MERV 13 filters

Other options are available by special request through WaterFurnace Commercial Sales.

Premium Efficiency

The Envision² Compact is a premium efficiency water source heat pump in a compact vertical and horizontal cabinet. The product features highly efficient and reliable single capacity rotary or scroll compressors or dual capacity Copeland UltraTech scroll compressors, mated with large blowers. These blowers are driven by efficient 5-speed ECM blower motors or highly efficient variable speed ECM blower motors.

Super Quiet Option

An optional Super Quiet Sound Package is also available for a modest cost and features multi-density laminate lined compressor blanket designed to completely surround the compressor and suppress low frequency noise.

Indoor Air Quality (IAQ)

All Envision² Compact features several IAQ benefits:

- Corrosion-free composite double-sloped drain pan to eliminate standing water and prevent bacterial growth
- A washable surface on 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 25.4 to 50.8 mm for more filter options.
- Optional factory mounted, four sided, deluxe filter rack that is field switchable from 25.4 to 50.8 mm is available for ducted return applications.
- Standard supplied filter is a pleated MERV 4, 25.4 mm. An optional low static high efficiency 50.8 mm MERV 13, for LEED certification points, is also available.

The Envision² Compact cont.

Aurora Base Control

The Aurora Base Control (ABC) System is a complete residential and commercial comfort system that brings all aspects of the HVAC system into one cohesive module network. Aurora uses the Modbus communication protocol to communicate between modules. Each module contains the logic to control all features that are connected to the module. The Aurora Base Control (ABC) has two Modbus channels. The first channel is configured as a master for connecting to devices such as a communicating thermostat, expansion board, or other slave devices. The second channel is configured as a slave for connecting the Aurora Interface Diagnostic (AID) Tool.

Aurora Unitary Protocol Converter (UPC)

The optional Aurora UPC control provides unparalleled capability in several areas including energy, refrigerant, and performance monitoring, humidity, energy management, and service diagnostics, and then communicates it all thru standard DDC protocols like N2, Lon and BACnet MS/TP. The most unique feature is integration of the Aurora Base Control and UPC into the Envision² Compact as an integrated heat Pump and DDC controller providing both a cost advantage and providing features not typically found on WSHP 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
Aurora Base Control 	The ABC microprocessor provides all the features necessary to operate today's standard WSHPs that utilize dual capacity compressors and variable speed ECM/5 speed ECM blower motors with hot gas reheat. This control can communicate to a handheld diagnostic tool to help the installing contractor or service technician with equipment setup and service. By utilizing Modbus RTU communication protocol, the ABC board can communicate with additional devices on the Aurora network	Used for residential and commercial applications that use single or dual capacity compressors with PSC, 5-speed ECM, or variable speed ECM blower motors. This base control can also communicate to the AID Tool to display faults, inputs/outputs, and software revision. Commercial features such as hot gas reheat, slow opening water valve, and random start are also capable with the ABC board.	Optional AID toll can be used for field service.	Standalone
Aurora Base Control w/UPC BACnet or N2 	The Aurora Unitary Protocol Converter (UPC) is an integrated solution and communicates directly with the Aurora Heat Pump Controls and allows access/control of a variety of internal Aurora heat pump operations such as sensors, relay operation, faults and other information. In turn, the UPC then converts internal Aurora Modbus protocol to BACnet MS/TP, or N2 protocols and communicates to the BAS system. This provides the great benefit of complete control integration and a myriad of information available to the BAS from the heat pump control. Plus it also allows individual unit configuration such as ECM fan speeds or freeze protection setting directly over the BAS without the need for access to the actual heat pump.	The Aurora UPC is implemented with the Aurora Base Controller (ABC) heat pump control into our latest water source heat pumps. All Internal Aurora points are accessible to the UPC via firmware providing an integrated solution. All zone temperatures and zone sensors are connected to the UPC on an RNet bus, simplifying hook up at the unit. RNet sensors can include a combination of zone temperature and humidity, CO2, and VOC sensors. The UPC includes built-in support for a custom configurable keypad/display unit.	Optional Equipment Touch display	BACnet MS/ TP or N2 Open (DIP selectable)
Aurora Base Control w/UPC LonWorks 	The Aurora Unitary Protocol Converter (UPC) is an integrated solution and communicates directly with the Aurora Heat Pump Controls and allows access/control of a variety of internal Aurora heat pump operations such as sensors, relay operation, faults and other information. In turn, the UPC then converts internal Aurora Modbus protocol to LONWorks protocol and communicates to the BAS system.	The Aurora UPC is implemented with the Aurora Base Controller (ABC) heat pump control into our latest water source heat pumps. All Internal Aurora points are accessible to the UPC via firmware providing an integrated solution. All zone temperatures and zone sensors are connected to the UPC on an RNet bus, simplifying hook up at the unit. RNet sensors can include a combination of zone temperature and humidity, CO2, and VOC sensors. The UPC includes built-in support for a custom configurable keypad/display unit.	Optional Equipment Touch display	LonWorks
AXB Expansion Board **(Future Availability)**	Aurora Advanced Control adds the Aurora AXB expansion board and provides added I/O and standard features. AXB can be added to any of the above packages to enhance the I/O of the controls.	• ***Refrigeration Monitoring –*** provides Suction and discharge pressure, Suction, liquid line temps and superheat and subcooling. • ***Performance Monitoring –*** provides entering and leaving loop water temperatures, loop flow rate as well as heat of extraction or rejection rate into the loop. • ***Energy Monitoring –*** provides real-time power measurement (Watt) of compressor, fan, auxiliary heat and zone pump. • Plus many more I/O options		

The Envision² Compact 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

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.

Hot Gas Bypass/Reheat

The hot gas bypass option is designed to limit the minimum evaporating pressure in the cooling mode to prevent the air coil from icing. Hot gas reheat option provides consistent comfort by removing moisture from the air without over cooling the space. These options are available together or standalone.

Phase Guard Monitor

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

Electrical Disconnect

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 7.1 g per year.
- Computer bar code equipped assembly line ensures all components are correct.
- All units are computer run-tested with water to verify both function and performance.

Inside the Envision² Compact

Refrigerant

Envision² Compact products all feature zero ozone depletion and low global warming potential refrigerant R-410A.

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. 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.

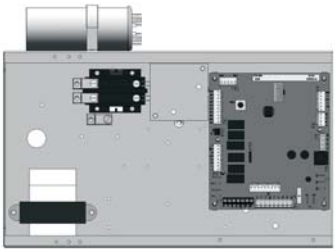
Filter Rack

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 25.4 mm and 50.8 mm thick filters for filter flexibility. A MERV 4, 25.4 mm is standard

Inside the Envision² Compact cont.

with an optional 50.8 mm MERV 13 for LEED certification points and high efficiency filtration.

Electrical Box

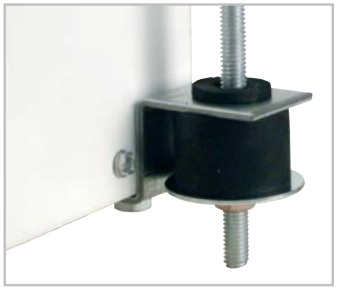


Unit controls feature quick connect wiring harnesses for easy servicing. Separate knockouts for low voltage and two sides of the electrical corner post for easy access to the control box. Large transformer (75VA with ABC with reheat and FX10, 50VA with ABC without reheat) assures adequate controls power 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.

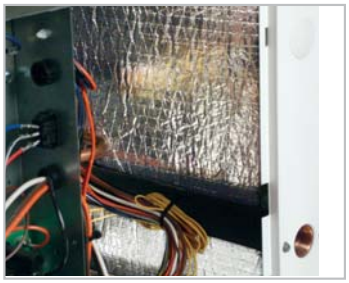
Compressors

High efficiency R-410A rotary or scroll compressors are used on every model. Rotary or scrolls provide both the highest efficiency available and great reliability. Single speed scroll and Copeland UltraTech dual capacity scroll models are available in commercial voltages.

Compressor Dual Isolation Mounting

Double isolated compressor mounting utilizing eight durometer selected rubber grommets. This isolation greatly reduces the primary noise frequency range of 100-300 Hz.

Air Handler Insulation



Washable air handler insulation surface provides cleanability to further enhance IAQ.

Thermostatic Expansion Valve

All Envision² Compact 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 (-7 to 49°C) found in geothermal systems. The TXV is located in the compressor compartment for easy access.

Inside the Envision² Compact cont.

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 3103 kPa water side and 4137 kPa 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 in. SAE connections. All water and electrical connections are made from the front of the unit. Unit is designed for front access serviceability.

4-Way Reversing Valve

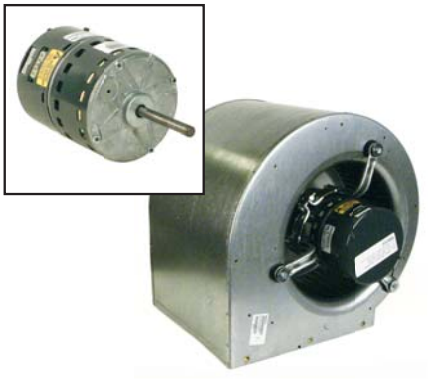
Envision² Compact units feature a reliable all-brass pilot operated refrigerant reversing valve. The reversing valve operation is limited to change of mode by the control to enhance reliability.

NEW!: All-Aluminum Air Coil

All models in the Envision² Compact Commercial line are equipped with all-aluminum air coils. WaterFurnace is the first manufacturer to offer an all-aluminum round-tube-and-fin air coil in a packaged water source heat pump. These air coils are constructed of lanced fin and rifled tube aluminum that is not susceptible to formicary corrosion. For additional condensate runoff and meeting project specifications, an optional AlumiSeal e-coating is available.

Blower Motor and Housing

High efficiency low rpm galvanized direct drive blower featuring 5-speed ECM motor and optional variable speed ECM blower motor. The variable speed ECM motor is controlled directly through the unit's Aurora Base Control. The lower rpm blower also reduces air noise. All 5-speed ECM motors have speed selection terminal strip on the motor for easy speed change. All motors are vibration isolated to reduce noise. Horizontal units can be field converted from end to side discharge as well.



NOTE: 420V 5-speed ECM blower motor does not require a neutral wire.

5-Speed ECM Constant Torque Motors

The 5-speed ECM is a 'Constant Torque' ECM motor and delivers air flow similar to a PSC but operates as efficiently as a variable speed ECM motor. Because it is an ECM motor, the 5-speed ECM can ramp slowly up or down like the variable speed ECM motor. There are 5 possible speed taps available on the 5-speed ECM motor with #1 being the lowest airflow and #5 being the highest airflow. These speed selections are preset at the time of manufacture and are easily changed in the field if necessary.

5-Speed ECM Benefits:

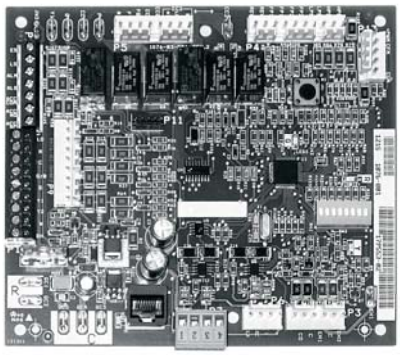
- High efficiency
- Soft start
- 5 speeds with up to 4 speeds on-line
- Built in logic allows air flow to change with G, Y1, Y2, and W signals
- Super efficient low airflow continuous blower setting (G)

IntelliStart®

The optional IntelliStart soft starter will reduce the normal start current (LRA) by 60%. This allows the heat pump to go off-grid. Using IntelliStart also provides a substantial reduction in voltage sag, reduces startup noise, and improves the compressor's start behavior.

Controls - Aurora Base Control

Aurora Base Control



Control Features

Single or Dual Capacity Compressors

Either single or dual capacity compressors can be operated.

Variable Speed ECM Blower Motor Option

A traditional variable speed ECM blower motor can be driven directly using the onboard PWM output. Three blower speeds are available based upon the G, Y1, and Y2/W input signals to the board. The blower speeds can be changed either by the variable speed ECM manual configurations mode method or by using the Aurora AID Tool directly. All three blower speeds can be set to the same speed if desired.

5-Speed Blower Motor Option

A 5-speed blower motor will be driven directly using the thermostat connections. Any three of the G, Y1, or Y2/W signals can drive any of the 5 available pre-programmed blower speeds on the motor.

Other Control Features

- Random start at power up
- Anti-short cycle protection
- High and low pressure cutouts
- Loss of charge
- Water coil freeze detection
- Air coil freeze detection
- Over/under voltage protection
- Condensate overflow sensor
- Load shed
- Dehumidification (where applicable)
- Emergency shutdown
- Hot gas reheat operation (where applicable)
- Diagnostic LED
- Test mode push button switch
- Two auxiliary electric heat outputs
- Alarm output
- Accessory output with N.O. and N.C.
- Modbus communication (master) (where applicable)
- Modbus communication (slave) (where applicable)

Field Selectable Options via Hardware

DIP Switch (SW1) – Test/Configuration Button (See SW1 Operation Table)

Test Mode

The control is placed in the test mode by holding the push button switch SW1 for 2 - 5 seconds. In test mode most of the control timings will be shortened by a factor of sixteen (16). LED3 (green) will flash at 1 second on and 1 second off. Additionally, when entering test mode LED1 (red) will flash the last lockout one time. Test mode will automatically time out after 30 minutes.

Test mode can be exited by pressing and holding the SW1 button for 2 to 5 seconds or by cycling the power.

Test mode will automatically be exited after 30 minutes.

Variable Speed ECM Configuration Mode

The control is placed in variable speed ECM configuration mode by holding the pushbutton switch SW1 for 5 to 10 seconds, the high, medium, and low variable speed ECM speeds can be selected by following the LED display lights. LED2 (yellow) will fast flash when entering variable speed ECM configuration. When setting low speed LED3 (green) will be continuously lit, for medium speed LED1 (red) will be continuously lit, and for high speed both LED3 (green) and LED1 (red) will be continuously lit. During variable speed ECM configuration mode LED2 (yellow) will flash each of the 12 possible blower speeds 3 times. When the desired speed is flashed press SW1, LED2 will fast flash until SW1 is released. Low speed has now been selected. Next select medium speed, and high speed blower selections following the same process above. After third selection has been made, the control will exit the variable speed ECM configuration mode.

Reset Configuration Mode

The control is placed in reset configuration mode by holding the push button switch SW1 for 50 to 60 seconds. This will reset all configuration settings and the EEPROM back to the factory default settings. LED3 (green) will turn off when entering reset configuration mode. Once LED3 (green) turns off release SW1 and the control will reset.

DIP Switch (SW2)

SW2-1 FP1 Selection – Temperature limit setting for freeze detection. On = -1.1°C; Off = -9.4°C.

SW2-2 FP2 Selection – Future Use

SW2-3 RV – O/B - thermostat type. Heat pump thermostats with “O” output in cooling or “B” output in Heating can be selected. On = O; Off = B.

SW2-4 and 2-5 Access Relay Operation (P2)

Controls - Aurora Base Control cont.

Access Relay Operation	SW2-4	SW2-5
Cycle with Blower	ON	ON
Cycle with Compressor	OFF	OFF
Water Valve Slow Opening	ON	OFF
(Reserved)	OFF	ON

Cycle with Blower - The accessory relay will cycle with the blower output.

Cycle with Compressor - The accessory relay will cycle with the compressor output.

Water Valve Slow Opening - The accessory relay will cycle and delay both the blower and compressor output for 90 seconds.

SW2-6 CC Operation – selection of single or dual capacity compressor. On = Single Stage; Off = Dual Capacity

SW2-7 Lockout and Alarm Outputs (P2) – selection of a continuous or pulsed output for both the LO and ALM Outputs. On = Continuous; Off = Pulsed

SW2-8 Reheat Operation – On = Normal; Off = Reheat

Alarm Jumper Clip Selection

From the factory, ALM is connected to 24 VAC via JW2. By cutting JW2, ALM becomes a dry contact connected to ALG.

Variable Speed ECM Blower Speeds

The blower speeds can be changed either by using the variable speed ECM manual configurations mode method or by using the Aurora AID Tool directly (see Instruction Guide: Aurora Interface and Diagnostic (AID) Tool topic).

Field Selectable Options via Software

(Selectable via the Aurora AID Tool)

Variable Speed ECM Blower Speeds

A traditional variable speed ECM blower motor can be driven directly using the onboard PWM output. Three blower speeds are available, based upon the G (low), Y1 (med), and Y2/W (high) input signals to the board. The blower speeds can be changed either by the variable speed ECM manual configurations mode method (see Variable Speed ECM Configuration Mode topic) or by using the Aurora AID Tool directly. All three blower speeds can be set to the same speed if desired.

Safety Features

The following safety features are provided to protect the compressor, heat exchangers, wiring and other components from damage caused by operation outside of design conditions.

Fuse – a 3 amp automotive type plug-in fuse provides protection against short circuit or overload conditions.

Anti-Short Cycle Protection – 4 minute anti-short cycle protection for the compressor.

Random Start – 5 to 80 second random start upon power up.

Fault Retry – in the fault condition, the control will stage off the outputs and then "try again" to satisfy the thermostat Y input call. Once the thermostat input calls are satisfied, the control will continue on as if no fault occurred. If 3 consecutive faults occur without satisfying the thermostat Y input call, then the control will go to Lockout mode.

Lockout – when locked out, the blower will operate continuously in low speed, and PSC blower motor output will remain on. The Alarm output (ALM) and Lockout output (L) will be turned on. The fault type identification display LED1 (Red) shall flash the fault code. To reset lockout conditions with SW2-8 On, thermostat inputs "Y1", "Y2", and "W" must be removed for at least three (3) seconds. To reset lockout conditions with SW2-8 Off, thermostat inputs "Y1", "Y2", "W", and "DH" must be removed for at least three (3) seconds. Lockout may also be reset by turning power off for at least 5 seconds or by enabling the emergency shutdown input for at least 3 seconds.

Lockout With Emergency Heat - if the control is locked out in the heating mode, and a Y2 or W input is received, the control will operate in the emergency heat mode while the compressor is locked out. The first emergency heat output will be energized ten (10) seconds after the W input is received, and the blower will shift to high speed. If the control remains locked out, and the W input is present, additional stage of emergency heat will stage on after two (2) minutes. When the W input is removed, all of the emergency heat outputs will turn off, and the variable speed ECM blower will shift to low speed and PSC blower motor output will remain on.

High Pressure – fault is recognized when the Normally Closed High Pressure Switch, P4-9/10 opens, no matter how momentarily. The High Pressure Switch is electrically in series with the Compressor Contactor and serves as a hard-wired limit switch if an overpressure condition should occur.

Low Pressure - fault is recognized when the Normally Closed Low Pressure Switch, P4-7/8 is continuously open for 30 seconds. Closure of the LPS any time during the 30 second recognition time restarts the 30 second continuous open requirement. A continuously open LPS shall not be recognized during the 2 minute startup bypass time.

Loss of Charge – fault is recognized when the Normally Closed Low Pressure Switch, P4-7/8 is open prior to the compressor starting.

Controls - Aurora Base Control cont.

Condensate Overflow - fault is recognized when the impedance between this line and 24 VAC common or chassis ground drops below 100K ohms for 30 seconds continuously.

Freeze Detection - set points shall be either -1.1°C or -9.4°C. When the thermistor temperature drops below the selected set point, the control shall begin counting down the 30 seconds delay. If the thermistor value rises above the selected set point, then the count should reset. The resistance value must remain below the selected set point for the entire length of the appropriate delay to be recognized as a fault. This fault will be ignored for the initial 2 minutes of the compressor run time.

Over/Under Voltage Shutdown - An over/under voltage condition exists when the control voltage is outside the range of 18 VAC to 30 VAC. If the over/under voltage shutdown lasts for 15 minutes, the lockout and alarm relay will be energized. Over/under voltage shutdown is self-resetting in that if the voltage comes back within range of 18 VAC to 30 VAC for at least 0.5 seconds, then normal operation is restored.

Operation Description

Power Up - The unit will not operate until all the inputs and safety controls are checked for normal conditions. The unit has a 5 to 80 second random start delay at power up. Then the compressor has a 4 minute anti-short cycle delay after the random start delay.

Standby In standby mode, Y1, Y2, W, DH, and G are not active. Input O may be active. The blower and compressor will be off.

Heating Operation

Heating, 1st Stage (Y1) - The blower is started on low speed immediately and the compressor is energized 10 seconds after the Y1 input is received. The variable speed ECM blower motor is switched to medium speed 15 seconds after the Y1 input.

Heating, 2nd Stage (Y1, Y2) - The compressor will be staged to full capacity 20 seconds after Y2 input is received. The variable speed ECM blower will shift to high speed 15 seconds after the Y2 input is received.

Heating, 3rd Stage (Y1, Y2, W) - The first stage of electric heat is energized 10 seconds after the W command is received. If the demand continues the second stage of electric heat will be energized after 5 minutes.

Emergency Heat (W) - The blower will be started on low speed, 10 seconds later the first stage of electric heat will be turned on. 5 seconds after the first stage of electric heat is energized the blower will shift to high speed. If the emergency heat demand is not satisfied after 2 minutes the second electric heat stage will be energized.

Blower (G) - The blower will start immediately upon receiving a thermostat G command. If there are no other commands from the thermostat the variable speed ECM will run on low speed until the G command is removed. Regardless of blower input (G) from the thermostat, the blower will remain on low speed for 30 seconds at the end of each heating cycle.

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, 1st Stage (Y1,O) - The blower is started on low speed immediately and the compressor is energized 10 seconds after the Y1 input is received. The variable speed ECM blower motor is switched to medium speed 15 seconds after the Y1 input.

Cooling, 2nd Stage (Y1, Y2, O) - The compressor will be staged to full capacity 20 seconds after Y2 input was received. The variable speed ECM blower will shift to high speed 15 seconds after the Y2 input was received.

Blower (G) - The blower will start immediately upon receiving a thermostat G command. If there are no other commands from the thermostat the variable speed ECM will run on low speed until the G command is removed. Regardless of blower input (G) from the thermostat, the blower will remain on low speed for 30 seconds at the end of each heating, cooling, emergency heat, and reheat cycle.

Dehumidification (Y1, O, DH or Y1, Y2, O, DH) - When a DH command is received from the thermostat during a compressor call for cooling the variable speed ECM blower speed will be reduced by 15% to increase dehumidification.

Emergency Shutdown - Four (4) seconds after a valid ES input, P2-7 is present, all control outputs will be turned off and remain off until the emergency shutdown input is no longer present. The first time that the compressor is started after the control exits the emergency shutdown mode, there will be an anti-short cycle delay followed by a random start delay. Input must be tied to common to activate.

Continuous Blower Operation - The blower output will be energized any time the control has a G input present, unless the control has an emergency shutdown input present. The blower output will be turned off when G input is removed.

Controls - Aurora Base Control cont.

Load Shed

The LS input disables all outputs with the exception of the blower output. When the LS input has been cleared, the anti-short cycle timer and random start timer will be initiated. Input must be tied to common to activate.

LED Displays

These three LEDs display the status, configuration, and fault codes for the control. These can also be read in plain English via the Aurora AID Tool.

Status LED (LED3, Green)

Description of Operation	Fault LED, Green
Normal Mode	ON
Control is Non-functional	OFF
Test Mode	Slow Flash
Lockout Active	Fast Flash
Dehumidification Mode	Flash Code 2
(Reserved)	Flash Code 3
(Reserved)	Flash Code 4
Load Shed	Flash Code 5
ESD	Flash Code 6
(Reserved)	Flash Code 7

Configuration LED (LED2, Yellow)

Description of Operation	Configuration LED, Yellow
No Software Overwritten	Flashing Variable Speed ECM Setting
DIP Switch was Overwritten	Slow Flash
Variable Speed ECM Configuration Mode	Fast Flash

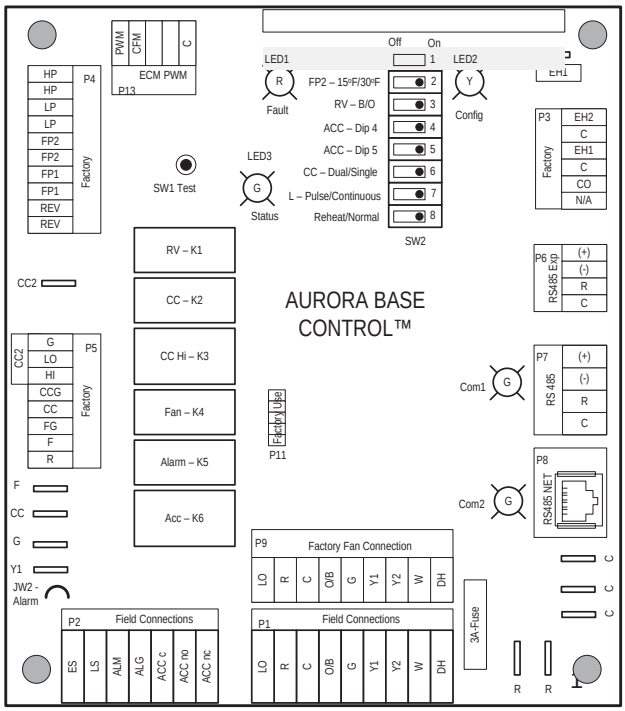
Fault LED (LED1, Red)

Description of Operation	Fault LED, Red
Normal Mode	OFF
Input Fault Lockout	Flash Code 1
High Pressure Lockout	Flash Code 2
Low Pressure Lockout	Flash Code 3
Freeze Detection 2 - (Future Use)	Flash Code 4
Freeze Detection 1 - (Coax)	Flash Code 5
(Reserved)	Flash Code 6
Condensate Overflow	Flash Code 7
Over/Under Voltage Shutdown	Flash Code 8
Freeze Detection Sensor Error (Sensor is Out of Range)	Flash Code 11

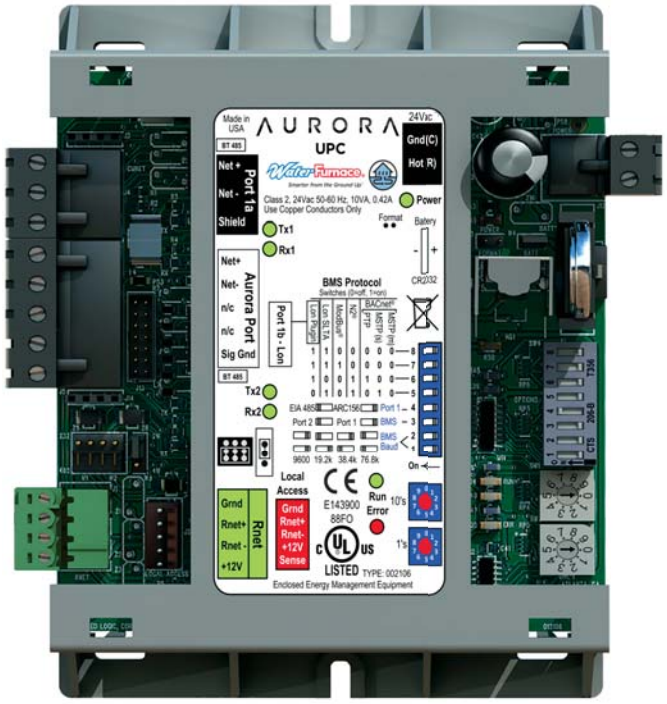
Aurora Interface and Design (AID) Tool

The Aurora Interface and Diagnostics (AID) Tool is a device that is a member of the Aurora network. The AID Tool is used to troubleshoot equipment which uses the Aurora control via Modbus RTU communication. The AID Tool provides diagnostics, fault management, variable speed ECM setup, and system configuration capabilities to the Aurora family of controls. An AID Tool is recommended, although not required, for variable speed ECM airflow settings.

ABC Control Board Layout



Controls - UPC DDC Control (optional)



Aurora UPC Controller

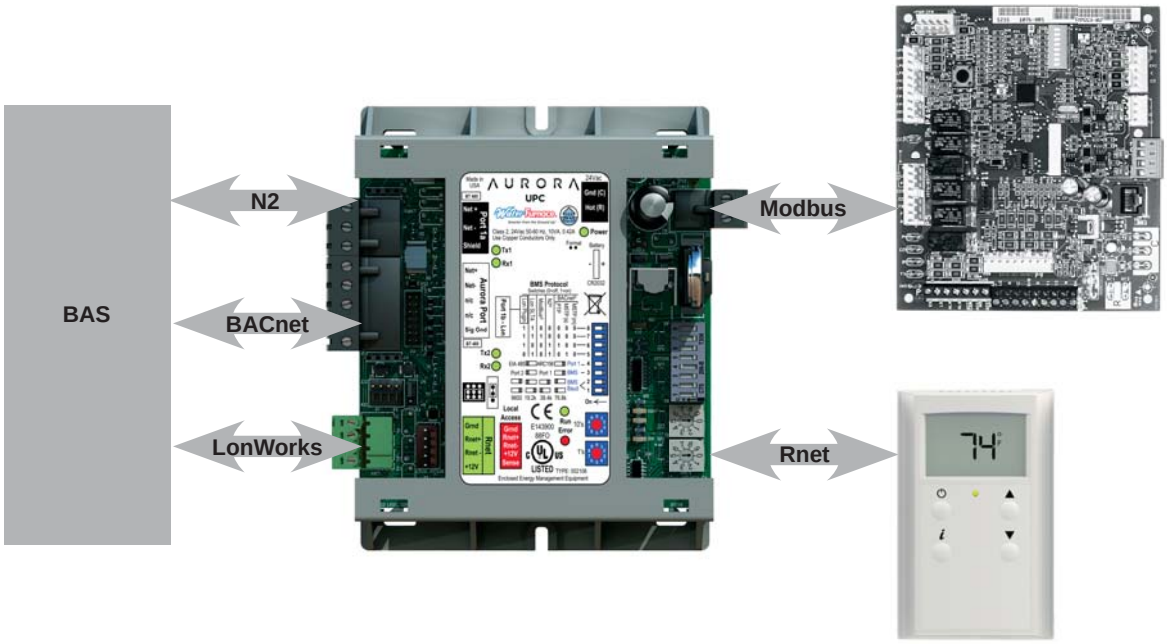
ZS Series Sensors

The Aurora Unitary Protocol Converter (UPC) is designed to add-on to any Aurora based heat pump control. The Aurora Unitary Protocol Convertor (UPC) is designed to allow water source heat pumps to be integrated into Building Automation Systems (BAS) with ease. The Aurora UPC is an integrated solution and communicates directly with the Aurora Heat Pump Controls and allows access/control of a variety of internal Aurora heat pump operations such as sensors, relay operation, faults and other information. In turn, the UPC then converts internal Aurora Modbus protocol to BACnet MS/TP, LON, or N2 protocols and communicates to the BAS system. This provides the great benefit of complete control integration and a myriad of information available to the BAS from the heat pump control. Plus it also allows individual unit configuration such as ECM fan speeds or freeze protection setting directly over the BAS without the need for access to the actual heat pump. The Aurora UPC is programmed using the powerful Eikon object oriented.

