



## Specification Catalog

### **7 Series** **700R11**

Indoor Split Geothermal Heat Pump  
033, 042, 050 ton Variable Speed



## Table of Contents

---

Model Nomenclature. . . . .	5
AHRI/ISO 13256-1 Performance Ratings . . . . .	6
7 Series 700R11 Design Features . . . . .	8
The Aurora™ Advanced VS Control System . . . . .	15
Operation Logic . . . . .	26
SVH Blower Performance Data . . . . .	27
Line Set Sizes . . . . .	28
SVH Controls. . . . .	29
Water Quality . . . . .	31
Dimensional Data . . . . .	32
Physical Data . . . . .	35
Electrical Data . . . . .	36
Reference Calculations . . . . .	37
Legend and Notes . . . . .	37
Operating Limits . . . . .	37
Pressure Drop/Thermistor Resistance . . . . .	38
Antifreeze Corrections . . . . .	38
Correction Factor Tables . . . . .	39
Performance Data . . . . .	40
Wiring Schematics . . . . .	46
Engineering Guide Specifications . . . . .	63
Revision Guide . . . . .	65

# 7 Series

## 700R11 Indoor Split Geothermal Heat Pump With Variable Speed Compressor Technology

The WaterFurnace 7 Series Indoor Split continues our level of innovation and performance in variable speed compressor technology. We have used all the great features and benefits first developed in 2012 with the launch of the 7 Series water to air package and incorporated them into a split system for flexibility in a variety of applications. Featuring the highest efficiencies for an indoor geothermal split system (Over 40 EER and 5.2 COP ISO/AHRH13256-1 GLHP) available in AHRI. The 7 Series Split will feature matched compressor and air handler module in 3 variable speed capacity sizes (033, 042 and 050) with Danfoss Variable Speed Compressors. This system features high efficiency permanent magnet compressors coupled with high efficiency electronic drives to allow capacity variation between 20 and 100%. These 7 Series Indoor Split units utilize ozone-safe R-410A refrigerant to meet the most stringent EPA requirements. 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. The multi position air handler module includes 1" foil lined insulation as well as two composite condensate pans.



The 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. Aurora Weblink (AWL) allows remote access to the thermostat via WiFi to the internet or smartphone as well as remote monitoring of the heat pump and receives lockout/fault info via text or email. A swing-out control box provides serviceability. Air handler configurations include top, bottom, horizontal left and right return discharge (field configurable air discharge). Heavy-gauge metal cabinets are fully insulated and coated with an attractive and durable gray paint for long lasting protection. The cabinet's rounded front corners, charcoal wave styling element, and 7 Series nameplate add a touch of elegance to the unit.

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

As a leader in the industry, WaterFurnace is 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 and is then 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.



WaterFurnace International's corporate headquarters and ISO 9001:2015 certified manufacturing facility are both located in Fort Wayne, IN. A scenic three-acre pond located in front of the building serves as our geothermal heating and cooling source to comfort-condition our 110,000 square feet of manufacturing and office space. As a pioneer, and now a leader in the industry, the team of WaterFurnace engineers, customer support staff, and skilled assembly technicians is dedicated to providing the finest comfort systems available.

By choosing or specifying WaterFurnace 7 Series products, you can be assured that your customer is investing in the ultimate comfort system and peace of mind for many years to come.



## Unit Nomenclature (Compressor Section)

	1	2	3	4-6	7	8	9	10	11	12	13	14	15	16	
	N	V	Z	042	*	1	1	0	C	N	N	0	K	N	
Model															Future Option
N – 7 Series															N – None
Compressor															Controls
V – Variable Speed															K – Aurora Variable Speed Control w/ Full Monitoring
Cabinet Configuration															M – Aurora Variable Speed Control w/ Full Monitoring and UPC <sup>1</sup>
Z – Indoor Split															
Unit Capacity <sup>2</sup>															Future Options
033, 042, 050															0 – None
Vintage															Future Options
* – Factory Use Only															N – None
Voltage															Future Options
1 – 208-230/60/1															N – None
Hot Water Generation															Water Coax Option
0 – None															C – Copper
1 – Hot Water Generation with Factory Installed Pump															N – CuproNickel

**Notes:**

<sup>1</sup> UPC is not compatible with Symphony or IntelliZone2

<sup>2</sup> Compressor section must be matched with identical model SVH air handler section. See Compatibility Table.

Rev.: 4/2/20

## Unit Nomenclature (Air Handler)

	1-3	4-6	7	8-9	10	11	12	13	14	15	16	
	SVH	042	*	00	2	C	R	1	S	1	1	
Model											Build	
SVH – Series Air Handler											1 – WF	
Unit Capacity <sup>2</sup>											Position	
Refrigeration (DX)											1 – Multi-position <sup>3</sup>	
033 MBTUH											Options	
042 MBTUH											S – Standard	
050 MBTUH <sup>1</sup>											U – UPC <sup>4</sup>	
Vintage											Voltage	
* = Factory Use Only											1-208-230/60/1	
Electric Heat											Air Coil	
00 – None											R – Refrigerant	
10 – 10kW (033 – 050 only) No Breakers											Controls/ Motor	
15 – 15kW (042 – 050 only) with Breakers											C – Aurora AHB/ Variable Speed ECM	
20 – 20kW (050 only) with Breakers											Expansion Valve	
											2 – EEV	

**Notes:**

<sup>1</sup> Air flow on the 050 unit in the horizontal configurations should be limited to 1900 cfm in cooling mode, or condensate blow off may occur.

<sup>2</sup> Compressor section must be matched with identical model SVH air handler section. See Compatibility Table

<sup>3</sup> To field convert the SVH to bottomflow air discharge. The SAHBCK kit must be ordered separately.

<sup>4</sup> UPC is not compatible with Symphony or IntelliZone2.

Rev.: 4/2/20

## AHRI/ISO 13256-1 Performance Ratings

### 7 Series Indoor Split Residential Series AHRI Data

ECM Motor

AHRI/ASHRAE/ISO 13256-1

Model	Capacity Modulation	Flow Rate Clg/Htg	Water Loop Heat Pump				Ground Water Heat Pump				Ground Loop Heat Pump			
			Cooling EWT 86°F		Heating EWT 68°F		Cooling EWT 59°F		Heating EWT 50°F		Cooling Full Load 77°F Part Load 68°F		Heating Full Load 32°F Part Load 41°F	
		cfm	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP
033	Full	1200/1500	31,600	16.8	49,800	5.2	37,000	29.2	40,700	4.5	33,300	20.3	31,700	3.4
	Part	650/800	10,900	20.9	16,800	7.3	12,900	46.0	13,900	5.7	13,700	36.0	12,000	5.2
042	Full	1500/1800	39,500	16.4	66,100	4.9	46,200	28.2	54,100	4.2	41,600	19.7	42,700	3.5
	Part	900/1100	15,600	22.4	23,800	7.5	17,300	52.0	18,800	5.8	17,500	40.8	15,800	5.1
050	Full	1800/2200	46,700	14.4	77,800	4.3	55,200	24.3	64,900	3.8	49,800	17.1	50,800	3.2
	Part	950/1200	19,400	20.9	28,900	7.4	21,200	45.6	22,800	5.8	22,000	35.5	19,800	5.0

Cooling capacities based upon 80.6°F DB, 66.2°F WB entering air temperature

3/20/20

Heating capacities based upon 68°F DB, 59°F WB entering air temperature

All ratings based upon 208V operation

### Energy Star Compliance Table

Model	Tier 3	
	Ground Water	Ground Loop
033	Yes	Yes
042	Yes	Yes
050	Yes	Yes

10/31/19

#### 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 Star rated.

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

Water-to-Air	EER	COP
Ground Loop	17.1	3.6
Ground Water	21.1	4.1
Water-to-Water		
Ground Loop	16.1	3.1
Ground Water	20.1	3.5



## 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

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

**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:

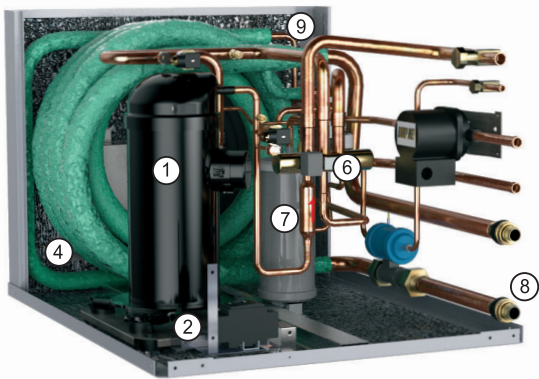
Airflow (lps) = cfm x 0.472;

ESP (Pascals) = ESP (in wg) x 249;

WaterFlow (lps) = gpm x 0.0631;

Press Drop (Pascals) = Press Drop (ft hd) x 2990

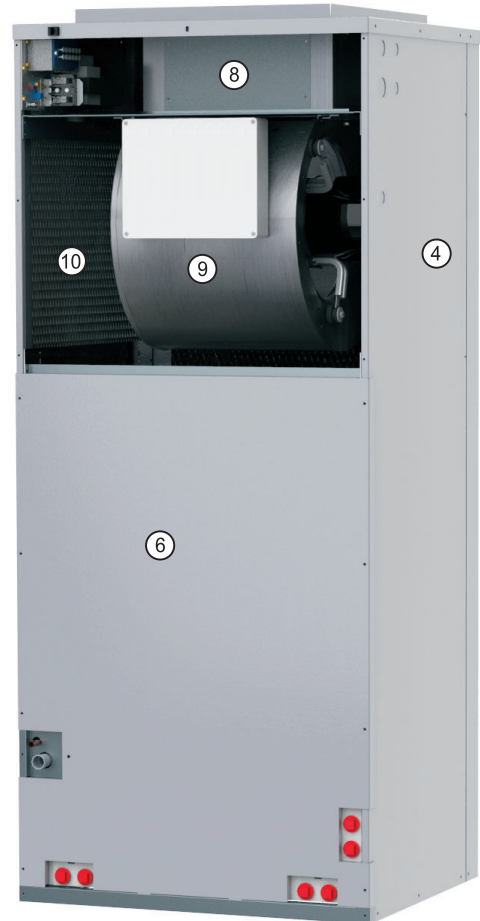
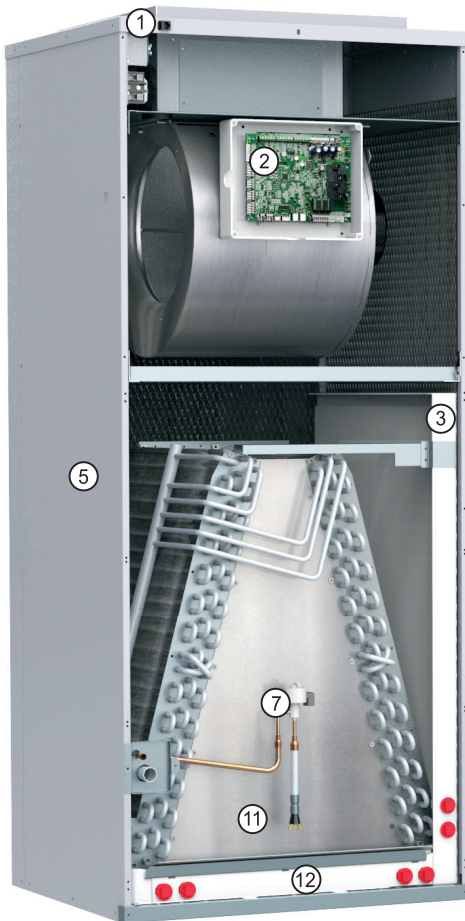
## 7 Series 700R11 Design Features



- 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 electronic expansion valve provides the ultimate in accurate control for the highest efficiency at any condition
- ⑦ **OIL SEPARATOR:** Provides exceptional long term compressor reliability
- ⑧ **SWIVEL LOOP CONNECTIONS:** Leak free swivel water connections provide a hand tight gasket connection that easily handles the temperature extremes of geothermal earth loops
- ⑨ **INSULATION:** Cleanable foil lined insulation to prevent mold growth
- ⑩ **CABINET FINISH:** Heavy gauge galvanized sheet metal cabinet has 1,000 hr. salt spray rated gray powder coat paint for long life
- ⑪ **ACCESS PANELS:** All access panels are lift out type for easier removal and servicing
- ⑫ **HINGED CONTROL BOX:** Hinged removable control box for ease of accessibility and serviceability
- ⑬ **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



## 7 Series 700R11 Design Features Cont.



- ① **AID TOOL PORT:** AID Tool port provides quick AID Tool connection with compressor section with field installed cable provided with air handler.
- ② **AURORA AHB** The AHB is the air handler control module which communicates information with the other modules of the Aurora Advanced control system
- ③ **FIELD SWITCHABLE DESIGN:** Horizontal left, right vertical and bottomflow capable.
- ④ **ONE CABINET SIZE:** 033, 042, 050 all in one size cabinet
- ⑤ **CABINET FINISH:** Heavy gauge galvanized sheet metal cabinet has 1,000 hr. salt spray rated gray powder coat paint for long life
- ⑥ **ACCESS PANELS:** Lift out panels for easier removal and servicing
- ⑦ **ELECTRONIC EXPANSION VALVE:** High efficiency electronic expansion valve provides the ultimate in accurate control for the highest efficiency at any condition
- ⑧ **FACTORY INSTALLED ELECTRIC HEAT:** Internal electric heat with circuit breakers on 15kw and 20kw models.
- ⑨ **ECM BLOWER MOTOR:** High efficiency and ultra-flexible ECM blower motors provide ultra-quiet operation
- ⑩ **FOIL LINED INSULATION:** Cleanable 1" insulation
- ⑪ **ALL ALUMINUM "A" AIR COIL:** Provides long term reliability
- ⑫ **COMPOSITE DRAIN PAN:** Vertical and horizontal drain pan with primary and secondary connections.

