# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Nomenclature</td>
<td>5</td>
</tr>
<tr>
<td>AHRI/ISO 13256-1 Performance Ratings</td>
<td>6</td>
</tr>
<tr>
<td>Sycamore Series Design Features</td>
<td>8</td>
</tr>
<tr>
<td>The Aurora™ Advanced VS Control System</td>
<td>12</td>
</tr>
<tr>
<td>Operation Logic</td>
<td>21</td>
</tr>
<tr>
<td>Water Quality</td>
<td>22</td>
</tr>
<tr>
<td>Dimensional Data</td>
<td>23</td>
</tr>
<tr>
<td>Physical Data</td>
<td>27</td>
</tr>
<tr>
<td>Auxiliary Heat Ratings</td>
<td>28</td>
</tr>
<tr>
<td>Auxiliary Heat Electrical Data</td>
<td>28</td>
</tr>
<tr>
<td>Electrical Data</td>
<td>28</td>
</tr>
<tr>
<td>Blower Performance Data</td>
<td>29</td>
</tr>
<tr>
<td>Reference Calculations</td>
<td>30</td>
</tr>
<tr>
<td>Legend and Notes</td>
<td>30</td>
</tr>
<tr>
<td>Operating Limits</td>
<td>30</td>
</tr>
<tr>
<td>Antifreeze Corrections</td>
<td>31</td>
</tr>
<tr>
<td>Pressure Drop</td>
<td>32</td>
</tr>
<tr>
<td>Correction Factor Tables</td>
<td>33</td>
</tr>
<tr>
<td>Performance Data</td>
<td>34</td>
</tr>
<tr>
<td>Wiring Schematics</td>
<td>40</td>
</tr>
<tr>
<td>Engineering Guide Specifications</td>
<td>44</td>
</tr>
<tr>
<td>Revision Guide</td>
<td>47</td>
</tr>
</tbody>
</table>
SYCAMORE SERIES

Variable Speed Geothermal Heat Pump

The GeoStar Sycamore Series is a new level of innovation and performance with all new advanced controls mated with variable speed compressor technology. Featuring the highest efficiencies (Over 40 EER and 5.3 COP ISO/AHRI 13256-1 GLHP) available in AHRI, the Sycamore Series is available in 3 variable speed capacity sizes (3 to 5 ton) with Danfoss Variable Speed Compressors. These units feature high efficiency permanent magnet compressors coupled with high efficiency electronic drives to allow capacity ranges between 20 and 100%. These Sycamore Series units utilize ozone-safe R-410A refrigerant to meet the most stringent EPA requirements. Double epoxy electro-coated air coils add durability and longer life. ECM blower motors bridge the gap of high efficiency ECM capability with great value. ECM blowers are used to increase comfort, efficiency, and airflow flexibility.

A new sophisticated Aurora™ Control system is modular and designed for the most demanding application. The Aurora Control features a microprocessor control to sequence all components during operation for optimum performance. Plus, it provides easy-to-use troubleshooting features with fault lights, on-board diagnostics, and a hand held Aurora Interface Diagnostic (AID) Tool. The Aurora system includes advanced loop and hot water generator pump control, as well as service, performance, and energy monitoring sensor kit capability. A swing-out control box provides serviceability. Unit configurations include vertical top, bottom, or rear discharge (left or right return) and horizontal units with left or right return and side or end discharge. Heavy-gauge metal cabinets are fully insulated and coated with an attractive and durable paint for long lasting protection.

Sycamore Series products are performance-certified to AHRI/ISO 13256-1 standards, ETL listed for safety, ENERGY STAR® qualified with ENERGY STAR Most Efficient qualifications, and tested in an ISO 17025 accredited testing lab.

As a leader in the industry, we are dedicated to innovation, quality, and customer satisfaction. In fact, every unit built is exposed to a wide range of quality control procedures throughout the assembly process in our ISO 9001:2008 certified manufacturing facility. At the end, it is subjected to a rigorous battery of computerized run tests to certify that it meets or exceeds performance standards for efficiency and safety, and will perform flawlessly at startup. As further affirmation of our quality standards, each unit carries our exclusive Quality Assurance emblem, signed by the final test technician.
## Model Nomenclature

<table>
<thead>
<tr>
<th>1-2</th>
<th>3</th>
<th>4</th>
<th>5-7</th>
<th>8</th>
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<tr>
<td>14</td>
<td>1</td>
<td>:</td>
<td>036</td>
<td>T</td>
<td>L</td>
<td>1</td>
<td>1</td>
<td>J</td>
<td>0</td>
<td></td>
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</tbody>
</table>

### Model Type
- 14 – Sycamore VS Water-to-Air

### Type
- 1 – Vertical
- 2 – Horizontal

### Vintage
- * - Factory Use Only

### Unit Capacity (MBTUH)
- 036, 048, 060

### Discharge Configuration
- T – Top (Vertical)
- B – Bottom (Vertical)
- R – Rear (Vertical)
- E – End (Horizontal)
- S – Side (Horizontal)

### Air Configuration
- L – Left
- R – Right

### Voltage
- 1 – 208-230/60/1

### Future Option
- 0 - Standard

### Controls Option
- J – Aurora™ Variable Speed Controls
- K – Aurora VS Controls w/ Performance Monitoring

### Filter Option
- 0 – Standard
- 0 – 2” MERV 11 Filter

### Coax Option
- C – Copper
- N – CuproNickel

### Blower Option
- 1 – Variable Speed ECM Blower
- 2 – High Static Variable Speed ECM Blower (036)

### Hot Water Generation
- 0 – No HWG
- 1 – HWG with Factory Installed Pump

Rev.: 03 March 2015D
## Energy Star Rating Criteria

In order for water-source heat pumps to be Energy Star rated they must meet or exceed the minimum efficiency requirements listed below. Tier 3 represents the current minimum efficiency water source heat pumps must have in order to be Energy Start rated.

### Tier 3: 1/1/2012 – No Effective End Date Published

<table>
<thead>
<tr>
<th>Water-to-Air</th>
<th>EER</th>
<th>COP</th>
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<tbody>
<tr>
<td>Ground Loop</td>
<td>17.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Ground Water</td>
<td>21.1</td>
<td>4.1</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Water-to-Water</th>
<th>EER</th>
<th>COP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Loop</td>
<td>16.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Ground Water</td>
<td>20.1</td>
<td>3.5</td>
</tr>
</tbody>
</table>

## Energy Star Compliance Table

<table>
<thead>
<tr>
<th>Model</th>
<th>Tier 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ground Water</td>
</tr>
<tr>
<td>036</td>
<td>Yes</td>
</tr>
<tr>
<td>048</td>
<td>Yes</td>
</tr>
<tr>
<td>060</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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

6/15/12
AHRI/ISO 13256-1 Performance Ratings cont.

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

Unit of Measure: The Cooling COP

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

Water Conditions Differences

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

Air Conditions Differences

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

Pump Power Correction Calculation

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

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

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

Blower Power Correction Calculation

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

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

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

ISO Capacity and Efficiency Calculations

The following equations illustrate cooling calculations:

• ISO Cooling Capacity = Cooling Capacity (Btu/h) + (Blower Power Correction (Watts) x 3.412)

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

The following equations illustrate heating calculations:

• ISO Heating Capacity = Heating Capacity (Btu/h) - (Blower Power Correction (Watts) x 3.412)

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

Comparison of Test Conditions

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

NOTES: * Flow rate is set by 10°F rise in standard cooling test
** Flow rate is specified by the manufacturer
Part load entering water conditions not shown
WLHP = Water Loop Heat Pump; GWHP = Ground Water Heat Pump; GLHP = Ground Loop Heat Pump

Conversions:

Airflow (lps) = cfm x 0.472;
WaterFlow (lps) = gpm x 0.0631;
ESP (Pascals) = ESP (in wg) x 249;
Press Drop (Pascals) = Press Drop (ft hd) x 2990
Sycamore Design Features

1. **VARIABLE SPEED COMPRESSOR**: High efficiency permanent magnet scroll compressor mated with high efficiency electronic drive providing 20-100% variable capacity, soft starting, ultra high efficiency, and lowest operating noise.

2. **DOUBLE ISOLATED COMPRESSOR**: Compressor is double isolation mounted to reduce noise and vibration.

3. **AURORA ADVANCED VARIABLE SPEED CONTROLS & AID TOOL**: Aurora Controls with the AID Tool provide advanced service diagnostics; this device provides setup and configurations as well as real-time sensors for fault and lockout history, plus energy and refrigeration monitoring as standard features, that can all be monitored on the handheld AID Tool and much more.

4. **OPTIONAL HOT WATER ASSIST**: Provides free hot water in cooling and very high efficiency hot water generation in heating mode.

5. **COAXIAL HEAT EXCHANGER**: Standard large high efficiency copper (optional cupronickel) coax with our exclusive void-free and robotically applied ThermaShield insulation coating.

6. **ELECTRONIC EXPANSION VALVE**: High efficiency bi-direction electronic expansion valve provides the ultimate in accurate control for the highest efficiency at any condition.

7. **AIR COIL**: Large air coil is designed for maximum efficiency and moisture removal; exclusive double electro-coated for superior protection from formicary corrosion and patented 11 element fin design with rifled tubing.

8. **DISCHARGE MUFFLER**: Helps quiet compressor gas pulsations.

9. **ECM BLOWER MOTOR**: High efficiency and ultra-flexible ECM blower motors provide ultra-quiet operation.

10. **FILTER RACK**: Filter rack holds 1 in. or 2 in. filters (field changeable) with exclusive snap on filter door.

11. **FILTER**: High holding capacity 2 in. Pleated MERV 11 filter is standard and 4 in. pleated MERV 11 is optional.

12. **SWIVEL LOOP CONNECTIONS**: Leak free swivel water connections provide a hand tight gasket connection that easily handles the temperature extremes of geothermal earth loops.

13. **INSULATION**: Cleanable foil lined insulation to prevent mold growth; corrosion resistant composite drain pan.

14. **CABINET FINISH**: Heavy gauge galvanized sheet metal cabinet has 1,000 hr. salt spray rated gray powder coat paint for long life.

15. **ACCESS PANELS**: All access panels are lift out type for easier removal and servicing.

16. **HINGED CONTROL BOX**: Hinged removable control box.

17. **HOT WATER GENERATOR SWITCH & AID TOOL PORT**: Hot water generator switch for easy enabling/disabling of the hot water generator pump; AID Tool port provides quick AID Tool connection.

18. **CORROSION RESISTANT COMPOSITE DRAIN PAN**
Sycamore Series Design Features cont.