The Aurora UPC is implemented with the Aurora Base Controller (ABC) heat pump control into our latest water source heat pumps. This will allow for a BAS to integrate and communicate to the heat pump thru a choice of 3 different communication protocols. The Aurora UPC has the ability to communicate BACnet MS/TP, N2 open, or LonWorks (requires LON Plugin card). This flexibility is possible due to the onboard dipswitches which allow for the desired protocol and baud rate to be selected in the field. All zone temperatures and zone sensors are connected to the UPC on an RNet bus, simplifying hook up at the unit. RNet sensors can include a combination of zone temperature and humidity, CO2, and VOC sensors. The UPC includes built-in support for a custom configurable keypad/display unit - BACview6 (4-line by 40 character per line display) or BACview5 (2-line by 16 character per line display). Up to 2 Keypad/display units can be mounted remotely for configuration and troubleshooting.

There are an extensive number of points that the UPC has available over the network for integration into the BAS. Control programmers need to carefully determine which points they want to add into the BAS database. A list of the BACnet points, N2 points, and LON SNVTs are available along with their individual point descriptions by contacting the Commercial Solutions Group at 1-877-677-4420.

Controls - UPC DDC Control (optional) cont.



Aurora UPC Features

- Rugged enclosure made of GE C2950 Cycoloy plastic
- Built-in surge transient protection circuitry
- Operating range of -20° to 140°F; 10 to 95% relative humidity, non-condensing
- Onboard CR123A battery has a life of 10 years with 720 hours of cumulative power outage
- Multi-Protocol field selectable communication port that supports:
  - EIA-485 BACnet MS/TP @ 9600, 19.2k, 38.4k, 76.8k baud
  - Metasys N2 Open
  - LonWorks TP/FT-10 (Requires optional LON plug-in communication card)
- Status of all unit operating conditions and fault lockouts
- Visual LED's for status of power, network communication, processor operation, and errors
- Provides gateway into Aurora heat pump controls for unsurpassed control flexibility
  - Network point for commanding unit into load shed
  - Network point for commanding unit into emergency shutdown
  - Network points to assist in fan speed selection
  - Network points for freeze protection settings
- Heating and cooling control from a remotely located zone sensor
- Rnet communication port which allows for multiple Rnet zone sensors (5) to be connected for space temperature averaging if desired.
- Local laptop or BACview connection for field service
- FCC, UL and CE listed. BTL Certification is pending

Aurora UPC Optional Features

- BACview handheld display, needed for field configuration of fan speeds, set points, etc.
- AID Tool for Aurora ABC configuration and troubleshooting.
- Aurora Advanced Control adds the Aurora AXB expansion board and provides added I/O and standard features
- Optional Sensor Kits (requires Aurora Advanced Control with AXB - Future Availability on Select Models/Configurations)
  - **Refrigeration Monitoring –** provides Suction and discharge pressure, Suction, liquid line temps and superheat and subcooling.
  - **Performance Monitoring –** provides entering and leaving loop water temperatures, loop flow rate as well as heat of extraction or rejection rate into the loop.
  - **Energy Monitoring –** provides real-time power measurement (Watt) of compressor, fan, auxiliary heat and zone pump.
- Graphics packages available in the future

Controls - UPC DDC Control (optional) cont.

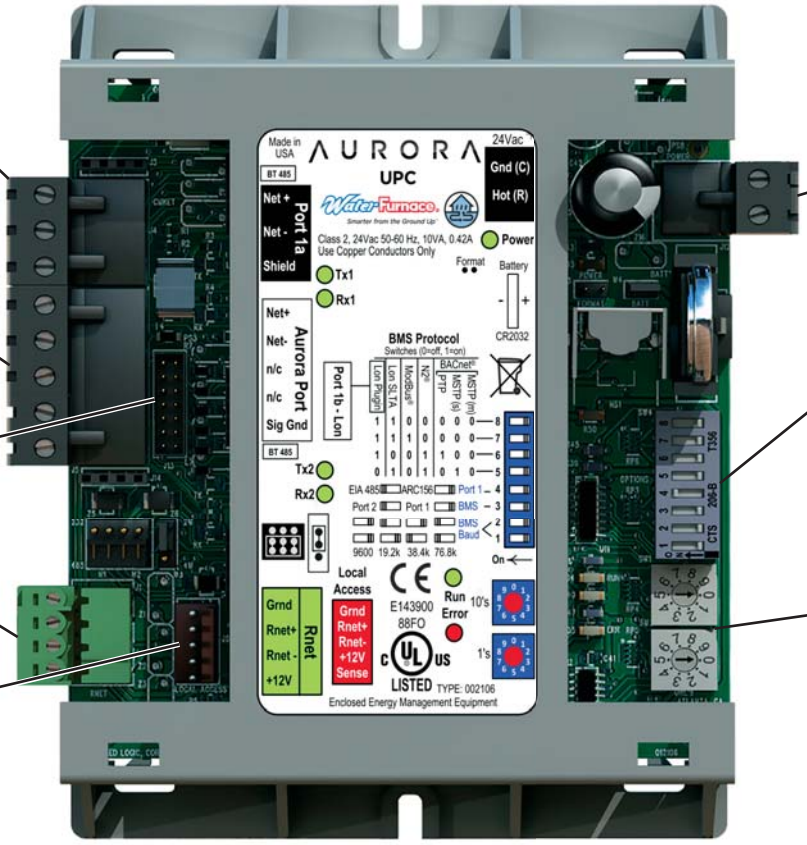
Port 1a is used to communicate to the Building Automation System (BAS). This port's settings are configured through the onboard dip switches.

Port 2 is used to communicate to the Aurora Base Controller (ABC).

Port 1b is used for the LonWorks plugin.

Rnet port is used for communicating zone sensors.

BACview or local laptop connection.



24Vac

Dip switches for configuring the communication port protocol and baud rate for the BAS port.

Mac address is set by 2 rotary dials.

Aurora Touch Interface

Utilizing a touch-screen interface, the UPC provides a technician the ability to configure and diagnose equipment at the unit or from any room sensor for added accessibility and simpler troubleshooting. The technician will have full access to equipment status, parameter values, temperature, and humidity sensing as well as access to alarm and trend history. With website-like navigation, the Aurora Touch Interface is easy to use and provides important insight into the system so your building can operate as efficiently as possible.

Controls - UPC DDC Control (optional) cont.

1. ***Leaving Air Temperature (LAT) Sensor –*** This 10 kOhm NTC sensor is factory installed on all UPC equipped heat pumps. It typically is attached to wiring inside the blower cabinet on the suction side of the blower. This sensor is attached on ABC FP2 pins available as LAT AU-30.

1. ***Compressor Proving Sensors –*** This optional factory installed current sensor is connected to confirm compressor operation via the power wires. The sensor is attached at ABC Y1 and available at point BV-65.

1. ***Valve End Switch –*** This optional input is setup for a field installed flow valve end switch. This end switch input is attached at ABC Y2 and available at point BV-67.

1. ***Fan Proving Sensors –*** This optional factory installed current sensor is connected to confirm fan operation via the power wires. The sensor is attached at ABC G and available at point BV-33.

1. ***Occupancy Sensor -*** This standard feature includes a field installed and wired room sensor with occupancy sensor typically found in DDC systems. The RNet room sensors can be found thru your commercial representative. The occupancy Sensors are attached at ABC 0 and can be found at point BV-49.

1. ***Dirty Filter Switch –*** This optional field installed switch is connected to confirm dirty filter operation. The dirty filter switch can be found thru your commercial representative. The sensor is attached at ABC W and available at point BV-63.

2. ***Fault, Configuration, and Status Codes –*** The codes can be visible to the BAS if desired

Aurora Base Fault Codes (ABC Only)

Fault LED (LED1, Red)

	Red Fault LED	LED Flash Code*	Lockout	Reset/ Remove
ABC Basic Faults	Normal - No Faults	OFF	–	
	Fault - Input	1	No	Auto
	Fault - High Pressure	2	Yes	Hard or Soft
	Fault - Low Pressure	3	Yes	Hard or Soft
	Fault - Freeze Detection FP2	4	Yes	Hard or Soft
	Fault - Freeze Detection FP1	5	Yes	Hard or Soft
	Fault - Condensate Overflow	7	Yes	Hard or Soft
	Fault - Over/Under Voltage	8	No	Auto
	Fault - FP1 & FP2 Sensor Error	11	Yes	Hard or Soft

NOTE: All codes >11 use long flash for tens digit and short flash for the ones digit. 20, 30, 40, 50, etc. are skipped.

Aurora Advanced Fault Codes (ABC + AXB Expansion Board)

Fault LED (LED1, Red)

	Red Fault LED	LED Flash Code *	Lockout	Reset/ Remove	Fault Condition Summary
ABC Basic Faults	Normal - No Faults	Off	-		
	Fault-Input	1	No	Auto	Tstat input error. Autoreset upon condition removal.
	Fault-High Pressure	2	Yes	Hard or Soft	HP switch has tripped (>600 psi)
	Fault-Low Pressure	3	Yes	Hard or Soft	Low Pressure Switch has tripped (<40 psi for 30 continuous sec.)
	Fault-Freeze Detection FP2	4	Yes	Hard or Soft	Freeze protection sensor has tripped (<15 or 30 degF for 30 continuous sec.)
	Fault-Freeze Detection FP1	5	Yes	Hard or Soft	Freeze protection sensor has tripped (<15 or 30 degF for 30 continuous sec.)
	Fault-Condensate Overflow	7	Yes	Hard or Soft	Condensate switch has shown continuity for 30 continuous sec.
	Fault-Over/Under Voltage	8	No	Auto	Instantaneous voltage is out of range. **Controls shut down until resolved.
	Fault-FP1 & 2 Snsr Error	11	Yes	Hard or Soft	If FP1 or 2 Sensor Error
ABC & AXB Advanced Faults	Fault-Compressor Monitor	10	Yes	Hard or Soft	Open Crkt, Run, Start or welded cont
	Non-CriticAXBSnsrErr	13	No	Auto	Any Other Sensor Error
	CriticAXBSnsrErr	14	Yes	Hard or Soft	Sensor Error for EEV or HW
	Alert-HotWtr	15	No	Auto	HW over limit or logic lockout. HW pump deactivated.
	Fault-VarSpdPump	16	No	Auto	Alert is read from PWM feedback.
	Not Used	17	No	Auto	IZ2 Com Fault. Autoreset upon condition removal.
	Non-CritComErr	18	No	Auto	Any non-critical com error
	Fault-CritComErr	19	No	Auto	Any critical com error. Auto reset upon condition removal
	Alarm - Low Loop Pressure	21	No	Auto	Loop pressure is below 3 psi for more than 3 minutes
	Alarm - Home Automation 1	23	No	Auto	Closed contact input is present on Dig 2 input - Text is configurable
	Alarm - Home Automation 2	24	No	Auto	Closed contact input is present on Dig 3 input - Text is configurable

NOTES:
*All codes >11 use long flash for tens digit and short flash for the ones digit. 20, 30, 40, 50 etc. are skipped!
Alert' is a noncritical sensor or function that has failed. Normal operation of the heat pump is maintained but service is desired at some point.

Controls - UPC DDC Control (optional) cont.

Aurora Base or Advanced Control Configuration and Status Codes

Status LED (LED3, Green)

Description of Operation	Fault LED, Green
Normal Mode	ON
Control is Non-functional	OFF
Test Mode	Slow Flash
Lockout Active	Fast Flash
Dehumidification Mode	Flash Code 2
Load Shed	Flash Code 5
Emergency Shutdown	Flash Code 6
On Peak Mode	Flash Code 7
(Future Use)	Flash Code 8
(Future Use)	Flach Code 9

Configuration LED (LED2, Yellow)

Description of Operation	Configuration LED, Yellow
No Software Overwritten	ECM Setting
DIP Switch Overwritten	Slow Flash
ECM Configuration Mode	Fast Flash
Reset Configuration Mode	OFF

9. ***Alarm Relay –*** The Alarm relay (ALM) is factory connected to 24 VAC via jumper JW2. By cutting JW2, ABC ALM becomes a dry contact connected to ABC ALG. The Relay is field switchable between Factory setting as an Alarm output or available for other uses.
10. ***Accessory Relay1 –*** A configurable, accessory relay on the ABC is provided that can be cycled with the compressor, blower, or the Dehumidifier (DH) input. A third (factory) setting cycles the relay with the compressor but delays the compressor and blower output for 90 sec. Source pump or slow opening solenoid valves in well systems or variable speed primary pumping systems would be a prime use of this feature.

Access Relay Operation	SW2-4	SW2-5
Cycle with Blower	ON	ON
Cycle with Compressor	OFF	OFF
Water Valve Slow Opening	ON	OFF
Cycle with Comm. T-stat Hum Cmd	OFF	ON

11. ***Electric Heat EH1 –*** A digital 24VDC output is provided for electric heat powering. UPC's Default programming has EH1 set for AUX/ELEC Heat operation and will be controlled using the UPC's internal P.I.D. logic. However it can be changed by the BAS to be network controlled.
12. ***Electric Heat EH2 –*** A digital VDC output is provided for field options converted from the original EH2 output. Default UPC program has the EH2 output set for Network Control but can be changed by the BAS to be controlled by the UPC's internal P.I.D. logic.

Controls - UPC DDC Control (optional) cont.

Aurora Advanced Control Configuration and Options (Future Availability on Select Models/Configurations)

1. ***Accessory Relay2 –*** A second, configurable, accessory relay on the AXB is provided that can be cycled with the compressor 1 or 2 , blower, or the Dehumidifier (DH) input. This is to complement the Accessory 1 Relay on the ABC board.

Position	DIP 4	DIP 5	Description
1	ON	ON	Cycles with Fan or ECM (or G)
2	OFF	ON	Cycles with CC1 first stage of compressor or compressor spd 1-12
3	ON	OFF	Cycles with CC2 second stage of compressor or compressor spd 7-12
4	OFF	OFF	Cycles with DH input from ABC board

2. ***Analog Out –*** A standard 0-10VDC analog output is provided. This output can be used to drive modulating dampers etc.
3. ***Variable Speed Pump or Modulating Water Valve -*** This input and output are provided to drive and monitor a variable speed pump. The VS pump output is a PWM signal to drive the variable speed pump. The minimum and maximum level are set using the AID Tool. 75% and 100% are the default settings respectively. The VS data input allows a separate PWM signal to return from the pump giving fault and performance information. Fault received from the variable speed pump will be displayed as E16. ***Modulating Water Valve -*** This Variable speed PWM output is provided to optionally drive a modulating water valve. Through advanced design a 0-10VDC valve can be driven directly from the VS pump output. The minimum and maximum level are set in the same way as the VS pump using the AID Tool. 75% and 100% are the default settings respectively.
4. ***Loop Pump Slaving -*** This input and output are provided so that two units can be slaved together with a common flow center. When either unit has a call for loop pump, both unit's loop pump relays and variable speed pumps are energized. The flow center then can simply be wired to either unit. The output from one unit should be routed to the input of the other. If daisy chained up to 16 heat pumps can be wired and slaved together in this fashion.

Controls - UPC DDC Control (optional) cont.

Aurora Advanced Control Optional Sensor Kits (Future Availability on Select Models/Configurations)

1. ***Energy Monitoring (Standard Sensor Kit on 'Advanced' models) -*** The Energy Monitoring Kit includes two current transducers (blower and electric heat) added to the existing two compressor sensors so that the complete power usage of the heat pump can be measured. The BACview Tool provides configuration detail for the type of blower motor and a line voltage calibration procedure to improve the accuracy. This real time power usage information can be displayed on the AID Tool and is available thru network points when using BACnet or N2 Open.
   - Compressor Current 1
   - Compressor Current 2
   - Fan Current
   - Aux Heat Current
   - Pump Selection
   - Voltage
   - Compressor Watts
   - Fan Watts
   - Aux Heat Watts
   - Pump Watts (VS Only)

2. ***Refrigerant Monitoring (optional sensor kit) -*** The optional Refrigerant Monitoring Kit includes two pressure transducers, and three temperature sensors, heating liquid line, suction temperature and existing cooling liquid line (FP1). These sensors allow the measurement of discharge and suction pressures, suction and liquid line temperatures as well as superheat and subcooling. This information can be displayed on the BACview Tool, or the network when using BACnet and N2.
   - Htg Liquid Line
   - Clg Liquid Line
   - Discharge pressure
   - Suction Pressure
   - Discharge Saturated Temp
   - Suction Saturated Temperature
   - Superheat
   - SubCooling

3. ***Performance Monitoring (optional sensor kit) -*** The optional Performance Monitoring Kit includes: three temperature sensors, entering and leaving water, leaving air temperature and a water flow rate sensor. With this kit, heat of extraction and rejection will be calculated. This requires configuration using the BACview Tool for selection of water or antifreeze.
   - Leaving Air Temperature (supply)
   - Alt Leaving Air Temperature (Supply)
   - Entering Water Temperature
   - Leaving Water Temperature
   - Water Flow Meter
   - Entering Air Temperature (from zone sensor)
   - Brine Selection (water/antifreeze)
   - Heat of Extraction/Rejection

Controls - UPC DDC Control (optional) cont.

ZS Series RNet Sensor Overview

The ZS Series line of intelligent zone sensors provides the function and flexibility you need to manage the conditions important to the comfort and productivity of the zone occupants. The ZS sensors are available in a variety of zone sensing combinations to address your application needs. These combinations include temperature, relative humidity, and indoor air quality (carbon dioxide or VOCs (Volatile Organic Compounds)). They are built to be flexible allowing for easy customization of what the user/ technician sees. Designed to work with the Aurora UPC controllers the ZS sensor line includes the ZS Base, ZS Plus, ZS Pro and ZS Pro-F.

The UPC uses a proprietary communication called Rnet to receive the space temperature from the zone sensor. This is done using (2) 18 AWG twisted pair unshielded cables for a total of 4 wires connected to the Rnet port. The sensor gets its power from the UPC controller and connecting multiple sensors to one UPC will allow for space temperature averaging. The UPC can support one ZS Pro or ZS Pro F with up to four ZS standard sensors wired to the Rnet port on the UPC for a total of 5 zone sensors. The sensors use a precise 10k ohm thermistor with less than 0.18°F drift over a ten year span, this allows for less maintenance or re-calibration after installation. The sensors also have a hidden communication port for connecting a BACview or local laptop that provides access to the equipment for commissioning and maintenance. The table below shows the features of each of the four sensors that are currently available.

Features	ZS Base	ZS Plus	ZS Pro	ZS Pro-F
Temp, CO^2, Humidity, and VOC Options	√	√	√	√
Neutral Color	√	√	√	√
Addressable/supports daisy chaining	√	√	√	√
Hidden communication port	√	√	√	√
Mounts on a standard 2” by 4” electrical box	√	√	√	√
Occupancy Status indicator LED		√	√	√
Push button occupancy override		√	√	√
Setpoint adjust		√	√	√
Large, easy to read LCD			√	√
Alarm indicator			√	√
°F to °C conversion button				√

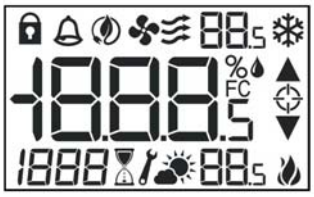
Options	Part Number	Part Number	Part Number	Part Number
Temperature Only	ZSU	ZSUPL	ZSUP	ZSUPF
Temp with CO^2	ZSU-C	ZSUPL-C	ZSUP-C	ZSUPF-C
Temp with Humidity	ZSU-H	ZSUPL-H	ZSUP-H	ZSUPF-H
Temp with Humidity, CO^2	ZSU-HC	ZSUPL-HC	ZSUP-HC	ZSUPF-HC
Temp, Humidity, VOC	ZSU-HV	ZSUPL-HV	ZSUP-HV	ZSUPF-HV
Temp with VOC	ZSU-V	ZSUPL-V	ZSUP-V	ZSUPF-V

Controls - UPC DDC Control (optional) cont.

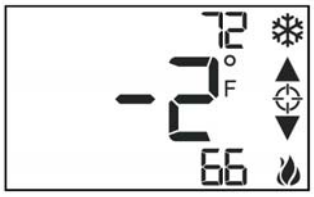
RNet Sensor Physical and Electrical Data

Sensing Element	**Range**	**Accuracy**
Temperature (on non-Humidity models)	-4° to 122° F (-20° C to 50° C)	30.35° F (0.2° C)
Temperature (on Humidity models)	50° F to 104° F (10° C to 40° C)	30.5° F (0.3° C)
Humidity	10% to 90%	31.8% typical
CO2	400 to 1250 PPM 1250 to 2000 PPM	330PPM or +/-3% of reading (greater of two) 35% of reading plus 30 PPM
VOC	0 to 2,000 PPM	3100 PPM
Power Requirements	**Sensor Type**	**Power Required**
Temperature Only	All Models	12 Vdc @ 8 mA
Temperature with Humidity	All Models	12 Vdc @ 15 mA (idle) to 190 mA (CO2 measurement cycle)
Temp with VOC, or Temp/VOC/Humidity	All Models	12 Vdc @ 60 mA
Temp with CO2 , or Temp/ CO2/Humidity	All Models	12 Vdc @ 15 mA (idle) to 190 mA (CO2 measurement cycle)
Power Supply	A controller supplies the Rnet sensor network with 12 Vdc @ 210 mA. Additional power may be required for your application. See sensor ZS Installation Guide	
Communication	115 kbps Rnet connection between sensor(s) and controller 15 sensors max per Rnet network; 5 sensors max per control program	
Local Access Port	For connecting a laptop computer to the local equipment for maintenance and commissioning	
Environmental Operating Range	32° to 122° F (0° - 50° C), 10% to 90% relative humidity, non-condensing	
Mounting Dimensions	Standard 4"x 2" electrical box using provided 6/32" x 1/2" mounting screws	

All Segments



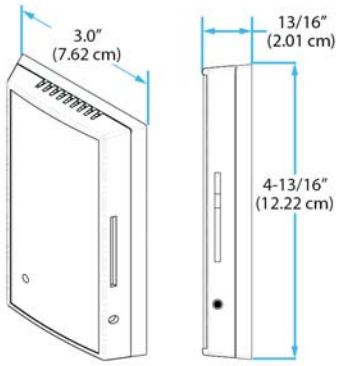
Setpoint Adjust



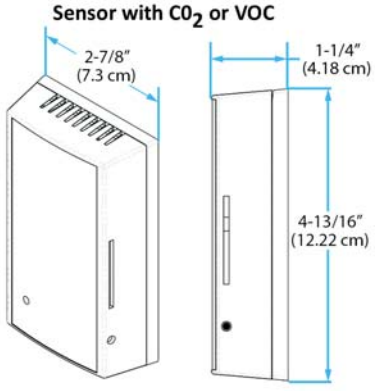
Home Screen

Info Screen - CO_2

Temperature Only or Temperature with Humidity



Sensor with CO_2 or VOC



Hot Gas Reheat/Hot Gas Bypass

Hot Gas Reheat 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 Bypass 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 894 kPa the HGB valve will begin to open and bypass hot discharge gas into the inlet of the evaporator. The valve will continue to open as needed until it reaches its maximum capacity. Upon a rise of suction pressure, the valve will begin to close back off and normal cooling operation will resume.

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. Schools, high latent auditorium and theaters, makeup air units*, and computer rooms are typical applications. Although reheat equipped water source 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 10°C. 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 30-32°C 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:

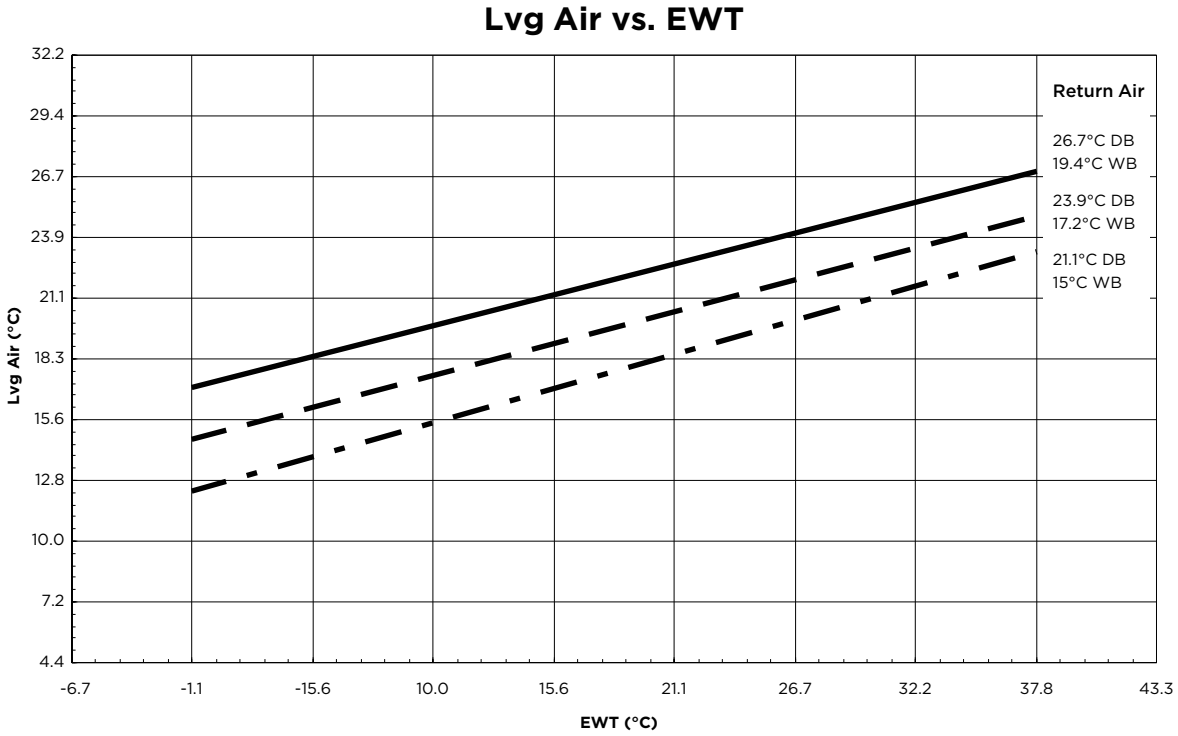
Model NBK*009, 614 L/s airflow, 0.6 L/s water flow, 32.2°C EWT

TC – SC = LC
9.8 – 8.2 kW = 1.6 kW

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

Hot Gas Reheat/Hot Gas Bypass cont.

Leaving Air Temperature vs. Entering Water and Air Conditions Chart



Hot Gas Reheat Dehumidification Overview cont.

3.48 kW / 0.7 kW/h per kg of water vapor
at 26.7/19.4 DB/WB°C = 4.97 kg/hr

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 (m/s)	1.3	1.5	1.8	2.0
ESP Increase (Pa)	24.9	34.9	42.3	49.8

Variable speed ECM models will generally compensate up to their maximum ESP of 124.5 Pa for 0.4 kW and 186.8 Pa for 0.7 kW.

Model NBKH009, 1614 L/s,

H x W = SA
508 x 889 = 0.451 m^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 L/s,

614 x 0.85 = 522 L/s

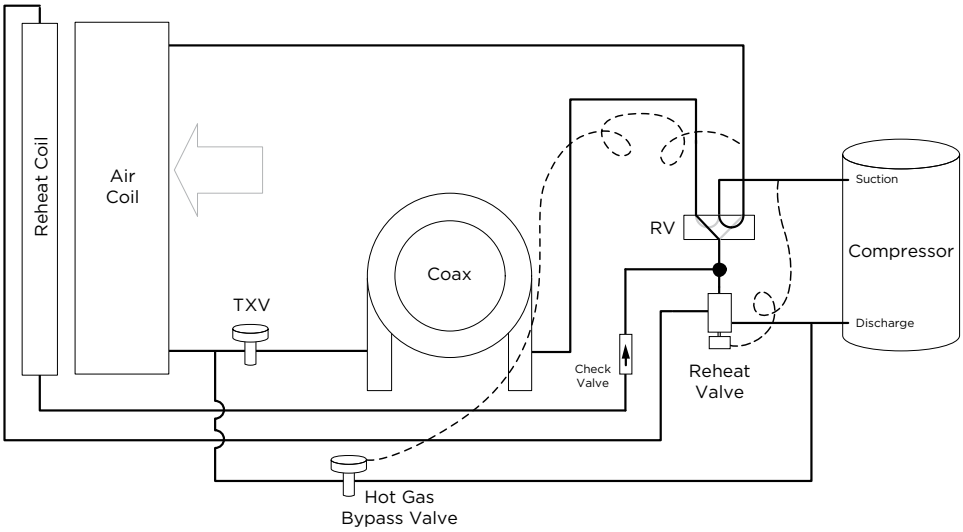
Calculate air velocity, m/s, L/s / SA

522 L/s / 0.45 m^2 = 1.16 m/s

Refer to the ESP vs. Coil Velocity Table and look up the m/s to find ESP increase. If air velocity is below 118 L/s assume 24.9 Pa increase in ESP. Interpolation of data within the table is permitted.

Hot Gas Reheat/Hot Gas Bypass cont.

Hot Gas Bypass with Hot Gas Reheat Layout



Hot Gas Reheat Controls

The reheat option is available with the Aurora or FX10 control. Three control schemes are 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 (FX10 only)
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 (FX10 only)
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 L/s 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.

Hot Gas Reheat/Hot Gas Bypass cont.

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 unoccupancy
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 the unoccupied mode 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.