## 7 Series 700R11 Design Features Cont.

### Introducing the 7 Series Split System

- Highest AHRI/ISO 13256-1 Ratings.
  - Over 40 EER and 5.2 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.
- **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 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 extra 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 or Symphony Contractor Connect Smart App provide advanced service diagnostics. This allows 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 7 Series Unit.
  - The 7 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, selected thermostats or thru AWL.
  - Performance Monitoring - With this standard factory installed sensor kit, the Aurora controls can measure actual capacity and performance of the heat pump. The information can be displayed on AID Tool or thru AWL.
  - Advanced communication to the VS drive with faults, electrical, and operational information for quick diagnosis.
  - Aurora can be internet capable simply by adding the Aurora WebLink (AWL). This device will connect your Aurora system to web for remote monitoring and control. It also comes standard with an SD disc drive for storing operating and performance data. Providing 'black box' capability.
- **Communicating Digital Thermostats** - The Aurora controls system features either mono-chromatic or color touch screen graphic display thermostats for user interface with the 7 Series system. These displays not only feature easy to use graphical interface but display alerts and faults in plain English.

## 7 Series 700R11 Design Features Cont.

- **Cabinet Design** – Lift out access panels and hinged control box for ease of service.
- **Cupronickel Heat Exchanger**
- **Unitary Protocol Converter (UPC)** for integration with Home Automation Systems (HAS)

### 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)
- Narrow cabinet for easy movement through doorways
- 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)
- Field convertible, 4-position design (top, bottom, horizontal right and left discharge).

### 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
- Efficient variable speed scroll compressors operate quietly
- Oversized coaxial tube water-to-refrigerant heat exchanger operates at low liquid pressure drops
- Convulsed copper water tube functions efficiently at low flow rates
- Utilizes the ozone-friendly R-410A refrigerant which produces higher efficiencies and warmer discharge air temperatures

### Service Advantages

- Hinged/removable control box for added serviceability
- Removable panels: three for the compressor section to provide quick access to all internal components.
- Easily accessible electronic expansion valve
- 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
- 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 has quick-attach wiring plugs for easy removal
- High and low pressure service ports in refrigerant circuit
- High and low pressure sensors as well as discharge, suction, heating/cooling liquid lines, EWT and LWT temperature sensors for ease of service via the AID Tool
- View subcooling and superheat on the AID Tool
- Energy monitoring is standard on the 7 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 with the factory installed Performance option.

### 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
- Noise reduction features include double isolation mounted compressors and soft starting variable speed compressors; 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, 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

### 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
- Hot water limit prevents scalding, and pump shuts down automatically when full unit capacity is needed for heating
- Communication capability for future expansions

## 7 Series 700R11 Design Features Cont.

### 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.
- **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.
- **Aurora WebLink (AWL)** - The Aurora Control System can be made internet capable simply by adding the Aurora WebLink (AWL) device. The AWL will connect your Aurora system to the web for remote monitoring and control. It also comes standard with an SD disc for storing operating and performance data providing true 'black box' capability for troubleshooting.
- **Optional Cupronickel Heat Exchangers** - for open loop applications.
- **Optional Hot Water Generator** - with internally mounted pump and water heater plumbing connector.
- **Closed Loop Variable Speed Flow Center**
- **Closed Loop Variable Speed Non-Pressurized Flow Center**
- **Open Loop Modulating Water Valve**
- **Hose Kits**
- **Additional Accessory Relay**
- **Aurora UPC** for DDC applications for connection to HAS using BACnet protocol
- **Aurora Touch Interface** used with Aurora UPC provides ability to configure and diagnose equipment

### 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
- WaterFurnace International, Inc. is an ISO 9001:2015 certified manufacturing facility
- WaterFurnace International, Inc. engineering labs are ISO 17025 accredited

## 7 Series 700R11 Design Features Cont.

### Air Coil

Designed for R-410A refrigerant. Configured as an 'A' coil, aluminum tubes and enhanced corrugated lanced aluminum fins to provide high efficiencies at low face velocities.

### Cabinet

Constructed of heavy gauge environmentally-responsible galvanized steel for maximum corrosion resistance. All units are painted with a powder coat finish. All interior surfaces are lined with 1" thick, foil lined acoustic type fiber insulation, applied in a manner that prevents the introduction of glass fibers into the air stream. Multiple knockouts in various sizes facilitate power and low voltage wiring. Multiple access panels for ease of service.

### Factory Sealed

Achieves 2% or less total airflow leakage rate.

### Installation Ease

Cabinets are shipped in one piece but can be separated for ease of installation in tight spaces.

### Auxiliary/ Emergency Electric Heat

Electric heat packages can be factory or field installed. For field installed electric heat the Auxiliary Heat Compatibility table shows the available heater packages for the air handler.

### Configurations

Cabinets are factory configured for upflow and horizontal right hand air discharge installation but can be easily configured for horizontal left hand or bottomflow air discharge.

### Drain Pans

Two composite drain pans included. One for vertical and one for horizontal applications. The pans come equipped with primary and secondary drain connections.

### Electrical Disconnect

Factory installed circuit breaker on 15kW/20kW heaters.

### Expansion Device

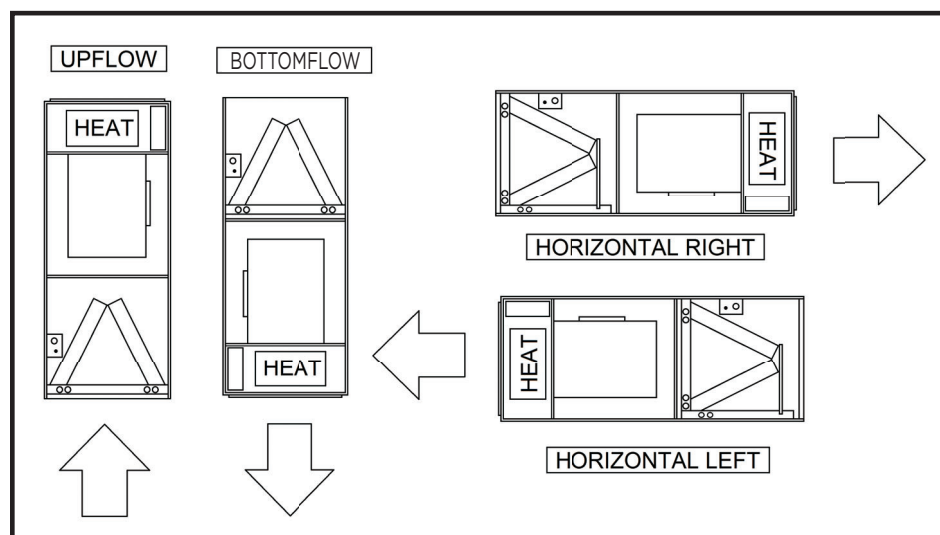
Factory installed EEV inside of cabinet.

### Refrigerant Connections

Suction and liquid lines have sweat connections extended outside of cabinet for ease of connection.

### Controls

The AHB is part of the Aurora controls platform and communicates via modbus to the ABC. The AHB board controls the air handler's variable speed motor, EEV auxiliary heat staging, provides condensate overflow protection, air coil freeze detection FP2, auxiliary heat and blower energy monitoring, and is Symphony compatible.



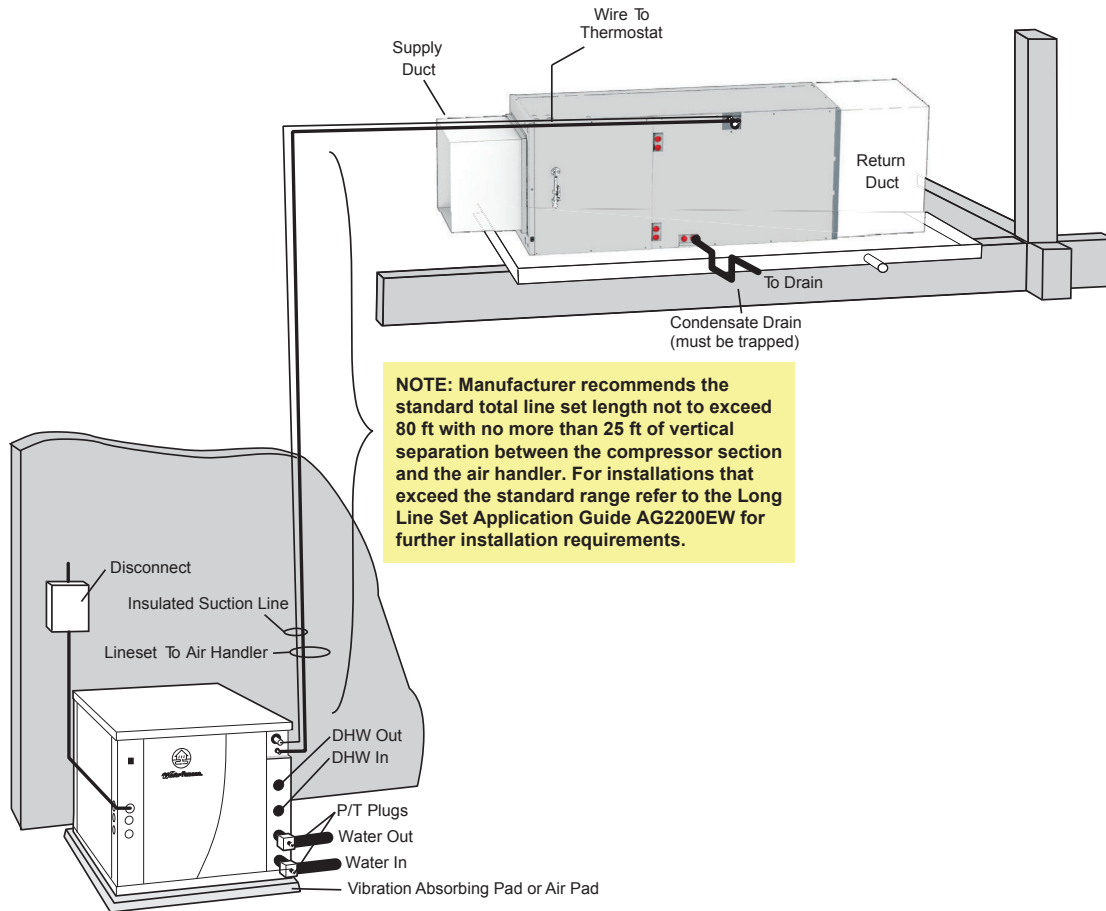
### TYPICAL INSTALLATION

**Note:** Air flow on the 050 unit in the horizontal configuration should be limited to 1900 CFM in cooling mode, or condensate blow off may occur.



## 7 Series 700R11 Design Features Cont.

### Typical Split System Application with Remote Blower Coil



### Refrigerant Piping Limits

The maximum refrigerant total line set length should not exceed 80 feet. The maximum vertical separation between the compressor section and air handler should not exceed 25 feet. As an example; if vertical separation is 25 feet then the rest of the line set can't exceed 55 feet in length,  $25' + 55' = 80'$ . Friction loss of copper elbows or bends should be included in the calculation of the total line set length.

**NOTE:** Manufacturer recommends the standard total line set length not to exceed 80 ft with no more than 25 ft of vertical separation between the compressor section and the air handler. For installations that exceed the standard range refer to the Long Line Set Application Guide AG2200EW for further installation requirements.

Longer line sets require more refrigerant that must be managed throughout the entire operating range of the application. Excess refrigerant in the compressor at start up, or condensed liquid refrigerant in the suction line at start up must be avoided for compressor reliability. Proper line set sizing is crucial for controlling oil return to the compressor and minimizing capacity losses. See Line Set Size table

in this manual or Symphony Contractor Connect phone app for proper sizing. The liquid line should be no larger than 3/8" in diameter. Pressure drop in the suction line will increase power consumption and reduce system capacity. A commonly accepted value for the suction line in R-410A systems is 5PSI pressure drop.

The use of long radius elbows can reduce the equivalent length of a line and thus reduce the friction loss. A factory installed filter drier is in the compressor section, do not add a drier or filter in series with the factory installed drier as the added pressure drop may cause "flashing" of liquid refrigerant.