Introducing the Sycamore Series

- Highest AHRI/ISO 13256-1 Ratings.
  - Over 40 EER and 5.3 COP
- Latest technology compressors
  - High efficiency permanent magnet scroll compressor mated with high efficiency electronic variable speed drive providing 20-100% variable capacity, soft starting, ultra high efficiency and ultra low operating noise.
- ECM blower motor options
  - ECM blower motors for the highest in efficiency and airflow flexibility
- Efficiency – Variable speed compressor provides the highest AHRI Efficiencies and improved seasonal EER/COP for reduced energy use.
- More Even Temperatures – Nearly continuous operation results in more even temperatures in the home.
- Soft Start Variable Speed Compressor - VS Drive Soft Start provides quieter starting and operation with no ‘light flicker’ commonly associated with air conditioning or heat pumps. No IntelliStart is required.
- Quieter Operation – Typical operation is at lower compressor speed, and resulting lower airflow means quieter operation.
- Higher Heating Capacity - The variable speed unit provides 20% higher heating capacity than comparable dual capacity or single speed compressor unit for reduced loop length and equipment size for a given cooling capacity.
- ‘Active’ Dehumidification – In active dehumidification mode, the VS unit monitors the air coil conditions and adjusts compressor speed and airflow operation to maximize the moisture removal based upon a dehumidistat call from the thermostat for improved dehumidification.
- ‘SuperBoost’ Mode - Occasionally there can be a requirement for a short term ‘boost’ of cooling capacity during a large party etc. The user can then select ‘SuperBoost’ mode on the thermostat which will allow the variable speed system to ramp up an extra 30% of cooling capacity if needed.
- Communicating Digital Thermostats - The Aurora controls system features either mono-chromatic or color touch screen graphic display thermostats for user interface with the variable speed system. These displays not only feature easy to use graphical interface but display alerts and faults in plain English.
- Aurora Communicating Control Features
  - Traditional Safety Sensors - HP, LP, condensate overflow, freeze detection loop, freeze detection air coil.
  - Variable Speed and EEV Watchdog Circuit - Drive control continually monitors the VS compressor for proper operation and digitally notifies the Aurora Control of any faults.
  - Communicating Modular Design - Communicating modular design for flexibility and expandability.
  - Intelligent hot water assist control - The Aurora control determines operation of hot water assist dependent upon system parameters to maximize overall system efficiency. Selectable hot water set points through the AID Tool.
  - Electronic Expansion Valve for improved refrigerant control and high efficiency.
- Loop Pump Linking - for multiple units on one flow center with either variable speed, single, or dual capacity units. It even works with our legacy controls.
- Electric Heat Powered Blower And Controls - Provides emergency heat in the event of an open compressor circuit breaker.
- Advanced Service Features
  - Aurora Controls with the AID Tool provide advanced service diagnostics. With this device setup and configurations as well as real-time sensors, fault and lockout history can be monitored and much more. This device is required for setup and troubleshooting of the Sycamore Series Unit.
  - The Sycamore Series features refrigeration service sensors as a standard feature. Now superheat, subcooling, refrigerant pressures and various temperatures needed to diagnose unit problems are readily available at your finger tips in the AID Tool right out of the box.
  - Energy Monitoring - With this standard sensor kit installation, the Aurora Control will feature power monitoring of the compressor, blower, and electric heat. The information can be displayed on AID Tool, or selected thermostats.
  - Performance Monitoring (optional) - With this optional field or factory installed sensor kit, the Aurora controls can measure actual capacity and performance of the heat pump. The information can be displayed on the AID Tool.
  - Advanced communication to the VS drive with faults, electrical, and operational information for quick diagnosis.
- Communicating Digital Thermostats - The Aurora controls system features either mono-chromatic or color touch screen graphic display thermostats for user interface with the Sycamore Series system. These displays not only feature easy to use graphical interface but display alerts and faults in plain English.
- Cabinet Design – Improved design of access panels, control box and filter rack.
- Cabinet Configurations – Top or rear air discharge for upflow or bottom discharge for counterflow installations in vertical units, side or end discharge for horizontal units.
- Cupronickel Heat Exchanger
- High Static Blower Option (3 ton only)
Sycamore Series Design Features cont.

Application Flexibility
- Safe, efficient operation in a wide range of liquid temperatures (20°F to 120°F) and flow rates (as low as 1.5 gpm/ton in open loop applications when EWT >50°F)
- Top or rear air discharge for upflow or bottom discharge for counterflow installations in vertical units, side or end discharge for horizontal units
- True left or right return air locations—vertical and horizontal units include filter rack/duct collar
- Variable-speed ECM blowers permit various duct applications with flexible airflow selection
- Narrow cabinet for easy movement through doorways
- Internally trapped condensate piping on vertical units for neat, compact installation
- Optional field-installed auxiliary electric heater
- Corner-located electrical box for field wiring from two sides
- Circuit breaker protected loop pump power block for easy wiring
- 2 relays to control field-mounted accessories
- Field-selectable freeze detection setting for well or closed loop systems
- Loop pump linking feature allows multiple units to share one flow center (standard on variable speed systems)

Operating Efficiencies
- AHRI/ISO 13256-1 rating for heating COPs, cooling EERs, and low water flow requirements
- Optional hot water generator with internal pump generates hot water at considerable savings while improving overall system efficiency
- High-stability electronic expansion valve delivers optimum refrigerant flow over a wide range of conditions and provides bidirectional operation without troublesome check valves
- Efficient variable speed scroll compressors operate quietly
- Oversized coaxial tube water-to-refrigerant heat exchanger operates at low liquid pressure drops
- Convoluted copper water tube functions efficiently at low flow rates
- Oversized rifled copper tube/lanced aluminum fin air-to-refrigerant heat exchanger provides high efficiencies at low-face velocity with patented 11 element fin design
- Large, low-RPM blowers with ECM motors provide quiet and efficient air movement with high static capability
- Utilizes the ozone-friendly R-410A refrigerant which produces higher efficiencies and warmer discharge air temperatures
- Brass, swivel-type water connections for quick connection union, and elimination of wrenches and sealants during installation; sweat type connections are on the hot water generator
- Insulated divider and separate air handling/compressor access panels permit service testing without air bypass
- Designed for front access in tight applications
- LED fault and status lights on the Aurora board with memory for easy diagnostics
- Aurora AID Tool provides enhanced service information via communication directly with the Aurora control including sensor inputs, fault history, and much more
- Detachable thermostat connection strip for wiring convenience
- Hot water generator pump shut-off switch for easy startup and service
- Control box and blower motors have quick-attach wiring plugs for easy removal
- Internal drop-out blower with permanently-lubricated ball bearing motor
- Blower and transformer powered from auxiliary heat supply (when installed) to provide emergency heat with open compressor circuit breaker
- High and low pressure service ports in refrigerant circuit
- High and low pressure sensors as well as discharge, suction, heating/cooling liquid lines, EWT, LWT and LAT temperature sensors for ease of service via the AID Tool
- View subcooling and superheat on the AID Tool
- Energy monitoring is standard on the Sycamore Series variable speed system; Easily check power consumption of the compressor, blower and auxiliary heat via the AID Tool or thermostat
- View heat of extraction/rejection on the AID Tool when the Performance option is installed

Product Quality
- Heavy-gauge steel cabinets are painted with durable powder coat paint for long lasting beauty and service
- Coaxial heat exchanger, refrigerant suction lines, hot water generator coil, and all water pipes are fully insulated to reduce condensation problems in low temperature operation
- All air coils are double electro-coated for extended life
- Noise reduction features include discharge muffler, double isolation mounted compressors and soft starting variable speed compressors and blower motors; insulated compressor compartment; interior cabinet insulation using 1/2 in. coated glass fiber; all units include compressor blanket for quiet operation
- Safety features include high-pressure, low-pressure, and loss of charge refrigerant controls to protect the compressor, condensate overflow protection, freeze detection sensor to safeguard the coaxial heat exchanger and air coil, blower start detection, hot water high-limit hot water generator pump shutdown, compressor monitoring, and fault lockout enables emergency heat and prevents compressor operation until thermostat or circuit breaker is reset

Service Advantages
- Hinged/removable control box for added serviceability
- Removable panels: three for the compressor compartment and one (on horizontals) or two (on verticals) for the air handling compartment to provide quick access to all internal components with ductwork in place
- Easily accessible electronic expansion valve
Sycamore Series Design Features cont.

Microprocessor Benefits

- Communicating monochromatic or color digital auto-changeover thermostat with 3-stage heating/2-stage cooling holds precise temperature and provides varying blower speed control
- Component sequencing delays for quiet startup, shutdown, and timed staging of auxiliary electric heat
- ECM blower speed control provides higher supply air temperature in heating, better dehumidification in cooling, and quiet operation at reduced airflows in all modes
- Hot water limit prevents scalding, and pump shuts down automatically when full unit capacity is needed for heating
- Communication capability for future expansions

Options and Accessories

- Communicating Digital Thermostats
  - Monochromatic Graphic Display Thermostats: For user interface with the Aurora system; these displays not only feature easy to use graphical interface but display alerts and faults in plain English. When Energy Monitoring is added, instantaneous usage is displayed on the thermostat itself.
  - Color Touch Screen Graphic Display Thermostats: For user interface with the Aurora system; these displays not only feature easy to use graphical interface but display alerts and faults in plain English. When Energy Monitoring is added not only instantaneous usage is displayed but also weekly and annual consumptions are stored and graphed. Other features include full color implementation, user loaded background photos, and USB port for easy configuration and software updates.
- Performance Monitoring Kit - With this optional sensor kit installation, the Aurora controls can measure actual capacity and efficiency performance of the heat pump; the information can be displayed on the AID Tool.
- IntelliZone2 Zone System - The IntelliZone2 zoning system provides up to 6 zones (Variable Speed), 4 zones (Dual Capacity), or 2 zones (Single Speed) of individualized comfort via communication to the Aurora Control System.
- AID Tool - The Aurora Interface and Diagnostics (AID) Tool is a plug-in configuration and troubleshooting tool for the Aurora Control System.
- Optional Cupronickel Heat Exchangers - for open loop applications.
- Optional Hot Water Generator - with internally mounted pump and water heater plumbing connector.
- Optional High Static ECM Blower Motor - for high static applications (3 ton only).
- 24 Volt 1 in. Electronic Air Cleaner
- 90% Efficient, Cleanable Electrostatic Filters
- Closed Loop Variable Speed Flow Center
- Open Loop Modulating Water Valve
- Auxiliary Electric Heater

Manufacturing Quality

- All units are computer run-tested, with conditioned source water, in all modes to ensure efficiency and reliability
- All refrigerant brazing is performed in a nitrogen atmosphere
- All units are deep evacuated to less than 150 microns prior to refrigerant charging
- All joints are helium leak-tested to ensure an annual leak rate of less than 1/4 ounce
- All major components bar coded; eliminating possibility of mismatched parts built into unit
- All assembly technicians thoroughly trained in proper quality procedures
- All units have model number and serial number embedded in control for local or remote retrieval
- Manufacturing facility is ISO 9001:2008 certified
- Engineering labs are ISO 17025 accredited
The Aurora™ Advanced VS Control System

Aurora Advanced VS Control

Aurora Advanced VS Control System is a complete residential and commercial comfort system that brings all aspects of the HVAC system into one cohesive module network. The Aurora Advanced VS Control features the Aurora Base Control (ABC) and the Aurora Expansion Board (AXB). The variable speed drive communicates to the Aurora Control and provides variable capacity and envelope control. The ABC features microprocessor control and HP, LP, loss of charge, condensate and freeze detection, over/under voltage faults, along with communicating thermostat capability for complete fault detection text at the thermostat. 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 ABC has two Modbus channels. The first channel is configured for connecting to devices such as a communicating thermostat, expansion board, or other devices. The second channel is configured for connecting the Aurora Interface Diagnostics Tool (AID Tool).

The Aurora AXB expands on the capability of the ABC control board. The additional features include active dehumidification, SuperBoost cooling mode, loop pump linking, intelligent hot water generator control, variable speed pump capability, and also allows for optional energy, refrigeration, and performance monitoring add-on sensor kits. The AXB also features a second field configurable accessory relay, and two home automation inputs that are AID configurable for different types of alarms from sump pumps to home security. The Smart Grid input is AID configurable with many options to react to Utility controlled relay operation for On Peak optimization. The AXB also expands the communication capability for IntelliZone2 ready operation as well as other expansion with the ClimateTalk protocol.