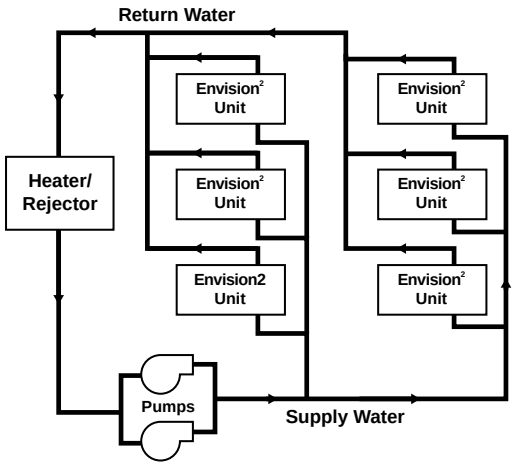
Space Humidity High and Low Alarm Limit
(building automation system only)
The control has a high and low alarm limit that can be enumerated over a building automation system. The factory default set point for these alarm limits is 0% for the low alarm and 100% for the high alarm limit. These limits can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

Envision 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 WaterFurnace Envision Series, 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 WaterFurnace 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 WaterFurnace closed source heat pump systems.



In the event that a building's net heating and cooling requirements create loop temperature extremes, Envision Series 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 WaterFurnace representative has the expertise and computer software to assist in determining optimum system type for specific applications.

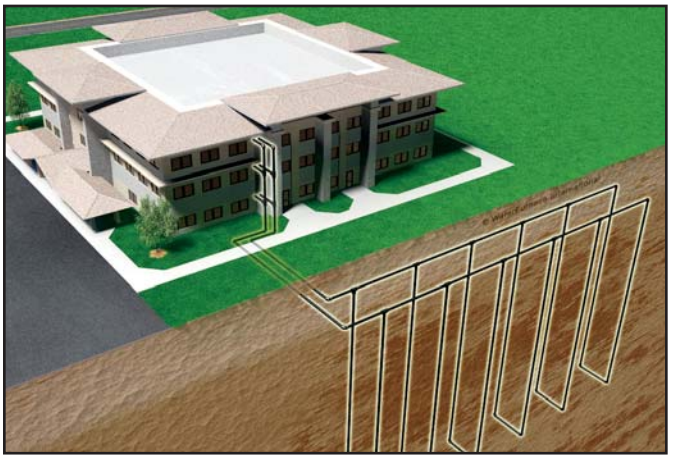
The Closed Loop Advantage

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 Envision Approach

There are a number of proven choices in the type of Envision Series 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 Envision Series 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, BS EN 14511-2 Ground Loop Heat Pumps are required for this application.

Envision 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 2.7-6.8 m^2/kW on vertical (drilled) installations and 20.4-40.8 m^2/kW for horizontal (trenched) installations. Closed loop heat exchangers can be located under parking areas or even under the building itself.

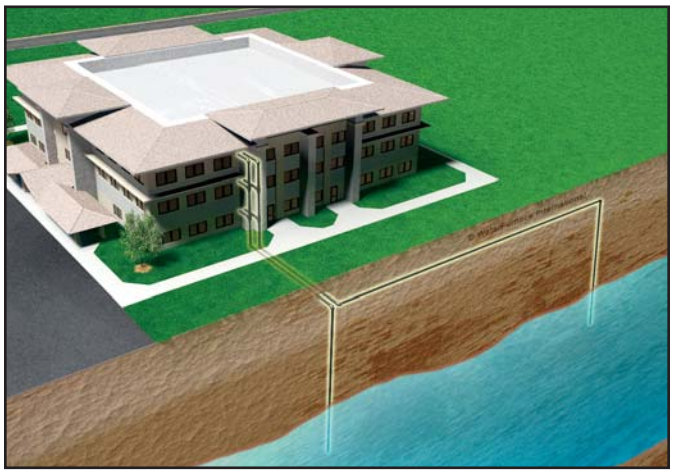
On large multi-unit systems, sizing the closed loop heat exchanger to meet only the net heating loads and assisting in the summer with a closed circuit cooling tower may be the most cost effective choice.

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 Envision Series 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, BS EN 14511-2 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 13.6 m^2/kW of surface area at a minimum depth of 2.4 m. WaterFumace 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 Envision 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, BS EN 14511-2 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.

Envision Application Notes cont.

Cooler/Boiler - Closed Loop

• ***Closed Loop/Boiler-Tower 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 15.6°C and a cooling tower to maintain loop temperatures below 32.2°C. 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, BS EN 14511-2 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. Failure to adhere to the guidelines in the water quality table could result in loss of warranty.

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 Cupronickel	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 0.5 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 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Chlorides	Less than 20 ppm	Less than 125 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 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Nitrate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Hydroxide	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Sulfate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Total Dissolved Solids (TDS)	Less than 1000 ppm	1000 - 1500 ppm	1000 - 1500 ppm
	LSI Index	+0.5 to -0.5	+0.5 to -0.5	+0.5 to -0.5
Iron Fouling (Biological Growth)	Iron, FE^{2}+ (Ferrous) Bacterial Iron Potential	< 0.2 ppm	< 0.2 ppm	< 0.2 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)	< 1.8 m/sec	< 1.8 m/sec	< 1.8 m/sec

NOTES: Grains = ppm divided by 17
mg/L is equivalent to ppm

2/22/12

Installation Notes

Typical Unit Installation

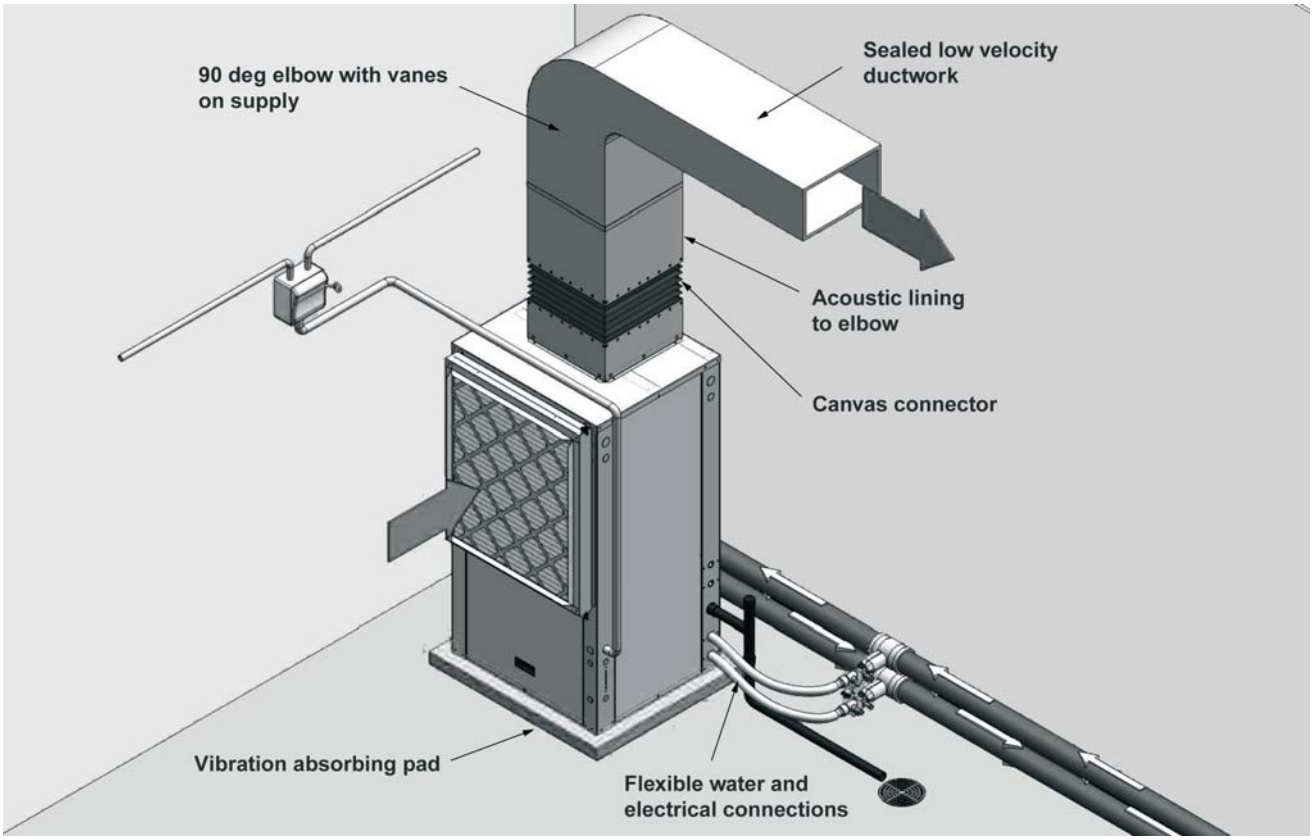
Unit Location

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.

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 3 meters per connection. Check carefully for water leaks.



Installation Notes cont.

Installing Horizontal Units

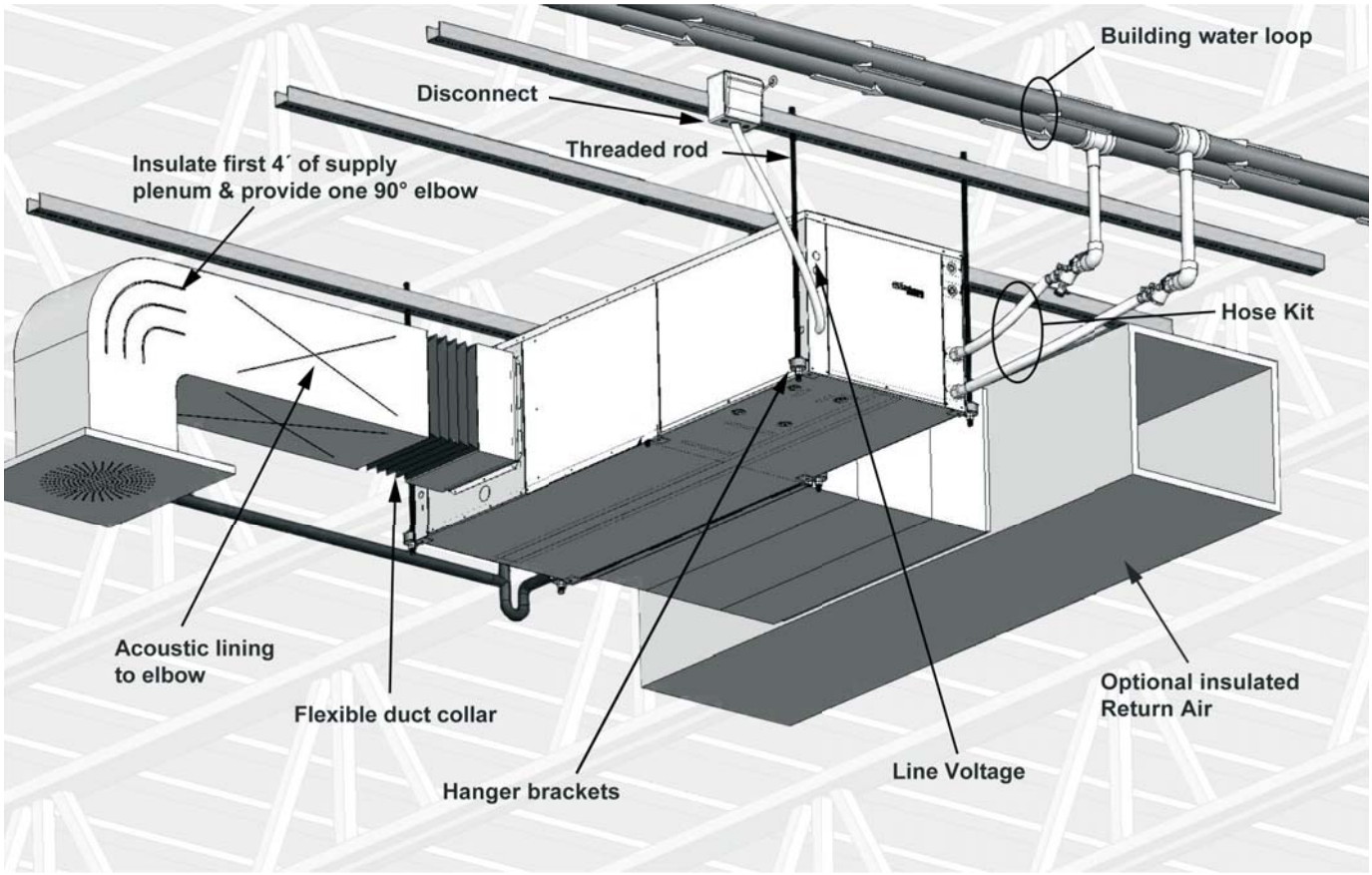
Remove and discard the compressor hold down shipping bolt located at the front of the compressor mounting bracket prior to setting the unit in place. Horizontal units are available with side or end discharge.

NOTE: Left (Right) Return Side Discharge cannot be converted to Left (Right) Return End Discharge or vice versa, without additional custom sheet metal parts. Horizontal units are normally suspended from a ceiling by four (006-015 models) or five (017 model) 9.5 mm 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 Hanger Bracket Dimensions table. 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, install hanger brackets as illustrated in the Hanger Bracket Locations section. The unit should be pitched approximately 6.35 mm 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 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.

CAUTION: Do not use rods smaller than 9.5 mm diameter since they may not be strong enough to support the unit. The rods must be securely anchored to the ceiling.



Installation Notes cont.

Acoustical Considerations and Equipment Sound Performance

Sound Performance

The Envision² Compact is third party sound rated in accordance with ARI 260. Please consult WaterFurnace Sound Performance Data Catalog for details on the AHRI standard and sound performance data.

Recommendations for Noise Reduction

Horizontal Unit Location

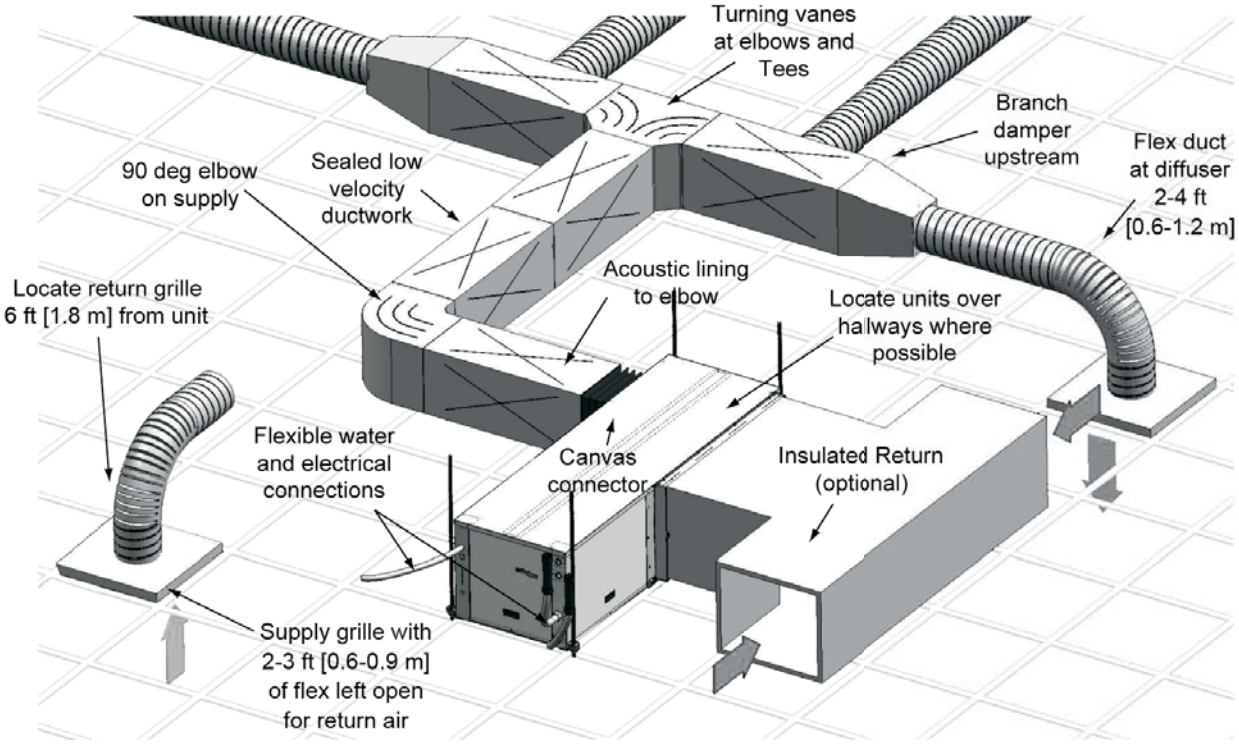
- Specify equipment with quietest sound power ratings
- Do not locate units above areas with a required NC 40 or less
- Space WSHP at least 3 m apart to avoid noise summing of multiple units in a space.
- Maximize the height of the unit above the ceiling (horizontal).
- Suspend unit with isolation grommets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

Vertical Unit Location

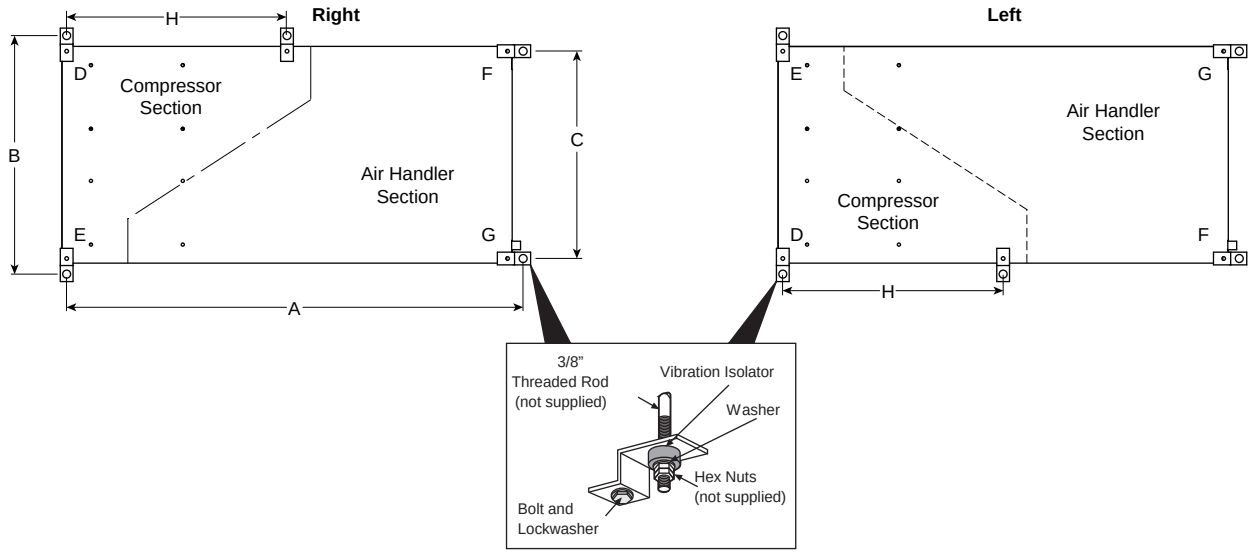
- Specify equipment with quietest sound power ratings
- Space WSHP at least 3m apart to avoid noise summing of multiple units in a space.
- Acoustic ceiling coatings can greatly reduce noise levels in mechanical rooms.
- Mount unit on a sound absorbing pad, extruded polystyrene, rubber or cork pad.

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 1.2-2.4 m 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 (0.6-1.2 m) 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).



Hanger Bracket Locations



NOTE: Model size 017 will be shipped with six (6) hanger brackets. Only five(5) hanger brackets will be used on the unit. See the above illustration for the fifth hanger bracket location. All other models will use four (4) hanger brackets.

Hanger Bracket Dimensions

Model	Hanger Kit Part Number	Unit Hanger Dimensions			
		A	B	C	D
005	99S500A04	108.7	63.8	54.4	n/a
006	99S500A04	116.3	63.8	54.4	n/a
009	99S500A03	124.0	71.4	62.0	n/a
012	99S500A04	136.7	71.4	62.0	n/a
015	99S500A04	157.0	71.4	62.0	n/a
017	99S500A03	174.8	71.4	62.0	74.4

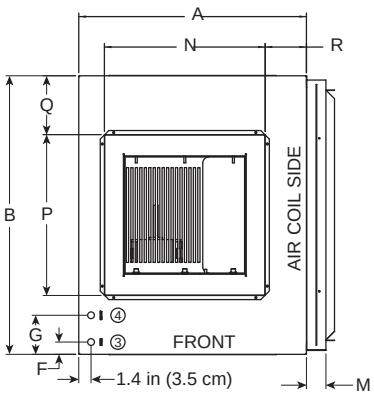
Dimensions are listed in cm. 6/25/12

Weight Distribution

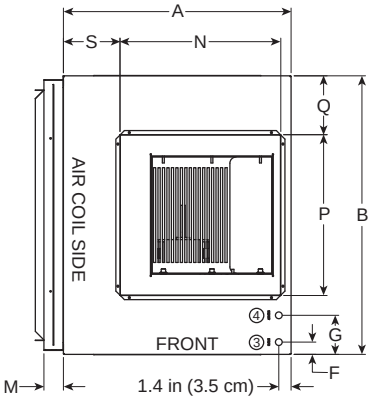
Model	Vertical Weight	Horizontal Weight	Horizontal Weight Distribution			
			Front		Back	
			D	E	F	G
005	95	100	29	18	32	16
006	127	134	34	31	34	13
009	163	170	52	43	34	27
012	168	172	54	45	36	29
015	186	191	54	50	43	36
017	202	206	61	54	45	39

Weights are listed in kg. 6/25/12

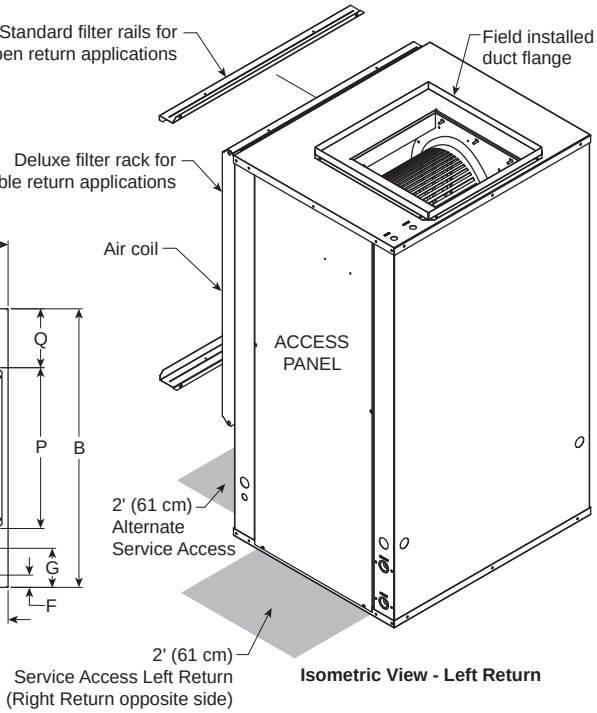
Vertical Dimensional Data



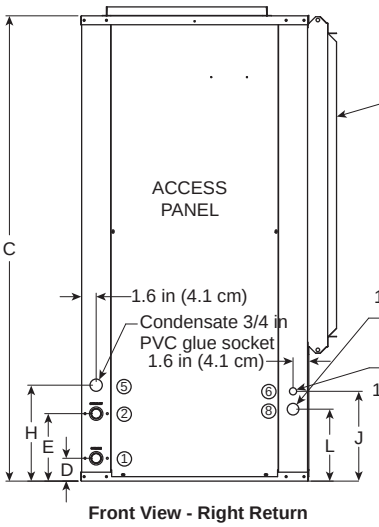
Top View - Right Return



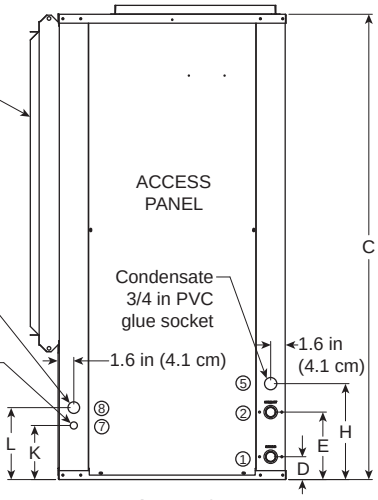
Top View - Left Return



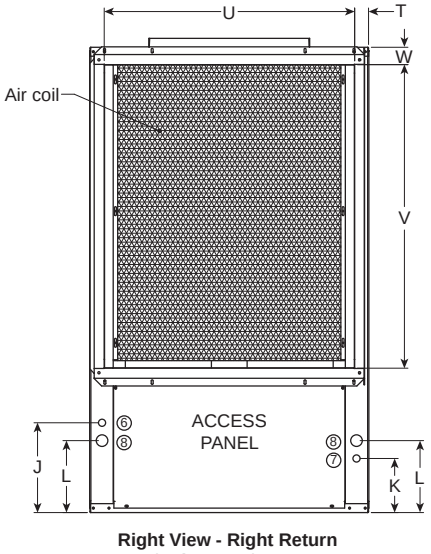
Isometric View - Left Return



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
												J	K	L
		A	B	C	D	E	F	G	H	Loop	Knockout	12.7 mm cond	12.7 mm cond	25.4 mm
		Width	Depth	Height*	In	Out	HWG In	HWG Out	Cond-ensate	Water FPT	HWG Provi-sions	Low Volt-age	Low Volt-age	Power Supply
005	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
006	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
009	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
012	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
015-017	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

6/25/12

Vertical Models			Discharge Connection duct flange installed (±2.54 mm)					**Return Connection using deluxe filter rack (±2.54 mm)			
		M	N	P	Q	R	S	T	U	V	W
		Filter Rack Width	Supply Width	Supply Depth					Return Depth	Return Height	
005	cm	5.6	35.6	35.6	15.5	11.4	19.6	5.1	56.1	55.9	4.8
006	cm	5.6	35.6	35.6	15.5	11.4	19.6	5.1	56.1	66.3	4.6
009	cm	5.6	45.7	45.7	16.8	11.7	16.0	4.1	71.4	66.3	5.1
012	cm	5.6	45.7	45.7	16.8	11.7	16.0	4.1	71.4	76.2	5.1
015-017	cm	5.6	45.7	45.7	16.8	12.7	16.3	4.1	71.4	86.4	5.1

Condensate is 3/4 in. PVC female glue socket and is switchable from side to front. 6/25/12

*Discharge flange is field installed and extends 25.4 mm from top of cabinet.

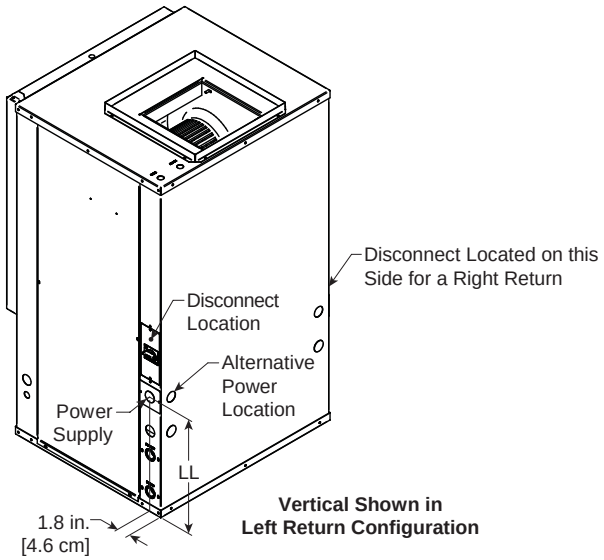
****Vertical units shipped with standard 50.8 mm (field adjustable to 25.4 mm) open application filter rack extending 55.88 mm from unit and is not suitable for duct connection. For ductable return connection applications, order the deluxe 50.8 mm (field adjustable to 25.4 mm) duct collar/filter rack which extends 82.55 mm from the unit and is suitable for duct connections.**

Vertical Disconnect

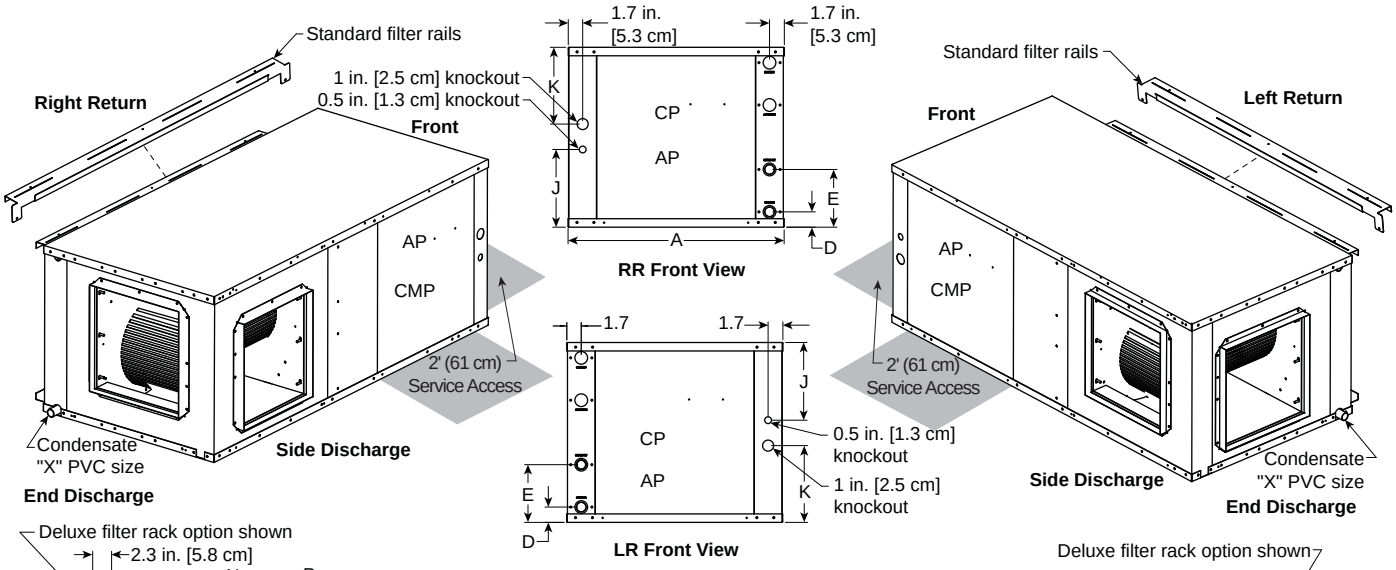
When using disconnect, do not use dimension L from the standard vertical dimensional data. Use dimension LL from the vertical disconnect dimensional data.