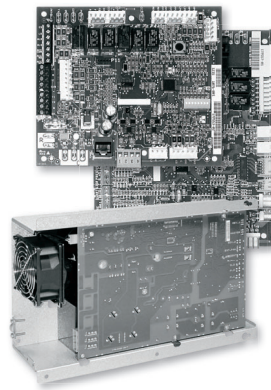
### Tube Bend/Fitting Losses in Equivalent Feet

Tube Size O.D. (in)	90° Standard Radius	90° Long Radius	45° Standard Radius
3/8	1.3	0.8	0.3
1/2	1.4	0.9	0.4
5/8	1.5	1.0	0.5
3/4	1.9	1.3	0.6
7/8	2.3	1.5	0.7
1-1/8	2.7	1.8	0.9

# 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), the Aurora Expansion Board (AXB), the Aurora Air Handler Board (AHB) and optional Unitary Protocol Converter (UPC). 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.




The SVH Air Handler with the 'Advanced' control option expands on the capability of the Aurora 'Advanced' Control (ABC and AXB) in the compressor section, by adding the AHB board in the air handler. The AHB features electric heat staging, energy monitoring, temperature and pressure inputs, ECM control, condensate overflow and freeze detection. The AHB also features, an AID Tool port, 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 AHB also offers another communication connection point for IntelliZone2.

Aurora Control Features	Description	Aurora Advanced VS
<b>Advanced Microprocessor Features</b>	Smart Grid, Home Automation Alarm Inputs, and Accessory2 Relay (HRV/ERV)	•
<b>Advanced Hot Water Generator Control</b>	Microprocessor and separate power relay for Hot Water Generator Pump with digital temperature monitoring and multiple HWG setpoint selection.	•
<b>Advanced Speed Pump Control</b>	Microprocessor and separate power relay for loop pump and inline circuit breakers and loop pump slaving.	•
<b>Variable Speed Pump</b>	Capable of setup, monitoring and controlling a variable speed flow center.	•
<b>Active Dehumidification</b>	Coil temperature is monitored and air flow is reduced for maximum latent moisture removal.	7 Series Variable Speed Only
<b>SuperBoost</b>	Allow the variable speed compressor to ramp up extra 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.	•
<b>Smart Grid/Utility Input</b>	Allows simple input to externally enable of occupied/unoccupied mode for basic utility time of use programs.	Dry Contact x1
<b>Home Automation Alarm Input</b>	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.	Dry Contact x2
<b>HAN/Smart Grid Com (AWL and Portal) Kit</b>	Allows direct communication of the Aurora to Smart Meters, Home Automation Network and Internet.	Optional AWL
<b>IntelliZone2® Compatibility</b>	IntelliZone2 communicates to the heat pump via the AXB board. IntelliZone requires traditional thermostat inputs and is not compatible with the 7 Series.	Optional IntelliZone2

Service Device	Description	Aurora Advanced VS
 <p><b>Aurora Interface and Diagnostics (AID) Tool</b></p>	<p>Allows setup, monitoring and troubleshooting of any Aurora Control.</p> <p><b>NOTE:</b> 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.</p>	<p>For Service (Ver. 2.10 or greater)</p>

## The Aurora Advanced VS Control System cont.

Add On Control Feature Kits (field or factory installed)	Description	Aurora Advanced VS
<b>Geo Energy Monitoring Kit</b>	Monitors real time power consumption of compressor, blower, aux heat and pump. Requires thermostat TPCM32U04A or TPCC32U01.	Standard
<b>Refrigeration Monitoring Kit</b>	Monitors real time pressures, temperatures, superheat, and subcooling.	Standard
<b>Performance Monitoring Kit</b>	Monitors air and water temperatures, and water flow rate and calculates heat of extraction/rejection.	Standard
<b>Data Logging (AWL) Kit</b>	Allows data logging of up to 12 months. Can also be temporarily installed.	Optional
<b>HAN/Smart Grid Com (AWL and Portal) Kit</b>	Allows direct communication of the Aurora to Smart Meters, HAN, and internet.	Optional

Add On Thermostats and Zoning	Description	Aurora Advanced VS
 <b>TPCM32U04A - MonoChrome Communicating Thermostat</b>	Elite Stat with full English fault codes and alerts, communicating thermostat; Required for viewing Energy Monitoring. Monochrome thermostat allows instantaneous energy measurement only. Compatible with AWL, not compatible with IntelliZone2.	Optional
 <b>TPCC32U01 - Color Touchscreen Communicating Thermostat</b>	4.3 in. color touchscreen communicating thermostat with full English fault codes and alerts; Required for viewing Energy Monitoring. Color thermostat allows instantaneous and 13 month history. Compatible with AWL.	Optional
 <b>IntelliZone2 Zoning</b>	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 4 thermostat options (MasterStat, SensorStat, ZoneStat and SensorStat-Remote). Compatible with AWL. IntelliZone2 is not compatible with UPC controls.	Optional

**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 SPL

- 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
- AWL compatible
- Accessory output with N.O. and N.C.
- Modbus communication

#### 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.

#### 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.

## The Aurora Advanced VS Control System cont.

### 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. Not compatible with UPC control option.

### Electronic Expansion Valve (EEV)

The electronic expansion valve is operated by the AXB board in the compressor section, and AHB board in the air handler, and is set to maintain optimal superheat setting for maximum efficiency. All operation parameters are communicated to the VS drive and the Aurora system.

### AWL - Aurora WebLink (Optional Accessory)

AWL is an add-on WiFi router that connects to the ABC and offers many features:

- Remote access to thermostat settings, schedules, etc. with your smartphone, tablet or laptop.
- Receive Lockout/Fault info via text or email.
- View heat pump energy usage from the internet for the day, week, month, year or real-time.
- Internet AID Tool capability allows remote troubleshooting for the technician.
- Remote AID Tool capability at the heat pump with smartphone, tablet or laptop for the technician.
- Allows data acquisition of the heat pump through the internet, see graphs of performance and chart historical data for the technician.
- Stores historical data on SD card.
- Not compatible with UPC control option

### 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. Variable speed pump flow centers are recommended for use over fixed speed pumps with the 7 Series so the water flow is adjusted along with the compressor speed. Using fixed speed pumps with the 7 Series will cost considerably more to operate than variable speed pumps and may cause system faults because the flow isn't being adjusted as it needs in certain operating conditions.

### 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. It is recommended to set the minimum no lower than 65% when using the modulating water valve.

### 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

AXB 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 5 and 7 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

## The Aurora Advanced VS Control System cont.

### 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

### Monitoring Sensor Kits

#### Energy Monitoring

*(Standard on all 7 Series units)*

The Energy Monitoring Kit includes two current transducers (blower and electric heat on AHB board). The variable speed drive measures compressor drive power 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 TPCM32U04A will display instantaneous energy use while the color touchscreen TPCC32U01 will, in addition, display a 13 month history in graph form.

#### Refrigerant Monitoring

*(Standard on all 7 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

*(Standard on all 7 Series units)*

The 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 7 Series allows the user to select 'SuperBoost' mode on the thermostat which will allow the 7 Series VS to ramp up extra 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.



## 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 = 15°F.
- 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)  
**and 2-5**

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

- 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 7 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 7 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.

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

### 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, additional stage of emergency heat will stage on after 2 minutes. When the W input is removed, all of the emergency heat outputs will turn off, and the variable speed ECM blower will shift to low speed.

**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.

## The Aurora Advanced VS Control System cont.

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

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

**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.

**NOTE:** The AID Tool is required when installing and servicing the 7 Series Indoor Split and Air Handler.

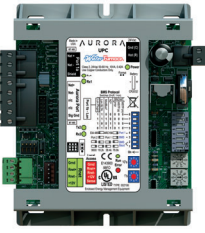
#### Status LED (LED3, Green)





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

#### Configuration LED (LED2, Yellow)

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

## The Aurora Advanced VS Control System cont.

<p><b>Aurora Control w/UPC BACnet</b></p> 	<p>The Aurora Unitary Protocol Converter (UPC) is an integrated solution and communicates directly with the Aurora Heat Pump Controls and allows access/control of a variety of internal Aurora Heat pump operations such as sensors, relay operation, faults and other information. In turn, the UPC then converts internal Aurora Modbus protocol to BACnet MS/TP protocol and communicates to the HAS system. This provides the great benefit of complete control integration and a myriad of information available to the HAS from the heat pump control. Plus it also allows individual unit configuration such as ECM fan speeds or freeze protection setting directly over the HAS without the need for access to the actual heat pump.</p>	<p>The Aurora UPC is implemented with the Aurora Base Controller (ABC) heat pump control into our latest water source heat pumps. All internal Aurora points are accessible to the UPC via firmware providing an integrated solution. All zone temperatures and zone sensors are connected to the UPC on an RNet bus, simplifying hook up at the unit. RNet sensors can include a combination of zone temperature and humidity, CO2, and VOC sensors. The UPC includes built-in support for a custom configurable keypad/display unit.</p>	<p>Optional Equipment Touch Cable kit</p>	<p>BACnet MS/TP</p>
---	--	--	---	---------------------

UPC Sensors & Thermostats	Description	Aurora 'Base'	Aurora 'Base'	Aurora 'Advanced'
<p><b>ZS Standard</b></p> 	<p>Local access port /No user control</p>	<p>Optional</p>	<p>Optional</p>	<p>Optional</p>
<p><b>ZS Plus</b></p> 	<p>Local access port/Slide potentiometer to make the zone warmer or cooler /Control button to override the schedule and put the zone in an occupied state, or force the zone to an unoccupied state/Green LED to Indicate occupied state.</p>	<p>Optional</p>	<p>Optional</p>	<p>Optional</p>
<p><b>ZS Pro</b></p> 	<p>Local access port/LED display/Control button to override the schedule and put the zone in an occupied state, or force the zone to an unoccupied state/Arrow UP and DOWN buttons to change any editable property, such as the setpoint temperature/button to cycle through information defined in the control program/Green LED to Indicate occupied state.</p>	<p>Optional</p>	<p>Optional</p>	<p>Optional</p>
<p><b>ZS Pro-F</b></p> 	<p>Local access port/LED display/Control button to override the schedule and put the zone in an occupied state, or force the zone to an unoccupied state/Arrow UP and DOWN buttons to change any editable property, such as the setpoint temperature/button to cycle through information defined in the control program/Green LED to Indicate occupied state/Mode button to turn on heating, cooling, or fan only, or to set auto control/ Fan button to adjust fan speed/ F/C button to set temperature to Fahrenheit of Celsius</p>	<p>Optional</p>	<p>Optional</p>	<p>Optional</p>

**NOTE:** A ZS type sensor/thermostat is necessary for compatibility with UPC.

### Aurora UPC

An optional Aurora UPC for DDC applications communicates directly with the entire Aurora system and provides DDC protocol of BACnet MS/TP for connection to the HAS providing a wide variety of points covering configurations, sensors, airflow and freeze protection. For more information on the Aurora UPC, please consult the Aurora UPC Application Guide for Variable Speed Applications.

**NOTE: The UPC is not compatible with IntelliZone2 or Symphony.**

### Aurora Touch Interface

Utilizing the service technicians personal Android tablet (Android 4.0 or higher) along with Equipment Touch App (purchased from the Play Store) and our Aurora Touch Cable (part number ATCK01), a technician will have the ability to access the UPC to configure and diagnose equipment at the unit or from any room sensor. The technician will have full access to equipment status, parameter values, temperature, and humidity sensing as well as access to alarm history. The Equipment Touch App is easy to use and provides important insight into the system so it can operate as efficiently as possible.