<table>
<thead>
<tr>
<th>Aurora Control Features</th>
<th>Description</th>
<th>Aurora Advanced VS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advanced Microprocessor Features</strong></td>
<td>Smart Grid, Home Automation Alarm Inputs, and Accessory2 Relay (HRV/ERV)</td>
<td>•</td>
</tr>
<tr>
<td><strong>Advanced Hot Water Generator Control</strong></td>
<td>Microprocessor and separate power relay for Hot Water Generator Pump with digital temperature monitoring and multiple HWG setpoint selection.</td>
<td>•</td>
</tr>
<tr>
<td><strong>Advanced Speed Pump Control</strong></td>
<td>Microprocessor and separate power relay for loop pump and inline circuit breakers and loop pump slaving.</td>
<td>•</td>
</tr>
<tr>
<td><strong>Variable Speed Pump</strong></td>
<td>Capable of setup, monitoring and controlling a variable speed flow center.</td>
<td>•</td>
</tr>
<tr>
<td><strong>Active Dehumidification</strong></td>
<td>Coil temperature is monitored and air flow is reduced for maximum latent moisture removal.</td>
<td>Affinity Variable Speed Only</td>
</tr>
<tr>
<td><strong>SuperBoost</strong></td>
<td>Allow the variable speed compressor to ramp up an extra 30% of cooling capacity if needed. This extra ‘SuperBoost’ will only be available for a 24 hr period and then the unit will revert to normal operation.</td>
<td>•</td>
</tr>
<tr>
<td><strong>Smart Grid/Utility Input</strong></td>
<td>Allows simple input to externally enable of occupied/unoccupied mode for basic utility time of use programs.</td>
<td>Dry Contact x1</td>
</tr>
<tr>
<td><strong>Home Automation Alarm Input</strong></td>
<td>Allows simple input to signal sump, security, or smoke/CO sensor alarms from other home automation or security systems. The two inputs can be field configured to a number of options and logic.</td>
<td>Dry Contact x2</td>
</tr>
<tr>
<td><strong>IntelliZone² Compatibility</strong></td>
<td>IntelliZone2 communicates to the heat pump via the AXB board. IntelliZone requires traditional thermostat inputs and is not compatible with the Affinity Variable Speed Series.</td>
<td>Optional IntelliZone2</td>
</tr>
</tbody>
</table>

**Service Device**

<table>
<thead>
<tr>
<th>Service Device</th>
<th>Description</th>
<th>Aurora Advanced VS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aurora Interface and Diagnostics (AID) Tool</strong></td>
<td>Allows setup, monitoring and troubleshooting of any Aurora Control. <strong>NOTE:</strong> Although the ABC has basic compatibility with all Aurora, new product features may not be available on older AID Tools. To simplify the basic compatibility ensure the version of AID is at least the same or greater than the ABC software version.</td>
<td>For Service (Ver. 2.xx or greater)</td>
</tr>
</tbody>
</table>
The Aurora Advanced VS Control System cont.

<table>
<thead>
<tr>
<th>Add On Control Feature Kits (field or factory installed)</th>
<th>Description</th>
<th>Aurora Advanced VS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geo Energy Monitoring Kit</td>
<td>Monitors real time power consumption of compressor, blower, aux heat and pump. Requires thermostat TPCM32U04AGSR or TPCC32U01GSR.</td>
<td>Standard</td>
</tr>
<tr>
<td>Refrigeration Monitoring Kit</td>
<td>Monitors real time pressures, temperatures, superheat, and subcooling.</td>
<td>Standard</td>
</tr>
<tr>
<td>Performance Monitoring Kit</td>
<td>Monitors air and water temperatures, and water flow rate and calculates heat of extraction/rejection.</td>
<td>Optional Sensor Kit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Add On Thermostats and Zoning</th>
<th>Description</th>
<th>Aurora Advanced VS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPCM32U04AGSR - MonoChrome Communicating Thermostat</td>
<td>Elite Stat with full English fault codes and alerts, communicating thermostat. Monochrome thermostat allows instantaneous energy measurement only.</td>
<td>Optional</td>
</tr>
<tr>
<td>TPCC32U01GSR - Color Touchscreen Communicating Thermostat</td>
<td>4.3 in. color touchscreen communicating thermostat with full English fault codes and alerts. Color thermostat allows instantaneous and 13 month history.</td>
<td>Optional</td>
</tr>
<tr>
<td>IntelliZone2® Zoning</td>
<td>Includes color main thermostat and up to 6 zones (with variable speed), 4 zones (with dual capacity), and 2 zones (with single speed). There are 3 thermostat options (MasterStat, SensorStat, ZoneStat).</td>
<td>Optional</td>
</tr>
</tbody>
</table>

NOTES: The IntelliZone2 or one of the communicating thermostats shown above must be used to control the variable speed heat pump.

Aurora Advanced VS Control Features

NOTE: Refer to the Aurora Advanced VS Control Application and Troubleshooting Guide and the Instruction Guide: Aurora Interface and Diagnostics (AID) Tool for additional information.

Control Features

Software ABC VS Version 2.04W29 Variable Capacity Compressors
- 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
- Diagnostic LED
- Test mode push button switch
- Two auxiliary electric heat outputs
- Alarm output
- Accessory output with N.O. and N.C.
- Modbus communication

Variable Speed ECM Blower Motor

A variable speed ECM blower motor is driven directly using the onboard PWM output. Multiple blower speeds are available based upon requirements of the compressor and electric heat. The blower speeds can be changed either by the variable speed ECM manual configurations mode method or by using the Aurora AID Tool directly.

Advanced Hot Water Generator Control (Domestic Hot Water Option)

An AID Tool selectable temperature limit and microprocessor control of the process is featured. This will maximize hot water generation and prevent undesirable energy use. An alert will occur when the hot water input temperature is at or above the set point (130°F default) for 30 continuous seconds. This alert will appear as an E15 on the AID Tool and the hot water pump de-energizes. Hot water pump operations resume on the next compressor cycle or after 15 minutes of continuous compressor operation during the current thermostat demand cycle.

Since compressor hot gas temperature is dependent on loop temperature in cooling mode, loop temperatures may be too low to allow proper heating of water. The control will monitor water and refrigerant temperatures to determine if conditions are satisfactory for heating water.
The Aurora Advanced VS Control System cont.

VS Drive and Envelope Control
The VS drive operates the compressor between 20 and 100% capacity. The VS drive communicates any out of refrigerant envelope conditions to the Aurora and will attempt to adjust the compressor speed to keep within the envelope. These conditions are measured using the discharge and suction pressure transducers, discharge temperature, and current sensors of the drive.

IntelliZone2 Zoning Compatibility
(Optional IntelliZone2 Communicating Zoning)
A dedicated input to connect and communicate with the IntelliZone2 (IZ2) zoning system is provided on P7 on the AXB control board. There is a dedicated communication port using a proprietary ModBus protocol. The AXB is standard on variable speed systems. Consult the IntelliZone2 literature for more information.

Electronic Expansion Valve (EEV)
The electronic expansion valve is operated by the EEV board and is set to maintain optimal superheat setting for maximum efficiency. All operation parameters are communicated to the VS drive and the Aurora system.

Variable Speed Pump
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. 50% 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 output is provided to drive a modulating water valve. Through advanced design the 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. 50% and 100% are the default settings respectively.

Loop Pump Linking
This input and output are provided so that two units can be linked together with a common flow center. When either unit has a call for loop outputs, 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 linked together in this fashion.

Advanced Communication Ports
Communication ports P6 and P8 will provide future expansion via dedicated protocols. These are for future use.

Smart Grid/On Peak (SG) Input
The ‘Smart Grid/On Peak’ input was designed to allow utilities to utilize simple radio controlled switches to control the On Electric Peak behavior of the Aston and Sycamore Series Geothermal Heat Pumps and provide demand reduction. With a closed contact signal, this input will limit the operation and thus the power consumption of the unit by disabling the compressor and electric heat as long as the signal is present. Code 7 will flash on the Green LED signifying the ‘On Peak’ mode. On Peak will also display on communicating thermostats.

Home Automation 1 and 2 Inputs
The Home Automation inputs are simple closed contact inputs that will trigger an AID Tool and thermostat alert for the homeowner. These would require optional sensors and or equipment for connection to the AXB board. With two inputs, two different sensors can be selected. The selected text will then be displayed on the AID Tool and communicating thermostats. These events will NOT alter functionality or operation of the heat pump/accessories and is for homeowner/service notification only.

Home Automation 1 - E23 HA1
With a closed dry contact signal, this input will cause an alarm and Alert Code 23 to indicate on the stat or flash on ABC. The AID Tool will allow configuration of this input between the following selections:
- No Action
- Home Automation Fault [no lockout info only] - Output from home automation system
- Security Alarm [no lockout info only] - Output from home security
- Sump Alarm Fault [no lockout info only] - Switch output from sump sensor
- Smoke/CO Alarm Fault [no lockout info only] - Switch output from Smoke/CO sensor
- Dirty Filter Alarm [no lockout info only] - Output from dirty filter sensor

Home Automation 2 – E24 HA2
With a closed dry contact signal, this input will cause an alarm and Alert Code 24 to indicate on the stat or flash on ABC. The AID Tool will allow configuration of this input between the following selections:
- No Action
- Home Automation Fault [no lockout info only] - Output from home automation system
- Security Alarm [no lockout info only] - Output from home security
- Sump Alarm Fault [no lockout info only] - Switch output from sump sensor
- Smoke/CO Alarm Fault [no lockout info only] - Switch output from Smoke/CO sensor
- Dirty Filter Alarm [no lockout info only] - Output from dirty filter sensor
The Aurora Advanced VS Control System cont.

Monitoring Sensor Kits

**Energy Monitoring**
(Standard on all Sycamore Series units)
The Energy Monitoring Kit includes two current transducers (blower and electric heat) added to the existing compressor drive sensor so that the complete power usage of the heat pump can be measured. The AID Tool provides configuration detail for the type of blower motor and a line voltage calibration procedure to improve the accuracy. This information can be displayed on the AID Tool or selected communicating thermostats. The TPCM32U04AGSR will display instantaneous energy use while the color touchscreen TPCC32U01GSR will, in addition, display a 13 month history in graph form.

**Refrigerant Monitoring**
(Standard on all Sycamore Series units)
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 will only be displayed on the AID Tool.

**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 AID Tool for selection of water or antifreeze.

**Special Modes and Applications**

**Communicating Digital Thermostats**
The Aurora VS controls system also requires either the monochromatic or color touch screen graphic display thermostats for user interface. These displays not only feature easy to use graphical interface but display alerts and faults in plain English.

**‘SuperBoost’ Cooling Mode**
Occasionally there can be a requirement for a short term ‘boost’ of cooling capacity during a large party etc. The Sycamore Series allows the user to select ‘SuperBoost’ mode on the thermostat which will allow the Sycamore Series VS to ramp up an extra 30% of cooling capacity if needed. This extra ‘SuperBoost’ will only be available for a 24 hr period and then the unit will revert to normal operation. The short term boost does not affect ground loop sizing since it is limited in operation. Continuous use of SuperBoost will result in overheating of the ground loop.

**Dehumidification – Active**
Active dehumidification will only activate during cooling operation and is based upon the humidity setpoint of the thermostat being at least 5% below the actual relative humidity and being within the temperature parameters described here. The green status LED will flash code 2 when active. The unit can operate a maximum of 1.5°F below the cooling setpoint. The compressor will ramp up and airflow will begin at a low level. Airflow is then reduced periodically until air coil temperature setpoint is reached. If coil temperature continues to drop, the airflow is increased until air coil setpoint is maintained. After 20 minutes of operation in the Active Dehumidification mode, normal cooling operation will resume for 5 minutes. This cycle continues until the dehumidification setpoint is reached, room temperature is more than 1.5°F below cooling setpoint, or more than 1°F above cooling setpoint (normal cooling takes over). In IntelliZone2 systems, active dehumidification is only enabled when system is operating on compressor speeds 4 or lower. Once active dehumidification is activated the main zone and any other active cooling zone will remain open.