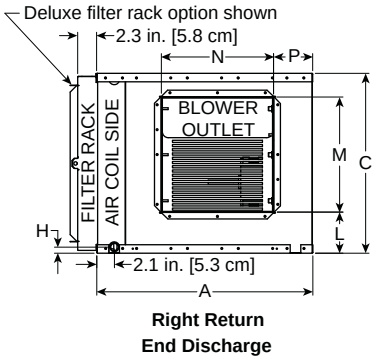
Vertical Models	LL
005	36.3
006	38.9
009	36.3
012	36.3
015	36.3
017	External

Dimensions in cm 6/25/12



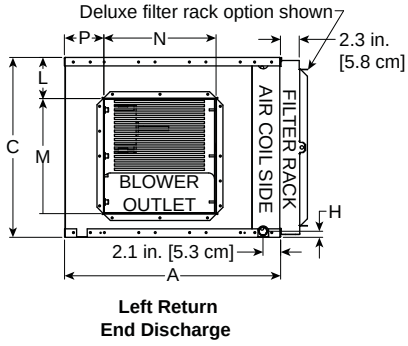
Horizontal Dimensional Data

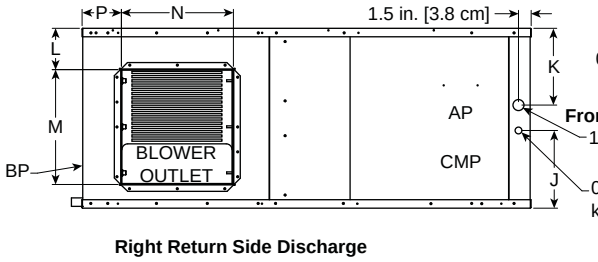


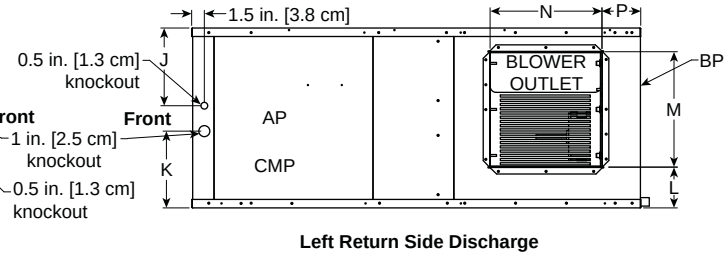


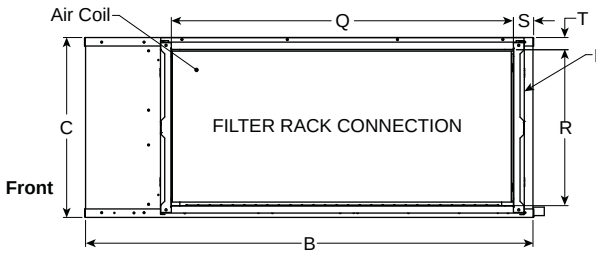
Legend

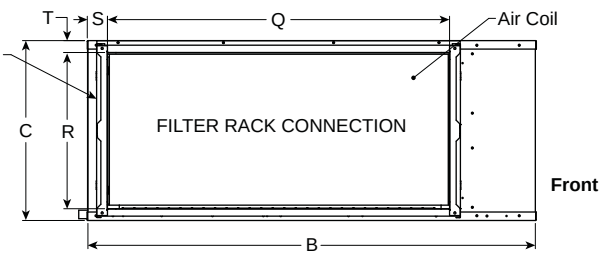
AP = Alternate Service Panel
BP = Blower Service Panel
CP = Control Access Panel
CMP = Compressor Service Panel











Horizontal Dimensional Data cont.

Horizontal Models		Overall Cabinet			Water Connections				Electrical Knockouts	
					1	2	3	Loop Water FPT	J	K
		A	B	C	D	E	H		12.7 mm cond	25.4 mm
		Width	Depth	Height*	In	Out	Condensate		Low Voltage	Power Supply
005	cm	57.2	106.7	48.8	4.6	17.3	2.0	19.05 mm	23.1	18.0
006	cm	57.2	114.3	48.8	4.6	17.3	2.0	19.05 mm	23.4	18.0
009	cm	64.8	121.9	53.8	4.6	17.3	2.0	25.4 mm	23.4	23.1
012	cm	64.8	134.6	53.8	4.6	17.3	2.0	25.4 mm	23.4	23.1
015	cm	64.8	154.9	53.8	4.6	17.3	2.0	25.4 mm	23.4	23.1
017	cm	64.8	172.7	53.8	4.6	17.3	2.0	25.4 mm	23.4	23.1

6/25/12

Horizontal Models		Discharge Connection duct flange installed (±2.54mm)				Return Connection using deluxe filter rack option (±2.54 mm)				Unit Hanger Dimensions			PVC Size
		L	M	N	P	Q	R	S	T	U	V	W	X
			Supply Width	Supply Depth		Return Depth	Return Height						
005	cm	17.0	26.7	23.9	12.4	69.6	42.2	5.1	3.6	108.6	63.8	54.4	1.9
006	cm	17.0	26.7	23.9	12.4	77.2	42.2	5.1	3.8	116.3	63.8	54.4	1.9
009	cm	12.4	34.5	33.5	11.7	89.9	47.2	5.8	3.6	124.0	71.4	62.0	1.9
012	cm	12.4	34.5	33.5	11.7	102.6	47.2	5.8	3.6	136.7	71.4	62.0	1.9
015	cm	12.4	34.5	33.5	11.7	115.3	47.2	5.8	3.6	157.0	71.4	62.0	1.9
017	cm	12.4	34.5	33.5	11.7	115.3	47.2	5.8	3.6	174.8	71.4	62.0	1.9

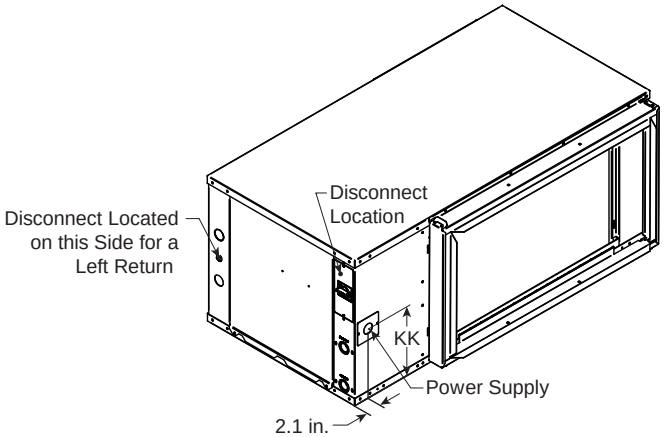
Horizontal units shipped with standard 50.8 mm (field adjustable to 25.4mm) open application filter rack extending 55.88 mm from unit and is not suitable for duct connection. For ductable return connection applications, order the deluxe 50.8 mm (field adjustable to 25.4 mm) duct collar/filter rack which extends 82.55 mm from the unit and is suitable for duct connections. 6/25/12

Horizontal Disconnect

When using disconnect, do not use dimension K from the standard horizontal dimensional data. Use dimension KK from the horizontal disconnect dimensional data.

Horizontal Models	KK
005	23.4
006	23.4
009	28.4
012	25.9
015	28.4
017	25.9

Dimensions in cm 6/25/12



Horizontal Shown in Right Return Configuration

Physical Data

Model		005	006	009	012	015	017
Compressor (1 each)		Rotary	2-Stage Scroll				Scroll
Factory Charge R-410A, oz [kg]	Vertical	48 [1.36]	56 [1.59]	78 [2.21]	93 [2.64]	104 [2.95]	128 [3.63]
Factory Charge R-410A, oz [kg]	Horizontal	42 [1.19]	50 [1.42]	74 [2.10]	93 [2.64]	118 [3.35]	118 [3.35]
Blower Motor & Blower							
Blower Motor Type/Speeds	VS ECM	Variable Speed ECM					
	5-Spd ECM	5-Speed ECM					
Blower Motor- W	VS ECM	373	373	373	746	746	746
	5-Spd ECM	373	373	746	746	746	746
Blower Wheel Size (Dia x W), mm	VS ECM	229 x 178	229 x 178	279 x 254	279 x 254	279 x 254	279 x 254
	5-Spd ECM	229 x 178	229 x 178	279 x 254	279 x 254	279 x 254	279 x 254
Coax and Water Piping							
Water Connections Size - FPT - in [mm]		3/4 [19.05]	3/4 [19.05]	1 [25.4]	1 [25.4]	1 [25.4]	1 [25.4]
HWG Connection Size - Female Sweat I.D. - in [mm] (Vertical Only)		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 - l		1.5	2.6	4.9	6.1	6.1	5.7
Vertical							
Air Coil Dimensions (H x W), mm		483 x 508	610 x 508	711 x 635	813 x 635	914 x 635	914 x 635
Air Coil Total Face Area, m^2		0.242	0.307	0.451	0.520	0.585	0.585
Air Coil Tube Size, mm		7.9	9.5	9.5	9.5	9.5	9.5
Air Coil Number of rows		3	3	3	3	4	4
Filter Standard - 25mm Pleated MERV 4 Throwaway, mm		1 - 610 x 610	712 x 610	711 x 762	813 x 762	914 x 762	762 x 914
Filter Standard - 51mm Pleated MERV 13 Throwaway, mm		1 - 610 x 610	712 x 610	711 x 762	813 x 762	914 x 762	762 x 914
Horizontal							
Air Coil Dimensions (H x W), mm		457 x 533	457 x 686	508 x 889	508 x 1016	508 x 1143	508 x 1143
Air Coil Total Face Area, m^2		0.242	0.316	0.451	0.520	0.585	0.585
Air Coil Tube Size, mm		7.9	9.5	9.5	9.5	9.5	9.5
Air Coil Number of rows		3	3	3	3	4	3
Filter Standard - 25mm Pleated MERV 4 Throwaway, mm		457 x 356	1 - 457 x 457 1 - 457 x 356	2 - 457 x 508	1 - 508 x 559 1 - 508 x 508	1 - 508 x 635 1 - 508 x 559	1 - 508 x 635 1 - 508 x 559
Filter Standard - 51mm Pleated MERV 13 Throwaway, mm		457 x 737	1 - 457 x 813	1 - 508 x 940	1 - 508 x 508 1 - 508 x 559	1 - 508 x 635 1 - 508 x 559	1 - 508 x 635 1 - 508 x 559

9/05/14

Electrical Availability

5-Speed ECM

Voltage	Single Speed		Dual Capacity			
	005	017	006	009	012	015
220-240/50/1	•	•	•	•	•	•
220-240/50/1 w/IntelliStart	•	•	•	•	•	•
380-420/50/3		•	•	•	•	•
380-420/50/3 w/IntelliStart		•	•	•	•	•

6/25/12

Variable Speed ECM

Voltage	Single Speed		Dual Capacity			
	005	017	006	009	012	015
220-240/50/1	•	•	•	•	•	•
220-240/50/1 w/IntelliStart	•	•	•	•	•	•
380-420/50/3		•	•	•	•	•
380-420/50/3 w/IntelliStart		•	•	•	•	•

6/25/12

Electrical Data

5-Speed Motor

Model		Rated Voltage	Voltage Min/Max	Compressor				Blower Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/HACR Breaker
				MCC	RLA	LRA	LRA*				
Single Speed	005	220-240/50/1	198/264	13.1	5.5	24.0	9.6	4.1	9.6	11.0	15
	017	220-240/50/1	198/264	38.2	24.5	153.0	61.2	7.6	32.1	38.2	60
		380-420/50/3	342/462	13.3	8.5	67.1	40.3	4.0	12.5	14.6	20
Dual Capacity	006	220-240/50/1	198/264	14.4	9.2	52.0	20.8	4.1	13.3	15.6	20
		380-420/50/3	342/462	5.0	3.2	27.0	16.2	2.1	5.3	6.1	10/15
	009	220-240/50/1	198/264	19.3	12.4	67.0	26.8	4.1	16.5	19.6	30
		380-420/50/3	342/462	8.0	5.1	38.0	22.8	2.1	7.2	8.5	10/15
	012	220-240/50/1	198/264	24.2	15.5	99.6	39.8	7.6	23.1	27.0	40
		380-420/50/3	342/462	9.5	6.1	43.0	25.8	4.0	10.1	11.6	15
	015	220-240/50/1	198/264	33.6	24.0	126.0	50.4	7.6	31.6	37.6	60
		380-420/50/3	342/462	10.8	6.9	51.5	30.9	4.0	10.9	12.6	15

HACR circuit breaker in USA only
*With optional IntelliStart

5/21/13

Variable Speed ECM Motor

Model		Rated Voltage	Voltage Min/Max	Compressor				Blower Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/HACR Breaker
				MCC	RLA	LRA	LRA*				
Single Speed	005	220-240/50/1	198/264	13.1	5.5	24.0	9.6	4.0	9.5	10.9	15
	017	220-240/50/1	198/264	38.2	24.5	153.0	61.2	7.0	31.5	37.6	60
		380-420/50/3	342/462	13.3	8.5	67.1	40.3	6.9	15.4	17.5	25
Dual Capacity	006	220-240/50/1	198/264	14.4	9.2	52.0	20.8	4.0	13.2	15.5	20
		380-420/50/3	342/462	5.0	3.2	27.0	16.2	4.1	7.3	8.1	10/15
	009	220-240/50/1	198/264	19.3	12.4	67.0	26.8	4.0	16.4	19.5	30
		380-420/50/3	342/462	8.0	5.1	38.0	22.8	4.1	9.2	10.5	15
	012	220-240/50/1	198/264	24.2	15.5	99.6	39.8	4.0	19.5	23.4	35
		380-420/50/3	342/462	9.5	6.1	43.0	25.8	4.1	10.2	11.7	15
	015	220-240/50/1	198/264	33.6	24.0	126.0	50.4	7.0	31.0	37.0	60
		380-420/50/3	342/462	10.8	6.9	51.5	30.9	6.9	13.8	15.5	20

HACR circuit breaker in USA only
Neutral wire required for variable speed ECM motor on 380-420V application.
*With optional IntelliStart

5/21/13

Blower Performance Data

5-Speed ECM Blower Motor

Model	Motor Spd	Motor Tap	T'Stat Cnct.	Blower Size	Motor kW	Airflow (L/s) at External Static Pressure (Pa)															
						0	12.45	24.90	37.35	49.80	62.25	74.70	87.15	99.60	112.05	124.50	149.40	174.30	199.20	224.10	249.00
	High	5				474	470	465	458	451	444	439	433	427	421	415	404	387	-	-	-
	Med High	**4**	W			434	427	420	413	408	399	392	388	385	375	366	356	335	-	-	-
005	Med	3		229 x 178	0.37	406	401	396	387	380	373	366	359	352	346	340	319	283	-	-	-
	Med Low	**2**	Y1			373	366	361	354	347	340	333	324	316	309	302	281	-	-	-	-
	Low	**1**	G			309	293	278	267	257	248	241	223	205	189	-	-	-	-	-	-
	High	**5**	W			512	507	500	493	486	479	474	467	463	455	448	437	408	385	-	-
	Med High	**4**	Y2			465	458	451	444	437	429	425	418	411	404	399	382	370	356	-	-
006	Med	3		229 x 178	0.37	422	413	404	396	392	382	375	368	363	354	345	335	321	271	-	-
	Med Low	**2**	Y1			380	370	363	356	347	342	335	326	316	309	304	288	257	-	-	-
	Low	**1**	G			335	323	314	307	300	290	283	276	269	250	234	224	-	-	-	-
	High	**5**	W			743	729	720	706	696	684	675	663	656	644	635	616	590	569	538	465
	Med High	**4**	Y2			710	689	668	658	649	637	625	611	599	588	578	555	538	498	465	
009	**Med**	**3**	Y1	279 x 254	0.37	694	668	644	621	604	592	583	573	564	550	538	512	484	420	-	-
	Med Low	2				687	661	635	606	590	578	569	555	543	531	522	493	465	427	-	-
	Low	**1**	G			635	609	583	545	517	479	444	432	420	382	356	-	-	-	-	-
	High	**5**	W			913	904	899	887	875	866	854	847	842	833	826	812	793	772	750	739
	Med High	4				857	843	831	819	812	802	798	788	781	772	762	746	729	710	694	675
012	**Med**	**3**	Y2	279 x 254	0.75	805	798	791	779	767	757	750	741	732	720	710	691	682	661	637	616
	Med Low	**2**	Y1			760	748	739	729	724	710	696	689	682	673	663	639	623	611	588	559
	Low	**1**	G			694	670	649	635	625	614	604	595	588	576	564	540	526	493	-	-
	High	**5**	W			1074	1067	1060	1048	1041	1031	1022	1015	1008	998	991	979	958	939	918	892
	Med High	**4**	Y2			1003	991	984	977	970	960	951	942	937	927	918	901	887	864	842	831
015	Med	3		279 x 254	0.75	934	923	916	906	901	890	880	871	864	854	847	828	812	795	774	757
	Med Low	**2**	Y1			868	857	847	838	828	821	814	805	795	786	776	762	739	727	701	663
	Low	**1**	G			805	793	783	769	762	755	748	736	727	720	713	694	673	644	621	599
	High	**5**	W			1163	1156	1149	1137	1130	1121	1114	1104	1095	1088	1081	1062	1045	1017	979	927
	Med High	**4**	Y1			1069	1060	1052	1045	1041	1029	1019	1012	1005	993	984	967	953	934	911	885
017	Med	3		279 x 254	0.75	1008	998	991	984	977	967	958	949	942	932	923	904	887	873	854	831
	Med Low	2				946	937	932	923	916	906	899	887	878	866	857	842	824	812	786	767
	Low	**1**	G			852	840	831	824	819	807	795	788	783	772	762	743	729	713	694	656

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5-Speed ECM Constant Torque Motors

The 5-speed ECM is a 'Constant Torque' ECM motor and delivers air flow similar to a PSC but operates as efficiently as a variable speed ECM motor. Because it is an ECM motor, the 5-speed ECM can ramp slowly up or down like the variable speed ECM motor. There are 5 possible speed taps available on the 5-speed ECM motor with #1 being the lowest airflow and #5 being the highest airflow. These speed selections are preset at the time of manufacture and are easily changed in the field if necessary.

If more than one tap are energized at the same time, built in logic gives precedence to the highest tap number and allows air flow to change with G, Y1, Y2 and W signals. Each of those 5 speeds has a specific 'Torque' value programmed into the motor for each speed selection. As static pressure increases, airflow decreases resulting in less torque on the rotor. The motor responds only to changes in torque and adjusts its speed accordingly.

The 5-speed ECM motor is powered by line voltage but the motor speed is energized by 24VAC.

5-Speed ECM Benefits:

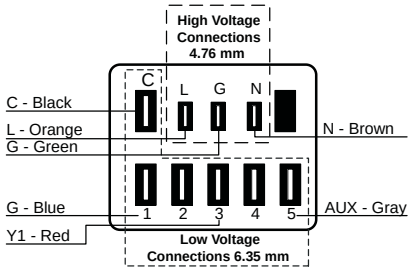
- High efficiency
- Soft start
- 5 speeds with up to 4 speeds on-line
- Built in logic allows air flow to change with G, Y1, Y2 and W signals
- Super efficient low airflow continuous blower setting (G)

Setting Blower Speed - 5-Speed ECM

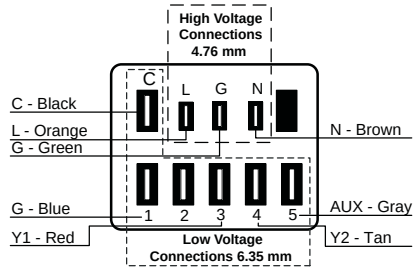
5-speed ECM blower motors have five (5) speeds of which three (3) are selectable on single speed and four (4) are selectable on dual capacity.

CAUTION: Disconnect all power before performing this operation.

5-Speed ECM Motor Connections - Single Speed



5-Speed ECM Motor Connections - Dual Capacity



Blower Performance Data cont.

Variable Speed ECM Motor

Model	Max ESP (Pa)	Blower Size	Motor kW	Airflow DIP Switch Settings											
				1	2	3	4	5	6	7	8	9	10	11	12
005	124.50	229 x 178	0.37	142	189 L	**236**	**283** **M**	**330** **H**	**378**						
006	124.50	229 x 178	0.37		189	236 L	283	**330** **M**	**378**	**425** **H**	**472**	519	566		
009	124.50	279 x 254	0.37	307	354 L	401	472	**519** **M**	**566**	**614** **H**	**661**	**708**			
012	124.50	279 x 254	0.37	307	378 L	425	496	543	**590**	**637** **M**	**684**	**732** **H**			
015	186.75	279 x 254	0.75	378	448 L	519	614	**708** **M**	**826**	**920** **H**	**991**	**1085**			
017	187.75	279 x 254	0.75	378	448	519 L	614	**708**	**826** **M**	**920**	**991** **H**	**1085**			

Factory settings are at recommended L-M-H DIP switch locations 6/15/12
M-H settings MUST be located within boldface L/s range
Lowest and Highest DIP switch settings are assumed to be L and H respectively
Air flow is controlled within 35% up to the maximum ESP
Max ESP includes allowance for wet coil and 25.4 mm MERV 4

Setting Blower Speed - Variable Speed ECM

The ABC board's Yellow Config LED will flash the current variable speed ECM blower speed selections for low, med, and high continuously with a short pause in between. The speeds can also be confirmed with the AID Tool under the Setup/ECM Setup screen. The variable speed ECM blower motor speeds can be field adjusted with or without using an AID Tool.

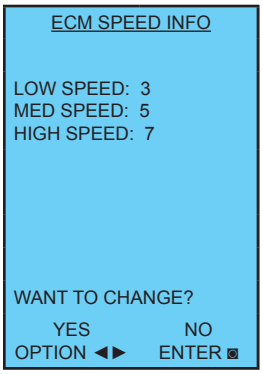
Variable Speed ECM Setup without an AID Tool

The blower speeds for Low (G only), Med (Y1), and High (Y2/Aux) can be adjusted directly at the Aurora ABC board which utilizes the push button (SW1) on the ABC board. This procedure is outlined in the variable speed ECM Configuration Mode portion of the Aurora 'Base' Control System section.

Variable Speed ECM Setup with an AID Tool

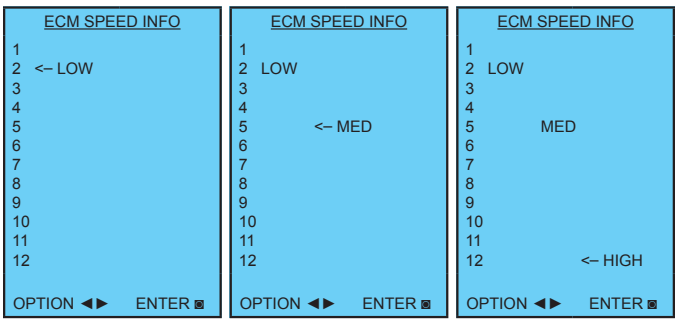
A much easier method utilizes the AID Tool to change the airflow using the procedure below. First navigate to the Setup screen and then select ECM Setup. This screen displays the current variable speed ECM settings. It allows the technician to enter the setup screens to change the variable speed ECM settings. Change the highlighted item using the ◄ and ► buttons and then press the ◙ button to select the item.

Variable Speed ECM Setup with an AID Tool cont.



Selecting YES will enter variable speed ECM speed setup, while selecting NO will return to the previous screen.

Variable Speed ECM Speed Setup - These screens allow the technician to select the low, medium, and high blower speed for the variable speed ECM blower motor. Change the highlighted item using the ▲ and ▼ buttons. Press the ◙ button to select the speed.



After the high speed setting is selected the AID Tool will automatically transfer back to the ECM Setup screen.

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. A computer software selection program can then be used to develop an accurate and complete heat pump schedule. Software can be obtained from your local WaterFurnace representative.

While a computer software program is the easiest and most accurate method to size and select equipment, however, selection can still be accomplished manually using this manual and the following selection procedure. Sizing so that the actual sensible capacity of the equipment will satisfy the sensible capacity of the zone is the recommended method for best results.

Boiler/Tower Application

Typical boiler/tower application will result in entering water temperatures of 15.6°C to 32.2°C with 21°C for heating and 32.2°C for cooling. Water to refrigerant insulation option would not be required. Flow rates are 0.045 to 0.06 L/s per kW with 0.045 L/s per kW often representing an economical design point.

Geothermal Application

Typical geothermal application can result in a wide entering water temperature range of -1.1°C to 37.8°C. Typically minimum heating entering water temperatures can range from -1.1°C to 10°C depending upon loop type and geographical location. Cooling performance should be calculated using a maximum loop temperature of 37.8°C in most loop applications. Water flow is typically 0.045 to 0.06 L/s per kW with 0.06 L/s per kW 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 7.7-10°C.**

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 L/s per kW, airflow in L/s, water flow pressure drop, and design wet and dry bulb temperatures. Airflow, L/s, should be between 142 and 212 L/s per kW. 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 L/s, water temperature, and/or airflow 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 26.7°C and wet bulb 18.3°C conditions is as follows:
Total Cooling.....15.8 kW
Sensible Cooling.....12.1 kW
Entering Air Temp.....24°C Dry Bulb / 18°C Wet Bulb

2. Design Conditions:
Similarly, we have also obtained the following design parameters:
Entering Water Temp..... 32°C
Water Flow (Based upon 5.6°C rise in temp.) 1.1 L/s
Airflow Required .....920 L/s @ 50Pa

Selection Example cont.

3, 4 & 5. HP Selection:
After making our preliminary selection (NBK*017 variable speed ECM), we enter the tables at design water flow and water temperature and read
Total Cooling, Sens. Cooling and Heat of Rej. capacities:
Total Cooling..... 16.4 kW
Sensible Cooling..... 13.4 kW
Heat of Rejection ..... 20.8 kW

6 & 7. Entering Air and Airflow Corrections:
Next, we determine our correction factors. (Refer to Correction Factor Tables - Airflow and Entering Air correction tables — using 920 L/s or 920÷1038 nom. = 89%).
Corrected Total Cooling = 16.4 x 0.982 x 0.967 = 15.57
Corrected Sens Cooling = 13.5 x 0.929 x 0.881 = 11.04
Corrected Heat of Reject = 20.9 x 0.978 x 0.972 = 19.87

$$HR = 4.2 \times \text{water flow [L/s]} \times (T_{in} - T_{out})$$

$$\frac{HR}{4.2 \times L/s} = (T_{in} - T_{out}) \text{ or } \Delta T \text{ Rise}$$

$$\frac{19.87}{4.2 \times 1.1} = 4.3°C \text{ Rise}$$

8. Water Temperature Rise Calculation & Assessment:
Note: 4.2 = parameters for water & 4.1 = 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 0.3 kW 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	Heating		Cooling		Pressure Drop
		Load	Source	Load	Source	
EWT - °C		**26.7**	**-1.1**	**10.0**	**32.2**	**-1.1**
Water	0	1.000	1.000	1.000	1.000	1.000
Ethylene Glycol	10	0.990	0.973	0.976	0.991	1.075
	20	0.978	0.943	0.947	0.979	1.163
	30	0.964	0.917	0.921	0.965	1.225
	40	0.953	0.890	0.897	0.955	1.324
	50	0.942	0.865	0.872	0.943	1.419
Propylene Glycol	10	0.981	0.958	0.959	0.981	1.130
	20	0.967	0.913	0.921	0.969	1.270
	30	0.946	0.854	0.869	0.950	1.433
	40	0.932	0.813	0.834	0.937	1.614
	50	0.915	0.770	0.796	0.922	1.816
Ethanol	10	0.986	0.927	0.945	0.991	1.242
	20	0.967	0.887	0.906	0.972	1.343
	30	0.944	0.856	0.869	0.947	1.383
	40	0.926	0.815	0.830	0.930	1.523
	50	0.907	0.779	0.795	0.911	1.639
Methanol	10	0.985	0.957	0.962	0.986	1.127
	20	0.969	0.924	0.929	0.970	1.197
	30	0.950	0.895	0.897	0.951	1.235
	40	0.935	0.863	0.866	0.936	1.323
	50	0.919	0.833	0.836	0.920	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 -1.1°C and 32.2°C respectively as well as pressure drop at -1.1°C for an Envision² Compact NBK*006-ECM.

The corrected cooling capacity at 32.2°C would be: 6.8 kW x 0.969 = 6.59 kW

The corrected heating capacity at -1.1°C would be: 4.9 kW x 0.913 = 4.47 kW

The corrected pressure drop at -1.1°C and 0.5 L/s would be: 29 kPa x 1.270 = 36.8 kPa

Reference Calculations

Heating Calculations:	Cooling Calculations:
$LWT = EWT - \frac{HE}{WF \times 500}$	$LWT = EWT + \frac{HR}{WF \times 500}$
$LAT = EAT + \frac{HC}{AF \times 1.08}$	$LAT\ (DB) = EAT\ (DB) - \frac{SC}{AF \times 1.08}$
$TH = HC + HW$	$LC = TC - SC$
	$S/T = \frac{SC}{TC}$

NOTE: * When using water. Use 4.1 for 15% methanol/water or Environol solution.

Notes (Refer to Performance Data tables)

- Performance ratings are based on 27°C DB / 19°C WB EAT for cooling and 20°C 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 10°C 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 7.16 ml/s per kW of rated capacity with an EWT of 32°C.
- Entering water temperatures below 4.5°C assumes 15% antifreeze solution.
- For non-standard EAT conditions, apply the appropriate correction factors on (Refer to Correction Factor Tables).
- Interpolation between EWT, WF and AF data is permissible.