# The Aurora Advanced VS Control System cont.

Red Fault LED	LED Flash Code *	Lock-out	Reset/ Remove	Fault Condition Summary	ABC Action ABC Green Status LED	AID Tool Display and History	IZZ and Stat Display
ABC & AXB Basic Faults							
Normal - No Faults	Off						
Fault-Input	1	No	Auto	Tstat input error. Autoreset upon condition removal.	Normal		
Fault-High Pressure	2	Yes	Hard or Soft	HP switch has tripped (<600 psi)	Code 1	Lockout - E2 High Press	Lockout - E2 High Press
Fault-Low Pressure	3	Yes	Hard or Soft	Low Pressure Switch has tripped (<40 psi for 30 continuous sec.)	Code 2	Lockout - E3 Low Press	Lockout - E3 Low Press
Fault-Freeze Detection FP2	4	Yes	Hard or Soft	Freeze protection sensor has tripped (<15 or 30 degF for 30 continuous sec.)	Code 3	Lockout - E4 Freeze Detection FP2	Lockout - E4 Freeze Detection FP2
Fault-Freeze Detection FP1	5	Yes	Hard or Soft	Freeze protection sensor has tripped (<15 or 30 degF for 30 continuous sec.)	Code 4	Lockout - E5 Freeze Detection FP1	Lockout - E5 Freeze Detection FP1
Fault-Loss of Charge	6	Yes	Hard or Soft	Loss of Charge (low pressure switch open before compressor startup)	Code 5	Lockout - E6 Loss of Charge	Lockout - E6 Loss of Charge
Fault-Condensate Overflow	7	Yes	Hard or Soft	Condensate switch has shown continuity for 30 continuous sec.	Code 6	Lockout - E7 Condensate	Lockout - E7 Condensate
Fault-Over/Under Voltage	8	No**	Auto	Instantaneous Voltage is out of range. **Controls shut down until resolved.	Code 7	Lockout - E8 Over/Under voltage	Lockout - E8 Over/Under voltage
Fault-FP1 & 2 Snsr Error	11	Yes	Hard or Soft	If FP1 or 2 Sensor Err	Code 8	Lockout - E11 FPI Sensor Error	Alert - E11 FPI Sensor Error
Non-CritcAXBsnsErr	13	No	Auto	Any Other Sensor Err	Code 11	Alert - E13 Non-Critical AXB Sensor Error	Alert - E13 Non-Critical AXB Sensor Error
CritcAXBsnsErr	14	Yes	Hard or Soft	Sensor Err for EEV or HW	Code 13	Lockout - E14 Critical AXB Sensor Error	Lockout - E14 Critical AXB Sensor Error
Alarm-HotWtr	15	No	Auto	HW over limit or logic lockout. HW pump deactivated.	Code 14	Alert - E15 Hot Water Temp Limit	No Display
Fault-VarSpdPump	16	No	Auto	Alert is read from PWM feedback.	Code 15	Alert - E16 Var Spd Pump Err	Alert - E16 Var Spd Pump Err
Fault-ComTstat	17	No	Auto	Fault with any com Tstat. Autoreset upon condition removal.	Code 16	Alert - E17 Stat Communication Error	Alert - E17 Stat Communication Error
Non-CritComErr	18	No	Auto	Any non-critical com error	Code 17	Alert - E18 Non-Critical Communication Error	Alert - E18 Non-Critical Communication Error
Fault-CritComErr	19	No	Auto	Any critical com error. Auto reset upon condition removal	Code 18	Alert - E19 Critical Communication Error	Alert - E19 Critical Communication Error
Alarm - Low Loop Pressure	21	No	Auto	Loop pressure is below 3 psi for more than 3 minutes	Code 19	Alert - E21 Low Loop Pressure	No Display
Alarm - Home Automation 1	23	No	Auto	Closed contact input is present on Dig 2 input - Text is configurable	Code 20	Alert - E23 Selected choice	Alert - E23 Selected choice
Alarm - Home Automation 2	24	No	Auto	Closed contact input is present on Dig 3 input - Text is configurable	Code 21	Alert - E24 Selected choice	Alert - E24 Selected choice
Derate-DriveTemp	41	No	Auto	Drive Temp has reached critical High Temp	Code 22	Warning! Derated - E41 DriveTemp	Warning! Derated - E41 DriveTemp
Derate-HiDisTemp	42	No	Auto	Compressor Discharge exceeded limit for 90 continuous sec.	Code 41	Warning! Derated - E42 HiDisTemp	Warning! Derated - E42 HiDisTemp
Derate-LoSucPres	43	No	Auto	Suction Pressure is critically low	Code 42	Warning! Derated - E43 LoSucPres	Warning! Derated - E43 LoSucPres
Derate-LoConPres	44	No	Auto	Condensing pressure is critically low	Code 43	Warning! Derated - E44 LoConPress	Warning! Derated - E44 LoConPress
Derate-HiConPres	45	No	Auto	Condensing pressure is critically high	Code 44	Warning! Derated - E45 HiConPress	Warning! Derated - E45 HiConPress
Derate-OutPwrLmt	46	No	Auto	Supply Voltage is <208V or Max Pwr is reached due to high pressure	Code 45	Warning! Derated - E46 OutPwrLmt	Warning! Derated - E46 OutPwrLmt
SafeM4-EEVIndCom	47	No	Auto	Com with EEV is interrupted EEV has gone independent mode	Code 46	Warning! SafeMode - E47 EEVIndCom	Warning! SafeMode - E47 EEVIndCom
SafeM4-EEVOutCom	48	No	Auto	Com with EEV is interrupted EEV has gone independent mode	Code 47	Warning! SafeMode - E48 EEVOutCom	Warning! SafeMode - E48 EEVOutCom
SafeM4-AmbTemp	49	No	Auto	Ambient Temperature (Tamb) is <76 or > 212 F and out of range or invalid	Code 48	Warning! SafeMode - E49	Warning! SafeMode - E49
Fault-DisTempSnr	51	Yes	Hard or Soft	Discharge Sensor (Sd) is > 280 F or invalid (<76 to 392 F)	Code 49	Lockout! - E51 DisTempSnr	Lockout! - E51 DisTempSnr
Fault-SucPrsSnr	52	Yes	Hard or Soft	Suction Pressure (PO) is invalid (0 to 252 psi)	Code 50	Lockout! - E52 SucPrsSnr	Lockout! - E52 SucPrsSnr
Fault-ComPrsSnr	53	10x then Yes	Hard or Soft	Low condensing pressure (PD) or invalid (0 to 870 psi) Retry 10x.	Code 51	Lockout! - E53 ConPrsSnr	Lockout! - E53 ConPrsSnr
Fault-LowSupVolt	54	Yes	Hard or Soft	Supply Voltage is <175 V (190V to reset) or powered off/on too quickly (<30 sec.).	Code 52	Lockout! - E54 LowSupVolt	Lockout! - E54 LowSupVolt
Fault-OverEnvelope	55	Yes	Hard or Soft	Comp Operating out of envelope (PO) more than 90 sec. Retry 10x.	Code 53	Lockout! - E55 OutEnvelope	No Display
Fault-OverCurrent	56	Yes	Hard or Soft	Over current tripped by phase loss, earth fault, short circuit or major drive fault.	Code 54	Lockout! - E56 OverCurrnt	Lockout! - E56 OverCurrnt
Fault-OverUnderVolt	57	Yes	Hard or Soft	DC Link Voltage to compressor is >253V or at minimum Volt.	Code 55	Lockout! - E57 Over/Under Volt	Lockout! - E57 Over/Under Volt
Fault-HiDrivTemp	58	Yes	Hard or Soft	Drive Temp has reached critical High Temp >239 F	Code 56	Lockout! - E58 HiDrivTemp	Lockout! - E58 HiDrivTemp
Fault-DrivIntErr MOC/AOC	59	Yes	Hard or Soft	The MOC has encountered an internal fault or an internal error. Probably fatal.	Code 57	Lockout! - E59 DrvIntErr	Lockout! - E59 DrvIntErr
Fault-MultiSafeM4	61	Yes	Hard or Soft	More than one SafeMode condition is present requiring lockout.	Code 58	Lockout! - E61 MultiSafeM4	Lockout! - E61 MultiSafeM4
EEV2 Fault-LossofCharge	71	Yes	Hard or Soft	High superheat and high EEV opening % for a long time will trigger a loss of charge fault	Code 59	Lockout! - E71 LossCharge	Lockout! - E71 LossCharge
EEV2 SafeM4-SucTmPsnr	72	No	Auto	Suction Temperature Sensor is invalid (<76 to 392 F)	Code 60	Warning! SafeMode - E72 SucTmPsnr	Warning! SafeMode - E72 SucTmPsnr
EEV2 SafeM4-LATSensor	73	No	Auto	Leaving Air Temperature Sensor is invalid (<76 to 392 F)	Code 71	Alert - E73 LAT Sensor	No Display
EEV2 SafeM4-MaxOpPres	74	No	Auto	Suction pressure has exceeded that maximum operating level for 90 sec.	Code 72	Warning! SafeMode - E74 MaxOpPres	Warning! SafeMode - E74 MaxOpPres
EEV1 Fault-LossofCharge	75	Yes	Hard or Soft	High superheat and high EEV opening % for a long time will trigger a loss of charge fault	Code 73	Lockout! - E75 Loss Charge	Lockout! - E75 Loss Charge
EEV1 SafeM4-SucTmPsnr	76	No	Auto	Suction Temperature Sensor is invalid (<76 to 392 F)	Code 74	Warning! SafeMode - E76 SucTmPsnr	Warning! SafeMode - E76 SucTmPsnr
EEV1 SafeM4-LATSensor	77	No	Auto	Leaving Air Temperature Sensor is invalid (<76 to 392 F)	Code 75	Alert - E77 LAT Sensor	No Display
EEV1 SafeM4-MaxOpPres	78	No	Auto	Suction pressure has exceeded that maximum operating level for 90 sec.	Code 76	Warning! SafeMode - E78 MaxOpPres	Warning! SafeMode - E78 MaxOpPres
Danfoss VS Drive							
Danfoss EEV1 & EEV2							
Note: *All codes >11 use long flash for tens digit and short flash for the ones digit - 20, 30, 40, 50 etc. will be skipped! Alert* is a noncritical sensor or function that has failed. Normal operation of the heat pump is maintained but service is desired at some point.							

8/6/2020



## The Aurora Advanced VS Control System cont.

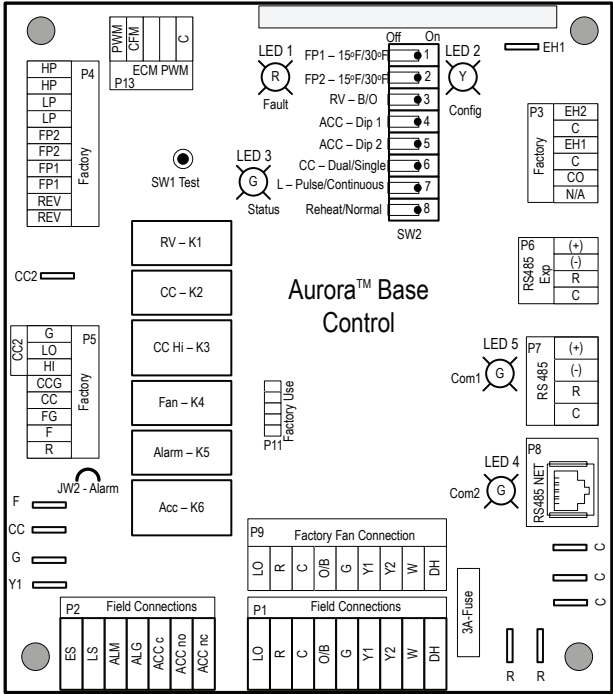
ABC Green Status LED	LED Code	Full Description	Removal
Normal Mode	ON	Normal operation of the heat pump	-
Control non-functional	OFF	Microprocessor is not operational	Board replacement
Test Mode	Slow Flash	Speeds some timings for faster troubleshooting. Entered from pushed button on ABC	Auto after 20 min
LOCKOUT Active	Fast Flash	Lockout is active. Can be removed by hard or soft reset.	Hard or Soft Reset
Dehumidification Mode	Code 2	Unit has either Dehumidification Mode Call from dehumidistat (Active or Passive).	Remove Dehumid Call from Stat
Load Shed	Code 5	Active Load Shed (LS) input on ABC	Remove LS input
Emergency Shutdown	Code 6	Active Emergency Shutdown (ES) input on ABC	Remove ES input
On Peak Mode	Code 7	On Peak Mode is signalled from external source through Smart Grid Input (dig1) or through ext communication.	Remove Smart Grid Input or com
Warning! VS Derated	Code 8	Unit has encountered unacceptable condition and has moderated compressor speed to compensate.	Only automatic removal
Warning! VS SafeMode	Code 9	Unit has encountered unacceptable condition or lost EEV com and has adjusted operation to 2400 rpm and safe EEV %.	Only automatic removal

ABC Yellow Config LED	LED
No Override	ECM Setting
DIP Switch Overridden	Slow Flash
ECM Config Mode	Fast Flash
Reset Config Mode	OFF

# The Aurora Advanced VS Control System cont.

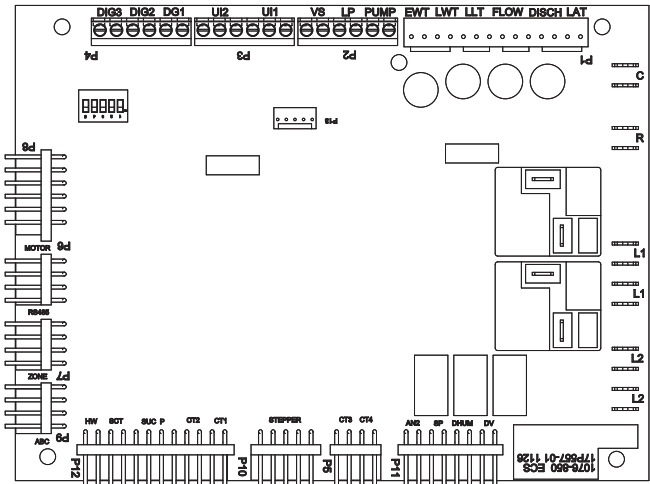
## ABC Control Board Layout

(Located in the NVZ compressor section)



## AXB Control Board Layout

(Located in the NVZ compressor section)



## 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.

### ECM Blower Motor

The variable speed controls will vary the 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 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.