**Field Hardware Selectable Options**

**ABC Field Selectable Options via Button (SW1)**

**Test/Configuration Button (See SW1 Operation Table)**

**Test Mode**
The control is placed in the test mode by holding the push button switch on the ABC 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. **NOTE:** Test mode will automatically be exited after 30 minutes.

**Variable Speed ECM Configuration Mode**
The control is placed in the variable speed ECM configuration mode by holding the push-button switch SW1 for 5 to 10 seconds, the high, low, and G variable speed ECM speeds can be selected by following the LED display lights. LED2 (yellow) will fast flash when entering the variable speed ECM configuration. When setting G speed LED3 (green) will be continuously lit, for low speed LED1 (red) will be continuously lit, and for high speed both LED3 (green) and LED1 (red) will be continuously lit. During the 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. G speed has now been selected. Next select low 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. Aux blower speed will remain at default or current setting and requires the AID Tool for adjustment.
The Aurora Advanced VS Control System cont.

Reset Configuration Mode
The control is placed in reset configuration mode by holding the push button switch SW1 on the ABC 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.

ABC DIP Switch (SW2)

- **SW2-1** FP1 Selection – Low water coil temperature limit setting for freeze detection. On = 30°F; Off = Not Used
- **SW2-2** FP2 Selection – Low air coil temperature limit setting for freeze detection. On = 30°F; Off = Not Used
- **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** Access Relay Operation (P2)
- **SW2-5** Access Relay Operation (P2)

<table>
<thead>
<tr>
<th>Access Relay Operation</th>
<th>SW2-4</th>
<th>SW2-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle with Blower</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Cycle with Compressor</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Water Valve Slow Opening</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Cycle with Comm. T-stat Hum Cmd</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

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

**NOTE:** SW2-6 is not applicable to the Affinity Variable Speed Series

- **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

**NOTE:** SW2-7 is not applicable to the Affinity Variable Speed Series

- **SW2-8** Future Use

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 Diagnostics (AID) Tool topic).

AXB DIP Switch (SW1)

**DIP 1 - ID:** This is the AXB ModBus ID and should always read On.

**DIP 2 & 3 - Future Use**

**DIP 4 & 5 - Accessory Relay2:** A second, DIP configurable, accessory relay 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.

<table>
<thead>
<tr>
<th>Position</th>
<th>DIP 4</th>
<th>DIP 5</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ON</td>
<td>ON</td>
<td>Cycles with blower or ECM (or G)</td>
</tr>
<tr>
<td>2</td>
<td>OFF</td>
<td>ON</td>
<td>Cycles with CC1 first stage of compressor or compressor spd 1-12</td>
</tr>
<tr>
<td>3</td>
<td>ON</td>
<td>OFF</td>
<td>Cycles with CC2 second stage of compressor or compressor spd 7-12</td>
</tr>
<tr>
<td>4</td>
<td>OFF</td>
<td>OFF</td>
<td>Cycles with DH input from ABC board</td>
</tr>
</tbody>
</table>

Field Selectable Options via Software
(Selectable via the Aurora AID Tool)
Many options are field selectable and configurable in Aurora software via the AID Tool. Consult the installation manual or Aurora documentation for further details.

Basic Aurora 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 VS 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 VS call, then the control will go to Lockout mode.

**Lockout** – when locked out, the blower will operate continuously in “G” blower speed setting. 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, the demand call must be removed for at least 30 seconds. To reset lockout conditions with SW2-8 Off, the demand call must be removed for at least 30 seconds. Lockout may also be reset by turning power off for at least 30 seconds or by enabling the emergency shutdown input for at least 30 seconds.

CAUTION: Frequent cycling of power to the drive can damage the drive! Wait at least 5 minutes between cycles (connecting and disconnecting power to the drive).
The Aurora Advanced VS Control System cont.

**Lockout With Emergency Heat** - if the control is locked out in the heating mode, and a call for emergency heat 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 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, all of the emergency heat outputs will turn off, and the variable speed ECM blower will shift to low speed.

**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 hardwired 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.

**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-Coax** - set points shall be either 30°F or 15°F. 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.

**Freeze Detection-Air Coil** - Air Coil Freeze Detection will use the FP2 input to protect against ice formation on the air coil. The FP2 input will operate exactly like FP1 except that the set point is 30 degrees and is not field adjustable.

**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.

**Other Lockouts and Alarms**

Several other lockouts and alarms are shown in the Status LED1 (LED1, Red) table with the associated codes visible on the thermostat, ABC Fault LED, and in text in the AID Tool.

**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 the compressor, pump, and blower motor are not active. The RV may be active. The blower and compressor will be off.

**Heating Operation** - The unit will operate based upon demand as calculated by the room setpoint algorithm. The resulting compressor speed (1-12) will also select an appropriate blower speed for the selected compressor speed. Aux Heat will not be available (on IntelliZone2 Aux Heat is available on compressor speeds 10-12) until after the 12th compressor speed has been operational and still is not satisfying the thermostat, then auxiliary electric heat will be activated.

**Emergency Heat (W)** - The blower will be started on G 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 Aux speed. If the emergency heat demand is not satisfied after 2 minutes the second electric heat stage will be energized.

**Cooling Operation** - The unit will operate based upon demand as calculated by the room setpoint algorithm. The resulting compressor speed, speeds 1-9, (speeds 10-12 are reserved for SuperBoost mode only) will also select an appropriate blower speed. The blower mode will also have the cooling airflow adjustment applied. 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.

**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, and emergency heat cycle.

**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.
The Aurora Advanced VS Control System cont.

**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.

**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.

### Aurora Advanced VS Control 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. See the LED tables for further explanation.

### Aurora Interface and Diagnostics (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. The AID Tool simply plugs into the exterior of the cabinet in the AID Tool port.

<table>
<thead>
<tr>
<th>Description of Operation</th>
<th>Fault LED, Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Mode</td>
<td>ON</td>
</tr>
<tr>
<td>Control is Non-functional</td>
<td>OFF</td>
</tr>
<tr>
<td>Test Mode</td>
<td>Slow Flash</td>
</tr>
<tr>
<td>Lockout Active</td>
<td>Fast Flash</td>
</tr>
<tr>
<td>Dehumidification Mode</td>
<td>Flash Code 2</td>
</tr>
<tr>
<td>Load Shed</td>
<td>Flash Code 5</td>
</tr>
<tr>
<td>Emergency Shutdown</td>
<td>Flash Code 6</td>
</tr>
<tr>
<td>On Peak Mode</td>
<td>Flash Code 7</td>
</tr>
<tr>
<td>Warning! VS Derated</td>
<td>Flash Code 8</td>
</tr>
<tr>
<td>Warning! VS SafeMode</td>
<td>Flash Code 9</td>
</tr>
</tbody>
</table>

### Configuration LED (LED2, Yellow)

<table>
<thead>
<tr>
<th>Description of Operation</th>
<th>Configuration LED, Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Software Overwritten</td>
<td>ECM Setting</td>
</tr>
<tr>
<td>DIP Switch Overwritten</td>
<td>Slow Flash</td>
</tr>
<tr>
<td>ECM Configuration Mode</td>
<td>Fast Flash</td>
</tr>
<tr>
<td>Reset Configuration Mode</td>
<td>OFF</td>
</tr>
</tbody>
</table>
The Aurora Advanced VS Control System cont.

<table>
<thead>
<tr>
<th>Status LED (LED1, Red)</th>
<th>ABC Tool</th>
<th>IntelliZone2 and ABC Red Display and History</th>
<th>Thermostat Display</th>
<th>Fault LED</th>
<th>Fault Condition Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal - No Faults</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Normal</td>
</tr>
<tr>
<td>Off - Fault</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Pressure 2</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeze Detection FP2</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeze Detection FP1</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condensate Overflow</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Var Spd Pump</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ComErr</td>
<td>No</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>EEV IndCom</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AmbTmpSnr</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DisTmpSnr</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SucPrsSnr</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ConPrsSnr</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OverCurrent</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DrivTemp</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OverTemp</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DrvIntErr</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of Charge</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SafeMode</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Note: The "Fault" column indicates whether the fault is a critical or non-critical condition. Critical faults require immediate attention, while non-critical faults can be addressed at a later time.
The Aurora Advanced VS Control System cont.

ABC Control Board Layout

AXB Control Board Layout

EEV Board Layout

Variable Speed Drive

The Aurora Advanced VS Control System cont.
Operation Logic

Heating Mode
When the variable speed controls determine that heating is needed in the space the blower will be turned on, the compressor will be ramped to speed 6 and the loop pump will be started. The compressor will continue to run at speed 6 for 60 seconds for oil circulation. During the 60 second oil circulation the controls will calculate what speed the compressor will need to operate at to maintain the set point in the space. If the compressor is operating at speed 12 and the unit is unable to maintain set point the controls will stage on the electric heat. Electric heat will not operate unless the compressor is already running at speed 12. Every 30 minutes if the compressor has been operating lower than speed 6, the controls will increase the compressor to speed 6 for one minute for oil circulation.

Cooling Mode
When the variable speed controls determine that cooling is needed in the space the blower will be turned on, the reversing valve will be enabled, the compressor will be ramped to speed 6, and the loop pump will be started. The compressor will continue to run at speed 6 for 60 seconds for oil circulation. During the 60 second oil circulation the controls will calculate what speed the compressor will need to operate at to maintain the set point in the space. The compressor will be limited to a maximum of speed 9 for cooling. If additional capacity is needed SuperBoost mode can be enabled from the thermostat allowing the compressor to run at speeds higher than 9 for a period of 24 hours. Every 30 minutes if the compressor has been operating lower than speed 6, the controls will increase the compressor to speed 6 for one minute for oil circulation.

Variable Speed ECM Blower Motor
The variable speed controls will vary the variable speed ECM blower output to maintain optimum air flow at each of the 12 compressor speeds. If dehumidification mode is selected during the cooling operation the airflow will be varied to allow for maximum moisture removal.

Variable Speed Loop Pump
The variable speed controls will operate the variable speed loop pump similar to the way the variable speed ECM blower motor operates. The speed of the pump will be increased as the compressor speed is increased to maintain adequate water flow.

Safe Mode
The system has encountered an unsafe operating condition that prevents automatic speed control, e.g. lost a sensor signal. To avoid damage to the system, the drive is running the compressor at a fixed speed of 2400 rpm awaiting the problem to be solved and eventually returning to normal operation. If the problem cannot be solved the drive stops and issues an alarm. (See fault/alarm table.)

Derating
The VS compressor utilizes ‘envelope control’ to maintain performance within operational limits and improve reliability. To accomplish this, pressure sensors for discharge and suction pressure as well as hot gas temperature sensing are used to monitor the conditions in which the compressor operates. The envelope does vary based upon operating speed (rpm). When operating out of these limits the control will attempt to improve the situation by moderating the compressor speed for a larger envelope. When this occurs it can be observed on the Aurora control as an ‘E’ code. The control will automatically try to resolve the situation. If the situation progresses, a fault and lockout will be generated by the control.
**Water Quality**

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

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

Units with cupronickel heat exchangers are recommended for open loop applications due to the increased resistance to build-up and corrosion, along with reduced wear caused by acid cleaning. Failure to adhere to the guidelines in the water quality table could result in the loss of warranty.