Operating Limits

Operating Limits	Cooling (°C)	Heating (°C)
Air Limits		
Min. Ambient Air	7.2	7.2
Rated Ambient Air	26.7	21.1
Max. Ambient Air	37.8	29.4
Min. Entering Air	10.0	4.4
Rated Entering Air db/wb	27/19	20.0
Max. Entering Air db/wb	43/28.3	26.7
Water Limits		
Min. Entering Water	-1.1	-6.7
Normal Entering Water	10-43.3	-1.1
Max. Entering Water	48.9	32.2

NOTE: Minimum/maximum limits are only for startup 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 dependent 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

Airflow Corrections (Dual Capacity Part Load)

Airflow		Cooling				Heating		
L/s Per kW of Clg	% of Nominal	Total Cap	Sens Cap	Power	Heat of Rej	Htg Cap	Power	Heat of Ext
32	60	0.922	0.778	0.956	0.924	0.943	1.239	0.879
37	69	0.944	0.830	0.962	0.944	0.958	1.161	0.914
40	75	0.957	0.866	0.968	0.958	0.968	1.115	0.937
44	81	0.970	0.900	0.974	0.970	0.977	1.075	0.956
47	88	0.982	0.933	0.981	0.980	0.985	1.042	0.972
50	94	0.991	0.968	0.991	0.991	0.993	1.018	0.988
54	**100**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
57	106	1.007	1.033	1.011	1.008	1.007	0.990	1.010
61	113	1.013	1.065	1.023	1.015	1.012	0.987	1.018
64	119	1.017	1.099	1.037	1.022	1.018	0.984	1.025
67	125	1.020	1.132	1.052	1.027	1.022	0.982	1.031
70	130	1.022	1.159	1.064	1.030	1.025	0.979	1.034

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Airflow Corrections (Dual Capacity Full Load and Single Speed)

Airflow		Cooling				Heating		
L/s Per kW of Clg	% of Nominal	Total Cap	Sens Cap	Power	Heat of Rej	Htg Cap	Power	Heat of Ext
32	60	0.922	0.786	0.910	0.920	0.943	1.150	0.893
37	69	0.944	0.827	0.924	0.940	0.958	1.105	0.922
40	75	0.959	0.860	0.937	0.955	0.968	1.078	0.942
44	81	0.971	0.894	0.950	0.967	0.977	1.053	0.959
47	88	0.982	0.929	0.964	0.978	0.985	1.031	0.973
50	94	0.992	0.965	0.982	0.990	0.993	1.014	0.988
54	**100**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
57	106	1.007	1.034	1.020	1.010	1.007	0.990	1.011
61	113	1.012	1.065	1.042	1.018	1.013	0.983	1.020
64	119	1.017	1.093	1.066	1.026	1.018	0.980	1.028
67	125	1.019	1.117	1.092	1.033	1.023	0.978	1.034
70	130	1.020	1.132	1.113	1.038	1.026	0.975	1.038

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Cooling Capacity Corrections

Entering Air WB °C	Total Clg Cap	Sensible Cooling Capacity Multipliers - Entering DB °C										Power Input	Heat of Rejection
		15.6	18.3	21.1	23.9	26.7	27	29.4	32.2	35	37.8		
12.8	0.898	0.723	0.866	1.048	1.185	*	*	*	*	*	*	0.985	0.913
15.6	0.912		0.632	0.880	1.078	1.244	1.260	*	*	*	*	0.994	0.927
18.3	0.967			0.694	0.881	1.079	1.085	1.270	*	*	*	0.997	0.972
19.0	0.983			0.655	0.842	1.040	1.060	1.232	*	*	*	0.999	0.986
19.4	**1.000**			0.616	0.806	**1.000**	1.023	1.193	1.330	*	*	**1.000**	**1.000**
21.1	1.053				0.693	0.879	0.900	1.075	1.250	1.404	*	1.003	1.044
23.9	1.168					0.687	0.715	0.875	1.040	1.261	1.476	1.007	1.141

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

Heating Corrections

Ent Air DB °C	Htg Cap	Power	Heat of Ext
7.2	1.062	0.739	1.158
10.0	1.050	0.790	1.130
12.8	1.037	0.842	1.096
15.6	1.025	0.893	1.064
18.3	1.012	0.945	1.030
20.0	1.005	0.976	1.012
21.1	**1.000**	**1.000**	**1.000**
23.9	0.987	1.048	0.970
26.7	0.975	1.099	0.930

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Pressure Drop

Model	L/s	Pressure Drop (kPa)				
		-1.11°C	10°C	21.1°C	32.2°C	43.3°C
005	0.19	11.0	11.0	10.3	10.3	9.7
	0.25	20.0	20.0	19.3	19.3	18.6
	0.32	29.0	29.0	28.3	27.6	26.9
	0.38	41.4	40.0	39.3	38.6	37.9
006	0.25	9.7	9.0	8.3	7.6	6.9
	0.38	19.3	17.9	16.5	15.9	14.5
	0.50	32.4	30.3	28.3	26.2	24.1
	0.63	48.3	45.5	42.7	40.0	36.5
009	0.32	8.3	8.3	7.6	6.9	6.9
	0.44	15.2	14.5	13.1	12.4	11.7
	0.57	23.4	22.1	20.7	19.3	17.9
	0.69	33.8	31.7	29.6	27.6	25.5
012	0.38	8.3	8.3	7.6	6.9	6.9
	0.57	16.5	15.2	14.5	13.8	12.4
	0.76	26.9	24.8	23.4	22.1	20.0
	0.95	39.3	36.5	34.5	32.4	29.6
015	0.50	12.4	11.7	11.0	9.7	9.0
	0.76	26.2	24.1	22.8	20.7	19.3
	1.00	44.8	41.4	38.6	35.9	33.1
	1.26	66.9	62.7	58.6	55.2	51.0
017	0.76	22.1	20.7	19.3	17.9	16.5
	0.95	31.0	29.0	27.6	25.5	23.4
	1.14	41.4	39.3	36.5	33.8	31.7
	1.51	53.8	50.3	46.9	44.1	40.7

6/25/12

Valve	L/s	Cv	Pressure Drop (kPa)
3/4”	0.19	9.9	0.63
	0.25	10.1	1.10
	0.32	10.4	1.59
	0.38	10.6	2.21
3/4”	0.25	10.1	1.07
	0.38	10.6	2.22
	0.50	11.0	3.64
	0.63	11.5	5.26
3/4”	0.32	10.4	1.61
	0.44	10.8	2.90
	0.57	11.2	4.43
	0.76	11.9	7.03
1”	0.38	16.1	0.96
	0.57	16.8	1.99
	0.76	17.4	3.27
	0.95	18.1	4.76
1”	0.57	16.8	1.99
	0.76	17.4	3.27
	1.01	18.3	5.24
	1.26	19.2	7.50
1”	0.76	17.4	3.27
	0.95	18.1	4.74
	1.14	18.7	6.36
	1.51	20.1	9.87

6/25/12

Performance Data

NK005- Single Speed - ECM, X13 Capacity Data (283 L/s)

EWT °C	Flow L/s	WPD kPa	HEATING - EAT 21.1°C							COOLING - EAT 26.7/19.4 °C							
			Airflow L/s	HC kW	Power kW	HE kW	LAT °C	COP	HWC kW	Airflow L/s	TC kW	SC kW	S/T Ratio	Power kW	HR kW	EER	HWC kW
-6.7	0.2	12.4	Operation not recommended							Operation not recommended							
	0.3	24.1															
	0.3	40.7	236	3.0	0.93	2.0	31.5	3.18	0.5								
			283	3.0	0.98	2.0	30.0	3.09	0.4								
-1.1	0.2	11.7	Operation not recommended							Operation not recommended							
	0.3	23.4	236	3.4	0.97	2.4	32.9	3.45	0.5	236	4.9	3.3	0.68	0.49	5.4	10.0	--
			283	3.4	0.99	2.4	31.1	3.46	0.5	283	4.8	3.4	0.72	0.60	5.4	8.0	--
	0.3	39.3	236	3.4	1.03	2.4	33.1	3.32	0.5	236	4.9	3.4	0.68	0.49	5.4	10.0	--
			283	3.5	1.02	2.5	31.4	3.48	0.5	283	4.8	3.4	0.70	0.56	5.4	8.7	--
4.4	0.2	11.7	Operation not recommended							Operation not recommended							
	0.3	22.8	236	3.9	1.00	2.9	34.8	3.91	0.5	236	5.1	3.6	0.69	0.55	5.7	9.4	--
			283	4.0	1.02	3.0	32.8	3.91	0.5	283	5.1	3.7	0.73	0.64	5.7	8.0	--
	0.3	37.9	236	4.0	1.02	3.0	35.2	3.92	0.5	236	5.2	3.6	0.69	0.54	5.7	9.5	--
			283	4.1	1.04	3.0	33.1	3.94	0.5	283	5.2	3.7	0.72	0.60	5.8	8.5	--
10	0.2	11.0	236	4.4	1.02	3.3	36.4	4.26	0.6	236	5.5	3.9	0.71	0.62	6.1	8.9	0.3
			283	4.4	1.03	3.4	34.0	4.25	0.5	283	5.5	4.0	0.73	0.69	6.2	8.0	0.3
	0.3	22.1	236	4.4	1.02	3.4	36.6	4.31	0.6	236	5.5	3.9	0.71	0.60	6.1	9.2	0.2
			283	4.5	1.04	3.5	34.3	4.32	0.5	283	5.5	4.1	0.74	0.68	6.2	8.1	0.3
	0.3	37.2	236	4.5	1.05	3.4	36.9	4.27	0.6	236	5.5	3.9	0.70	0.59	6.1	9.4	0.2
			283	4.6	1.06	3.5	34.6	4.35	0.5	283	5.6	4.1	0.73	0.65	6.2	8.6	0.3
15.6	0.2	11.0	236	4.8	1.05	3.7	37.8	4.56	0.6	236	5.0	3.6	0.71	0.73	5.8	6.9	0.3
			283	4.8	1.05	3.8	35.3	4.59	0.6	283	5.1	3.8	0.74	0.80	6.0	6.4	0.3
	0.3	21.4	236	4.9	1.05	3.8	38.2	4.65	0.6	236	5.1	3.6	0.71	0.71	5.8	7.2	0.3
			283	4.9	1.07	3.9	35.6	4.65	0.6	283	5.2	3.8	0.74	0.78	6.0	6.6	0.3
	0.3	35.9	236	5.0	1.07	3.9	38.6	4.67	0.6	236	5.1	3.6	0.71	0.70	5.8	7.3	0.3
			283	5.1	1.08	4.0	36.0	4.71	0.6	283	5.2	3.8	0.74	0.75	6.0	6.9	0.3
21.1	0.2	10.3	236	5.1	1.08	4.0	38.9	4.70	0.7	236	4.7	3.5	0.73	0.84	5.6	5.7	0.4
			283	5.2	1.07	4.1	36.2	4.82	0.6	283	4.9	3.7	0.75	0.94	5.9	5.2	0.4
	0.3	20.7	236	5.4	1.08	4.3	39.9	4.98	0.7	236	4.8	3.5	0.73	0.81	5.6	5.9	0.3
			283	5.4	1.08	4.3	36.9	4.98	0.6	283	5.0	3.8	0.75	0.87	5.9	5.8	0.4
	0.3	34.5	236	5.5	1.13	4.3	40.3	4.85	0.7	236	4.9	3.5	0.71	0.79	5.7	6.2	0.3
			283	5.6	1.10	4.5	37.4	5.06	0.6	283	5.0	3.8	0.76	0.84	5.8	5.9	0.4
26.7	0.2	10.3	236	5.6	1.07	4.5	40.6	5.18	0.8	236	4.7	3.5	0.74	0.95	5.6	5.0	0.5
			283	5.7	1.07	4.6	37.7	5.27	0.7	283	4.8	3.7	0.77	1.01	5.8	4.8	0.5
	0.3	20.0	236	5.8	1.09	4.7	41.5	5.33	0.8	236	4.7	3.5	0.74	0.91	5.6	5.2	0.4
			283	5.9	1.08	4.8	38.3	5.43	0.7	283	4.9	3.7	0.76	0.96	5.8	5.1	0.5
	0.3	33.1	236	5.9	1.11	4.8	41.8	5.35	0.8	236	4.8	3.5	0.74	0.90	5.7	5.3	0.4
			283	6.0	1.11	4.9	38.7	5.41	0.7	283	4.9	3.8	0.77	0.94	5.8	5.2	0.4
32.2	0.2	9.7	236	5.9	1.08	4.9	42.0	5.50	0.9	236	4.4	3.2	0.74	1.09	5.4	4.0	0.6
			283	6.0	1.08	5.0	38.8	5.60	0.8	283	4.4	3.4	0.77	1.16	5.5	3.8	0.6
	0.3	19.3	236	6.3	1.11	5.2	43.1	5.66	0.9	236	4.4	3.2	0.74	1.05	5.4	4.2	0.5
			283	6.3	1.08	5.3	39.6	5.87	0.8	283	4.4	3.4	0.76	1.09	5.5	4.1	0.6
	0.3	32.4	236	6.3	1.17	5.1	43.2	5.40	0.9	236	4.4	3.3	0.74	1.03	5.5	4.3	0.5
			283	6.5	1.13	5.3	40.0	5.74	0.8	283	4.5	3.4	0.76	1.06	5.5	4.2	0.5
37.8	0.2	9.7	Operation not recommended							Operation not recommended							
	0.3	18.6								236	4.2	3.2	0.78	1.16	5.3	3.6	0.6
										283	4.2	3.4	0.80	1.19	5.4	3.5	0.7
	0.3	32.4								236	4.2	3.3	0.78	1.14	5.3	3.7	0.6
										283	4.2	3.4	0.81	1.16	5.4	3.7	0.7
43.3	0.2	9.0								Operation not recommended							
	0.3	17.9								236	3.7	3.1	0.83	1.30	5.0	2.8	0.8
										283	3.7	3.2	0.86	1.31	5.0	2.8	0.9
	0.3	30.0								236	3.7	3.1	0.84	1.27	5.0	2.9	0.8
										283	3.7	3.2	0.86	1.28	5.0	2.9	0.9
48.9	0.2	9.0								Operation not recommended							
	0.3	17.2								236	3.3	2.8	0.84	1.46	4.8	2.3	1.0
										283	3.3	2.8	0.87	1.47	4.7	2.2	1.2
	0.3	29.0								236	3.3	2.8	0.85	1.43	4.8	2.3	0.9
										283	3.3	2.9	0.86	1.42	4.7	2.3	1.0

9/5/2014

Performance Data cont.

NK017 - Single Speed - ECM, X13 - Capacity Data (1038 L/s)

EWT °C	Flow L/s	WPD kPa	HEATING - EAT 21.1°C							COOLING - EAT 26.7/19.4 °C							
			Airflow L/s	HC kW	Power kW	HE kW	LAT °C	COP	HWC kW	Airflow L/s	TC kW	SC kW	S/T Ratio	Power kW	HR kW	EER	HWC kW
-6.7	0.8	26.2	Operation not recommended							Operation not recommended							
	1.0	37.2															
	1.1	50.3	802	12.0	3.99	8.1	33.5	3.02	2.3								
			1038	12.2	4.09	8.1	30.8	2.97	2.0								
-1.1	0.8	25.5	Operation not recommended							Operation not recommended							
	1.0	36.5	802	13.6	4.06	9.6	35.2	3.35	2.4	802	14.1	9.4	0.66	2.15	16.3	6.6	---
			1038	13.9	4.14	9.8	32.2	3.36	2.2	1038	13.7	9.6	0.71	2.60	16.3	5.3	---
	1.1	49.0	802	13.8	4.29	9.5	35.4	3.23	2.4	802	14.2	9.5	0.67	2.15	16.3	6.6	---
			1038	14.3	4.24	10.1	32.5	3.38	2.2	1038	13.9	9.6	0.69	2.43	16.3	5.7	---
4.4	0.8	24.8	Operation not recommended							Operation not recommended							
	1.0	35.2	802	15.6	4.14	11.5	37.2	3.77	2.6	802	16.5	11.2	0.68	2.46	19.0	6.7	---
			1038	16.0	4.23	11.7	33.9	3.77	2.4	1038	16.4	11.7	0.72	2.88	19.2	5.7	---
	1.1	47.6	802	16.0	4.24	11.8	37.7	3.78	2.7	802	16.6	11.3	0.68	2.46	19.1	6.8	---
			1038	16.3	4.31	12.0	34.2	3.80	2.5	1038	16.6	11.7	0.70	2.72	19.3	6.1	---
10	0.8	24.1	802	17.4	4.27	13.1	39.1	4.08	2.8	802	19.5	13.3	0.68	2.97	22.4	6.6	1.2
			1038	17.6	4.32	13.3	35.1	4.07	2.6	1038	19.5	13.8	0.71	3.32	22.8	5.9	1.3
	1.0	34.5	802	17.6	4.26	13.3	39.3	4.13	2.9	802	19.5	13.4	0.68	2.86	22.4	6.8	1.2
			1038	18.1	4.37	13.7	35.5	4.14	2.7	1038	19.5	14.0	0.72	3.26	22.8	6.0	1.3
	1.1	46.2	802	18.0	4.40	13.6	39.7	4.09	3.0	802	19.7	13.4	0.68	2.84	22.5	6.9	1.1
			1038	18.4	4.41	14.0	35.8	4.17	2.8	1038	19.7	14.0	0.71	3.10	22.8	6.4	1.2
15.6	0.8	23.4	802	19.3	4.39	14.9	41.0	4.39	3.2	802	17.8	12.8	0.72	3.24	21.1	5.5	1.5
			1038	19.6	4.43	15.2	36.7	4.42	2.9	1038	18.3	13.5	0.74	3.55	21.8	5.1	1.6
	1.0	33.1	802	19.7	4.41	15.3	41.5	4.47	3.3	802	17.9	12.8	0.72	3.12	21.0	5.7	1.4
			1038	20.0	4.48	15.5	37.1	4.47	3.0	1038	18.3	13.6	0.74	3.45	21.8	5.3	1.5
	1.1	44.8	802	20.2	4.49	15.7	41.9	4.49	3.4	802	18.1	12.9	0.71	3.10	21.2	5.8	1.3
			1038	20.6	4.54	16.0	37.5	4.53	3.1	1038	18.4	13.7	0.74	3.32	21.8	5.6	1.5
21.1	0.8	22.8	802	20.7	4.57	16.2	42.5	4.53	3.6	802	17.6	12.9	0.74	3.66	21.2	4.8	1.9
			1038	21.1	4.53	16.6	37.9	4.66	3.3	1038	18.3	13.8	0.76	4.12	22.4	4.4	2.0
	1.0	31.7	802	21.9	4.55	17.3	43.7	4.80	3.7	802	17.6	13.0	0.74	3.52	21.2	5.0	1.8
			1038	22.0	4.57	17.4	38.6	4.80	3.4	1038	18.5	14.0	0.76	3.79	22.3	4.9	1.9
	1.1	43.4	802	22.3	4.76	17.5	44.1	4.68	3.8	802	18.1	12.9	0.71	3.46	21.6	5.2	1.7
			1038	22.8	4.67	18.1	39.3	4.88	3.5	1038	18.5	14.2	0.77	3.68	22.2	5.0	1.8
26.7	0.8	21.4	802	23.0	4.65	18.4	44.9	4.95	4.0	802	17.7	13.3	0.75	4.13	21.8	4.3	2.4
			1038	23.4	4.66	18.8	39.8	5.03	3.7	1038	18.1	14.2	0.78	4.41	22.5	4.1	2.6
	1.0	31.0	802	24.0	4.73	19.3	45.9	5.09	4.1	802	17.8	13.4	0.75	3.97	21.8	4.5	2.2
			1038	24.3	4.68	19.6	40.5	5.18	3.8	1038	18.3	14.2	0.78	4.20	22.5	4.4	2.4
	1.1	42.1	802	24.4	4.79	19.6	46.3	5.10	4.3	802	18.0	13.5	0.75	3.91	21.9	4.6	2.1
			1038	24.9	4.83	20.1	41.0	5.16	3.9	1038	18.4	14.3	0.78	4.08	22.5	4.5	2.3
32.2	0.8	20.7	802	25.0	4.80	20.2	46.9	5.20	4.5	802	16.0	12.7	0.79	4.57	20.6	3.5	3.0
			1038	25.4	4.79	20.6	41.3	5.29	4.2	1038	16.1	13.3	0.83	4.84	20.9	3.3	3.2
	1.0	29.6	802	26.3	4.91	21.4	48.2	5.35	4.7	802	16.1	12.8	0.79	4.38	20.5	3.7	2.8
			1038	26.6	4.79	21.8	42.3	5.55	4.3	1038	16.3	13.3	0.82	4.57	20.8	3.6	3.1
	1.1	40.0	802	26.4	5.17	21.2	48.4	5.11	4.8	802	16.3	12.9	0.79	4.30	20.6	3.8	2.6
			1038	27.1	4.99	22.1	42.7	5.43	4.4	1038	16.4	13.5	0.82	4.44	20.9	3.7	2.9
37.8	0.8	20.0	Operation not recommended							Operation not recommended							
	1.0	29.0								802	16.2	13.0	0.80	5.00	21.2	3.2	3.5
										1038	16.3	13.5	0.83	5.12	21.5	3.2	3.8
	1.1	38.6								802	16.3	13.1	0.80	4.89	21.2	3.3	3.3
										1038	16.5	13.7	0.83	4.99	21.5	3.3	3.6
43.3	0.8	19.3								Operation not recommended							
	1.0	27.6								802	14.2	11.8	0.83	5.58	19.8	2.6	4.3
										1038	14.4	12.3	0.86	5.64	20.0	2.6	4.7
	1.1	37.2								802	14.4	12.0	0.83	5.44	19.8	2.6	4.0
										1038	14.5	12.5	0.86	5.50	20.0	2.6	4.4
48.9	0.8	18.6								Operation not recommended							
	1.0	26.9								802	13.4	11.9	0.88	6.26	19.7	2.1	5.2
										1038	13.2	12.1	0.92	6.27	19.4	2.1	5.6
	1.1	35.9								802	13.5	12.1	0.90	6.09	19.6	2.2	4.8
										1038	13.4	12.2	0.91	6.09	19.5	2.2	5.3

9/5/2014

Performance Data cont.

NK006 - Dual Capacity - ECM, X13 - Low Speed (354L/s)

EWT °C	Flow L/s	WPD kPa	HEATING - EAT 21.1°C							COOLING - EAT 26.7/19.4 °C							
			Airflow L/s	HC kW	Power kW	HE kW	LAT °C	COP	HWC kW	Airflow L/s	TC kW	SC kW	S/T Ratio	Power kW	HR kW	EER	HWC kW
-6.7	0.2	4.8	Operation not recommended							Operation not recommended							
	0.3	13.1															
	0.4	24.8	260	2.7	0.98	1.7	29.6	2.72	0.5								
			354	2.8	0.96	1.9	27.7	2.92	0.5								
-1.1	0.2	4.8	Operation not recommended							Operation not recommended							
	0.3	12.4	260	3.4	0.95	2.4	31.9	3.57	0.5	260	5.3	3.3	0.63	0.48	5.8	10.9	---
			354	3.5	0.97	2.5	29.2	3.57	0.5	354	5.1	3.4	0.67	0.59	5.7	8.7	---
	0.4	24.1	260	3.4	1.00	2.4	32.1	3.43	0.5	260	5.3	3.3	0.63	0.49	5.8	10.9	---
			354	3.6	0.99	2.6	29.5	3.59	0.5	354	5.2	3.4	0.65	0.55	5.8	9.5	---
4.4	0.2	4.8	Operation not recommended							Operation not recommended							
	0.3	12.4	260	3.9	0.92	3.0	33.6	4.26	0.5	260	5.4	3.7	0.68	0.53	5.9	10.2	---
			354	4.0	0.94	3.1	30.5	4.27	0.5	354	5.3	3.8	0.72	0.62	5.9	8.6	---
	0.4	23.4	260	4.0	0.94	3.1	33.9	4.28	0.5	260	5.4	3.7	0.68	0.53	5.9	10.3	---
			354	4.1	0.95	3.1	30.7	4.29	0.5	354	5.4	3.8	0.71	0.58	6.0	9.2	---
10	0.2	4.1	260	4.3	0.96	3.3	34.7	4.45	0.6	260	5.5	4.1	0.75	0.60	6.1	9.1	0.2
			354	4.3	0.97	3.3	31.2	4.45	0.5	354	5.5	4.3	0.77	0.68	6.2	8.2	0.2
	0.3	11.7	260	4.3	0.95	3.4	34.8	4.51	0.6	260	5.5	4.1	0.75	0.58	6.1	9.5	0.2
			354	4.4	0.98	3.4	31.4	4.52	0.5	354	5.5	4.3	0.78	0.66	6.2	8.3	0.2
	0.4	22.8	260	4.4	0.99	3.4	35.2	4.47	0.6	260	5.6	4.2	0.75	0.58	6.2	9.6	0.2
			354	4.5	0.99	3.5	31.6	4.56	0.5	354	5.6	4.3	0.77	0.63	6.2	8.8	0.2
15.6	0.2	4.1	260	4.9	0.96	3.9	36.6	5.06	0.6	260	5.2	3.9	0.75	0.70	5.9	7.4	0.3
			354	4.9	0.97	4.0	32.6	5.10	0.6	354	5.3	4.1	0.78	0.77	6.1	6.9	0.3
	0.3	11.7	260	5.0	0.96	4.0	37.0	5.16	0.6	260	5.2	3.9	0.75	0.68	5.9	7.7	0.3
			354	5.0	0.98	4.1	32.9	5.16	0.6	354	5.3	4.1	0.78	0.75	6.1	7.2	0.3
	0.4	22.1	260	5.1	0.98	4.1	37.3	5.19	0.6	260	5.3	3.9	0.75	0.67	5.9	7.9	0.2
			354	5.2	0.99	4.2	33.2	5.23	0.6	354	5.4	4.2	0.78	0.72	6.1	7.5	0.3
21.1	0.2	4.1	260	5.3	0.97	4.3	38.0	5.45	0.7	260	4.9	3.8	0.77	0.80	5.7	6.1	0.4
			354	5.4	0.96	4.4	33.7	5.60	0.6	354	5.1	4.1	0.79	0.91	6.0	5.7	0.4
	0.3	11.0	260	5.6	0.97	4.6	38.9	5.78	0.7	260	5.0	3.8	0.77	0.77	5.7	6.4	0.4
			354	5.6	0.97	4.6	34.2	5.78	0.6	354	5.2	4.1	0.79	0.83	6.0	6.2	0.4
	0.4	21.4	260	5.7	1.01	4.7	39.2	5.63	0.7	260	5.1	3.8	0.74	0.76	5.9	6.7	0.3
			354	5.8	0.99	4.8	34.7	5.87	0.7	354	5.2	4.2	0.80	0.81	6.0	6.4	0.4
26.7	0.2	4.1	260	5.6	1.06	4.6	39.1	5.32	0.8	260	4.9	3.9	0.81	0.93	5.8	5.2	0.5
			354	5.7	1.06	4.7	34.5	5.41	0.7	354	5.0	4.2	0.84	0.99	6.0	5.0	0.6
	0.3	10.3	260	5.9	1.08	4.8	39.9	5.46	0.8	260	4.9	4.0	0.81	0.90	5.8	5.5	0.5
			354	5.9	1.07	4.9	35.0	5.57	0.7	354	5.1	4.2	0.84	0.95	6.0	5.3	0.5
	0.4	20.7	260	6.0	1.09	4.9	40.2	5.48	0.8	260	5.0	4.0	0.81	0.88	5.8	5.6	0.5
			354	6.1	1.10	5.0	35.4	5.55	0.7	354	5.1	4.3	0.84	0.92	6.0	5.5	0.5
32.2	0.2	4.1	260	5.9	1.15	4.8	40.1	5.15	0.8	260	4.7	3.9	0.82	1.09	5.8	4.3	0.7
			354	6.0	1.15	4.9	35.2	5.24	0.8	354	4.7	4.1	0.86	1.15	5.9	4.1	0.8
	0.3	10.3	260	6.3	1.18	5.1	41.1	5.30	0.9	260	4.7	3.9	0.83	1.04	5.8	4.5	0.7
			354	6.3	1.15	5.2	35.9	5.49	0.8	354	4.8	4.1	0.85	1.09	5.8	4.4	0.7
	0.4	20.0	260	6.3	1.24	5.0	41.2	5.05	0.9	260	4.8	3.9	0.83	1.02	5.8	4.6	0.6
			354	6.4	1.20	5.2	36.2	5.37	0.8	354	4.8	4.1	0.85	1.06	5.9	4.6	0.7
37.8	0.2	3.4	Operation not recommended							Operation not recommended							
	0.3	9.7								260	4.4	3.9	0.88	1.19	5.6	3.7	0.9
										354	4.5	4.1	0.91	1.22	5.7	3.7	0.9
	0.4	19.3								260	4.5	3.9	0.88	1.17	5.6	3.8	0.8
										354	4.5	4.1	0.91	1.19	5.7	3.8	0.9
43.3	0.2	3.4								Operation not recommended							
	0.3	9.7								260	3.9	3.7	0.93	1.37	5.3	2.9	1.1
										354	4.0	3.8	0.96	1.38	5.3	2.9	1.2
	0.4	18.6								260	4.0	3.7	0.93	1.33	5.3	3.0	1.0
										354	4.0	3.9	0.96	1.35	5.4	3.0	1.1
48.9	0.2	3.4								Operation not recommended							
	0.3	9.0								260	3.8	3.7	0.96	1.57	5.4	2.4	1.4
										354	3.7	3.7	1.00	1.57	5.3	2.4	1.5
	0.4	17.9								260	3.8	3.7	0.98	1.53	5.3	2.5	1.3
										354	3.8	3.8	0.99	1.53	5.3	2.5	1.4

9/5/2014

Performance Data cont.