## SVH Blower Performance Data

### Variable Speed ECM

Model	Max ESP	Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Speed 6	Speed 7	Speed 8	Speed 9	Speed 10	Speed 11	Speed 12
033	0.75	<b>250</b>	<b>400 G</b>	<b>550 L</b>	<b>650</b>	<b>750</b>	<b>850</b>	1000	1150	1250 H	1350 Aux	1450	1600
042	0.75	<b>250</b>	<b>450 G</b>	<b>650 L</b>	<b>800</b>	<b>950</b>	<b>1050</b>	1200	1350	1450	1600 H	1750 Aux	1850
050	0.75	<b>300</b>	<b>550 G</b>	<b>800 L</b>	<b>1000</b>	<b>1150</b>	<b>1300</b>	1450	1600	1750	1900 H	2050 Aux	2200
**VS Com- pressor Speed				1-2	3-4		5-6	7-8		9-10	11-12		

4/15/2020

\*\* VS Compressor speed is given for the factory default cfm settings. When the cfm default settings are changed it will change the relationship to the compressor speed that is shown in the table. In cooling mode compressor speeds 10-12 are only available when SuperBoost mode is selected at the thermostat.

Factory settings are at recommended G, L, H and Aux positions

“G” may be located anywhere within the airflow table.

“L” setting should be located within the boldface CFM range

“H” setting MUST be located within the shaded CFM range

“Aux” setting MUST be equal to or higher than factory setting shown in the table above

CFM is controlled within 5% up to the maximum ESP

## Line Set Sizes

**NOTE:** Manufacturer recommends the standard total line set length not to exceed 80 ft with no more than 25 ft of vertical separation between the compressor section and the air handler. For installations that exceed the standard range refer to the Long Line Set Application Guide AG2200EW for further installation requirements.

Unit	Air	20 feet		40 feet		60 feet		80 feet		NZ Factory Charge (oz.)	*Charge Amount with SVH Air Handler (oz.)
Size	Handler	Suction	Liquid	Suction	Liquid	Suction	Liquid	Suction	Liquid		
NVZ033	SVH033	3/4" OD	3/8" OD	3/4" OD	3/8" OD	3/4" OD	3/8" OD	3/4" OD	3/8" OD	68	118
NVZ042	SVH042	3/4" OD	3/8" OD	3/4" OD	3/8" OD	3/4" OD	3/8" OD	3/4" OD	3/8" OD	90	142
NVZ050	SVH050	3/4" OD	3/8" OD	3/4" OD	3/8" OD	3/4" OD	3/8" OD	7/8" OD	3/8" OD	92	152
CAPACITY MULTIPLIER		1.00		0.985		0.97		0.955			

12/7/20

Notes: \* The "Charge Amount with SVH Air Handler" column is based on the charge amount for a SVH Air Handler + Compressor Section/Split.

Additional charge will need to be added accordingly for line set length.

After charge is added, additional adjustments can be made to get appropriate subcooling and superheat measurements.

Additional charge for R410A is 0.50 oz. per ft. for 3/8" and 1.0 oz. per ft. for 1/2" tube.

Longer line sets will significantly reduce capacity and efficiency of the system as well as adversely effect the system reliability due to poor oil return.



## SVH Controls

### SVH AHB Board

The SVH Air Handler with the 'Advanced' control option expands on the capability of the Aurora 'Advanced' Control (ABC and AXB) in the compressor section, by adding the AHB board in the air handler.

The AHB board includes the following features:

#### AHB DIP Switch

**DIP 1 - ID:** This is the AHB ModBus ID and should always read Off.

#### 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.

Position	DIP 4	DIP 5	Description
1	ON	ON	Cycles with Fan or ECM (or G)
2	OFF	ON	Cycles with CC1 first stage of compressor or compressor spd 1-6
3	ON	OFF	Cycles with CC2 second stage of compressor or compressor spd 7-12
4	OFF	OFF	Cycles with DH input from ABC board

### 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 AHB and AXB. This is a dedicated communication port using a proprietary ModBus protocol. An AXB in the compressor section or an AHB in the air handler is required. Consult the IntelliZone2 literature for more information.

### Communicating Digital Thermostats

The Aurora controls system also features either mono-chromatic 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. Many of the features discussed here may not be applicable without these thermostats.

### Energy Monitoring (AXB Board Required in Compressor Section) (Standard Sensor Kit on 'Advanced' models)

The Energy Monitoring Kit includes two current transducers (blower and electric heat) so that the complete power usage of the air handler can be measured. The AID Tool provides configuration detail for the type of blower motor, power adjustment and a line voltage calibration procedure to improve the accuracy. The information can be displayed on the AID Tool or selected communicating thermostats. The TPCM32U04A(\*) will display instantaneous energy use while the color touchscreen TPCC32U01(\*) will in addition display a 13 month history in graph form. Refer to Compressor Section Start Up Energy Monitoring for configuration details.

**Freeze Detection (Air Coil)** – uses 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.

**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.

### Leaving Air Temperature (AXB Board Required in Compressor Section)

A leaving air temperature (LAT) thermistor is located near the blower inlet and can be read via the AID tool.

### Electric Heat Staging

The AHB board provides two stages of auxiliary heat operation. During normal operation, the first stage of electric heat is energized 10 seconds after the W command is received. If the demand continues the second stage of electric heat will be energized after 5 minutes. In an Emergency heat operation the time delay between stage one and stage two will be 2 minutes.

SVH Controls Cont.

Setting Blower Speed - Variable Speed ECM

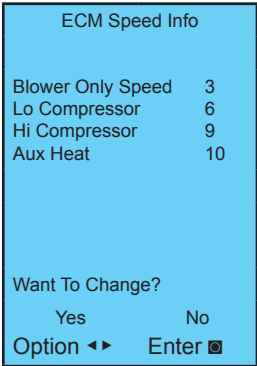
The ABC board's Yellow Config LED will flash the current ECM blower speed selections for "G", low, and high continuously with a short pause in between. The speeds can also be confirmed with the AID Tool under the Setup/ECM Setup screen. The Aux will not be flashed but can be viewed in the AID Tool. The ECM blower motor speeds can be field adjusted with or without using an AID Tool.

ECM Setup without an AID Tool

The blower speeds for "G", Low (Y1) and High (Y2) 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 blower speed will remain at default or current settings, and requires the AID tool for adjustments.

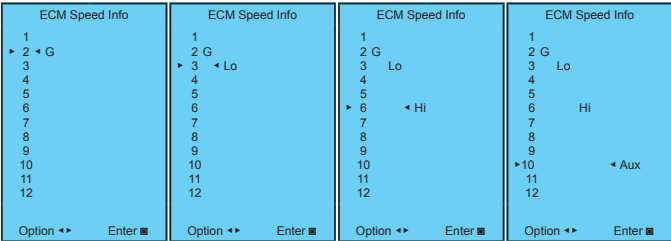
ECM Setup with an AID Tool

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 [Enter] button to select the item.



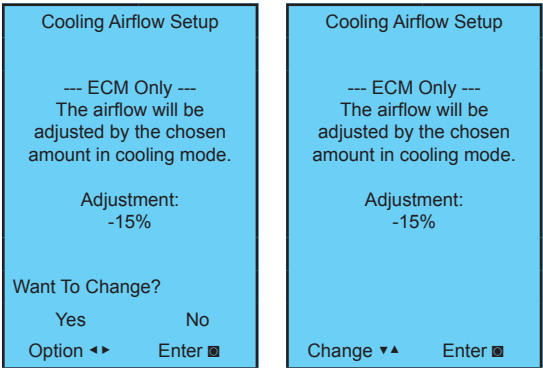
Selecting YES will enter ECM speed setup, while selecting NO will return to the previous screen.

**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 [Enter] button to select the speed.



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

**Cooling Airflow Setup** - These screens allow the technician to select -15%, -10%, -5%, None or +5%. Change the adjustment percentage using the ▲ and ▼ buttons. Press the [Enter] button to save the change.



## Water Quality

It is the responsibility of the system designer and installing contractor to ensure that acceptable water quality is present and that all applicable codes have been met in these installations. Failure to adhere to the guidelines in the water quality table could result in loss of warranty. 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.

Heat pumps 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.

### Water Treatment

Do not use untreated or improperly treated water. Equipment damage may occur. The use of improperly treated or untreated water in this equipment may result in scaling, erosion, corrosion, algae or slime. Purchase of a pre-mix antifreeze could significantly improve system reliability if the water quality is controlled and there are additives in the mixture to inhibit corrosion. There are many examples of such fluids on the market today such as Environol™ 1000

(pre-mix ethanol), and others. The services of a qualified water treatment specialist should be engaged to determine what treatment, if any, is required. The product warranty specifically excludes liability for corrosion, erosion or deterioration of equipment.

The heat exchangers and water lines in the units are copper or cupronickel tube. There may be other materials in the buildings piping system that the designer may need to take into consideration when deciding the parameters of the water quality. If antifreeze or water treatment solution is to be used, the designer should confirm it does not have a detrimental effect on the materials in the system.

### Contaminated Water

In applications where the water quality cannot be held to prescribed limits, the use of a secondary heat exchanger is recommended to separate the unit from the contaminated water. The table outlines the water quality guidelines for unit heat exchangers. If these conditions are exceeded, a secondary heat exchanger is required. Failure to supply a secondary heat exchanger where needed will result in a warranty exclusion for primary heat exchanger corrosion or failure.

### Low Water Coil Limit

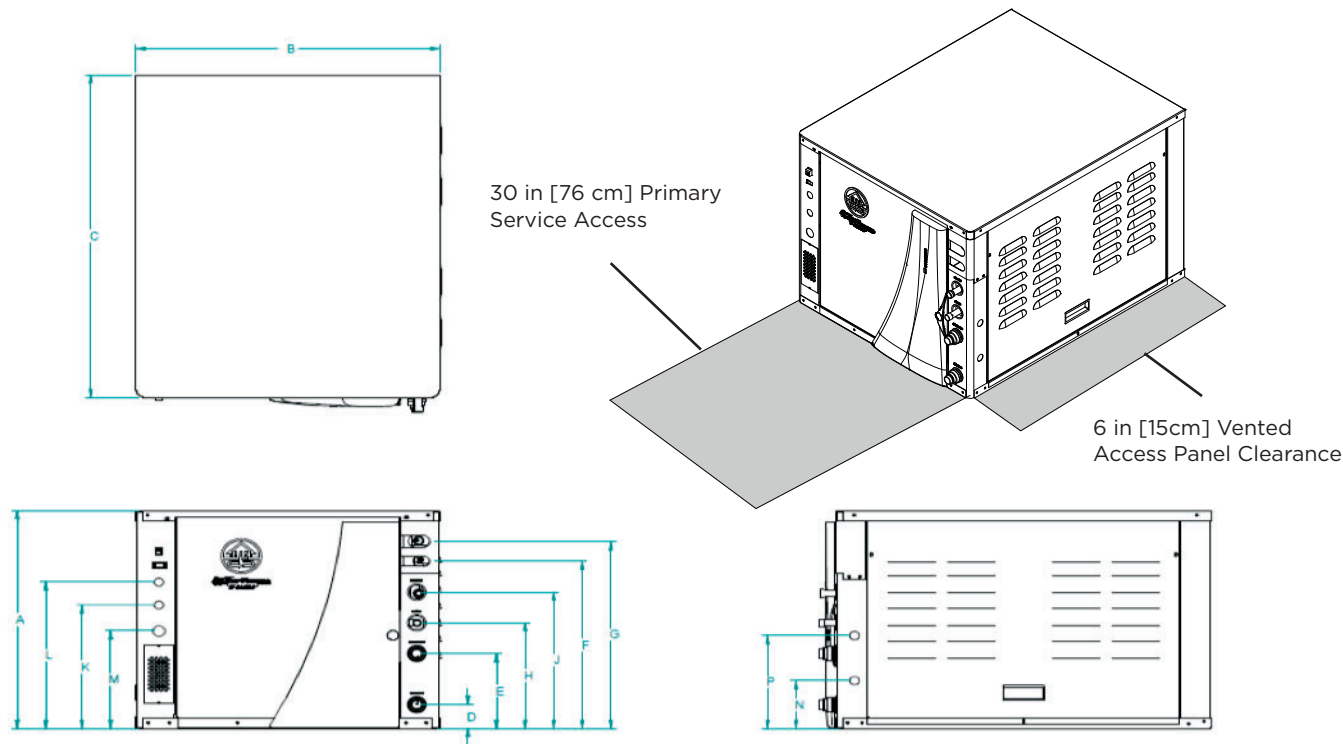
Set the freeze sensing switch SW2-1 on the Aurora Base Control (ABC) printed circuit board for applications using a closed loop antifreeze solution to "LOOP" (15°F). On applications using an open loop/ground water system (or closed loop no antifreeze), set this dip switch to "WELL" (30°F), the factory default setting. (Refer to the DIP Switch Settings table in the Aurora Control section.)