<table>
<thead>
<tr>
<th>Material</th>
<th>Copper</th>
<th>90/10 Cupronickel</th>
<th>316 Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7 - 9</td>
<td>7 - 9</td>
<td>7 - 9</td>
</tr>
<tr>
<td>Acidity/Alkalinity</td>
<td>(Total Hardness)</td>
<td>less than 350 ppm</td>
<td>(Total Hardness)</td>
</tr>
<tr>
<td>Scaling</td>
<td>Calcium and Magnesium Carbonate</td>
<td>Less than 0.5 ppm (rotten egg smell appears at 0.5 ppm)</td>
<td></td>
</tr>
<tr>
<td>Corrosion</td>
<td>Hydrogen Sulfide</td>
<td>Less than 0.5 ppm (rotten egg smell appears at 0.5 ppm)</td>
<td>10 - 50 ppm</td>
</tr>
<tr>
<td>Sulfates</td>
<td>Less than 125 ppm</td>
<td>Less than 125 ppm</td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
</tr>
<tr>
<td>Chlorides</td>
<td>Less than 20 ppm</td>
<td>Less than 125 ppm</td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>Less than 50 ppm</td>
<td>Less than 1 ppm</td>
<td></td>
</tr>
<tr>
<td>Ammonia</td>
<td>Less than 2 ppm</td>
<td>Less than 2 ppm</td>
<td></td>
</tr>
<tr>
<td>Ammonia Chloride</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
</tr>
<tr>
<td>Ammonia Nitrate</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
</tr>
<tr>
<td>Ammonia Hydroxide</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
</tr>
<tr>
<td>Ammonia Sulfate</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
<td>Less than 0.5 ppm</td>
</tr>
<tr>
<td>Total Dissolved Solids (TDS)</td>
<td>Less than 1000 ppm</td>
<td>1000 - 1500 ppm</td>
<td>1000 - 1500 ppm</td>
</tr>
<tr>
<td>LSI Index</td>
<td>+0.5 to -0.5</td>
<td>+0.5 to -0.5</td>
<td></td>
</tr>
<tr>
<td>Iron Fouling (Biological Growth)</td>
<td>Iron, Fe²⁺ (Ferrous)</td>
<td>&lt; 0.2 ppm</td>
<td></td>
</tr>
<tr>
<td>Bacterial Iron Potential</td>
<td>&lt; 0.2 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron Oxide</td>
<td>Less than 1 ppm, above this level deposition will occur</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion</td>
<td>Suspended Solids</td>
<td>Less than 10 ppm and filtered for max. of 600 micron size</td>
<td></td>
</tr>
<tr>
<td>Threshold Velocity (Fresh Water)</td>
<td>&lt; 6 ft/sec</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

2/22/12
Vertical Dimensional Data

Top Air Discharge

2 ft [61 cm] Primary Service Access

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

Unit shipped with deluxe 2 in. (field adjustable to 1 in.) duct collar/filter rack extending from unit 3.25 in. and is suitable for duct connection.

Discharge flange is field installed and extends 1 in. [25.4mm] from cabinet.

Decorative molding and/or water connections extend 1.2 in. [30.5mm] beyond front of cabinet.

Louvered vents in the compressor section right side access panel extend 1/2 in. [12.7 mm] from side of cabinet. Allow clearance for venting.

Top auxiliary electric heat power knockouts are 1.125", 1.375", and 2".

<table>
<thead>
<tr>
<th>Vertical Top Flow Model</th>
<th>Overall Cabinet</th>
<th>Water Connections</th>
<th>Electrical Connections</th>
<th>Discharge Connection</th>
<th>Return Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A Width</td>
<td>B Depth</td>
<td>C Height</td>
<td>D Loop In</td>
<td>E Loop Out</td>
</tr>
<tr>
<td>036</td>
<td>in. 25.6</td>
<td>31.6</td>
<td>54.4</td>
<td>2.3</td>
<td>7.3</td>
</tr>
<tr>
<td>cm. 65.0</td>
<td>80.3</td>
<td>138.2</td>
<td>5.8</td>
<td>18.5</td>
<td>40.4</td>
</tr>
<tr>
<td>048</td>
<td>in. 25.6</td>
<td>31.6</td>
<td>54.4</td>
<td>2.3</td>
<td>7.3</td>
</tr>
<tr>
<td>cm. 65.0</td>
<td>80.3</td>
<td>138.2</td>
<td>5.8</td>
<td>18.5</td>
<td>40.4</td>
</tr>
<tr>
<td>060</td>
<td>in. 25.6</td>
<td>31.6</td>
<td>58.4</td>
<td>2.3</td>
<td>7.3</td>
</tr>
<tr>
<td>cm. 65.0</td>
<td>80.3</td>
<td>148.3</td>
<td>5.8</td>
<td>18.5</td>
<td>40.4</td>
</tr>
</tbody>
</table>
Vertical Dimensional Data cont.

Bottom Air Discharge

<table>
<thead>
<tr>
<th>Bottomflow Models</th>
<th>Overall Cabinet</th>
<th>Water Connections</th>
<th>Electrical Knockouts</th>
<th>Discharge Connection</th>
<th>Return Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A Width</td>
<td>B Depth</td>
<td>C Height</td>
<td>D In</td>
<td>E Out</td>
</tr>
<tr>
<td>036-060</td>
<td>25.5</td>
<td>31.5</td>
<td>62.5</td>
<td>43.4</td>
<td>48.4</td>
</tr>
<tr>
<td></td>
<td>64.8</td>
<td>80.0</td>
<td>158.8</td>
<td>110.2</td>
<td>122.9</td>
</tr>
</tbody>
</table>

- Condensate is 3/4 in. PVC female glue socket and is switchable from side to front.
- Unit shipped with deluxe 2 in. (field adjustable to 1 in.) duct collar/filter rack extending from unit 3.25 in. and is suitable for duct connection.
- Decorative molding and/or water connections extend 1.2 in. (30.5mm) beyond front of cabinet.
- Louvered vents in the compressor section right side access panel extend 1/2 in. [12.7 mm] from side of cabinet. Allow clearance for venting.
- Top auxiliary electric heat power knockouts are 1.125”, 1.375”, and 2”.

2 ft [61 cm] Primary Service Access
Vertical Dimensional Data cont.

### Rear Air Discharge

![Diagram of Rear Air Discharge](image)

#### Vertical Dimensional Data cont.

<table>
<thead>
<tr>
<th>Vertical Rear Discharge Model</th>
<th>Overall Cabinet</th>
<th>Water Connections</th>
<th>Electrical Connections</th>
<th>Discharge Connection</th>
<th>Return Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A Width</td>
<td>B Depth</td>
<td>C Height</td>
<td>D Loop</td>
<td>E Loop</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------</td>
<td>---------</td>
<td>----------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>036</td>
<td>25.6</td>
<td>31.6</td>
<td>54.4</td>
<td>2.3</td>
<td>7.3</td>
</tr>
<tr>
<td>cm</td>
<td>65.0</td>
<td>80.3</td>
<td>138.2</td>
<td>5.8</td>
<td>18.5</td>
</tr>
<tr>
<td>048</td>
<td>25.6</td>
<td>31.6</td>
<td>54.4</td>
<td>2.3</td>
<td>7.3</td>
</tr>
<tr>
<td>cm</td>
<td>65.0</td>
<td>80.3</td>
<td>138.2</td>
<td>5.8</td>
<td>18.5</td>
</tr>
<tr>
<td>060</td>
<td>25.6</td>
<td>31.6</td>
<td>58.4</td>
<td>2.3</td>
<td>7.3</td>
</tr>
<tr>
<td>cm</td>
<td>65.0</td>
<td>80.3</td>
<td>148.3</td>
<td>5.8</td>
<td>18.5</td>
</tr>
</tbody>
</table>

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

Unit shipped with deluxe 2 in. (field adjustable to 1 in.) duct collar/filter rack extending from unit 3.25 in. and is suitable for duct connection.

Discharge flange is field installed and extends 1 in. [25.4mm] from cabinet.

Decorative molding and/or water connections extend 1.2 in. [30.5mm] beyond front of cabinet.

Louvered vents in the compressor section right side access panel extend 1/2 in. [12.7 mm] from side of cabinet. Allow clearance for venting.

Top auxiliary electric heat power knockouts are 1.125", 1.375", and 2".

*6/29/12*
Horizontal Dimensional Data

<table>
<thead>
<tr>
<th>Horizontal Models</th>
<th>Overall Cabinet</th>
<th>Water Connections</th>
<th>Electrical Connections</th>
<th>Discharge Connection</th>
<th>Return Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A Width</td>
<td>B Depth</td>
<td>C Height</td>
<td>D In</td>
<td>E Out</td>
</tr>
<tr>
<td>036 in.</td>
<td>25.6</td>
<td>77.0</td>
<td>21.3</td>
<td>2.3</td>
<td>7.3</td>
</tr>
<tr>
<td>cm. 65.0</td>
<td>51.6</td>
<td>195.6</td>
<td>54.1</td>
<td>5.8</td>
<td>18.5</td>
</tr>
<tr>
<td>048 in.</td>
<td>25.6</td>
<td>77.0</td>
<td>21.3</td>
<td>2.3</td>
<td>7.3</td>
</tr>
<tr>
<td>cm. 65.0</td>
<td>51.6</td>
<td>195.6</td>
<td>54.1</td>
<td>5.8</td>
<td>18.5</td>
</tr>
<tr>
<td>060 in.</td>
<td>25.6</td>
<td>82.0</td>
<td>21.3</td>
<td>2.3</td>
<td>7.3</td>
</tr>
<tr>
<td>cm. 65.0</td>
<td>51.6</td>
<td>208.3</td>
<td>54.1</td>
<td>5.8</td>
<td>18.5</td>
</tr>
</tbody>
</table>

Condensate is 3/4 in. PVC female glue socket and is switchable from side to front.
Unit shipped with deluxe 2 in. (field adjustable to 1 in.) duct collar/filter rack extending from unit 3.25 in. and is suitable for duct connection.
Discharge flange is field installed and extends 1 in. [25.4mm] from cabinet.
Decorative molding and/or water connections extend 1.2 in. [30.5mm] beyond front of cabinet.
Louvered vents in the compressor section right side access panel extend 1/2 in. [12.7 mm] from side of cabinet. Allow clearance for venting.