NK006 - Dual Capacity - ECM, X13 - High Speed (448 L/s)

EWT °C	Flow L/s	WPD kPa	HEATING - EAT 21.1°C							COOLING - EAT 26.7/19.4 °C							
			Airflow L/s	HC kW	Power kW	HE kW	LAT °C	COP	HWC kW	Airflow L/s	TC kW	SC kW	S/T Ratio	Power kW	HR kW	EER	HWC kW
-6.7	0.25	8.3	Operation not recommended							Operation not recommended							
	0.38	17.2															
	0.50	29.6	354	4.0	1.24	2.7	30.4	3.21	0.6								
			448	4.0	1.28	2.8	28.6	3.16	0.6								
-1.1	0.25	8.3	Operation not recommended							Operation not recommended							
	0.38	17.2	354	4.6	1.27	3.4	31.9	3.66	0.7	353.960	5.9	4.0	0.68	0.74	6.6	8.0	---
			448	4.7	1.29	3.4	29.8	3.67	0.6	448	5.7	4.1	0.72	0.89	6.6	6.4	---
	0.50	29.0	354	4.7	1.33	3.4	32.1	3.52	0.7	353.960	5.9	4.0	0.68	0.74	6.6	8.0	---
			448	4.9	1.32	3.5	30.1	3.69	0.6	448	5.8	4.1	0.70	0.83	6.6	6.9	---
4.4	0.25	8.3	Operation not recommended							Operation not recommended							
	0.38	16.5	354	5.3	1.31	4.0	33.5	4.03	0.7	353.960	6.6	4.7	0.70	0.84	7.5	7.9	---
			448	5.4	1.34	4.1	31.1	4.04	0.7	448	6.6	4.9	0.74	0.98	7.5	6.7	---
	0.50	27.6	354	5.4	1.34	4.1	33.8	4.05	0.8	353.960	6.7	4.7	0.70	0.83	7.5	8.0	---
			448	5.5	1.36	4.2	31.3	4.06	0.7	448	6.6	4.8	0.73	0.92	7.6	7.2	---
10	0.25	7.6	354	5.9	1.36	4.6	35.0	4.36	0.8	353.960	7.6	5.5	0.73	0.98	8.5	7.7	0.4
			448	6.0	1.38	4.6	32.2	4.36	0.7	448	7.6	5.7	0.76	1.10	8.7	6.9	0.4
	0.38	15.9	354	6.0	1.36	4.7	35.2	4.42	0.8	353.960	7.6	5.5	0.73	0.95	8.5	8.0	0.4
			448	6.2	1.39	4.8	32.5	4.43	0.8	448	7.6	5.8	0.76	1.08	8.7	7.0	0.4
	0.50	26.9	354	6.1	1.41	4.7	35.5	4.37	0.9	353.960	7.6	5.6	0.73	0.94	8.6	8.1	0.3
			448	6.3	1.41	4.9	32.7	4.46	0.8	448	7.7	5.8	0.76	1.03	8.7	7.4	0.4
15.6	0.25	7.6	354	6.6	1.42	5.2	36.6	4.66	0.9	353.960	7.0	5.2	0.74	1.11	8.2	6.4	0.5
			448	6.7	1.43	5.3	33.5	4.69	0.8	448	7.2	5.5	0.77	1.21	8.4	6.0	0.5
	0.38	15.2	354	6.8	1.42	5.3	36.9	4.75	0.9	353.960	7.1	5.2	0.74	1.07	8.1	6.6	0.4
			448	6.9	1.44	5.4	33.8	4.75	0.9	448	7.2	5.5	0.77	1.18	8.4	6.2	0.5
	0.50	26.2	354	6.9	1.45	5.5	37.3	4.77	1.0	353.960	7.1	5.3	0.74	1.06	8.2	6.8	0.4
			448	7.1	1.47	5.6	34.1	4.81	0.9	448	7.3	5.6	0.77	1.13	8.4	6.4	0.5
21.1	0.25	7.6	354	7.1	1.50	5.6	37.7	4.74	1.0	353.960	6.8	5.1	0.75	1.26	8.0	5.4	0.6
			448	7.2	1.48	5.7	34.5	4.87	0.9	448	7.0	5.4	0.77	1.42	8.5	4.9	0.6
	0.38	15.2	354	7.5	1.49	6.0	38.7	5.03	1.0	353.960	6.8	5.1	0.75	1.21	8.0	5.6	0.5
			448	7.5	1.50	6.0	35.0	5.03	1.0	448	7.1	5.5	0.78	1.31	8.4	5.4	0.6
	0.50	25.5	354	7.6	1.56	6.1	39.0	4.90	1.1	353.960	7.0	5.1	0.73	1.19	8.2	5.8	0.5
			448	7.8	1.53	6.3	35.5	5.11	1.0	448	7.1	5.6	0.78	1.27	8.4	5.6	0.6
26.7	0.25	6.9	354	8.0	1.53	6.4	39.8	5.22	1.1	353.960	7.0	5.4	0.78	1.41	8.4	4.9	0.7
			448	8.1	1.53	6.6	36.1	5.30	1.1	448	7.2	5.8	0.81	1.50	8.7	4.8	0.8
	0.38	14.5	354	8.3	1.55	6.8	40.6	5.36	1.2	353.960	7.0	5.4	0.78	1.36	8.4	5.2	0.7
			448	8.4	1.54	6.9	36.6	5.46	1.1	448	7.2	5.8	0.80	1.43	8.7	5.0	0.7
	0.50	24.1	354	8.5	1.57	6.9	40.9	5.38	1.2	353.960	7.1	5.5	0.78	1.33	8.4	5.3	0.6
			448	8.6	1.59	7.0	37.1	5.44	1.1	448	7.3	5.8	0.80	1.39	8.6	5.2	0.7
32.2	0.25	6.9	354	8.7	1.59	7.1	41.5	5.48	1.3	353.960	6.6	5.2	0.79	1.57	8.2	4.2	0.9
			448	8.8	1.58	7.3	37.4	5.58	1.2	448	6.7	5.5	0.82	1.67	8.4	4.0	1.0
	0.38	13.8	354	9.2	1.62	7.5	42.5	5.64	1.3	353.960	6.7	5.3	0.79	1.51	8.2	4.4	0.9
			448	9.3	1.58	7.7	38.2	5.85	1.2	448	6.8	5.5	0.82	1.57	8.3	4.3	0.9
	0.50	23.4	354	9.2	1.71	7.5	42.6	5.38	1.4	353.960	6.8	5.3	0.79	1.48	8.2	4.6	0.8
			448	9.4	1.65	7.8	38.6	5.73	1.3	448	6.8	5.6	0.82	1.53	8.3	4.5	0.9
37.8	0.25	6.2	Operation not recommended							Operation not recommended							
	0.38	13.1								353.960	5.7	5.4	0.83	1.71	8.1	3.4	1.1
										448	5.8	5.6	0.86	1.75	8.3	3.3	1.1
	0.50	22.8								353.960	5.8	5.4	0.83	1.67	8.2	3.5	1.0
										448	5.9	5.6	0.86	1.70	8.3	3.4	1.1
43.3	0.25	6.2								Operation not recommended							
	0.38	13.1								353.960	5.7	5.1	0.89	1.89	7.6	3.0	1.3
										448	5.8	5.3	0.92	1.91	7.7	3.0	1.4
	0.50	22.1								353.960	5.8	5.2	0.90	1.85	7.6	3.1	1.2
										448	5.9	5.4	0.92	1.86	7.7	3.1	1.3
48.9	0.25	6.2								Operation not recommended							
	0.38	12.4								353.960	5.4	4.9	0.91	2.14	7.5	2.5	1.6
										448	5.3	5.0	0.94	2.15	7.4	2.5	1.7
	0.50	20.7								353.960	5.4	5.0	0.92	2.09	7.5	2.6	1.4
										448	5.4	5.0	0.94	2.09	7.5	2.6	1.6

9/5/2014

Performance Data cont.

NK009 - Dual Capacity - ECM, X13 - Low Speed (543 L/s)

EWT	Flow	WPD	HEATING - EAT 21.1°C							COOLING - EAT 26.7/19.4 °C							
°C	L/s	kPa	Airflow L/s	HC kW	Power kW	HE kW	LAT °C	COP	HWC kW	Airflow L/s	TC kW	SC kW	S/T Ratio	Power kW	HR kW	EER	HWC kW
-6.7	0.3	4.80	Operation not recommended							Operation not recommended							
	0.4	10.30															
	0.5	18.60	425	3.7	1.29	2.4	28.4	2.89	0.7								
			543	3.8	1.35	2.5	27.0	2.84	0.7								
-1.1	0.3	4.10	Operation not recommended							Operation not recommended							
	0.4	10.30	425	4.5	1.29	3.2	29.8	3.46	0.7	425	6.3	3.9	0.62	0.68	7.0	9.2	-
			543	4.6	1.31	3.2	28.1	3.46	0.6	543	6.1	4.1	0.66	0.83	6.9	7.4	-
	0.5	17.90	425	4.5	1.36	3.2	29.9	3.33	0.7	425	6.3	4.0	0.63	0.69	7.0	9.2	-
			543	4.7	1.35	3.3	28.3	3.48	0.7	543	6.2	4.0	0.65	0.78	7.0	8.0	-
4.4	0.3	4.10	Operation not recommended							Operation not recommended							
	0.4	9.70	425	5.2	1.30	3.9	31.3	4.02	0.7	425	7.0	4.9	0.69	0.74	7.8	9.5	-
			543	5.4	1.33	4.0	29.3	4.03	0.7	543	7.0	5.1	0.73	0.87	7.9	8.0	-
	0.5	17.90	425	5.4	1.33	4.0	31.6	4.04	0.8	425	7.1	4.9	0.69	0.74	7.8	9.6	-
			543	5.5	1.35	4.1	29.5	4.05	0.7	543	7.1	5.0	0.71	0.82	7.9	8.6	-
10	0.3	4.10	425	5.9	1.32	4.6	32.7	4.51	0.8	425	7.9	5.9	0.74	0.85	8.8	9.3	0.3
			543	6.0	1.33	4.7	30.3	4.50	0.7	543	8.0	6.1	0.76	0.95	8.9	8.4	0.3
	0.4	9.70	425	6.0	1.31	4.7	32.8	4.57	0.8	425	8.0	5.9	0.74	0.82	8.8	9.7	0.3
			543	6.2	1.35	4.8	30.5	4.58	0.7	543	8.0	6.2	0.77	0.93	8.9	8.5	0.3
	0.5	17.20	425	6.1	1.36	4.8	33.1	4.52	0.8	425	8.0	5.9	0.74	0.82	8.9	9.9	0.3
			543	6.3	1.36	4.9	30.7	4.61	0.7	543	8.0	6.2	0.76	0.89	8.9	9.1	0.3
15.6	0.3	4.10	425	6.6	1.31	5.3	34.0	5.04	0.8	425	7.4	5.7	0.78	0.97	8.3	7.6	0.4
			543	6.7	1.32	5.4	31.4	5.08	0.8	543	7.5	6.1	0.81	1.06	8.6	7.1	0.4
	0.4	9.00	425	6.8	1.32	5.5	34.3	5.14	0.9	425	7.4	5.7	0.78	0.93	8.3	7.9	0.4
			543	6.9	1.33	5.5	31.6	5.14	0.8	543	7.6	6.1	0.81	1.03	8.6	7.4	0.4
	0.5	16.50	425	6.9	1.34	5.6	34.6	5.16	0.9	425	7.5	5.8	0.77	0.92	8.4	8.1	0.3
			543	7.1	1.35	5.7	31.9	5.21	0.8	543	7.6	6.1	0.81	0.99	8.6	7.7	0.4
21.1	0.3	4.10	425	7.1	1.32	5.8	35.0	5.38	0.9	425	7.2	5.8	0.80	1.10	8.3	6.6	0.5
			543	7.2	1.31	5.9	32.2	5.53	0.9	543	7.5	6.2	0.82	1.24	8.8	6.1	0.6
	0.4	9.00	425	7.5	1.32	6.2	35.8	5.70	1.0	425	7.3	5.8	0.80	1.06	8.3	6.9	0.5
			543	7.5	1.32	6.2	32.6	5.70	0.9	543	7.6	6.3	0.82	1.14	8.8	6.7	0.6
	0.5	15.90	425	7.7	1.38	6.3	36.0	5.56	1.0	425	7.5	5.8	0.77	1.04	8.5	7.2	0.5
			543	7.8	1.35	6.5	33.1	5.79	0.9	543	7.6	6.3	0.83	1.10	8.7	6.9	0.5
26.7	0.3	3.40	425	7.9	1.30	6.6	36.5	6.09	1.0	425	7.2	6.0	0.84	1.26	8.4	5.7	0.7
			543	8.1	1.30	6.8	33.4	6.20	1.0	543	7.4	6.5	0.88	1.35	8.7	5.5	0.8
	0.4	8.30	425	8.3	1.32	6.9	37.2	6.26	1.1	425	7.2	6.1	0.84	1.22	8.4	5.9	0.7
			543	8.3	1.31	7.0	33.8	6.38	1.0	543	7.4	6.5	0.87	1.29	8.7	5.8	0.8
	0.5	15.20	425	8.4	1.34	7.1	37.5	6.28	1.1	425	7.3	6.2	0.84	1.20	8.5	6.1	0.6
			543	8.6	1.35	7.2	34.2	6.36	1.0	543	7.5	6.5	0.87	1.25	8.7	6.0	0.7
32.2	0.3	3.40	425	8.6	1.29	7.3	37.8	6.63	1.2	425	6.5	5.8	0.89	1.46	8.0	4.5	1.0
			543	8.7	1.29	7.4	34.4	6.75	1.1	543	6.6	6.1	0.93	1.55	8.1	4.2	1.1
	0.4	8.30	425	9.0	1.32	7.7	38.7	6.83	1.2	425	6.6	5.9	0.90	1.40	8.0	4.7	0.9
			543	9.1	1.29	7.8	35.0	7.08	1.1	543	6.6	6.1	0.92	1.46	8.1	4.5	1.0
	0.5	15.20	425	9.1	1.39	7.7	38.8	6.51	1.3	425	6.6	6.0	0.90	1.38	8.0	4.8	0.9
			543	9.3	1.34	8.0	35.3	6.93	1.2	543	6.7	6.2	0.92	1.42	8.1	4.7	1.0
37.8	0.3	3.40	Operation not recommended							Operation not recommended							
	0.4	8.30								425	6.5	5.9	0.91	1.60	8.1	4.1	1.2
										543	6.6	6.2	0.94	1.64	8.2	4.0	1.3
	0.5	14.50								425	6.6	6.0	0.91	1.57	8.2	4.2	1.1
										543	6.7	6.2	0.94	1.60	8.3	4.2	1.2
43.3	0.3	3.40								Operation not recommended							
	0.4	7.60								425	5.8	5.5	0.96	1.83	7.6	3.1	1.5
										543	5.8	5.8	0.99	1.85	7.7	3.1	1.7
	0.5	13.80								425	5.8	5.6	0.96	1.79	7.6	3.3	1.4
										543	5.9	5.8	0.99	1.80	7.7	3.3	1.6
48.9	0.3	3.40								Operation not recommended							
	0.4	7.60								425	5.4	5.2	0.97	2.09	7.5	2.6	1.9
										543	5.3	5.3	1.00	2.10	7.4	2.5	2.1
	0.5	13.10								425	5.4	5.4	0.98	2.04	7.5	2.7	1.8
										543	5.4	5.4	1.00	2.03	7.4	2.7	2.0

9/5/2014

Performance Data cont.

NK009 - Dual Capacity - ECM, X13 - High Speed (614 L/s)

EWT °C	Flow L/s	WPD kPa	HEATING - EAT 21.1°C							COOLING - EAT 26.7/19.4 °C							
			Airflow L/s	HC kW	Power kW	HE kW	LAT °C	COP	HWC kW	Airflow L/s	TC kW	SC kW	S/T Ratio	Power kW	HR kW	EER	HWC kW
-6.7	0.3	7.60	Operation not recommended							Operation not recommended							
	0.4	14.50															
	0.6	24.10	543	6.0	1.79	4.2	30.3	3.37	0.8								
			614	6.1	1.83	4.3	29.4	3.34	0.8								
-1.1	0.3	7.60	Operation not recommended							Operation not recommended							
	0.4	14.50	543	6.7	1.78	4.9	31.3	3.77	0.9	543	7.3	4.6	0.64	0.94	8.2	7.7	-
			614	6.8	1.81	5.0	30.3	3.77	0.8	614	7.0	4.8	0.68	1.14	8.2	6.1	-
	0.6	23.40	543	6.8	1.88	4.9	31.5	3.63	0.9	543	7.3	4.7	0.64	0.95	8.2	7.7	-
			614	7.0	1.86	5.2	30.6	3.79	0.8	614	7.1	4.7	0.66	1.07	8.2	6.7	-
4.4	0.3	7.60	Operation not recommended							Operation not recommended							
	0.4	13.80	543	7.7	2.25	5.5	32.9	3.44	1.0	543	8.4	5.8	0.69	1.08	9.5	7.8	-
			614	7.9	2.30	5.6	31.8	3.44	0.9	614	8.3	6.1	0.73	1.27	9.6	6.6	-
	0.6	22.80	543	8.0	2.31	5.7	33.3	3.45	1.0	543	8.5	5.9	0.69	1.08	9.6	7.9	-
			614	8.1	2.34	5.8	32.1	3.46	0.9	614	8.4	6.1	0.72	1.20	9.6	7.0	-
10	0.3	6.90	543	8.6	1.95	6.7	34.3	4.43	1.1	543	9.2	6.9	0.75	1.26	10.5	7.3	0.6
			614	8.7	1.97	6.8	32.9	4.43	1.0	614	9.2	7.2	0.78	1.40	10.6	6.6	0.6
	0.4	13.10	543	8.7	1.95	6.8	34.4	4.49	1.1	543	9.2	6.9	0.75	1.21	10.4	7.6	0.5
			614	9.0	1.99	7.0	33.2	4.50	1.0	614	9.2	7.2	0.78	1.38	10.6	6.7	0.6
	0.6	22.10	543	8.9	2.01	6.9	34.7	4.45	1.2	543	9.3	7.0	0.75	1.20	10.5	7.8	0.5
			614	9.1	2.01	7.1	33.4	4.53	1.1	614	9.3	7.2	0.78	1.31	10.7	7.1	0.5
15.6	0.3	6.90	543	9.5	1.45	8.0	35.6	6.54	1.2	543	9.7	7.2	0.75	1.49	11.2	6.5	0.7
			614	9.6	1.46	8.2	34.1	6.59	1.1	614	9.9	7.7	0.78	1.63	11.5	6.1	0.7
	0.4	13.10	543	9.7	1.46	8.3	35.9	6.67	1.3	543	9.7	7.3	0.75	1.43	11.1	6.8	0.6
			614	9.9	1.48	8.4	34.4	6.67	1.2	614	9.9	7.7	0.78	1.58	11.5	6.3	0.7
	0.6	21.40	543	9.9	1.48	8.4	36.3	6.70	1.3	543	9.8	7.3	0.75	1.42	11.2	6.9	0.6
			614	10.1	1.50	8.6	34.8	6.76	1.2	614	10.0	7.8	0.78	1.52	11.5	6.6	0.7
21.1	0.3	6.90	543	10.2	2.01	8.2	36.6	5.05	1.4	543	10.2	7.7	0.76	1.73	11.9	5.9	0.8
			614	10.4	2.00	8.4	35.1	5.19	1.3	614	10.6	8.3	0.78	1.95	12.6	5.4	0.9
	0.4	12.40	543	10.7	2.00	8.7	37.5	5.35	1.4	543	10.2	7.8	0.76	1.67	11.9	6.1	0.8
			614	10.8	2.01	8.8	35.7	5.35	1.3	614	10.8	8.4	0.78	1.80	12.6	6.0	0.8
	0.6	20.70	543	10.9	2.10	8.8	37.8	5.22	1.5	543	10.5	7.7	0.73	1.64	12.2	6.4	0.7
			614	11.2	2.06	9.1	36.2	5.44	1.3	614	10.8	8.5	0.79	1.74	12.5	6.2	0.8
26.7	0.3	6.20	543	11.2	1.80	9.4	38.3	6.25	1.5	543	10.0	7.9	0.79	1.92	11.9	5.2	1.0
			614	11.4	1.80	9.6	36.6	6.35	1.4	614	10.2	8.5	0.83	2.05	12.3	5.0	1.1
	0.4	12.40	543	11.7	1.83	9.9	39.0	6.42	1.6	543	10.0	8.0	0.79	1.85	11.9	5.4	1.0
			614	11.8	1.81	10.0	37.1	6.54	1.5	614	10.3	8.5	0.82	1.95	12.3	5.3	1.1
	0.6	20.00	543	11.9	1.85	10.1	39.3	6.44	1.6	543	10.1	8.0	0.79	1.82	12.0	5.6	0.9
			614	12.2	1.87	10.3	37.5	6.52	1.5	614	10.4	8.5	0.82	1.90	12.3	5.5	1.0
32.2	0.3	6.20	543	12.1	2.13	10.0	39.6	5.68	1.7	543	9.5	7.7	0.81	2.15	11.7	4.4	1.3
			614	12.3	2.13	10.2	37.7	5.78	1.6	614	9.6	8.1	0.84	2.28	11.9	4.2	1.4
	0.4	11.70	543	12.8	2.18	10.6	40.6	5.85	1.8	543	9.6	7.8	0.81	2.06	11.7	4.7	1.2
			614	12.9	2.13	10.8	38.5	6.06	1.6	614	9.7	8.1	0.83	2.15	11.9	4.5	1.3
	0.6	19.30	543	12.8	2.30	10.5	40.7	5.58	1.8	543	9.7	7.8	0.81	2.03	11.7	4.8	1.1
			614	13.2	2.22	10.9	38.9	5.93	1.7	614	9.8	8.2	0.83	2.09	11.9	4.7	1.3
37.8	0.3	6.20	Operation not recommended							Operation not recommended							
	0.4	11.00								543	9.4	7.9	0.84	2.33	11.7	4.0	1.5
										614	9.5	8.3	0.87	2.39	11.9	4.0	1.6
	0.6	18.60								543	9.5	8.0	0.84	2.28	11.8	4.2	1.4
										614	9.6	8.4	0.87	2.32	11.9	4.1	1.6
43.3	0.3	5.50								Operation not recommended							
	0.4	11.00								543	8.4	7.5	0.90	2.59	11.0	3.2	1.8
										614	8.5	7.8	0.92	2.62	11.1	3.2	2.0
	0.6	17.90								543	8.5	7.6	0.90	2.52	11.0	3.4	1.7
										614	8.6	7.9	0.93	2.55	11.1	3.4	1.9
48.9	0.3	5.50								Operation not recommended							
	0.4	10.30								543	7.9	7.2	0.91	2.88	10.8	2.8	2.2
										614	7.8	7.3	0.94	2.89	10.6	2.7	2.4
	0.6	17.20								543	7.9	7.3	0.92	2.80	10.7	2.8	2.1
										614	7.9	7.4	0.94	2.80	10.7	2.8	2.3

9/5/2014

Performance Data cont.

NK012 - Dual Capacity - ECM, X13 - Low Speed (637 L/s)

EWT °C	Flow L/s	WPD	HEATING - EAT 21.1°C							COOLING - EAT 26.7/19.4 °C							
		kPa	Airflow L/s	HC kW	Power kW	HE kW	LAT °C	COP	HWC kW	Airflow L/s	TC kW	SC kW	S/T Ratio	Power kW	HR kW	EER	HWC kW
-6.7	0.3	6.90	Operation not recommended							Operation not recommended							
	0.5	13.80															
	0.7	22.10	543	5.6	1.86	3.8	29.7	3.03	1.2								
			637	5.8	1.89	3.9	28.6	3.05	1.1								
-1.1	0.3	6.90	Operation not recommended							Operation not recommended							
	0.5	13.10	543	6.4	1.82	4.6	30.9	3.52	1.3	543	9.1	5.2	0.57	0.90	10.0	10.1	-
			637	6.6	1.86	4.7	29.6	3.53	1.1	637	8.8	5.3	0.60	1.09	9.9	8.1	-
	0.7	21.40	543	6.5	1.92	4.6	31.1	3.39	1.3	543	9.1	5.2	0.57	0.90	10.0	10.1	-
			637	6.8	1.90	4.9	29.9	3.55	1.2	637	8.9	5.3	0.59	1.02	10.0	8.8	-
4.4	0.3	6.20	Operation not recommended							Operation not recommended							
	0.5	12.40	543	7.3	1.82	5.5	32.3	4.03	1.3	543	9.8	6.3	0.65	0.98	10.7	9.9	---
			637	7.5	1.86	5.6	30.9	4.03	1.2	637	9.7	6.6	0.68	1.15	10.8	8.4	---
	0.7	20.70	543	7.5	1.86	5.7	32.6	4.04	1.4	543	9.8	6.3	0.64	0.98	10.8	10.0	---
			637	7.7	1.89	5.8	31.1	4.06	1.2	637	9.8	6.5	0.67	1.09	10.9	9.0	---
10	0.3	6.20	543	8.3	1.85	6.4	33.7	4.47	1.4	543	10.8	7.6	0.71	1.13	11.9	9.5	0.5
			637	8.4	1.87	6.5	32.0	4.47	1.3	637	10.8	7.9	0.73	1.27	12.1	8.5	0.5
	0.5	12.40	543	8.4	1.84	6.5	33.9	4.53	1.4	543	10.8	7.6	0.71	1.09	11.9	9.9	0.4
			637	8.6	1.89	6.7	32.3	4.54	1.3	637	10.8	8.0	0.74	1.25	12.1	8.7	0.5
	0.7	20.00	543	8.5	1.90	6.6	34.2	4.49	1.5	543	10.9	7.7	0.70	1.09	12.0	10.0	0.4
			637	8.7	1.91	6.8	32.5	4.57	1.4	637	10.9	8.0	0.73	1.19	12.1	9.2	0.5
15.6	0.3	6.20	543	9.2	1.85	7.3	35.1	4.97	1.5	543	9.7	7.2	0.74	1.30	11.0	7.5	0.7
			637	9.3	1.86	7.5	33.2	5.01	1.4	637	10.0	7.7	0.77	1.43	11.4	7.0	0.7
	0.5	11.70	543	9.4	1.85	7.5	35.5	5.07	1.6	543	9.8	7.3	0.74	1.25	11.0	7.8	0.6
			637	9.5	1.88	7.6	33.5	5.07	1.5	637	10.0	7.7	0.77	1.38	11.4	7.2	0.7
	0.7	19.30	543	9.6	1.89	7.7	35.8	5.09	1.6	543	9.9	7.3	0.74	1.24	11.1	8.0	0.6
			637	9.8	1.91	7.9	33.9	5.13	1.5	637	10.1	7.8	0.77	1.33	11.4	7.6	0.6
21.1	0.3	5.50	543	9.9	1.87	8.1	36.3	5.31	1.7	543	9.2	7.2	0.79	1.48	10.7	6.2	0.9
			637	10.1	1.85	8.2	34.2	5.45	1.6	637	9.6	7.8	0.81	1.67	11.3	5.8	1.0
	0.5	11.70	543	10.5	1.86	8.6	37.1	5.62	1.7	543	9.3	7.3	0.79	1.42	10.7	6.5	0.9
			637	10.5	1.87	8.6	34.8	5.62	1.6	637	9.7	7.9	0.81	1.53	11.3	6.3	0.9
	0.7	19.30	543	10.7	1.95	8.7	37.4	5.48	1.8	543	9.5	7.2	0.76	1.40	10.9	6.8	0.8
			637	10.9	1.91	9.0	35.3	5.71	1.7	637	9.7	8.0	0.82	1.49	11.2	6.5	0.9
26.7	0.3	5.50	543	11.2	1.87	9.3	38.2	5.99	1.9	543	9.2	7.5	0.82	1.72	11.0	5.4	1.3
			637	11.4	1.87	9.5	35.9	6.09	1.7	637	9.5	8.1	0.85	1.84	11.3	5.2	1.4
	0.5	11.00	543	11.7	1.90	9.8	39.0	6.16	1.9	543	9.3	7.6	0.82	1.66	10.9	5.6	1.2
			637	11.8	1.88	9.9	36.5	6.27	1.8	637	9.6	8.1	0.84	1.75	11.3	5.5	1.3
	0.7	18.60	543	11.9	1.93	10.0	39.3	6.18	2.0	543	9.4	7.7	0.82	1.63	11.0	5.8	1.1
			637	12.1	1.94	10.2	36.9	6.25	1.9	637	9.6	8.2	0.85	1.70	11.3	5.7	1.2
32.2	0.3	5.50	543	12.3	1.89	10.4	39.9	6.51	2.1	543	8.4	7.2	0.85	2.00	10.4	4.2	1.7
			637	12.5	1.89	10.6	37.4	6.63	2.0	637	8.5	7.6	0.89	2.12	10.6	4.0	1.8
	0.5	11.00	543	13.0	1.94	11.1	40.9	6.70	2.2	543	8.5	7.3	0.85	1.92	10.4	4.4	1.6
			637	13.1	1.89	11.3	38.2	6.95	2.0	637	8.6	7.6	0.88	2.00	10.6	4.3	1.7
	0.7	17.90	543	13.1	2.04	11.0	41.0	6.39	2.2	543	8.6	7.3	0.85	1.89	10.5	4.6	1.5
			637	13.4	1.97	11.4	38.5	6.80	2.1	637	8.7	7.7	0.88	1.95	10.6	4.5	1.7
37.8	0.3	5.50	Operation not recommended							Operation not recommended							
	0.5	10.30								543	8.3	7.4	0.89	2.20	10.5	3.8	2.1
										637	8.4	7.7	0.92	2.25	10.6	3.7	2.3
	0.7	17.20								543	8.4	7.4	0.89	2.15	10.5	3.9	1.9
										637	8.4	7.7	0.92	2.19	10.6	3.9	2.1
43.3	0.3	4.80								Operation not recommended							
	0.5	9.70								543	7.3	6.7	0.92	2.53	9.9	2.9	2.6
										637	7.4	7.0	0.94	2.56	10.0	2.9	2.9
	0.7	16.50								543	7.4	6.8	0.92	2.47	9.9	3.0	2.5
										637	7.5	7.1	0.95	2.49	10.0	3.0	2.7
48.9	0.3	4.80								Operation not recommended							
	0.5	9.70								543	6.8	6.6	0.97	2.87	9.7	2.4	3.3
										637	6.7	6.7	1.01	2.88	9.6	2.3	3.5
	0.7	15.90								543	6.9	6.8	0.99	2.80	9.7	2.4	3.0
										637	6.8	6.8	1.00	2.80	9.6	2.4	3.4

9/5/2014

Performance Data cont.