Material		Copper	90/10 Cupronickel	316 Stainless Steel
pH	Acidity/Alkalinity	7 - 9	7 - 9	7 - 9
Scaling	Calcium and Magnesium Carbonate	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm
Corrosion	Hydrogen Sulfide	Less than 0.5 ppm (rotten egg smell appears at 0.5 ppm)	10 - 50 ppm	Less than 1 ppm
	Sulfates	Less than 125 ppm	Less than 125 ppm	Less than 200 ppm
	Chlorine	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Chlorides	Less than 20 ppm	Less than 125 ppm	Less than 300 ppm
	Carbon Dioxide	Less than 50 ppm	10 - 50 ppm	10 - 50 ppm
	Ammonia	Less than 2 ppm	Less than 2 ppm	Less than 20 ppm
	Ammonia Chloride	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Nitrate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Hydroxide	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Sulfate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
Iron Fouling (Biological Growth)	Total Dissolved Solids (TDS)	Less than 1000 ppm	1000 - 1500 ppm	1000 - 1500 ppm
	LSI Index	+0.5 to -0.5	+0.5 to -0.5	+0.5 to -0.5
Iron Fouling (Biological Growth)	Iron, FE <sup>2+</sup> (Ferrous) Bacterial Iron Potential	< 0.2 ppm	< 0.2 ppm	< 0.2 ppm
	Iron Oxide	Less than 1 ppm, above this level deposition will occur	Less than 1 ppm, above this level deposition will occur	Less than 1 ppm, above this level deposition will occur
Erosion	Suspended Solids	Less than 10 ppm and filtered for max. of 600 micron size	Less than 10 ppm and filtered for max. of 600 micron size	Less than 10 ppm and filtered for max. of 600 micron size
	Threshold Velocity (Fresh Water)	< 6 ft/sec	< 6 ft/sec	< 6 ft/sec

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

2/22/12

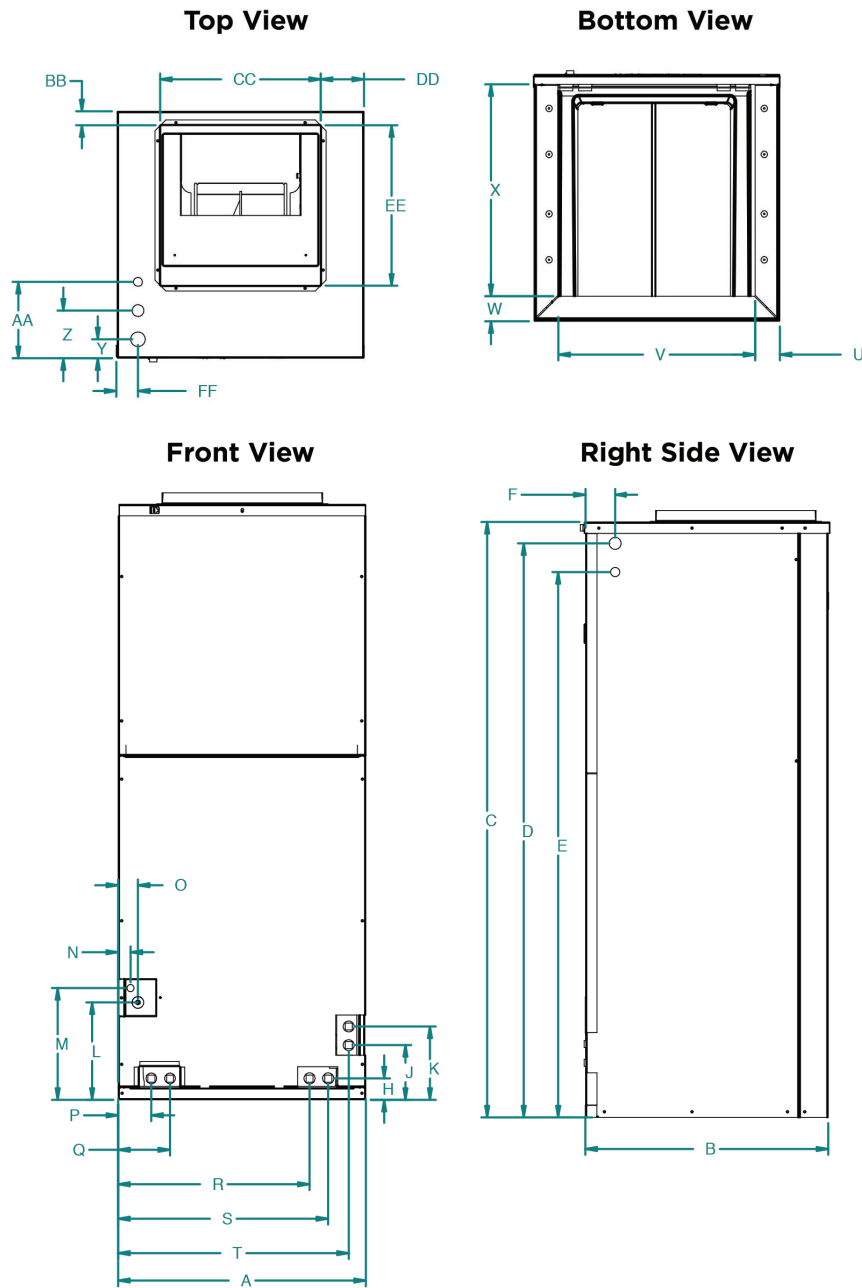
Compressor Section Dimensional Data



Models		Height	Width	Depth	Water In	Water Out	Service Valve		HWG In	HWG Out	Low	External	Line	KNOCK OUT	KNOCK OUT
		A	B	C	D	E	Liquid	Gas	H	J	Voltage	Pump	Voltage	N	P
033-050	in.	21.25	25.62	31.60	2.30	7.21	16.40	18.30	10.30	13.30	12.10	14.30	9.50	4.70	9.10
	cm.	54.00	65.10	80.30	5.80	18.50	41.70	46.50	26.20	33.80	30.70	36.30	24.10	11.90	23.10

# Air Handler Dimensional Data - SVH Air Handler

## Top Flow/Horizontal Unit Configuration



SVH Air Handler - Topflow/Horizontal

Topflow/ Horizontal Configuration	Overall Cabinet											Refrigerant Connections																					
				D		E																											
	A	B	C	3/4" cond Power Supply	1/2" cond Low Voltage	F	H	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF			
	Width	Depth	Height								Suction	Liquid																					
																									Power Supply	Low Voltage							
033-050	in.	cm.	24.9	21.2	58.0	56.1	53.2	142.5	2.6	1.9	4.8	6.4	9.6	10.8	1.1	1.7	2.9	4.5	20.3	21.9	23.5	2.2	20.6	2.2	18.4	1.7	4.2	6.7	1.5	18.0	3.4	18.0	1.8
			63.2	53.8	147.3	142.5	135.1	366.3	6.6	4.8	12.2	16.3	24.4	27.4	2.8	4.3	7.4	11.4	51.6	55.6	59.7	5.6	52.3	5.6	46.7	4.3	10.7	17.0	3.8	45.7	8.6	45.7	4.6

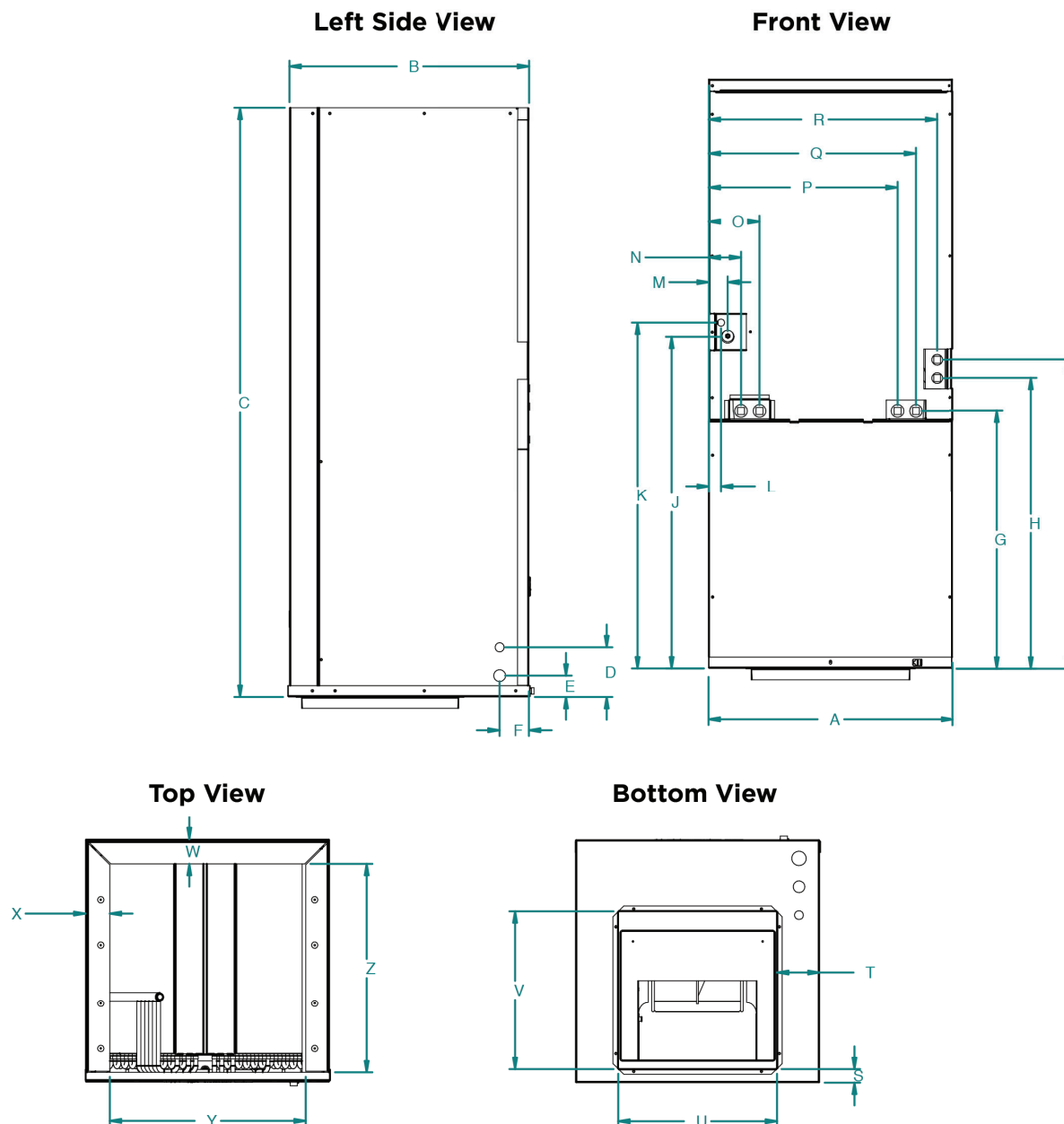
Condensate is plastic 3/4" FPT  
Discharge flange is field installed and extends 1" (25.4 mm) from cabinet  
NOTE: Clearance for maintenance and servicing access - minimum 30" from front of unit  
recommended for blower motor/coil replacement. Condensate drain lines routed to clear filter  
and panel access. Filter removal - minimum 30" recommended.

*Y" IS 1 3/8 KNOCKOUT HIGH VOLTAGE
*Z" IS 1 1/8 KNOCKOUT HIGH VOLTAGE
*AA" IS 7/8 KNOCKOUT LOW VOLTAGE



# Air Handler Dimensional Data - SVH Air Handler

## Bottom Flow Unit Configuration



## SVH Air Handler - Bottom flow

Bottomflow Configuration		Overall Cabinet									Refrigerant Connections																
		D	E	F						J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
		A	B	C	1/2" cond	3/4" cond		G	H	I	Suction	Liquid															
	Width	Depth	Height	Low Voltage	Power Supply	Power Supply																					
033-050	in.	24.9	21.2	58.0	4.4	1.9	2.6	24.0	27.0	28.5	31.3	32.8	1.1	1.7	2.8	4.5	20.2	21.9	23.5	1.2	3.4	18.0	18.0	2.1	2.2	20.5	18.5
	cm.	63.2	53.8	147.3	11.2	4.8	6.6	61.0	68.6	72.4	79.5	83.3	2.8	4.3	7.1	11.4	51.3	55.6	59.7	3.0	8.6	45.7	45.7	5.3	5.6	52.1	47.0

Condensate is plastic 3/4" FPT

Discharge flange is field installed and extends 1" (25.4 mm) from cabinet

NOTE: Clearance for maintenance and servicing access - minimum 30" from front of unit recommended for blower motor/coil replacement.

Condensate drain lines routed to clear filter and panel access. Filter removal - minimum 30" recommended.