Units Not Shown Above

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Return End Discharge</td>
<td>2.8</td>
<td>4.6</td>
</tr>
<tr>
<td>cm.</td>
<td>7.1</td>
<td>11.8</td>
</tr>
<tr>
<td>Right Return Side Discharge</td>
<td>4.9</td>
<td>6.9</td>
</tr>
<tr>
<td>cm.</td>
<td>12.4</td>
<td>17.5</td>
</tr>
<tr>
<td>Left Return End Discharge</td>
<td>4.9</td>
<td>7.6</td>
</tr>
<tr>
<td>cm.</td>
<td>12.4</td>
<td>19.4</td>
</tr>
<tr>
<td>Left Return Side Discharge</td>
<td>2.8</td>
<td>6.9</td>
</tr>
<tr>
<td>cm.</td>
<td>7.1</td>
<td>17.5</td>
</tr>
</tbody>
</table>
## Physical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>Variable Speed</th>
<th>036</th>
<th>048</th>
<th>060</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressor (1 each)</td>
<td>Variable Speed Scroll</td>
<td>95 [2.69]</td>
<td>120 [3.40]</td>
<td>140 [3.96]</td>
</tr>
</tbody>
</table>

**ECM Blower Motor & Blower**

<table>
<thead>
<tr>
<th>Blower Motor Type/Speeds</th>
<th>ECM</th>
<th>Variable Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blower Motor - hp [W]</td>
<td>ECM</td>
<td>1/2 [373]</td>
</tr>
<tr>
<td>High Static Blower Motor - hp [W]</td>
<td>ECM</td>
<td>1 [746]</td>
</tr>
<tr>
<td>Blower Wheel Size (Dia x W), in. [mm]</td>
<td>ECM</td>
<td>11 x 10 [279 x 254]</td>
</tr>
<tr>
<td>High Static Blower Wheel Size - [Dia. x W], in. [mm]</td>
<td>ECM</td>
<td>11 x 10 [279 x 254]</td>
</tr>
</tbody>
</table>

**Coax and Water Piping**


**Vertical**

| Air Coil Dimensions (H x W), in. [mm] | 32 x 25 [813 x 635] | 32 x 25 [813 x 635] | 36 x 25 [914 x 635] |
| Air Coil Total Face Area, ft² [m²] | 5.6 [0.570] | 5.6 [0.570] | 6.3 [0.641] |
| Air Coil Number of rows | 3 | 3 | 4 |
| Filter Standard - 2 in. [51 mm] Pleated MERV 11 Throwaway, in [mm] | 32 x 30 [813 x 762] | 32 x 30 [813 x 762] | 36 x 30 [914 x 762] |
| Weight - Operating, lb [kg] | 352 [160] | 361 [164] | 385 [175] |

**Horizontal**

| Air Coil Dimensions (H x W), in. [mm] | 20 x 40 [508 x 1016] | 20 x 40 [508 x 1016] | 20 x 45 [508 x 1143] |
| Air Coil Total Face Area, ft² [m²] | 5.6 [0.570] | 5.6 [0.570] | 6.3 [0.641] |
| Air Coil Number of rows | 3 | 3 | 4 |
| Filter Standard - 2 in. [51 mm] Pleated MERV 11 Throwaway, in [mm] | 1 - 20 x 20 [508 x 508] | 1 - 20 x 20 [508 x 508] | 1 - 20 x 25 [508 x 635] |
## Auxiliary Heat Ratings

<table>
<thead>
<tr>
<th>Model</th>
<th>kW</th>
<th>Stages</th>
<th>Btu/h</th>
<th>Min CFM</th>
<th>Model Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>208V</td>
<td>230V</td>
<td>208V</td>
<td>230V</td>
<td></td>
</tr>
<tr>
<td>EAL(H)10A</td>
<td>7.2</td>
<td>9.6</td>
<td>2</td>
<td>24,600</td>
<td>32,700</td>
</tr>
<tr>
<td>EAL(H)15A</td>
<td>10.8</td>
<td>14.4</td>
<td>3</td>
<td>36,900</td>
<td>49,100</td>
</tr>
<tr>
<td>EAL(H)20A</td>
<td>14.4</td>
<td>19.2</td>
<td>4</td>
<td>49,200</td>
<td>65,500</td>
</tr>
</tbody>
</table>

Air flow level for auxiliary heat (Aux) must be above the minimum cfm in this table.

Order the "H" part number when installed on horizontal and vertical rear discharge units.

---

## Auxiliary Heat Electrical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>Supply Circuit</th>
<th>Heater Amps</th>
<th>Min Circuit Amp</th>
<th>Max Fuse (USA)</th>
<th>Max Fuse (CAN)</th>
<th>Max CKT BRK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>208 V</td>
<td>240 V</td>
<td>208 V</td>
<td>240 V</td>
<td>208 V</td>
</tr>
<tr>
<td>EAL(H)10A</td>
<td>Single</td>
<td>34.7</td>
<td>40</td>
<td>53.3</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>208 V</td>
<td>240 V</td>
<td>208 V</td>
<td>240 V</td>
<td>208 V</td>
</tr>
<tr>
<td>EAL(H)15A</td>
<td>Single</td>
<td>52.0</td>
<td>60</td>
<td>75</td>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>L1/L2</td>
<td>34.7</td>
<td>40</td>
<td>53.3</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>L3/L4</td>
<td>17.3</td>
<td>20</td>
<td>21.7</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>EAL(H)20A</td>
<td>Single</td>
<td>69.3</td>
<td>80</td>
<td>96.7</td>
<td>110</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>L1/L2</td>
<td>34.7</td>
<td>40</td>
<td>53.3</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>L3/L4</td>
<td>34.7</td>
<td>40</td>
<td>43.3</td>
<td>50</td>
<td>45</td>
</tr>
</tbody>
</table>

All heaters rated single phase 60 cycle and include unit fan load.

All fuses type "D" time delay (or HACR circuit breaker in USA).

---

## Electrical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>Rated Voltage</th>
<th>Voltage Min/Max</th>
<th>Compressor</th>
<th>Drive</th>
<th>HWG Pump FLA</th>
<th>Ext Loop FLA</th>
<th>Blower Motor FLA</th>
<th>Total Unit FLA</th>
<th>Minimum Circuit Amp</th>
<th>Max Fuse HACR Breaker</th>
</tr>
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<tbody>
<tr>
<td>036</td>
<td>208-230/60/1</td>
<td>187/253</td>
<td>10.2</td>
<td>18.0</td>
<td>22.0</td>
<td>30.0</td>
<td>0.4</td>
<td>5.4</td>
<td>4.0</td>
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<td>187/253</td>
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<td>22.0</td>
<td>30.0</td>
<td>0.4</td>
<td>5.4</td>
<td>7.0</td>
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<td>187/253</td>
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<td>23.5</td>
<td>28.0</td>
<td>35.0</td>
<td>0.4</td>
<td>5.4</td>
<td>7.0</td>
<td>40.8</td>
</tr>
<tr>
<td>060</td>
<td>208-230/60/1</td>
<td>187/253</td>
<td>12.0</td>
<td>30.0</td>
<td>33.0</td>
<td>40.0</td>
<td>0.4</td>
<td>5.4</td>
<td>7.0</td>
<td>45.8</td>
</tr>
</tbody>
</table>

*With optional 1 hp Variable Speed ECM Motor

Rated Voltage of 208/230/60/1

HACR circuit breaker in USA only

All fuses Class RK-5
**Blower Performance Data**

### Variable Speed ECM Blower Motor

<table>
<thead>
<tr>
<th>Model</th>
<th>Speed 1</th>
<th>Speed 2</th>
<th>Speed 3</th>
<th>Speed 4</th>
<th>Speed 5</th>
<th>Speed 6</th>
<th>Speed 7</th>
<th>Speed 8</th>
<th>Speed 9</th>
<th>Speed 10</th>
<th>Speed 11</th>
<th>Speed 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>036</td>
<td>0.50</td>
<td>285</td>
<td>380</td>
<td>525</td>
<td>675</td>
<td>815</td>
<td>980</td>
<td>1100</td>
<td>1220</td>
<td>1330</td>
<td>1440</td>
<td>1540</td>
</tr>
<tr>
<td>036 w/1hp*</td>
<td>0.75</td>
<td>480</td>
<td>565</td>
<td>665</td>
<td>761</td>
<td>870</td>
<td>1000</td>
<td>1100</td>
<td>1200</td>
<td>1300</td>
<td>1410</td>
<td>1520</td>
</tr>
<tr>
<td>048</td>
<td>0.75</td>
<td>475</td>
<td>620</td>
<td>730</td>
<td>850</td>
<td>1020</td>
<td>1140</td>
<td>1270</td>
<td>1400</td>
<td>1520</td>
<td>1650</td>
<td>1790</td>
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<tr>
<td>060</td>
<td>0.75</td>
<td>400</td>
<td>600</td>
<td>830</td>
<td>1050</td>
<td>1230</td>
<td>1400</td>
<td>1560</td>
<td>1700</td>
<td>1870</td>
<td>2010</td>
<td>2140</td>
</tr>
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</table>

**VS Compressor Speed**

- 1-2
- 3-4
- 5-6
- 7-8
- 9-10
- 11-12

**ECM Speed Info**

<table>
<thead>
<tr>
<th>Option</th>
</tr>
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<tbody>
<tr>
<td>Blower Only Speed</td>
</tr>
<tr>
<td>Lo Compressor</td>
</tr>
<tr>
<td>Hi Compressor</td>
</tr>
<tr>
<td>Aux Heat</td>
</tr>
</tbody>
</table>

**Setting Blower Speed - Variable Speed ECM**

The ABC board's Yellow Config LED will flash the current ECM blower speed selections for G, low, 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 Aux will not be flashed but can be viewed in the AID Tool. The 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 G only, Low (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 ECM Configuration Mode portion of the Aurora 'Base' Control System section. The Aux cannot be set manually without an AID Tool.

**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 ECM settings. It allows the technician to enter the setup screens to change the ECM settings. Change the highlighted item using the ▲ and ▼ buttons and then press the ▶ button to select the item.

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

**ECM Speed Setup - These screens allow the technician to select the G, low, high, and auxiliary heat blower speed for the ECM blower motor. Change the highlighted item using the ▲ and ▼ buttons. Press the ▶ button to select the speed.**

**Cooling Airflow Setup**

- ECM Only: The airflow will be adjusted by the chosen amount in cooling mode.

Adjustment: -15%

Want To Change?

Yes ▶ Enter ▶

No Option ▶ Enter ▶

Change ▼ Enter ▶

--- ECM Only ---

The airflow will be adjusted by the chosen amount in cooling mode.

Adjustment: -15%
Reference Calculations

<table>
<thead>
<tr>
<th>Heating Calculations:</th>
<th>Cooling Calculations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>( LWT = EWT - \frac{HE}{gpm \times 500} )</td>
<td>( LWT = EWT + \frac{HR}{gpm \times 500} )</td>
</tr>
<tr>
<td>( LAT = EAT + \frac{HC}{cfm \times 1.08} )</td>
<td>( LAT (DB) = EAT (DB) - \frac{SC}{cfm \times 1.08} )</td>
</tr>
<tr>
<td>( TH = HC + HW )</td>
<td>( LC = TC - SC )</td>
</tr>
<tr>
<td>( S/T = \frac{SC}{TC} )</td>
<td></td>
</tr>
</tbody>
</table>

Legend and Notes

Abbreviations and Definitions
- cfm = airflow, cubic feet/minute
- EWT = entering water temperature, Fahrenheit
- gpm = water flow in gallons/minute
- WPD = water pressure drop, psi and feet of water
- EAT = entering air temperature, Fahrenheit (dry bulb/wet bulb)
- HC = air heating capacity, MBtu/h
- TC = total cooling capacity, MBtu/h
- SC = sensible cooling capacity, MBtu/h
- kW = total power unit input, kilowatts
- HR = total heat of rejection, MBtu/h
- HE = total heat of extraction, MBtu/h
- HWC = hot water generator capacity, MBtu/h
- EER = Energy Efficient Ratio
- COP = Coefficient of Performance
- LWT = leaving water temperature, °F
- LAT = leaving air temperature, °F
- TH = total heating capacity, MBtu/h
- LC = latent cooling capacity, MBtu/h
- S/T = sensible to total cooling ratio

Notes to Performance Data Tables
The following notes apply to all performance data tables:
- Performance ratings are based on 80°F DB/67°F WB EAT for cooling and 70°F DB EAT for heating.
- Three flow rates are shown for each unit. The lowest flow rate shown is used for geothermal open loop/well water systems with a minimum of 50°F EWT. The middle flow rate shown is the minimum geothermal closed loop flow rate. The highest flow rate shown is optimum for geothermal closed loop systems and the suggested flow rate for boiler/tower applications.
- The hot water generator numbers are based on a flow rate of 0.4 gpm/ton of rated capacity with an EWT of 90°F.
- Entering water temperatures below 40°F assumes 15% antifreeze solution.
- For non-standard EAT conditions, apply the appropriate Correction Factor tables.
- Interpolation between EWT, gpm, and cfm data is permissible, extrapolation is not.