NK012 - Dual Capacity - ECM, X13 - High Speed (732 L/s)

EWT °C	Flow L/s	WPD kPa	HEATING - EAT 21.1°C							COOLING - EAT 26.7/19.4 °C							
			Airflow L/s	HC kW	Power kW	HE kW	LAT °C	COP	HWC kW	Airflow L/s	TC kW	SC kW	S/T Ratio	Power kW	HR kW	EER	HWC kW
-6.7	0.4	9.00	Operation not recommended							Operation not recommended							
	0.6	16.50															
	0.8	26.90	637	8.2	2.39	5.8	31.7	3.42	1.6								
			732	8.2	2.43	5.8	30.4	3.39	1.4								
-1.1	0.4	8.30	Operation not recommended							Operation not recommended							
	0.6	16.50	637	9.0	2.40	6.6	32.8	3.74	1.6	637	12.5	7.1	0.57	1.37	13.8	9.1	-
			732	9.1	2.44	6.7	31.5	3.75	1.5	732	12.1	7.3	0.61	1.65	13.7	7.3	-
	0.8	26.20	637	9.1	2.53	6.6	32.9	3.60	1.7	637	12.5	7.2	0.58	1.37	13.9	9.1	-
			732	9.4	2.50	6.9	31.8	3.77	1.6	732	12.3	7.3	0.59	1.55	13.8	7.9	-
4.4	0.4	8.30	Operation not recommended							Operation not recommended							
	0.6	15.90	637	10.3	2.46	7.8	34.5	4.18	1.8	637	13.1	8.2	0.62	1.53	14.7	8.6	---
			732	10.5	2.51	8.0	33.0	4.19	1.7	732	13.0	8.5	0.66	1.79	14.8	7.3	---
	0.8	25.50	637	10.6	2.52	8.1	34.9	4.20	1.9	637	13.2	8.2	0.62	1.53	14.7	8.7	---
			732	10.8	2.56	8.2	33.3	4.22	1.7	732	13.2	8.5	0.65	1.69	14.8	7.8	---
10	0.4	8.30	637	11.5	2.50	9.0	36.0	4.59	2.0	637	14.0	9.4	0.67	1.79	15.8	7.8	0.9
			732	11.6	2.53	9.1	34.3	4.58	1.8	732	14.0	9.7	0.69	2.01	16.0	7.0	0.9
	0.6	15.20	637	11.6	2.50	9.1	36.2	4.65	2.0	637	14.0	9.4	0.67	1.73	15.7	8.1	0.8
			732	11.9	2.56	9.4	34.6	4.66	1.9	732	14.0	9.8	0.70	1.97	16.0	7.1	0.9
	0.8	24.80	637	11.9	2.58	9.3	36.5	4.60	2.1	637	14.2	9.4	0.67	1.72	15.9	8.2	0.8
			732	12.1	2.58	9.5	34.8	4.69	1.9	732	14.2	9.8	0.69	1.88	16.1	7.6	0.8
15.6	0.4	7.60	637	12.6	2.62	9.9	37.4	4.80	2.2	637	13.2	9.0	0.68	2.00	15.2	6.6	1.1
			732	12.8	2.64	10.1	35.6	4.84	2.0	732	13.5	9.6	0.71	2.19	15.7	6.1	1.1
	0.6	14.50	637	12.9	2.63	10.2	37.8	4.90	2.3	637	13.2	9.0	0.68	1.93	15.1	6.9	1.0
			732	13.0	2.66	10.4	35.9	4.90	2.1	732	13.5	9.6	0.71	2.13	15.7	6.4	1.1
	0.8	24.10	637	13.1	2.67	10.5	38.2	4.92	2.4	637	13.3	9.1	0.68	1.91	15.2	7.0	0.9
			732	13.4	2.71	10.7	36.3	4.96	2.2	732	13.6	9.7	0.71	2.05	15.6	6.6	1.0
21.1	0.4	7.60	637	13.4	2.78	10.6	38.6	4.84	2.5	637	12.7	9.2	0.72	2.28	15.0	5.6	1.3
			732	13.7	2.75	10.9	36.6	4.97	2.3	732	13.2	9.8	0.74	2.56	15.8	5.2	1.4
	0.6	14.50	637	14.2	2.76	11.4	39.5	5.12	2.6	637	12.7	9.2	0.72	2.19	14.9	5.8	1.3
			732	14.2	2.78	11.4	37.2	5.12	2.4	732	13.4	9.9	0.74	2.36	15.7	5.7	1.4
	0.8	23.40	637	14.4	2.89	11.5	39.9	4.99	2.6	637	13.1	9.1	0.70	2.15	15.2	6.1	1.2
			732	14.7	2.83	11.9	37.8	5.21	2.4	732	13.4	10.0	0.75	2.29	15.7	5.8	1.3
26.7	0.4	6.90	637	14.9	2.77	12.1	40.5	5.37	2.8	637	12.6	9.3	0.74	2.55	15.2	4.9	1.7
			732	15.2	2.77	12.4	38.3	5.46	2.6	732	12.9	9.9	0.77	2.72	15.7	4.8	1.8
	0.6	13.80	637	15.5	2.82	12.7	41.3	5.52	2.9	637	12.7	9.3	0.74	2.46	15.1	5.2	1.6
			732	15.7	2.79	12.9	38.9	5.63	2.7	732	13.1	9.9	0.76	2.60	15.7	5.0	1.7
	0.8	22.10	637	15.8	2.85	12.9	41.7	5.54	3.0	637	12.8	9.4	0.74	2.42	15.2	5.3	1.5
			732	16.1	2.87	13.2	39.4	5.61	2.7	732	13.1	10.0	0.76	2.52	15.7	5.2	1.6
32.2	0.4	6.90	637	16.1	2.84	13.3	42.0	5.67	3.1	637	11.8	8.8	0.75	2.85	14.6	4.1	2.1
			732	16.4	2.83	13.5	39.6	5.77	2.9	732	11.9	9.3	0.78	3.02	14.9	3.9	2.3
	0.6	13.10	637	16.9	2.90	14.0	43.1	5.84	3.2	637	11.9	8.9	0.75	2.73	14.6	4.3	2.0
			732	17.2	2.83	14.3	40.5	6.05	3.0	732	12.0	9.3	0.77	2.85	14.9	4.2	2.2
	0.8	21.40	637	17.0	3.06	14.0	43.2	5.57	3.3	637	12.0	9.0	0.75	2.68	14.7	4.5	1.9
			732	17.5	2.95	14.5	40.9	5.92	3.1	732	12.1	9.4	0.77	2.77	14.9	4.4	2.1
37.8	0.4	6.90	Operation not recommended							Operation not recommended							
	0.6	13.10								637	11.5	9.1	0.79	3.12	14.7	3.7	2.5
										732	11.6	9.5	0.81	3.20	14.8	3.6	2.7
	0.8	20.70								637	11.6	9.2	0.79	3.05	14.7	3.8	2.3
										732	11.8	9.6	0.81	3.11	14.9	3.8	2.5
43.3	0.4	6.20								Operation not recommended							
	0.6	12.40								637	10.6	8.4	0.79	3.50	14.1	3.0	3.0
										732	10.7	8.7	0.82	3.53	14.2	3.0	3.3
	0.8	20.00								637	10.7	8.5	0.79	3.41	14.1	3.1	2.8
										732	10.8	8.8	0.82	3.44	14.2	3.1	3.1
48.9	0.4	6.20								Operation not recommended							
	0.6	11.70								637	9.7	8.5	0.88	3.94	13.6	2.4	3.7
										732	9.5	8.6	0.91	3.96	13.4	2.4	4.0
	0.8	19.30								637	9.7	8.6	0.89	3.84	13.5	2.5	3.4
										732	9.6	8.7	0.90	3.84	13.5	2.5	3.8

9/5/2014

Performance Data cont.

NK015 - Dual Capacity - ECM, X13 - Low Speed (708 L/s)

EWT °C	Flow L/s	WPD	HEATING - EAT 21.1°C							COOLING - EAT 26.7/19.4 °C							
		kPa	Airflow L/s	HC kW	Power kW	HE kW	LAT °C	COP	HWC kW	Airflow L/s	TC kW	SC kW	S/T Ratio	Power kW	HR kW	EER	HWC kW
-6.7	0.4	9.00	Operation not recommended							Operation not recommended							
	0.6	19.30															
	0.9	33.8	590	5.7	2.32	3.3	29.1	2.44	1.4								
			708	5.8	2.38	3.4	27.9	2.43	1.3								
-1.1	0.4	8.30	Operation not recommended							Operation not recommended							
	0.6	18.60	590	6.5	2.29	4.2	30.2	2.82	1.5	590	12.2	7.7	0.63	1.15	13.3	10.6	0.4
			708	6.6	2.33	4.3	28.8	2.83	1.3	708	11.8	8.0	0.68	1.39	13.2	8.5	0.4
	0.9	33.1	590	6.6	2.41	4.1	30.3	2.72	1.5	590	12.2	7.8	0.64	1.15	13.4	10.6	0.4
			708	6.8	2.39	4.4	29.1	2.84	1.4	708	12.0	7.9	0.66	1.30	13.3	9.2	0.4
4.4	0.4	8.30	Operation not recommended							Operation not recommended							
	0.6	17.90	590	7.8	2.29	5.5	32.0	3.40	1.6	590	12.6	8.4	0.66	1.27	13.9	9.9	0.4
			708	8.0	2.34	5.6	30.4	3.40	1.4	708	12.5	8.7	0.70	1.49	14.0	8.4	0.5
	0.9	31.7	590	8.0	2.34	5.7	32.3	3.41	1.6	590	12.7	8.4	0.66	1.27	14.0	10.0	0.4
			708	8.1	2.38	5.8	30.6	3.43	1.5	708	12.7	8.7	0.69	1.41	14.1	9.0	0.4
10	0.4	7.60	590	9.0	2.31	6.6	33.7	3.87	1.6	590	13.2	9.1	0.69	1.46	14.7	9.0	0.6
			708	9.0	2.34	6.7	31.7	3.87	1.5	708	13.3	9.4	0.71	1.64	14.9	8.1	0.6
	0.6	17.90	590	9.0	2.31	6.7	33.8	3.92	1.7	590	13.2	9.1	0.69	1.41	14.7	9.4	0.5
			708	9.3	2.36	6.9	32.0	3.93	1.5	708	13.3	9.5	0.72	1.61	14.9	8.3	0.6
	0.9	31.0	590	9.3	2.38	6.9	34.1	3.88	1.7	590	13.4	9.1	0.68	1.40	14.8	9.5	0.5
			708	9.5	2.39	7.1	32.2	3.96	1.6	708	13.4	9.5	0.71	1.53	14.9	8.8	0.6
15.6	0.4	7.60	590	10.2	2.32	7.9	35.4	4.40	1.8	590	12.6	8.8	0.70	1.70	14.3	7.4	0.8
			708	10.4	2.34	8.0	33.2	4.44	1.7	708	12.8	9.3	0.73	1.87	14.7	6.9	0.9
	0.6	17.20	590	10.5	2.33	8.1	35.8	4.49	1.8	590	12.6	8.8	0.70	1.64	14.2	7.7	0.8
			708	10.6	2.36	8.2	33.5	4.49	1.7	708	12.9	9.4	0.73	1.81	14.7	7.1	0.8
	0.9	30.3	590	10.7	2.37	8.3	36.1	4.51	1.9	590	12.7	8.9	0.70	1.63	14.4	7.8	0.7
			708	10.9	2.40	8.5	33.9	4.55	1.7	708	13.0	9.4	0.73	1.74	14.7	7.4	0.8
21.1	0.4	7.60	590	11.4	2.36	9.0	37.1	4.82	2.0	590	12.0	8.8	0.73	1.97	14.0	6.1	1.2
			708	11.6	2.34	9.2	34.7	4.95	1.8	708	12.5	9.4	0.75	2.22	14.7	5.6	1.2
	0.6	16.50	590	12.0	2.35	9.6	38.0	5.10	2.0	590	12.1	8.9	0.73	1.90	14.0	6.4	1.1
			708	12.1	2.36	9.7	35.2	5.10	1.9	708	12.7	9.6	0.75	2.04	14.7	6.2	1.2
	0.9	29.0	590	12.2	2.46	9.8	38.3	4.97	2.1	590	12.4	8.8	0.71	1.86	14.3	6.7	1.0
			708	12.5	2.41	10.1	35.7	5.19	1.9	708	12.7	9.7	0.76	1.98	14.7	6.4	1.1
26.7	0.4	6.90	590	12.9	2.36	10.5	39.2	5.48	2.2	590	11.9	8.8	0.74	2.25	14.1	5.3	1.6
			708	13.1	2.36	10.8	36.5	5.57	2.0	708	12.2	9.4	0.77	2.40	14.6	5.1	1.7
	0.6	15.90	590	13.5	2.40	11.1	40.0	5.63	2.3	590	12.0	8.9	0.74	2.16	14.1	5.5	1.5
			708	13.6	2.37	11.2	37.0	5.73	2.1	708	12.3	9.4	0.77	2.28	14.6	5.4	1.6
	0.9	28.3	590	13.7	2.43	11.3	40.3	5.65	2.4	590	12.1	9.0	0.74	2.13	14.2	5.7	1.4
			708	14.0	2.45	11.5	37.5	5.71	2.2	708	12.4	9.5	0.77	2.22	14.6	5.6	1.6
32.2	0.4	6.90	590	14.3	2.39	12.0	41.3	6.01	2.5	590	11.3	8.5	0.75	2.59	13.8	4.4	2.2
			708	14.6	2.38	12.2	38.2	6.11	2.3	708	11.3	8.9	0.79	2.74	14.1	4.1	2.3
	0.6	15.20	590	15.1	2.44	12.7	42.3	6.18	2.6	590	11.3	8.6	0.76	2.48	13.8	4.6	2.0
			708	15.3	2.38	12.9	39.0	6.41	2.4	708	11.5	8.9	0.78	2.59	14.0	4.4	2.2
	0.9	26.9	590	15.2	2.57	12.6	42.4	5.90	2.6	590	11.5	8.7	0.76	2.44	13.9	4.7	1.9
			708	15.6	2.48	13.1	39.3	6.27	2.4	708	11.6	9.0	0.78	2.51	14.1	4.6	2.1
37.8	0.4	6.90	Operation not recommended							Operation not recommended							
	0.6	15.20								590	10.7	8.5	0.80	2.84	13.5	3.8	2.6
										708	10.8	8.9	0.82	2.91	13.7	3.7	2.8
	0.9	26.2								590	10.8	8.6	0.80	2.77	13.6	3.9	2.4
										708	10.9	9.0	0.82	2.83	13.7	3.8	2.7
43.3	0.4	6.20								Operation not recommended							
	0.6	14.50								590	9.5	7.8	0.83	3.22	12.7	2.9	3.3
										708	9.6	8.2	0.85	3.26	12.8	2.9	3.6
	0.9	24.8								590	9.6	7.9	0.83	3.14	12.7	3.0	3.1
										708	9.7	8.3	0.85	3.18	12.9	3.0	3.4
48.9	0.4	6.20								Operation not recommended							
	0.6	13.80								590	8.7	7.8	0.90	3.67	12.4	2.4	4.1
										708	8.5	7.9	0.93	3.68	12.2	2.3	4.5
	0.9	24.10								590	8.7	8.0	0.91	3.58	12.3	2.4	3.8
										708	8.7	8.0	0.92	3.57	12.2	2.4	4.2

9/5/2014

Performance Data cont.

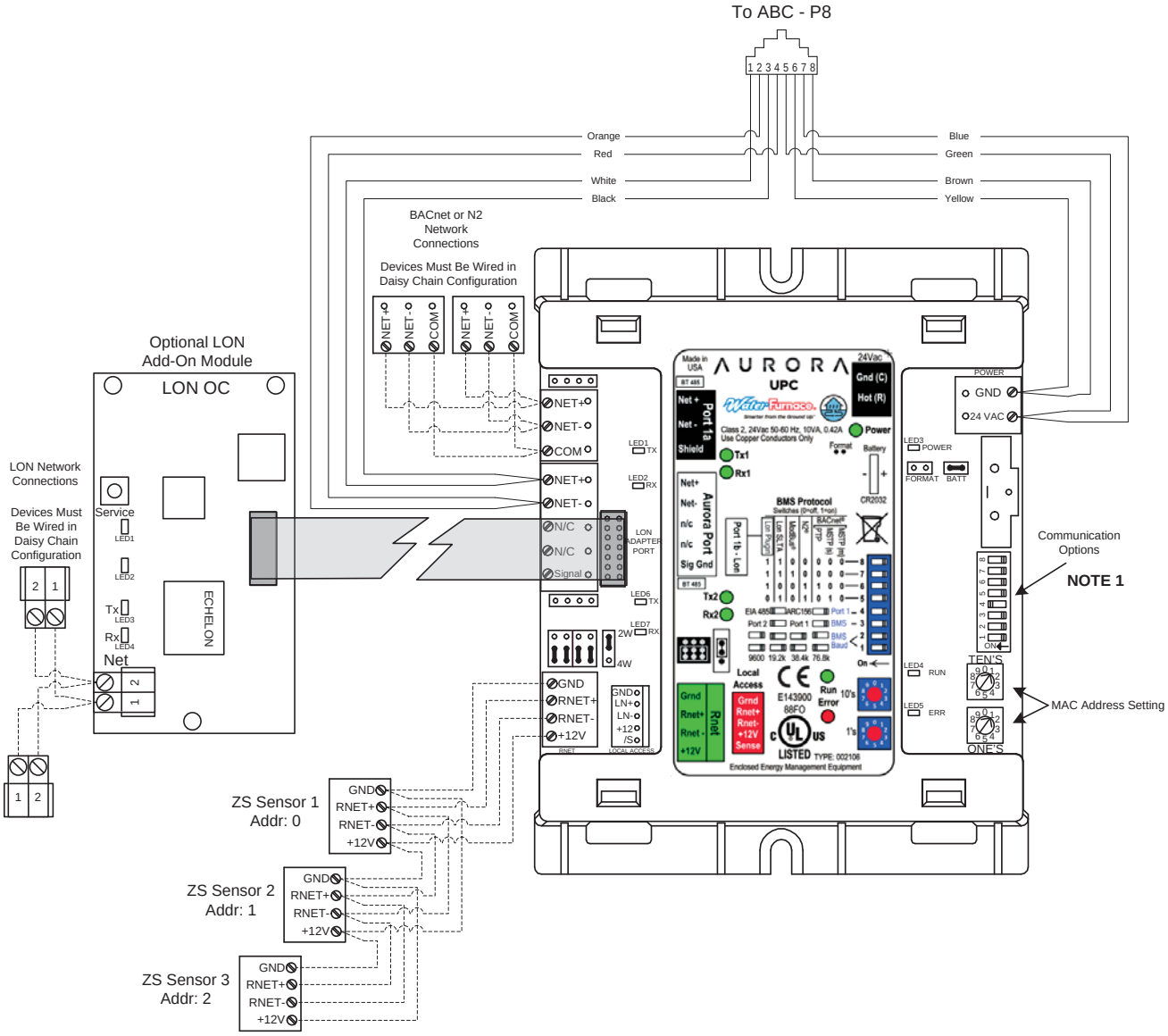
NK015 - Dual Capacity - ECM, X13 - High Speed (850 L/s)

EWT °C	Flow L/s	WPD kPa	HEATING - EAT 21.1°C							COOLING - EAT 26.7/19.4 °C							
			Airflow L/s	HC kW	Power kW	HE kW	LAT °C	COP	HWC kW	Airflow L/s	TC kW	SC kW	S/T Ratio	Power kW	HR kW	EER	HWC kW
-6.7	0.5	13.80	Operation not recommended							Operation not recommended							
	0.8	26.2															
	1.0	43.4	708	9.3	2.94	6.4	32.0	3.16	1.8								
			850	9.4	3.17	6.2	30.3	2.97	1.6								
-1.1	0.5	13.10	Operation not recommended							Operation not recommended							
	0.8	25.5	708	10.3	3.08	7.3	33.2	3.35	1.9	708	13.6	9.1	0.67	1.75	15.3	7.8	-
			850	10.5	3.14	7.4	31.4	3.36	1.8	850	13.1	9.4	0.72	2.12	15.2	6.2	-
	1.0	42.1	708	10.5	3.25	7.2	33.4	3.23	2.0	708	13.6	9.2	0.68	1.75	15.4	7.8	-
			850	10.9	3.22	7.6	31.7	3.38	1.8	850	13.3	9.3	0.70	1.98	15.3	6.7	-
4.4	0.5	13.10	Operation not recommended							Operation not recommended							
	0.8	24.8	708	12.2	3.20	9.0	35.4	3.83	2.1	708	15.8	10.4	0.66	2.08	17.9	7.6	---
			850	12.5	3.27	9.3	33.3	3.84	1.9	850	15.7	10.9	0.70	2.44	18.1	6.4	---
	1.0	40.7	708	12.6	3.27	9.3	35.8	3.85	2.2	708	15.9	10.5	0.66	2.08	18.0	7.7	---
			850	12.8	3.32	9.5	33.6	3.86	2.0	850	15.8	10.9	0.69	2.30	18.1	6.9	---
10	0.5	12.40	708	13.8	3.32	10.5	37.3	4.15	2.3	708	18.6	12.1	0.65	2.58	21.1	7.2	1.2
			850	14.0	3.36	10.6	34.7	4.15	2.1	850	18.6	12.5	0.67	2.89	21.5	6.4	1.2
	0.8	24.10	708	14.0	3.32	10.6	37.4	4.21	2.3	708	18.6	12.1	0.65	2.49	21.1	7.5	1.1
			850	14.3	3.40	10.9	35.1	4.22	2.2	850	18.6	12.7	0.68	2.84	21.5	6.6	1.2
	1.0	39.3	708	14.3	3.42	10.8	37.8	4.17	2.4	708	18.8	12.2	0.65	2.48	21.3	7.6	1.0
			850	14.6	3.43	11.1	35.3	4.25	2.2	850	18.8	12.7	0.67	2.70	21.5	7.0	1.1
15.6	0.5	11.70	708	15.5	3.46	12.1	39.3	4.49	2.5	708	17.1	11.4	0.67	2.79	19.9	6.1	1.4
			850	15.8	3.49	12.3	36.5	4.52	2.4	850	17.5	12.1	0.69	3.06	20.5	5.7	1.5
	0.8	23.40	708	15.9	3.48	12.4	39.7	4.58	2.6	708	17.1	11.4	0.67	2.69	19.8	6.4	1.3
			850	16.1	3.53	12.6	36.8	4.58	2.4	850	17.5	12.1	0.69	2.97	20.5	5.9	1.4
	1.0	38.6	708	16.3	3.54	12.7	40.1	4.60	2.7	708	17.3	11.5	0.66	2.67	20.0	6.5	1.2
			850	16.6	3.58	13.0	37.3	4.64	2.5	850	17.6	12.2	0.69	2.86	20.5	6.2	1.4
21.1	0.5	11.70	708	17.1	3.69	13.4	41.1	4.64	2.9	708	16.7	11.2	0.67	3.14	19.8	5.3	1.8
			850	17.4	3.65	13.7	38.1	4.76	2.7	850	17.4	12.0	0.69	3.54	20.9	4.9	1.9
	0.8	22.80	708	18.0	3.67	14.4	42.2	4.92	3.0	708	16.8	11.2	0.67	3.02	19.8	5.6	1.7
			850	18.1	3.69	14.4	38.8	4.92	2.7	850	17.6	12.1	0.69	3.25	20.9	5.4	1.8
	1.0	37.2	708	18.4	3.84	14.5	42.6	4.79	3.0	708	17.3	11.2	0.65	2.97	20.2	5.8	1.5
			850	18.8	3.76	15.0	39.4	5.00	2.8	850	17.6	12.3	0.70	3.16	20.8	5.6	1.7
26.7	0.5	11.00	708	19.0	3.78	15.2	43.4	5.03	3.2	708	16.9	11.6	0.68	3.52	20.4	4.8	2.2
			850	19.4	3.79	15.6	40.0	5.11	3.0	850	17.3	12.4	0.71	3.76	21.1	4.6	2.4
	0.8	22.10	708	19.9	3.85	16.0	44.4	5.16	3.3	708	17.0	11.7	0.69	3.39	20.4	5.0	2.1
			850	20.0	3.81	16.2	40.7	5.26	3.1	850	17.5	12.4	0.71	3.58	21.1	4.9	2.3
	1.0	35.9	708	20.2	3.90	16.3	44.7	5.18	3.4	708	17.2	11.8	0.69	3.33	20.5	5.2	1.9
			850	20.6	3.93	16.7	41.2	5.24	3.2	850	17.6	12.5	0.71	3.48	21.1	5.1	2.2
32.2	0.5	11.00	708	20.8	3.97	16.8	45.5	5.24	3.6	708	15.4	11.1	0.72	3.83	19.2	4.0	2.8
			850	21.1	3.96	17.2	41.7	5.33	3.3	850	15.5	11.7	0.75	4.06	19.6	3.8	3.0
	0.8	21.40	708	21.9	4.06	17.8	46.7	5.39	3.7	708	15.5	11.2	0.72	3.68	19.2	4.2	2.6
			850	22.2	3.96	18.2	42.7	5.59	3.5	850	15.7	11.7	0.74	3.83	19.5	4.1	2.8
	1.0	34.5	708	22.0	4.28	17.7	46.9	5.14	3.8	708	15.7	11.3	0.72	3.61	19.3	4.3	2.4
			850	22.6	4.13	18.5	43.1	5.47	3.6	850	15.8	11.8	0.74	3.72	19.5	4.3	2.7
37.8	0.5	10.30	Operation not recommended							Operation not recommended							
	0.8	20.00								708	15.4	11.2	0.72	4.17	19.6	3.7	3.3
										850	15.6	11.6	0.75	4.27	19.8	3.6	3.5
	1.0	33.1								708	15.6	11.3	0.72	4.08	19.6	3.8	3.0
										850	15.7	11.8	0.75	4.15	19.9	3.8	3.4
43.3	0.5	10.30								Operation not recommended							
	0.8	19.30								708	13.6	10.3	0.76	4.56	18.1	3.0	4.0
										850	13.7	10.7	0.78	4.60	18.3	3.0	4.3
	1.0	31.7								708	13.7	10.4	0.76	4.44	18.2	3.1	3.7
										850	13.9	10.8	0.78	4.49	18.4	3.1	4.1
48.9	0.5	9.70								Operation not recommended							
	0.8	18.60								708	12.7	10.0	0.79	5.08	17.7	2.5	4.8
										850	12.4	10.2	0.82	5.10	17.5	2.4	5.2
	1.0	31.0								708	12.7	10.2	0.80	4.95	17.7	2.6	4.5
										850	12.6	10.3	0.81	4.95	17.6	2.6	5.0

9/5/2014

Wiring Schematics

Aurora UPC



ZS Sensor Information

Zone Sensors can be wired in daisy chain as show or in a star or hybrid configuration. Maximum of 5 sensors per UPC. Maximum allowable load 210mA. See the UPC install manual for possible sensor combinations.

DIP Switch Value

1
2
4
8

Each ZS sensor must have a unique address, but the addresses do not need to be sequential. Use the DIP switches on the back of the ZS sensor to set an address from 0 to 4. (0 is the factory default.) Each DIP switch has the value shown in the figure to the left. Turn on as many DIP switches as you need so that their total value equals the address.

Notes

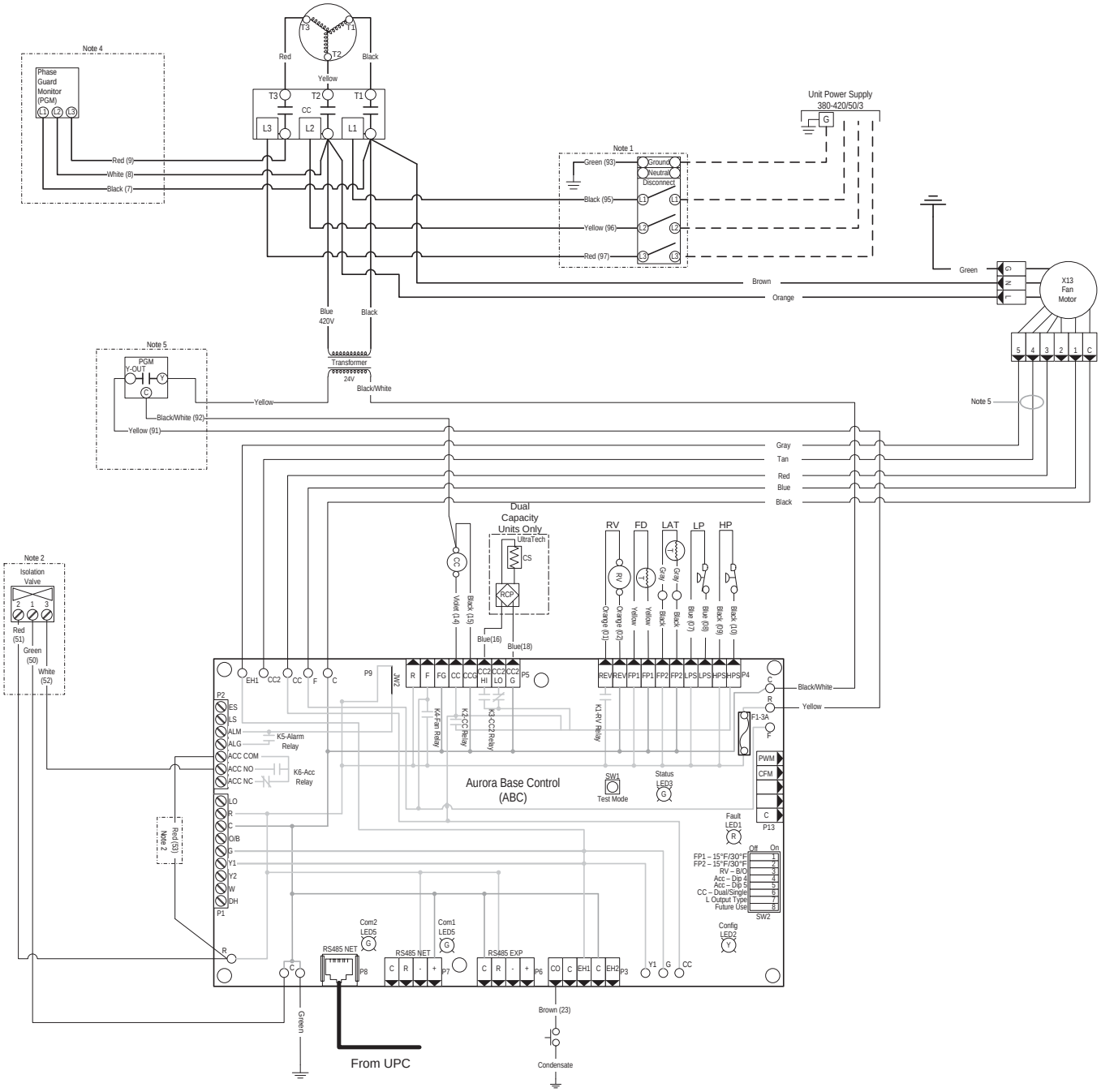
1. Use DIP Switches 5 – 8 to change communication protocol and DIP switches 1 – 2 to change BACnet baud rate

Legend

Factory Low Voltage Wiring
Field Low Voltage Wiring
RJ45 Connector

Wiring Schematics cont.