## Compressor Section Physical Data

Model	NVZ033	NVZ042	NVZ050
Compressor (1 each)	Variable Speed Scroll		
Factory Charge R410a, oz [kg]	68 [1.93]	90 [2.55]	92 [2.61]
<b>Coax and Water Piping</b>			
Water Connections Size - Swivel - in [mm]	1" [25.4]	1" [25.4]	1" [25.4]
HWG Connection Size - Female Sweat I.D. - in [mm]	1/2" [12.7]	1/2" [12.7]	1/2" [12.7]
Brass Service Valve - Liquid Line - in [mm]	3/8" [9.45]		
Brass Service Valve - Suction Line - in [mm]	3/4" [19.1]		7/8" [22.23]
Coax & Piping Water Volume - gal [l]	1.3 [4.9]	2.3 [8.7]	2.3 [8.7]
Weight - Operating, lb [kg]	241 [109]	302 [137]	302 [137]
Weight - Packaged, lb [kg]	261 [118]	322 [146]	322 [146]

Notes: All units have an EEV and 1/2 in. [12.7mm], and 3/4 in. [19.1] electrical knockouts  
Brass services valves are sweat type valves

03/18/20

## Air Handler Physical Data

Air Handler Model Number (Refrigerant)		033	042	050
<b>Evaporator Coil</b>	Air Coil Total Face Area, ft <sup>2</sup> [m <sup>2</sup> ]	6.81 [0.63]		
	Tube outside diameter - in. [mm]	3/8 [9.52]		
	Number of rows	3		
	Fins per inch	12		
	Suction line connection - in. [mm] sweat	7/8 [22.23]		
	Liquid line connection - in. [mm] sweat	3/8 [9.45]		
Refrigerant		R-410a		
Condensate drain connection - (FPT) in. [mm]		3/4 [19.05]		
Blower Wheel Size (Dia x W), in. [mm]		11 x 10 [279 x 254]		
Blower motor type/speeds		Variable Speed ECM		
Blower motor output - hp [W]		1 [746]		
Filter Standard - 1" [51mm] Field Supplied.		22 X 20 [559 x 508]		
Electrical characteristics (60hz)		208/230 - 1ph		
Shipping weight - lbs. [kg]		206 [93.4]		
Operating weight - lbs. [kg]		188 [85.3]		

04/07/2020

## Electrical Data

### Variable speed with external loop pump

Model	Rated Voltage	Voltage Min/Max	COMP LRA	COMP MCC	Drive RLA	Drive Internal Fuse	HWG Pump FLA	Ext Loop FLA	Total Unit FLA	Minimum Circuit Amp	Max Fuse HACR Breaker
033	208-230/60/1	187/253	10.2	18.0	22.0	30.0	0.4	5.4	27.8	33.3	35
042	208-230/60/1	187/253	12.0	23.5	28.0	35.0	0.4	5.4	33.8	40.8	45
050	208-230/60/1	187/253	12.0	30.0	33.0	40.0	0.4	5.4	38.8	47.1	50

Rated Voltage of 208/230/60/1

8/21/19

HACR circuit breaker in USA only

All fuses Class RK-5

## Air Handler Electrical Data

Model	Electric Heat Capacity		Supply Circuit	Aux. Heat Minimum CFM	Rated Voltage	Voltage Min/Max	Fan Motor FLA	Heater Ampacity		Total Unit FLA		Minimum Circuit Ampacity		Maximum Fuse/HACR	
	KW	BTUH						208v	240v	208v	240v	208v	240v	208v	240v
	240v	240v													
033	0	0	-		208-230/60/1	197/253	7.0	-	-	7.0	7.0	8.8	8.8	15	15
	9.6	32,765	single	1,300			7.0	34.7	40.0	41.7	47.0	52.1	58.8	60	60
042	0	0	-				7.0	-	-	7.0	7.0	8.8	8.8	15	15
	9.6	32,765	single	1,300			7.0	34.7	40.0	41.7	47.0	52.1	58.8	60	60
	14.4	49,147	single	1,700			7.0	52.0	60.0	59.0	67.0	73.8	83.8	80	90
	14.4	49,147	L1/L2				7.0	34.7	40.0	41.7	47.0	52.1	58.8	60	60
			L3/L4				-	17.3	20.0	17.3	20.0	21.6	25.0	25	25
050	0	0	-				7.0	-	-	7.0	7.0	8.8	8.8	15	15
	9.6	32,765	single	1,300			7.0	34.7	40.0	41.7	47.0	52.1	58.8	60	60
	14.4	49,147	single	1,700			7.0	52.0	60.0	59.0	67.0	73.8	83.8	80	90
	14.4	49,147	L1/L2				7.0	34.7	40.0	41.7	47.0	52.1	58.8	60	60
			L3/L4				-	17.3	20.0	17.3	20.0	21.6	25.0	25	25
	19.2	65,530	single	2,000			7.0	69.3	80.0	76.3	87.0	95.4	108.8	100	110
	19.2	65,530	L1/L2				7.0	34.7	40.0	41.7	47.0	52.1	58.8	60	60
			L3/L4				-	34.7	40.0	34.7	40.0	43.4	50.0	50	50

1/29/20

Rated Voltage of 208/230/60/1

HACR circuit breaker in USA only

## Reference Calculations

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

## Legend and Notes

### Abbreviations and Definitions

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

### 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

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

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

## Compressor Section Pressure Drop

Model	GPM	Pressure Drop (psi)				
		30° F	50° F	70°	90° F	110° F
033	11.5	3.60	3.30	3.10	2.90	2.70
	9.0	2.30	2.10	2.00	1.90	1.70
	7.0	2.10	2.00	1.80	1.80	1.60
	6.0	1.10	1.05	1.00	0.90	0.85
	4.5	0.70	0.66	0.64	0.60	0.55
042	13.5	4.10	3.80	3.60	3.40	3.10
	10.5	1.90	1.80	1.70	1.60	1.50
	7.5	1.70	1.50	1.40	1.30	1.20
	6.0	1.00	0.90	0.80	0.7	0.60
	4.0	0.40	0.38	0.36	0.34	0.30
050	17.0	6.20	5.80	5.40	5.00	4.60
	13.5	3.90	3.70	3.50	3.10	2.90
	9.5	1.90	1.80	1.70	1.60	1.50
	7.5	1.40	1.30	1.20	1.10	0.90
	5.0	0.60	0.55	0.50	0.45	0.40

8/21/2019

## Compressor Section Thermistor Resistance

Thermistor Resistance (10k Ohm) for FP1, FP2, HWL, LWT and LLT (EWT with Performance Option)		Thermistor Resistance (1k Ohm) for compressor discharge line, suction line, LAT, compressor ambient and EWT	
Thermistor Temperature (°F)	Thermistor Resistance (Ohms)	Thermistor Temperature (°F)	Thermistor Resistance (Ohms)
5	75757-70117	20	974.4-973.4
14	57392-53234	25	985.4-984.4
23	43865-40771	30	996.1-995.1
32	33809-31487	35	1007.0-1006.0
41	26269-24513	40	1017.8-1016.8
50	20570-19230	45	1028.6-1027.6
59	16226-15196	50	1039.5-1038.5
68	12889-12093	55	1050.2-1049.2
77	10310-9688	60	1061.2-1060.2
86	8300-7812	65	1072.9-1071.9
95	6723-6337	70	1082.7-1081.7
104	5480-5172	75	1093.4-1092.4
113	4490-4246	80	1103.0-1102.0
122	3700-3504	85	1115.5-1114.5
131	3067-2907	90	1126.2-1125.2
140	2554-2424	95	1136.6-1135.6
149	2149-2019	100	1147.2-1146.2
4/24/12		105	1158.1-1157.1
		110	1168.8-1167.8
		115	1179.4-1178.4
		120	1190.1-1189.1
		125	1200.3-1199.3
		130	1212.2-1211.2

4/24/12

## Antifreeze Corrections

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

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



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

### Antifreeze Correction Example

Antifreeze solution is Propylene Glycol 20% by weight. Determine the corrected heating and cooling performance at 30°F and 90°F respectively as well as pressure drop at 30°F for a 033 operating at 100% capacity.

The corrected cooling capacity at 90°F would be: 30,500 Btu/h x 0.969 = 29,554 Btu/h

The corrected heating capacity at 30°F would be: 34,100 Btu/h x 0.913 = 31,133 Btu/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



## Correction Factor Tables

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

Airflow		Cooling				Heating		
CFM Per Ton of Clg	% of Nominal	Total Cap	Sens Cap	Power	Heat of Rej	Htg Cap	Power	Heat of Ext
240	60	0.940	0.740	0.967	0.951	0.943	1.106	0.902
275	69	0.950	0.783	0.973	0.959	0.953	1.088	0.918
300	75	0.960	0.827	0.978	0.967	0.962	1.070	0.935
325	81	0.970	0.870	0.984	0.975	0.972	1.053	0.951
350	88	0.980	0.913	0.989	0.984	0.981	1.035	0.967
375	94	0.990	0.957	0.995	0.992	0.991	1.018	0.984
<b>400</b>	<b>100</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>
425	106	1.030	1.022	1.024	1.026	1.009	0.982	1.016
450	113	1.060	1.045	1.048	1.051	1.019	0.965	1.033
475	119	1.091	1.067	1.071	1.077	1.028	0.947	1.049
500	125	1.121	1.089	1.095	1.103	1.038	0.930	1.065
520	130	1.151	1.111	1.110	1.129	1.047	0.912	1.082

6/29/12

### Air Flow Corrections (Compressor Speeds 4-12)

Airflow		Cooling				Heating		
CFM Per Ton of Clg	% of Nominal	Total Cap	Sens Cap	Power	Heat of Rej	Htg Cap	Power	Heat of Ext
240	60	0.928	0.747	0.936	0.929	0.961	1.097	0.938
275	69	0.940	0.789	0.946	0.941	0.967	1.081	0.948
300	75	0.952	0.831	0.957	0.953	0.974	1.064	0.959
325	81	0.964	0.873	0.968	0.965	0.980	1.048	0.969
350	88	0.976	0.916	0.979	0.976	0.987	1.032	0.979
375	94	0.988	0.958	0.989	0.988	0.993	1.016	0.990
<b>400</b>	<b>100</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>
425	106	1.020	1.023	1.004	1.018	1.010	0.966	1.018
450	113	1.056	1.042	1.008	1.035	1.020	0.932	1.036
475	119	1.072	1.079	1.011	1.053	1.029	0.898	1.054
500	125	1.087	1.095	1.015	1.070	1.039	0.865	1.071
520	130	1.099	1.113	1.019	1.088	1.049	0.831	1.089

6/14/12

### Cooling Capacity Corrections

Entering Air WB ° F	Total Clg Cap	Sensible Cooling Capacity Multipliers - Entering DB ° F										Power Input	Heat of Rejection
		60	65	70	75	80	80.6	85	90	95	100		
55	0.898	0.723	0.866	1.048	1.185	*	*	*	*	*	*	0.985	0.913
60	0.912		0.632	0.880	1.078	1.244	1.260	*	*	*	*	0.994	0.927
63	0.945			0.768	0.960	1.150	1.175	*	*	*	*	0.996	0.954
65	0.976			0.694	0.881	1.079	1.085	1.270	*	*	*	0.997	0.972
66.2	0.983			0.655	0.842	1.040	1.060	1.232	*	*	*	0.999	0.986
<b>67</b>	<b>1.000</b>			0.616	0.806	1.000	1.023	1.193	1.330	1.480	*	<b>1.000</b>	<b>1.000</b>
70	1.053				0.693	0.879	0.900	1.075	1.205	1.404	*	1.003	1.044
75	1.168					0.687	0.715	0.875	1.040	1.261	1.476	1.007	1.141