Operating Limits

<table>
<thead>
<tr>
<th>Operating Limits</th>
<th>Cooling</th>
<th>Heating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Limits</td>
<td>(°F)</td>
<td>(°C)</td>
</tr>
<tr>
<td>Min. Ambient Air</td>
<td>45</td>
<td>7.2</td>
</tr>
<tr>
<td>Rated Ambient Air</td>
<td>80</td>
<td>26.7</td>
</tr>
<tr>
<td>Max. Ambient Air</td>
<td>100</td>
<td>37.8</td>
</tr>
<tr>
<td>Min. Entering Air</td>
<td>50</td>
<td>10.0</td>
</tr>
<tr>
<td>Rated Entering Air db/wb</td>
<td>80.6/66.2</td>
<td>27/19</td>
</tr>
<tr>
<td>Max. Entering Air db/wb</td>
<td>110/83</td>
<td>43/28.3</td>
</tr>
<tr>
<td>Water Limits</td>
<td>(°F)</td>
<td>(°C)</td>
</tr>
<tr>
<td>Min. Entering Water</td>
<td>30</td>
<td>-1.1</td>
</tr>
<tr>
<td>Normal Entering Water</td>
<td>50-110</td>
<td>10-43.3</td>
</tr>
<tr>
<td>Max. Entering Water</td>
<td>120</td>
<td>48.9</td>
</tr>
</tbody>
</table>

**NOTE:** Minimum/maximum limits are only for start-up conditions, and are meant for bringing the space up to occupancy temperature. Units are not designed to operate at the minimum/maximum conditions on a regular basis. The operating limits are 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.
Antifreeze Corrections

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

<table>
<thead>
<tr>
<th>Antifreeze Type</th>
<th>Antifreeze % by wt</th>
<th>Heating 30 [-1.1]</th>
<th>Heating 90 [32.2]</th>
<th>Cooling 30 [-1.1]</th>
<th>Pressure Drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>EWT - °F [°C]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>0</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Ethylene Glycol</td>
<td>10</td>
<td>0.973</td>
<td>0.991</td>
<td>1.075</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>0.943</td>
<td>0.979</td>
<td>1.163</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>0.917</td>
<td>0.965</td>
<td>1.225</td>
<td></td>
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<tr>
<td></td>
<td>40</td>
<td>0.890</td>
<td>0.955</td>
<td>1.324</td>
<td></td>
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<tr>
<td></td>
<td>50</td>
<td>0.865</td>
<td>0.943</td>
<td>1.419</td>
<td></td>
</tr>
<tr>
<td>Propylene Glycol</td>
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<td>0.958</td>
<td>0.981</td>
<td>1.130</td>
<td></td>
</tr>
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<td></td>
<td>20</td>
<td>0.913</td>
<td>0.969</td>
<td>1.270</td>
<td></td>
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<tr>
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<td>30</td>
<td>0.854</td>
<td>0.950</td>
<td>1.433</td>
<td></td>
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<td></td>
<td>40</td>
<td>0.813</td>
<td>0.937</td>
<td>1.614</td>
<td></td>
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<tr>
<td></td>
<td>50</td>
<td>0.770</td>
<td>0.922</td>
<td>1.816</td>
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<td>0.927</td>
<td>0.991</td>
<td>1.242</td>
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<td>0.972</td>
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<td>30</td>
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<td>0.947</td>
<td>1.383</td>
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<td>Methanol</td>
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<td>0.986</td>
<td>1.127</td>
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</tr>
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<td>0.924</td>
<td>0.970</td>
<td>1.197</td>
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</tr>
<tr>
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<td>30</td>
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<td>0.951</td>
<td>1.235</td>
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<td>50</td>
<td>0.833</td>
<td>0.920</td>
<td>1.399</td>
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</tr>
</tbody>
</table>

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

**Antifreeze Correction Example**

Antifreeze solution is Propylene Glycol 20% by weight. Determine the corrected heating and cooling performance at 30°F and 90°F respectively as well as pressure drop at 30°F for Model 036 operating at 100% capacity.

The corrected cooling capacity at 90°F would be: 35,200 MBtu/h x 0.969 = 34,109 MBtu/h

The corrected heating capacity at 30°F would be: 37,400 MBtu/h x 0.913 = 34,146 MBtu/h

The corrected pressure drop at 30°F and 11.5 gpm would be: 7.9 feet of head x 1.270 = 10.03 feet of head
## Pressure Drop

<table>
<thead>
<tr>
<th>Model</th>
<th>gpm</th>
<th>30° F</th>
<th>50° F</th>
<th>70°</th>
<th>90° F</th>
<th>110° F</th>
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<tbody>
<tr>
<td>36</td>
<td>11.5</td>
<td>3.40</td>
<td>3.20</td>
<td>3.00</td>
<td>2.80</td>
<td>2.60</td>
</tr>
<tr>
<td></td>
<td>9.0</td>
<td>2.70</td>
<td>2.60</td>
<td>2.40</td>
<td>2.20</td>
<td>2.10</td>
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<tr>
<td></td>
<td>7.0</td>
<td>1.65</td>
<td>1.55</td>
<td>1.45</td>
<td>1.35</td>
<td>1.25</td>
</tr>
<tr>
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<td>5.5</td>
<td>1.10</td>
<td>1.00</td>
<td>0.90</td>
<td>0.85</td>
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<tr>
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<td>48</td>
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<td>4.40</td>
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<td>3.80</td>
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<td>2.90</td>
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<td>2.30</td>
<td>2.20</td>
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<td>7.5</td>
<td>1.70</td>
<td>1.60</td>
<td>1.50</td>
<td>1.40</td>
<td>1.30</td>
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<td>6.0</td>
<td>1.20</td>
<td>1.10</td>
<td>1.00</td>
<td>0.96</td>
<td>0.91</td>
</tr>
<tr>
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<td>4.0</td>
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<td>0.60</td>
<td>0.58</td>
<td>0.56</td>
</tr>
<tr>
<td>60</td>
<td>17.0</td>
<td>6.40</td>
<td>6.00</td>
<td>5.60</td>
<td>5.20</td>
<td>4.80</td>
</tr>
<tr>
<td></td>
<td>13.5</td>
<td>4.10</td>
<td>3.80</td>
<td>3.60</td>
<td>3.30</td>
<td>3.10</td>
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<td>2.20</td>
<td>2.10</td>
<td>2.00</td>
<td>1.80</td>
<td>1.70</td>
</tr>
<tr>
<td></td>
<td>7.5</td>
<td>1.70</td>
<td>1.60</td>
<td>1.50</td>
<td>1.40</td>
<td>1.30</td>
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<td>0.68</td>
<td>0.62</td>
<td>0.58</td>
<td>0.55</td>
<td>0.53</td>
</tr>
</tbody>
</table>

6/29/12
## Correction Factor Tables

### Air Flow Corrections (Compressor Speeds 1-3)

<table>
<thead>
<tr>
<th>CFM Per Ton of Clg</th>
<th>% of Nominal</th>
<th>Total Cap</th>
<th>Sens Cap</th>
<th>Power</th>
<th>Heat of Rej</th>
<th>Htg Cap</th>
<th>Power</th>
<th>Heat of Ext</th>
</tr>
</thead>
<tbody>
<tr>
<td>240</td>
<td>60</td>
<td>0.940</td>
<td>0.740</td>
<td>0.967</td>
<td>0.951</td>
<td>0.943</td>
<td>1.106</td>
<td>0.902</td>
</tr>
<tr>
<td>275</td>
<td>69</td>
<td>0.950</td>
<td>0.783</td>
<td>0.973</td>
<td>0.959</td>
<td>0.953</td>
<td>1.088</td>
<td>0.918</td>
</tr>
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<td>300</td>
<td>75</td>
<td>0.960</td>
<td>0.827</td>
<td>0.978</td>
<td>0.967</td>
<td>0.962</td>
<td>1.070</td>
<td>0.935</td>
</tr>
<tr>
<td>325</td>
<td>81</td>
<td>0.970</td>
<td>0.870</td>
<td>0.984</td>
<td>0.975</td>
<td>0.972</td>
<td>1.053</td>
<td>0.951</td>
</tr>
<tr>
<td>350</td>
<td>88</td>
<td>0.980</td>
<td>0.913</td>
<td>0.989</td>
<td>0.984</td>
<td>0.981</td>
<td>1.035</td>
<td>0.967</td>
</tr>
<tr>
<td>375</td>
<td>94</td>
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<td>0.957</td>
<td>0.995</td>
<td>0.992</td>
<td>0.991</td>
<td>1.018</td>
<td>0.984</td>
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<td>100</td>
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<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
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### Air Flow Corrections (Compressor Speeds 4-12)

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<th>Power</th>
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### Cooling Capacity Corrections

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

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6/10/09

6/29/12

6/14/12

4/22/12
## Performance Data

### 036 - 50% Part Load

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Performance capacities shown in thousands of BTUh.
### Performance Data cont.

#### 036 - 100% Full Load

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Performance capacities shown in thousands of Btuh.
### Performance Data cont.

#### 048 - 50% Part Load

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*Performance capacities shown in thousands of Btuh.*

---

### SYCAMORE SERIES SPECIFICATION CATALOG

---

---
## Performance Data cont.

### 048 - 100% Full Load

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Performance capacities shown in thousands of Btuh. 7/30/15
### Performance Data cont.

#### 060 - 50% Part Load

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#### 60 - 50% Part Load

- **Flow gpm**: 4.5
- **WPD FT**: 0.48
- **Airflow cfm**: 0.11
- **HEATING - EAT 70°F**: Operation not recommended
- **COOLING - EAT 80/67°F**: Operation not recommended

Performance capacities shown in thousands of Btuh.
## Performance Data cont.

### 060 - 100% Full Load

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**Operation not recommended**
Wiring Schematics

Aurora Variable Speed
Wiring Schematics cont.

Aurora Variable Speed cont.

With optional EA Series 20kW Auxiliary Electric Heat Shown

208-230/60\1
208-230/60\1

Circuit 2

Circuit 1

Connects to variable speed ECM motor only

Place auxiliary heat schematic from kit here

Legend

Factory Low voltage wiring
Drum line wiring wiring
Optional field wiring
DC Voltage PCB trace
Quick connect terminal
Thermal Limit Switch
Field wire lug
Ground

N.O., N.C.

EH - Heater element
PB - Power block

Notes

1 - Switch blue and red wires for 208V operation.
2 - The black and gray wires are removed when Aux Heat is installed
3 - Use manufacturer's part number 19P592-01 (jumper bar assembly) when single source power is required.
4 - Variable speed pump low voltage harness provided with Variable Speed Flow Center.
5 - Low voltage wiring CLASS 2.
6 - Wires provided for Auxiliary Heat low voltage control. Wires are secured at blower.
7 - When Auxiliary Heat is field installed the harness will then be connected to the auxiliary heat unit. The auxiliary heat unit will then power the blower. Refer to EAS/EAM/EAL Auxiliary Heat kit installation instructions.
8 - Brown blower power wire routed through Current Transducer two times.
10 - Communication cable routed through Ferrite shield four times.
11 - Compressor power cable routed through Ferrite shield three times.
12 - Variable speed pump power wires to connect the pump to L1 and L2 on the AXB board are provided with Variable Speed Flow Center.
13 - Field installed SPST relay required for dual fuel installation.
14 - Wiring harness supplied with valve.

97P842-01A
Wiring Schematics cont.

Aurora Variable Speed Drive/EEV Wiring

Danfoss
Variable Speed
Drive

Compressor
Ambient
Entering
Water Temp
EWT
Discharge
Line Temp
S-AUX
S-D
P-O
P-C
RLY-1

EEV 1
MASTER
EEV 2
EXT. FAN
S_AMBIENT
S_AUX
S_D
P_O
P_C
RLY 1

Unit Power
208-230/60/1

Power to
Danfoss
Variable Speed
Drive

Power to
Compressor

(+) (–)
2
1
3
4

5 VDC
OUT
COM
N/A

RS485 EXP
C
R
(–)
(+)

ABC P6
To Aurora Board

AXB™

To AXB Board

EEV CONTROL BOARD

97P842-01B

NOTE 11
Ferrite Toroid

NOTE 10
Ferrite Toroid

Metal Flexible
Conduit

Ferrite Toroid

Ferrite Toroid

Metal Flexible
Conduit

Circuit Breaker

Circuit Breaker
Wiring Schematics cont.