Commercial Aurora, UPC with X13 Motor – 380-420/50/31



Wiring Schematics cont.

Commercial Aurora, UPC with X13 Motor – 380-420/50/31

Notes:

1 – Optional, factory installed unit mounted disconnect.
2 – Optional, factory installed internal isolation valve.
3 – Optional, factory installed phase guard
4 – Optional, factory installed phase guard. The yellow transformer wire shall be connected directly to the CPU board, if this option is not installed.
5 – Wire is provided with the unit but only connected to the X13 motor for dual capacity units.

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.
- Capacitor
- Fuse
- Thermistor
- Relay Coil
- Switch - Condensate Overflow
- Switch - High pressure
- Switch - Low pressure
- 3 2 1 – Polarized connector
- G – Light Emitting Diode - Green
- Y – Light Emitting Diode - Yellow
- R – Light Emitting Diode - Red

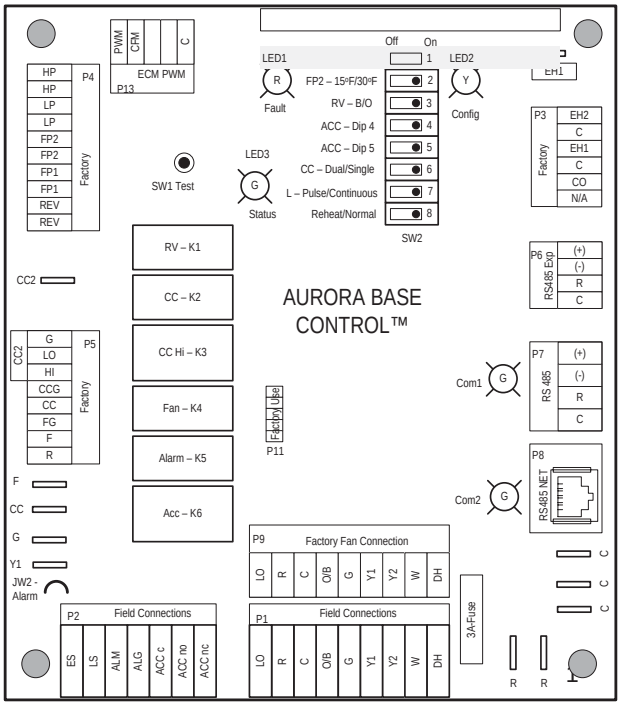
CC – Compressor Contactor
CO – Condensate Overflow Sensor
ES – Emergency Shutdown
HP – High Pressure Switch
LP – Low Pressure Switch
FD – Freeze Detection Sensor
F1 – Fuse

SW1 – Push button
SW2 – DIP package 8 position
RB – Blower Relay
RV – Reversing Valve Coil
PGM – Phase Guard Monitor
RH – Reheat Valve Coil

Aurora LED Flash Codes	
Slow Flash	1 second on and 1 second off
Fast Flash	100 milliseconds on and 100 milliseconds off
Flash Code	100 milliseconds on and 400 milliseconds off with a 2 second pause before repeating

Random Start Delay	
Status LED (LED1, Green)	Fast Flash
Configuration LED (LED2, Yellow)	Fast Flash
Fault LED (LED3, Red)	Fast Flash

Status LED (LED1, Green)		Configuration LED (LED2, Yellow)		Fault LED (LED3, Red)	
Normal Mode	ON	No Software Overide	Flash ECM Setting	Normal Mode	OFF
Control is Non-Functional	OFF	DIP Switch Overide	Slow Flash	Input Fault Lockout	Flash Code 1
Test Mode	Slow Flash	ECM Configure Mode	Fast Flash	High Pressure Lockout	Flash Code 2
Lockout Active	Fast Flash	Reset Configure Mode	Off	Low Pressure Lockout	Flash Code 3
Dehumidification Mode	Flash Code 2			Low Air Coil Limit Lockout - FP2	Flash Code 4
Reserved	Flash Code 3			Low Water Coil Limit Lockout - FP1	Flash Code 5
Reserved	Flash Code 4			Reserved	Flash Code 6
Load Shed	Flash Code 5			Condensate Overflow Lockout	Flash Code 7
ESD	Flash Code 6			Over/Under Voltage Shutdown	Flash Code 8
Reserved	Flash Code 7			Reserved	Flash Code 9
				Reserved	Flash Code 10
				Air/Water Coil Limit Sensor Error	Flash Code 11

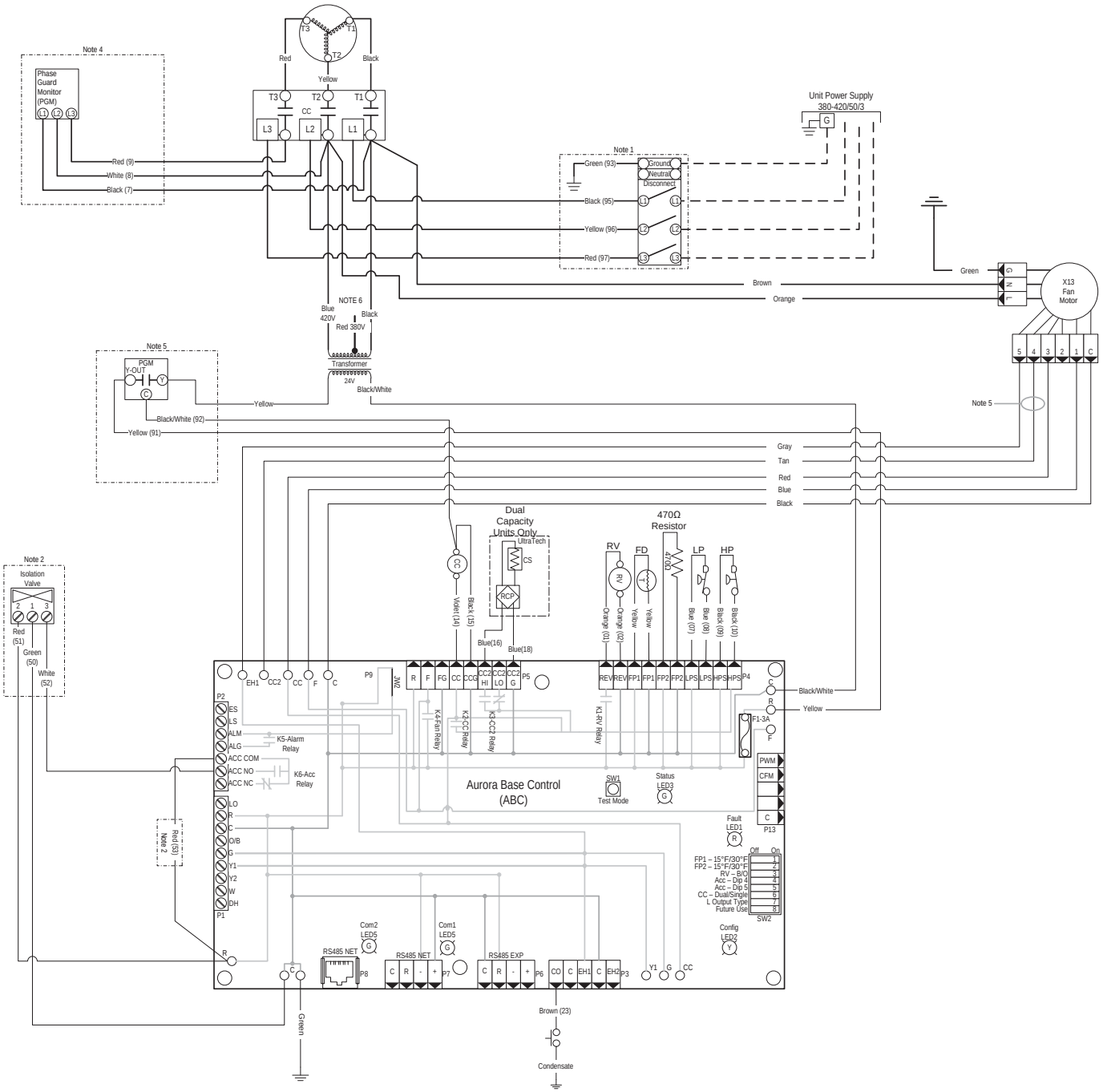


Accessory Relay		
Operation	SW2-4	SW2-5
Cycle with Blower	On	On
Cycle with Compressor	Off	Off
Water Valve Slow Open	On	Off
Outdoor Air Damper	Off	On

Aurora Timing Events		
Event	Normal Mode	Test Mode
Random Start Delay	5 to 80 seconds	1 second
Compressor On Delay	5 seconds	< 1 second
Compressor Minimum On Time	2 minutes	5 seconds
Compressor Short Cycle Delay	4 minutes	15 seconds
Blower Off Delay	30 seconds	2 seconds
Fault Recognition Delay – High Pressure	Less than 1 second	Less than 1 second
Start-Up Bypass – Low Pressure	2 minutes	30 seconds
Fault Recognition Delay – Low Pressure	30 seconds	30 seconds
Start-Up Bypass – Low Water/Air Coil Limit	2 minutes	30 seconds
Fault Recognition Delay – Low Water/Air Coil Limit	30 seconds	30 seconds
Fault Recognition Delay – Condensate Overflow	30 seconds	30 seconds
Thermostat Call Recognition Time	2 seconds	2 seconds
Auxiliary Heat Staging Delay	5 minutes	20 seconds
Emergency Heat Staging Delay	2 minutes	7.5 seconds
Water Valve Slow Open Delay	90 seconds	90 seconds
Reheat Delay	30 seconds	30 seconds

Wiring Schematics cont.

Commercial Aurora with X13 Motor – 380-420/50/31



Wiring Schematics cont.

Commercial Aurora with X13 Motor – 380-420/50/31

Notes:

1 – Optional, factory installed unit mounted disconnect.
2 – Optional, factory installed internal isolation valve.
3 – Optional, factory installed phase guard
4 – Optional, factory installed phase guard. The yellow transformer wire shall be connected directly to the CPU board, if this option is not installed.
5 – Wire is provided with the unit but only connected to the X13 motor for dual capacity units.
6 – Switch Blue and Red transformer wires for 380V Operation.

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.
- Capacitor
- Fuse
- Thermistor
- Relay Coil
- Switch - Condensate Overflow
- Switch - High pressure
- Switch - Low pressure
- 3 2 1 – Polarized connector
- G – Light Emitting Diode - Green
- Y – Light Emitting Diode - Yellow
- R – Light Emitting Diode - Red

CC – Compressor Contactor
CO – Condensate Overflow Sensor
ES – Emergency Shutdown
HP – High Pressure Switch
LP – Low Pressure Switch
FD – Freeze Detection Sensor
F1 – Fuse

SW1 – Push button
SW2 – DIP package 8 position
RB – Blower Relay
RV – Reversing Valve Coil
PGM – Phase Guard Monitor
RH – Reheat Valve Coil

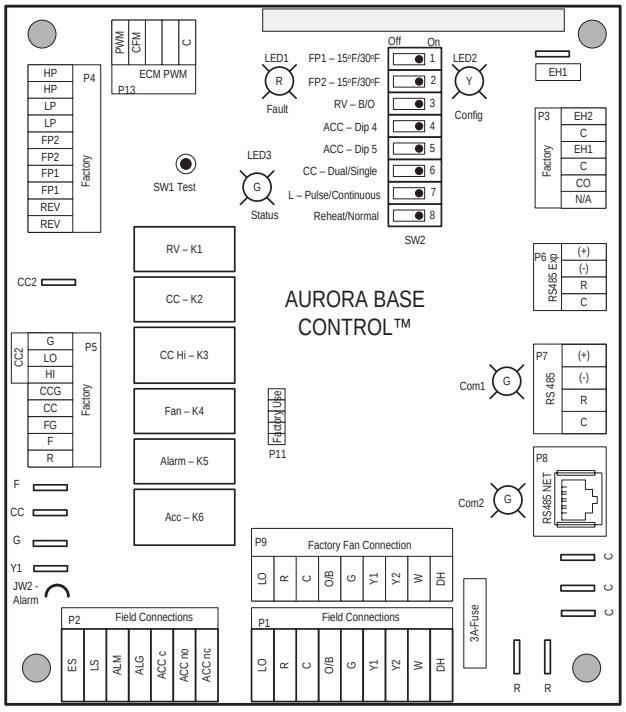
Aurora LED Flash Codes	
Slow Flash	1 second on and 1 second off
Fast Flash	100 milliseconds on and 100 milliseconds off
Flash Code	100 milliseconds on and 400 milliseconds off with a 2 second pause before repeating

Random Start Delay	
Status LED (LED1, Green)	Fast Flash
Configuration LED (LED2, Yellow)	Fast Flash
Fault LED (LED3, Red)	Fast Flash

Status LED (LED1, Green)	
Normal Mode	ON
Control is Non-Functional	OFF
Test Mode	Slow Flash
Lockout Active	Fast Flash
Dehumidification Mode	Flash Code 2
Reserved	Flash Code 3
Reserved	Flash Code 4
Load Shed	Flash Code 5
ESD	Flash Code 6
Reserved	Flash Code 7

Configuration LED (LED2, Yellow)	
No Software Overide	Flash ECM Setting
DIP Switch Overide	Slow Flash
ECM Configure Mode	Fast Flash
Reset Configure Mode	Off

Fault LED (LED3, Red)	
Normal Mode	OFF
Input Fault Lockout	Flash Code 1
High Pressure Lockout	Flash Code 2
Low Pressure Lockout	Flash Code 3
Low Air Coil Limit Lockout - FP2	Flash Code 4
Low Water Coil Limit Lockout - FP1	Flash Code 5
Reserved	Flash Code 6
Condensate Overflow Lockout	Flash Code 7
Over/Under Voltage Shutdown	Flash Code 8
Reserved	Flash Code 9
Reserved	Flash Code 10
Air/Water Coil Limit Sensor Error	Flash Code 11

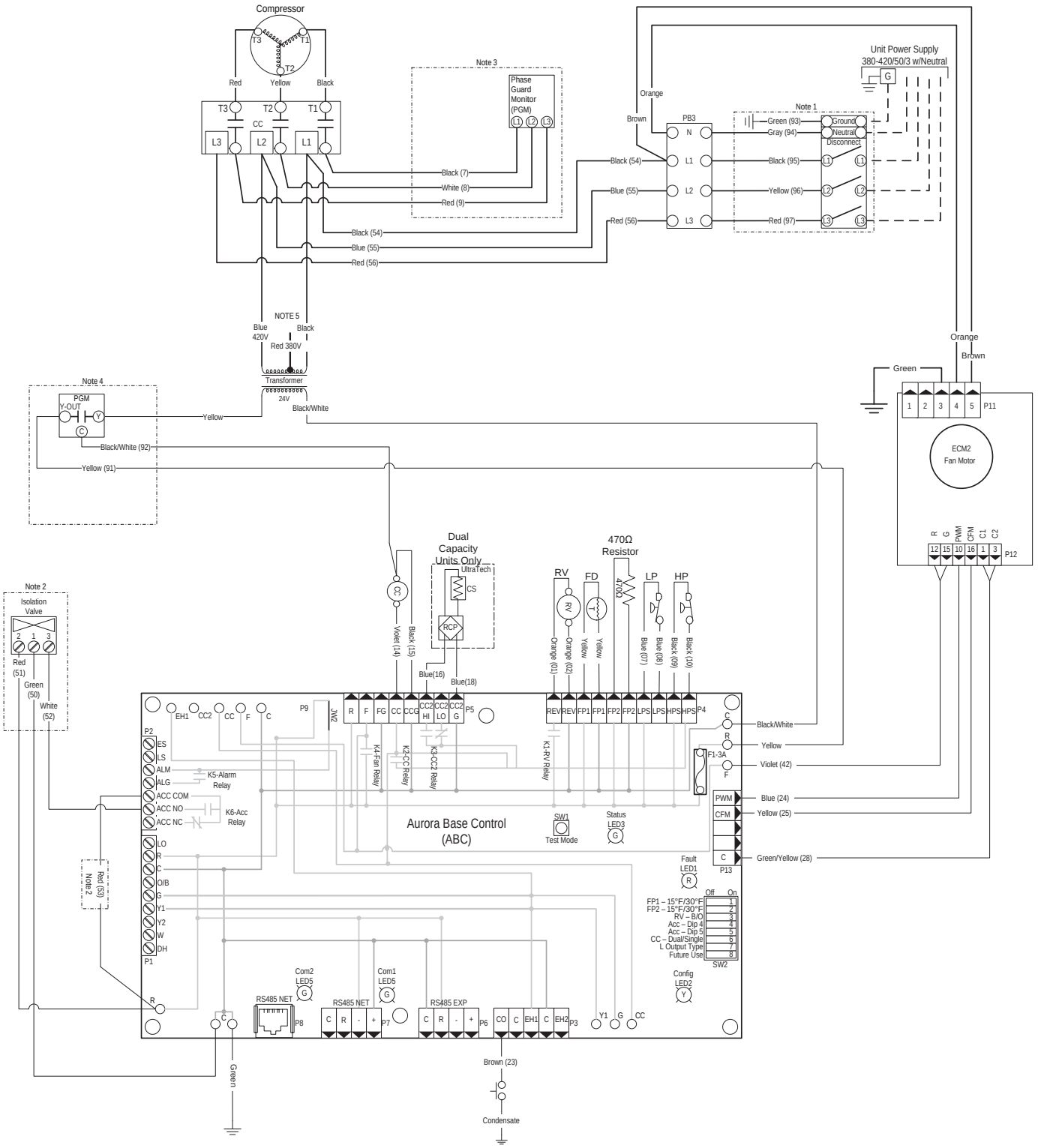


Accessory Relay		
Operation	SW2-4	SW2-5
Cycle with Blower	On	On
Cycle with Compressor	Off	Off
Water Valve Slow Open	On	Off
Outdoor Air Damper	Off	On

Aurora Timing Events		
Event	Normal Mode	Test Mode
Random Start Delay	5 to 80 seconds	1 second
Compressor On Delay	5 seconds	< 1 second
Compressor Minimum On Time	2 minutes	5 seconds
Compressor Short Cycle Delay	4 minutes	15 seconds
Blower Off Delay	30 seconds	2 seconds
Fault Recognition Delay – High Pressure	Less than 1 second	Less than 1 second
Start-Up Bypass – Low Pressure	2 minutes	30 seconds
Fault Recognition Delay – Low Pressure	30 seconds	30 seconds
Start-Up Bypass – Low Water/Air Coil Limit	2 minutes	30 seconds
Fault Recognition Delay – Low Water/Air Coil Limit	30 seconds	30 seconds
Fault Recognition Delay – Condensate Overflow	30 seconds	30 seconds
Thermostat Call Recognition Time	2 seconds	2 seconds
Auxiliary Heat Staging Delay	5 minutes	20 seconds
Emergency Heat Staging Delay	2 minutes	7.5 seconds
Water Valve Slow Open Delay	90 seconds	90 seconds
Reheat Delay	30 seconds	30 seconds

Wiring Schematics cont.

Aurora Base Control 420/50/3 Variable Speed ECM



Wiring Schematics cont.

Aurora Base Control 420/50/3 Variable Speed ECM

Accessory Relay		
Operation	SW2-4	SW2-5
Cycle with Blower	On	On
Cycle with Compressor	Off	Off
Water Valve Slow Open	On	Off
Outdoor Air Damper	Off	On

Aurora Timing Events		
Event	Normal Mode	Test Mode
Random Start Delay	5 to 80 seconds	1 second
Compressor On Delay	5 seconds	< 1 second
Compressor Minimum On Time	2 minutes	5 seconds
Compressor Short Cycle Delay	4 minutes	15 seconds
Blower Off Delay	30 seconds	2 seconds
Fault Recognition Delay – High Pressure	Less than 1 second	Less than 1 second
Start-Up Bypass – Low Pressure	2 minutes	30 seconds
Fault Recognition Delay – Low Pressure	30 seconds	30 seconds
Start-Up Bypass – Low Water/Air Coil Limit	2 minutes	30 seconds
Fault Recognition Delay – Low Water/Air Coil Limit	30 seconds	30 seconds
Fault Recognition Delay – Condensate Overflow	30 seconds	30 seconds
Thermostat Call Recognition Time	2 seconds	2 seconds
Auxiliary Heat Staging Delay	5 minutes	20 seconds
Emergency Heat Staging Delay	2 minutes	7.5 seconds
Water Valve Slow Open Delay	90 seconds	90 seconds
Reheat Delay	30 seconds	30 seconds

Aurora LED Flash Codes	
Slow Flash	1 second on and 1 second off
Fast Flash	100 milliseconds on and 100 milliseconds off
Flash Code	100 milliseconds on and 400 milliseconds off with a 2 second pause before repeating

Random Start Delay	
Status LED (LED1, Green)	Fast Flash
Configuration LED (LED2, Yellow)	Fast Flash
Fault LED (LED3, Red)	Fast Flash

Status LED (LED1, Green)	
Normal Mode	ON
Control is Non-Functional	OFF
Test Mode	Slow Flash
Lockout Active	Fast Flash
Dehumidification Mode	Flash Code 2
Reserved	Flash Code 3
Reserved	Flash Code 4
Load Shed	Flash Code 5
ESD	Flash Code 6
Reserved	Flash Code 7

Configuration LED (LED2, Yellow)	
No Software Overide	Flash ECM Setting
DIP Switch Overide	Slow Flash
ECM Configure Mode	Fast Flash
Reset Configure Mode	Off

Fault LED (LED3, Red)	
Normal Mode	OFF
Input Fault Lockout	Flash Code 1
High Pressure Lockout	Flash Code 2
Low Pressure Lockout	Flash Code 3
Low Air Coil Limit Lockout - FP2	Flash Code 4
Low Water Coil Limit Lockout - FP1	Flash Code 5
Reserved	Flash Code 6
Condensate Overflow Lockout	Flash Code 7
Over/Under Voltage Shutdown	Flash Code 8
Reserved	Flash Code 9
Reserved	Flash Code 10
Air/Water Coil Limit Sensor Error	Flash Code 11

Notes:

1 – Optional, factory installed unit mounted disconnect.
2 – Optional, factory installed internal isolation valve.
3 – Optional, factory installed phase guard
4 – Optional, factory installed phase guard. The yellow transformer wire shall be connected directly to the CPU board, if this option is not installed.
5 – Switch Blue and Red transformer wires for 380V Operation

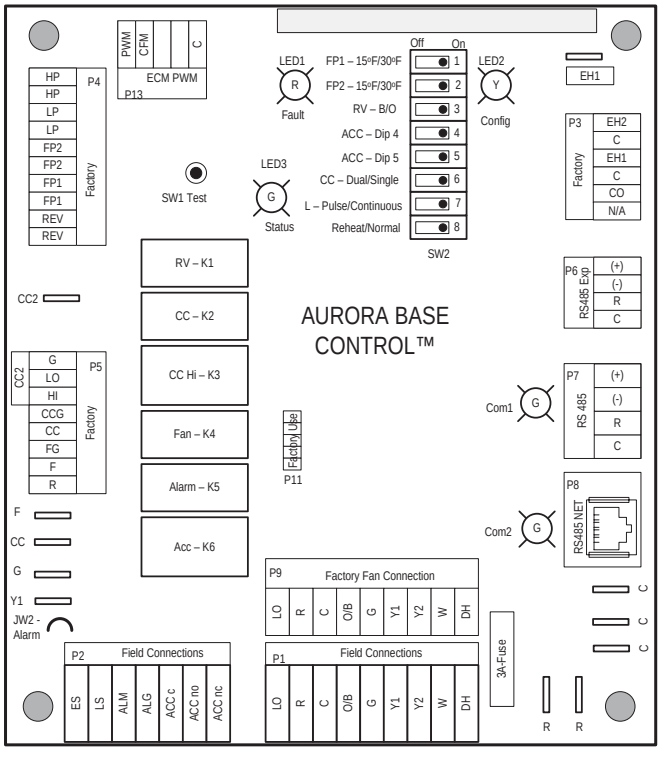
Legend

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.
Capacitor
Fuse

Thermistor
Relay Coil
Switch - Condensate Overflow
Switch - High pressure
Switch - Low pressure
Polarized connector
G Light Emitting Diode - Green
Y Light Emitting Diode - Yellow
R Light Emitting Diode - Red

CC – Compressor Contactor
CO – Condensate Overflow Sensor
ES – Emergency Shutdown
HP – High Pressure Switch
LP – Low Pressure Switch
FD – Freeze Detection Sensor
F1 – Fuse

SW1 – Push button
SW2 – DIP package 8 position
RB – Blower Relay
RV – Reversing Valve Coil
PGM – Phase Guard Monitor
RH – Reheat Valve Coil



Engineering Guide Specifications

General

Furnish and install WaterFurnace 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. 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 -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 12.7 mm 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 25.4 mm MERV 4 filters shall be provided with each unit. Units shall have a return air filter rack that is field convertible from 25.4 mm to 50.8 mm. The units shall have an insulated divider panel between the air handling section and the compressor section to minimize the transmission of compressor noise. 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 50.8 mm thick MERV 13 filter can help fulfill a credit under the LEED Rating System. Its low initial resistance promotes low energy consumption (52.3 Pa @ 1.5 m/s) and provides nearly twice the life of a standard filter (1.5 m/s vs. standard 2.54 m/s application).

Option: A Super Quiet Sound package shall include multi-density full coverage compressor blanket.

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 0.06 L/s per kW to deliver optimal flow to the unit.

Refrigerant Circuit

All units shall utilize the non-ozone depleting and low global warming potential refrigerant R-410A. 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.

Option: AlumiSeal electro-coated air coil.

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 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 4135 kPa working refrigerant pressure and 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 4135 kPa working refrigerant pressure and 3101 kPa working water pressure. Water lines shall also be of cupronickel construction.

Engineering Guide Specifications cont.

Option: Hot water generator - Internal double wall vented hot water generator coil refrigerant to water heat exchangers shall be of copper inner water tube and steel refrigerant outer tube design, rated to withstand 4135 kPa working refrigerant pressure and 3101 kPa working water pressure.

Option: ThermaShield coated water-to-refrigerant heat exchanger, water lines and refrigerant suction lines shall be insulated to prevent condensation at low liquid temperatures below 10°C.

Option: AlpinePure hot gas bypass

Option: AlpinePure hot gas reheat

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: 5-speed ECM blower motor shall be a 5-speed ECM type. The 5-speed ECM blower motor shall be soft starting, shall maintain constant torque over its operating static range, and shall provide 5 speed settings. The blower motor shall be isolated from the housing by rubber grommets. The motor shall be permanently lubricated and have thermostatic overload protection. 5-speed ECM motors shall be long-life ball bearing type.

Option: Variable speed ECM blower motor shall be a variable speed ECM type. The variable speed ECM blower motor shall be soft starting, shall maintain constant L/s over its operating static range, and shall provide 12 airflow settings in L/s. Variable speed ECM motors shall be long-life ball bearing type.

Electrical

A control box shall be located within the unit compressor compartment and shall contain a 50VA or 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.

An Aurora 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.

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, 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.

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

Option: IntelliStart® (compressor soft starter) shall be factory installed for use in applications that require low starting amps, reduced compressor startup noise, off-grid, and improved start-up behavior. IntelliStart shall reduce normal starting current by 60%.

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 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 in. threaded rods. Unit sizes 005-015 shall require four brackets and unit size 017 shall require five brackets. Brackets shall not inhibit filter removal in any way.

Engineering Guide Specifications cont.

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 2°C to 82°C.
- Max. working pressure of 2757 kPa for 12.7 mm and 19.05 mm hose kits; max. working pressure of 2413 kPa for 25.4 mm and 31.75 mm 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 2°C to 82°C
- Max. working pressure of 2757 kPa for 12.7 mm and 19.05 mm hose kits; max. working pressure of 2413 kPa for 25.4 mm and 31.75 mm 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 2°C to 82°C
- Max. working pressure of 2757 kPa for 12.7 mm and 19.05 mm hose kits; max. working pressure of 2413 kPa for 25.4 mm and 31.75 mm hose kits
- Minimum burst pressure of four times working pressure

Hot Water Pump Kit

An accessory pump kit is available for hot water generation option. This kit includes hot water pump, fittings, and water heater kit necessary for potable water application. Order DPK5 for use with Aurora and FX10 controls.

Revision Guide

Pages:	Description:	Date:	By:
All	Released UPC Control option	19 Jan 2015	MA
36, 45-54	Updated Data tables to show EER values in W/W units	18 Nov 2014	MA
37	Updated Compressor LRA with IntelliStart	31 Jun 2013	DS
All	Updated Nomenclature to Reflect new ECM Blower Motor	06 Nov 2012	DS
63	Added Revision Guide	06 Nov 2012	DS

Manufactured by
WaterFurnace International, Inc.
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Product:	**Envision² Compact**
Type:	Water Source/Geothermal Heat Pump - 50 Hz
Size:	Commercial 05-17 kW
Document:	Specification Catalog

SC1025AN 01/15