Aurora Variable Speed Drive/EEV Wiring cont.

Legend
- Factory Low voltage wiring
- Factory High voltage wiring
- Field low voltage wiring
- Field high voltage wiring
- Optional block
- 
- Ground
- Wire nut
- Fan
- Light
- Condenser

Danfoss EEV Control

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<td>SW1-5</td>
<td>ON</td>
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<tr>
<td>OFF</td>
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<tr>
<td>OFF</td>
<td>Cycles with DH from ABC board</td>
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ABC SW Accessory Relay

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<td>Cycle with Compressor</td>
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<td>Cycle with Compressor Anti Cold</td>
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Aurora LED Flash Codes

- Normal Mode
- Flash Code 1
- Flash Code 2
- Flash Code 3
- Flash Code 4
- Flash Code 5
- Flash Code 6
- Flash Code 7
- Flash Code 8
- Flash Code 9
- Flash Code 10
- Flash Code 11
- Flash Code 12
- Flash Code 13
- Flash Code 14
- Flash Code 15
- Flash Code 16
- Flash Code 17
- Flash Code 18
- Flash Code 19
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- Flash Code 67
- Flash Code 68
- Flash Code 69
- Flash Code 70
- Flash Code 71
- Flash Code 72
- Flash Code 73
- Flash Code 74
**Engineering Guide Specifications**

**General**
Furnish and install GeoStar 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, downflow, or rear air discharge. Units shall be AHRI/ISO 13256-1 certified and listed by a nationally recognized safety-testing laboratory or agency, such as ETL Testing Laboratory. Each unit shall be computer run-tested at the factory with conditioned water and operation verified to catalog data. Each unit shall be mounted on a pallet and shipped in a corrugated box or stretch-wrapped. The units shall be designed to operate with entering liquid temperature between 20°F and 120°F [-6.7°C and 48.9°C].

**Casing and Cabinet**
The cabinet shall be fabricated from heavy-gauge galvanized steel and finished with corrosion-resistant powder coating. This corrosion protection system shall meet the stringent 1000 hour salt spray test per ASTM B117. The interior shall be insulated with 1/2-inch 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 three compressor compartment access panels shall be “lift-out” removable with supply and return ductwork in place. The front access panel shall be lift-out to provide easy access to the electrical/compressor section. The control box shall be hinged and removable to allow easy access to the compressor. The internal component layout shall provide for service access from the front side for restricted installations.

A duct collar shall be provided on the supply air opening. Standard size 2 in. [5.1 cm] MERV 11 pleated filters shall be provided with each unit. Vertical and horizontal units shall have a return air filter rack/duct collar which is field convertible from 2 in. [5.1 cm] to 1 in. [2.5 cm]. The upflow vertical units shall have a removable insulated divider panel between the air handling section and the compressor section to minimize the transmission of compressor noise and to permit operational service testing without air bypass. Vertical units shall be supplied with left or right horizontal air inlet and top, bottom, or rear 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 drain pan shall be of plastic construction to inhibit corrosion and bacterial growth. Drain outlet shall be located on pan as to allow complete and unobstructed drainage of condensate. The unit as standard will be supplied with solid-state electronic condensate overflow protection. Mechanical float switches WILL NOT be accepted. Vertical units shall be furnished with a PVC slip condensate drain connection and an internal factory installed condensate trap.

**Refrigerant Circuit**
All units shall contain a sealed refrigerant circuit including a hermetic motor-compressor, discharge line muffler, bidirectional electronic expansion valve, finned tube air-to-refrigerant heat exchanger, reversing valve, coxial tube water-to-refrigerant heat exchanger, optional hot water generator coil, and service ports. Compressors shall be high-efficiency variable speed scroll type designed for heat pump duty and mounted on double vibration isolators.

Compressor motors shall be permanent magnet type. The double electro-coated air coil shall be sized for low-face velocity and constructed of patented 11 element lanced aluminum fins bonded to rifled copper tubes in a staggered pattern not less than three rows deep for enhanced performance. All models shall include discharge mufflers to help quiet compressor discharge gas pulsations.

Refrigerant to air heat exchangers shall utilize rifled copper tube construction rated to withstand 600 psig (4135 kPa) refrigerant working pressure. Refrigerant to water heat exchangers shall be of copper (cupronickel optional) inner water tube and steel refrigerant outer tube design, rated to withstand 600 psig (4135 kPa) working refrigerant pressure and 450 psig (3101 kPa) working water pressure. An electronic 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.

All units shall have the source coaxial tube refrigerant-to water heat exchanger and the optional hot water generator coil coated with ThermaShield insulation. Refrigerant suction lines shall be insulated to prevent condensation at low liquid temperatures.

**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 a variable-speed ECM type. The ECM blower motor shall be soft starting, shall maintain constant cfm over its operating static range, and shall provide 12 cfm settings. The blower motor shall be isolated from the housing by rubber grommets. The motor shall be permanently lubricated, have thermostatic overload protection and be long-life ball bearing type.
Engineering Guide Specifications cont.

Electrical
A control box shall be located within the unit compressor compartment and shall contain a 75VA transformer, 24 Volt activated, 2 pole compressor contactor, circuit breakers for protecting loop pumps and compressor drive, removable terminal block for thermostat wiring, variable speed compressor drive 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 communicating type and provide heating or cooling as required by the remote thermostat/sensor. An Aurora Advanced VS Control, a microprocessor based controller, interfaces with a digital communicating thermostat to monitor and control unit operation shall be provided. The control shall provide operational sequencing, blower speed control, blower failure, high and low pressure switch monitoring, freeze detection, hot water limit thermistor sensing, condensate overflow sensing, auxiliary heat staging, lockout mode control, hot water and loop pump control, LED status and fault indicators, fault memory, field selectable options, compressor envelope management, energy consumption measurement, and accessory output. The fault signals shall be plain English text and displayed on the thermostat.

The Aurora Advanced VS Control shall also feature an On Peak input signal for utility controlled demand programs, intelligent hot water generation with user adjustable temperature limit, loop pump slaving for multiple units driving a common flow center and up to two optional home automation inputs to drive dedicated alarms for sump pump, security system, and smoke/CO2 or dirty air filter sensors. As standard, the energy and refrigerant monitoring kits will provide real time data including total power consumption, refrigerant superheat and subcooling. Optional performance monitoring kit to provide real time data including, entering and leaving water temperature, flow rate and heat of extraction/rejection capacity data. The capability for communicating to advanced zoning packages with up to six zones shall also be provided with complete fault and information display on the zoning MasterStat.

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.

An optional Aurora Interface Diagnostic (AID) Tool shall communicate with the Aurora control allowing quick and easy access to setup, monitoring, and troubleshooting of any Aurora control. The device shall include the features of ECM airflow setup, VS pump and modulating water valve setup, fault description and history, manual operation capability, sensor readings, timings, and other diagnostic tools.

Piping
Supply and return water connections shall be 1 in. [25.4 mm] FPT brass swivel fittings, which provide a union and eliminate the need for pipe wrenches and sealants when making field connections. The optional hot water generator shall have sweat type connections. All source water piping shall be insulated to prevent condensation at low liquid temperatures. On the vertical units, the condensate connection shall be a 3/4 in. [19.1 mm] PVC socket with internally-trapped hose that can be routed to front or side locations.

Hanger Kit
(field-installed horizontal units only)
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- inch threaded rods. All unit size shall include six brackets hanging brackets.

Options and Accessories
Cupronickel Heat Exchanger
An optional cupronickel water-to-refrigerant heat exchanger shall be provided.

Hot Water Generator
An optional ThermaShield coated heat reclaiming hot water generator coil of vented double-wall copper construction suitable for potable water shall be provided. The coil and hot water circulating pump shall be factory mounted inside the unit with integral electronic high limit temperature monitoring and external on/off switch. Hot water set point is selectable through the AID Tool.

Thermostat (field-installed)
A communicating auto-changeover electronic digital thermostat shall be provided. The thermostat shall offer variable speed heating and cooling staging with precise temperature control. An OFF-HEAT-AUTO-COOL-EMERG system switch, OFF-AUTO-INTERMITTENT blower switch, and indicating display shall be provided. The thermostat shall display in °F or °C. The thermostat shall provide real time energy consumption data of the unit.

Color Touchscreen Thermostat (field-installed)
A color touchscreen communicating auto-changeover electronic digital thermostat shall be provided. The thermostat shall offer variable speed heating and cooling staging with precise temperature control. An OFF-HEAT-AUTO-COOL-EMERG system switch, OFF-AUTO-INTERMITTENT blower switch, and indicating display shall be provided. The thermostat shall display in °F or °C. The thermostat shall provide real time and historical energy consumption data of the unit.
Engineering Guide Specifications cont.

Electronic Air Cleaner (field-installed)
A 1 in. [25 mm] electronic air cleaner, cleanable 97% efficiency at 0.3 microns and larger, shall be provided in lieu of the standard throwaway filter. The initial pressure drop across the filter shall not exceed 0.2 in. w.g. at 300 fpm force velocity.

Electrostatic Air Cleaner (field-installed)
A 1 in. [25 mm] electrostatic air cleaner, cleanable 90% efficiency, shall be provided in lieu of the standard throwaway filter. The initial pressure drop across the filter shall not exceed 0.15 in. w.g. at 300 fpm force velocity.

AlpinePure MERV 13 Filter
A 2 in. [50 mm] thick MERV 13 filter shall be provided in lieu of the standard filter and fits the factory filter rack. The filter maintains MERV 13 rating in full ASHRAE 52.2 independent testing as required for LEED® certification. Helps fulfill a full credit under the LEED rating system.

AlpinePure Drain Pan Treatment
Provides dependable, sustained time-release protection from slime build-up and foul smelling odors in the drain pan. Also adds a light, pleasant scent to the air.

Earth Loop Flow Center (field-installed)
A self-contained module shall provide all liquid flow, fill and connection requirements for ground source closed loop systems up to 20 gpm. The pumps shall be wired to a power block located in the nearest unit. The heat pump units shall contain low voltage pump slaving control so that two units may share one flow center.

Auxiliary Heater (field-installed)
An electric resistance heater shall provide supplemental and/or emergency heating capability. Vertical units shall have the control panel and resistance heater coil assembly mounted internally. For horizontal units, the control panel shall be mounted internally while the resistance heater coil assembly shall be mounted externally. A low voltage plug shall be provided in each unit for quick auxiliary heat connection. The heater shall operate in sequenced stages as controlled by the unit’s microprocessor. The heater shall feed line voltage power to the unit blower and transformer to provide emergency heat capability in the event of an open compressor circuit breaker.
# Revision Guide

<table>
<thead>
<tr>
<th>Pages:</th>
<th>Description:</th>
<th>Date:</th>
<th>By:</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Misc. Updates</td>
<td>04 Jan 2017</td>
<td>MA</td>
</tr>
<tr>
<td>All</td>
<td>Misc Updates, Performance Data Updated</td>
<td>12 Aug 2016</td>
<td>MA</td>
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<tr>
<td>All</td>
<td>Various Updates for Electric Heating Change</td>
<td>23 April 2014</td>
<td>MA</td>
</tr>
<tr>
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<td>01 Jul 2013</td>
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</table>