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

1/5/2017

### Heating Capacity Corrections

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

1/5/17

# Performance Data

## NVZ033 - 50% Part Load

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F							EWT °F	Flow gpm	WPD		COOLING - EAT 80/67 °F														
		PSI	FT	Airflow cfm	HC MBtuh	Power kW	HE MBtuh	LAT °F	COP	HWC MBtuh			PSI	FT	Airflow cfm	TC MBtuh	SC MBtuh	S/T Ratio	Power kW	HR MBtuh	EER	HWC MBtuh							
20	3.0	0.5	1.1	Operation not recommended							20	2.5	0.2	0.5	Operation not recommended														
	4.5	0.7	1.6									3.5	0.5	1.1															
	6.0	1.2	2.7									4.5	0.7	1.6															
30	3.0	0.5	1.1	550	13.1	1.22	8.3	91.0	3.00	2.0	30	2.5	0.2	0.5	500	17.8	12.8	0.72	0.54	18.8	31.6	-							
				750	13.6	1.25	8.7	86.1	3.04	1.7					650	18.1	14.0	0.77	0.56	19.2	30.9	-							
	4.5	0.7	1.6	550	13.4	1.23	8.6	91.6	3.06	2.1		3.5	0.5	1.1	500	18.0	12.9	0.71	0.51	18.9	33.7	-							
				750	14.0	1.26	9.0	86.5	3.11	1.8					650	18.3	14.1	0.77	0.54	19.3	32.5	-							
	6.0	1.1	2.6	550	14.6	1.39	9.0	93.1	2.89	2.2		4.5	0.7	1.6	500	18.1	12.9	0.71	0.50	19.0	34.9	-							
				750	14.9	1.29	9.8	87.5	3.23	1.9					650	18.6	14.1	0.76	0.52	19.5	34.0	-							
40	3.0	0.4	1.0	550	15.6	1.27	11.0	95.8	3.55	2.0	40	2.5	0.2	0.5	500	19.3	13.2	0.68	0.59	20.4	31.1	-							
				750	16.2	1.29	11.5	89.6	3.60	1.8					650	19.7	14.5	0.73	0.62	20.9	30.5	-							
	4.5	0.7	1.5	550	16.1	1.27	11.5	96.6	3.65	2.1		3.5	0.4	1.0	500	19.6	13.4	0.68	0.56	20.6	33.2	-							
				750	16.7	1.29	12.0	90.2	3.71	1.9					650	19.9	14.6	0.73	0.59	21.0	32.2	-							
	6.0	1.1	2.5	550	17.0	1.30	12.2	98.1	3.76	2.2		4.5	0.7	1.5	500	19.7	13.4	0.68	0.55	20.6	34.5	-							
				750	17.6	1.33	12.7	91.3	3.82	2.0					650	20.2	14.6	0.72	0.57	21.1	33.7	-							
50	3.0	0.4	1.0	550	18.2	1.31	13.7	100.6	4.06	2.5	50	2.5	0.2	0.5	500	20.6	13.2	0.64	0.63	21.8	31.2	-							
				750	18.8	1.33	14.2	93.2	4.13	2.2					650	21.2	14.7	0.69	0.64	22.4	31.4	-							
	4.5	0.6	1.5	550	18.8	1.31	14.4	101.7	4.20	2.5		3.5	0.4	1.0	500	20.8	13.3	0.64	0.61	21.9	32.3	-							
				750	19.4	1.33	14.9	94.0	4.28	2.3					650	21.4	14.7	0.69	0.63	22.5	32.6	-							
	6.0	1.1	2.5	550	19.7	1.34	15.1	103.2	4.30	2.6		4.5	0.6	1.5	500	21.1	13.7	0.65	0.61	22.2	33.1	-							
				750	20.3	1.36	15.7	95.1	4.37	2.4					650	21.7	15.1	0.70	0.62	22.8	33.4	-							
60	3.0	0.4	1.0	550	20.7	1.33	16.1	104.8	4.55	2.7	60	2.5	0.2	0.5	500	20.0	13.2	0.66	0.74	21.6	25.6	1.3							
				750	21.2	1.34	16.6	96.2	4.63	2.5					650	20.5	14.6	0.71	0.76	22.1	25.9	1.4							
	4.5	0.6	1.4	550	21.5	1.33	17.0	106.2	4.74	2.8		3.5	0.4	1.0	500	20.2	13.3	0.66	0.72	21.7	26.6	1.2							
				750	22.0	1.34	17.4	97.2	4.83	2.6					650	20.7	14.7	0.71	0.74	22.2	26.8	1.3							
	6.0	1.0	2.4	550	22.3	1.36	17.6	107.5	4.80	2.9		4.5	0.6	1.4	500	20.5	13.6	0.66	0.72	22.0	27.2	1.1							
				750	22.8	1.37	18.1	98.1	4.88	2.7					650	21.1	15.1	0.72	0.73	22.5	27.5	1.2							
70	3.0	0.4	0.9	550	23.1	1.35	18.5	108.9	5.03	3.1	70	2.5	0.2	0.5	500	19.3	13.2	0.68	0.85	21.3	21.6	1.7							
				750	23.6	1.32	19.1	99.1	5.24	2.8					650	19.9	14.6	0.73	0.87	21.9	21.7	1.8							
	4.5	0.6	1.4	550	24.1	1.34	19.6	110.6	5.27	3.2		3.5	0.4	0.9	500	19.5	13.2	0.68	0.83	21.4	22.3	1.6							
				750	24.6	1.34	20.0	100.4	5.37	2.9					650	20.0	14.6	0.73	0.85	22.0	22.5	1.7							
	6.0	1.0	2.3	550	24.8	1.37	20.1	111.7	5.29	3.3		4.5	0.6	1.4	500	19.8	13.6	0.68	0.82	21.7	22.9	1.5							
				750	25.2	1.37	20.5	101.1	5.39	2.7					650	20.4	15.0	0.74	0.84	22.3	23.1	1.7							
80	3.0	0.4	0.9	550	25.4	1.34	20.9	112.8	5.57	3.7	80	2.5	0.2	0.4	500	18.5	12.9	0.70	0.93	20.8	18.8	2.3							
				750	25.8	1.33	21.2	101.8	5.68	3.4					650	19.0	14.3	0.75	0.95	21.3	19.0	2.5							
	4.5	0.6	1.3	550	26.6	1.33	22.1	114.9	5.87	3.9		3.5	0.4	0.9	500	18.6	13.0	0.69	0.91	20.9	19.5	2.2							
				750	27.0	1.32	22.5	103.3	5.99	3.5					650	19.2	14.3	0.75	0.93	21.4	19.7	2.4							
	6.0	1.0	2.2	550	27.0	1.36	22.4	115.5	5.84	4.0		4.5	0.6	1.3	500	19.0	13.3	0.70	0.90	21.1	20.0	2.0							
				750	27.3	1.35	22.7	103.7	5.95	3.7					650	19.5	14.7	0.75	0.92	21.7	20.2	2.2							
90	3.0	0.4	0.9	550	27.7	1.33	23.2	116.7	6.12	4.3	90	2.5	0.2	0.4	500	17.6	12.6	0.71	1.02	20.3	16.5	3.0							
				750	27.9	1.31	23.5	104.5	6.25	4.0					650	18.1	13.9	0.77	1.04	20.8	16.7	3.2							
	4.5	0.6	1.3	550	29.1	1.32	24.7	119.1	6.49	4.5		3.5	0.4	0.9	500	17.8	12.7	0.71	0.99	20.3	17.1	2.9							
				750	29.3	1.30	24.9	106.2	6.63	4.1					650	18.3	14.0	0.77	1.01	20.9	17.3	3.1							
	6.0	0.9	2.2	550	29.3	1.34	24.7	119.3	6.40	4.6		4.5	0.6	1.3	500	17.6	12.3	0.70	1.17	20.8	14.4	2.8							
				750	29.4	1.32	24.9	106.3	6.53	4.3					650	18.6	14.4	0.77	1.00	21.1	17.7	2.6							
100	3.0	0.4	0.8	Operation not recommended							100	2.5	0.2	0.4	500	16.7	12.4	0.74	1.34	20.5	11.9	3.6							
	4.5	0.5	1.2									3.5	0.4	0.8	650	17.2	13.7	0.80	1.36	21.0	12.0	3.8							
	6.0	0.9	2.1									4.5	0.5	1.2	500	16.9	12.4	0.74	1.30	20.5	12.4	3.3							
110	3.0	0.3	0.8								110	2.5	0.2	0.4	650	17.4	13.8	0.79	1.33	21.1	12.5	3.6							
															500	17.2	12.8	0.74	1.29	20.7	12.7	3.0							
	4.5	0.5	1.2									3.5	0.3	0.8	650	17.6	14.1	0.80	1.32	21.3	12.8	3.4							
120	3.0	0.3	0.8								120	2.5	0.2	0.4	500	15.8	12.1	0.77	1.66	20.7	9.1	4.7							
															650	16.3	13.4	0.83	1.69	21.3	9.2	5.0							
	4.5	0.5	1.2	3.5	0.3	0.8	500	16.0	12.2	0.76		1.61	20.7	9.4	4.4														
120	3.0	0.3	0.8								120	2.5	0.2	0.4	650	16.4	13.5	0.82	1.64	21.3	9.5	4.8							
															500	16.2	12.5	0.77	1.60	20.9	9.7	4.1							
	4.5	0.5	1.2	3.5	0.3	0.8	650	16.7	13.9	0.83		1.63	21.5	9.8	4.6														
120	3.0	0.3	0.8								120	2.5	0.2	0.4	500	13.2	12.1	0.92	1.95	19.2	6.4	6.2							
															650	13.5	13.2	0.98	2.00	19.6	6.4	6.0							
	4.5	0.5	1.2	3.5	0.3	0.8	500	13.4	12.2	0.91		1.84	19.0	6.9	5.5														
120	3.0	0.3	0.8								120	2.5	0.2	0.4	650	13.6	13.2	0.97	1.89	19.4	6.8	5.9							
															500	13.5	12.2	0.90	1.78	18.9	7.2	5.0							
	4.5	0.5	1.2	3.5	0.3	0.8	650	13.8	13.2	0.96		1.84	19.4	7.1	5.6														

## Performance Data cont.

### NVZ033 - 100% Full Load

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F							EWT °F	Flow gpm	WPD		COOLING - EAT 80/67 °F								
		PSI	FT	Airflow cfm	HC MBtuh	Power kW	HE MBtuh	LAT °F	COP	HWC MBtuh			PSI	FT	Airflow cfm	TC MBtuh	SC MBtuh	S/T Ratio	Power kW	HR MBtuh	EER	HWC MBtuh	
20	6.0	1.5	3.5	Operation not recommended							20	4.5	0.7	1.6	Operation not recommended								
	9.0	2.3	5.4									6.5	1.5	3.5									
	12.0	4.1	9.5	1150	27.6	2.94	17.6	92.2	2.75	3.0		9.0	2.3	5.4									
30	6.0	1.5	3.4	1150	31.7	2.70	22.5	95.5	3.44	3.1	30	4.5	0.7	1.6	1000	34.6	22.1	0.64	1.14	38.5	30.4	-	
				1500	32.6	2.79	23.1	90.1	3.42	2.8					1200	35.2	24.3	0.69	1.18	39.3	29.8	-	
	9.0	2.3	5.3	1150	32.5	2.74	23.1	96.2	3.48	3.2		6.5	1.5	3.4	1000	35.1	22.3	0.64	1.08	38.7	32.5	-	
				1500	33.4	2.82	23.8	90.6	3.47	2.9					1200	35.6	24.4	0.68	1.14	39.5	31.3	-	
	12.0	4.0	9.2	1150	32.8	2.99	22.6	96.4	3.22	3.2		9.0	2.3	5.3	1000	35.2	22.3	0.63	1.05	38.8	33.6	-	
				1500	34.1	2.85	24.4	91.0	3.51	2.9					1200	36.1	24.4	0.68	1.10	39.9	32.8	-	
40	6.0	1.4	3.3	1150	35.4	2.84	25.7	98.5	3.66	3.3	40	4.5	0.7	1.5	1000	35.4	23.6	0.67	1.31	39.9	27.1	-	
				1500	36.5	2.91	26.5	92.5	3.67	3.1					1200	36.1	25.9	0.72	1.36	40.7	26.5	-	
	9.0	2.2	5.1	1150	36.5	2.89	26.7	99.4	3.70	3.4		6.5	1.4	3.3	1000	35.8	23.9	0.67	1.24	40.1	28.8	-	
				1500	37.7	2.96	27.6	93.2	3.73	3.1					1200	36.5	26.1	0.71	1.30	40.9	28.0	-	
	12.0	3.9	8.9	1150	37.3	2.92	27.3	100.0	3.74	3.5		9.0	2.2	5.1	1000	36.1	23.9	0.66	1.20	40.2	30.0	-	
				1500	38.5	2.99	28.3	93.7	3.78	3.2					1200	36.9	26.1	0.71	1.26	41.2	29.3	-	
50	6.0	1.4	3.2	1150	39.2	2.98	29.0	101.5	3.85	3.7	50	4.5	0.6	1.5	1000	34.7	23.1	0.66	1.47	39.7	23.6	-	
				1500	40.3	3.02	30.0	94.9	3.91	3.4					1200	36.5	25.7	0.70	1.55	41.8	23.6	-	
	9.0	2.1	4.9	1150	40.6	3.05	30.2	102.7	3.90	3.8		6.5	1.4	3.2	1000	35.5	23.4	0.66	1.39	40.2	25.6	-	
				1500	41.9	3.09	31.3	95.9	3.97	3.5					1200	37.3	25.9	0.70	1.45	42.2	25.6	-	
	12.0	3.7	8.6	1150	41.5	3.08	31.0	103.4	3.95	3.9		9.0	2.1	4.9	1000	35.8	24.9	0.70	1.35	40.4	26.5	-	
				1500	42.8	3.12	32.2	96.4	4.02	3.6					1200	37.7	27.7	0.73	1.42	42.5	26.5	-	
60	6.0	1.3	3.1	1150	43.4	3.03	33.1	105.0	4.20	4.1	60	4.5	0.6	1.4	1000	32.9	23.4	0.71	1.68	38.6	19.6	1.9	
				1500	44.8	3.05	34.4	97.7	4.31	3.8					1200	34.5	26.0	0.75	1.75	40.4	19.7	2.1	
	9.0	2.1	4.8	1150	45.4	3.11	34.7	106.5	4.27	4.3		6.5	1.3	3.1	1000	33.6	23.7	0.70	1.59	39.1	21.1	1.8	
				1500	46.8	3.13	36.1	98.9	4.38	3.9					1200	35.2	26.2	0.74	1.66	40.9	21.2	2.0	
	12.0	3.6	8.4	1150	46.5	3.15	35.7	107.4	4.33	4.4		9.0	2.1	4.8	1000	34.0	24.9	0.73	1.55	39.3	21.9	1.7	
				1500	48.0	3.16	37.2	99.6	4.45	4.0					1200	35.7	27.7	0.78	1.63	41.2	21.9	1.9	
70	6.0	1.3	3.0	1150	47.7	3.07	37.2	108.4	4.55	4.6	70	4.5	0.6	1.4	1000	31.0	23.7	0.76	1.92	37.6	16.2	2.4	
				1500	49.1	3.15	38.4	100.3	4.57	4.3					1200	32.1	25.4	0.79	1.98	38.9	16.2	2.5	
	9.0	2.0	4.6	1150	50.2	3.17	39.3	110.4	4.63	4.8		6.5	1.3	3.0	1000	31.8	24.0	0.75	1.80	38.0	17.7	2.2	
				1500	51.8	3.17	41.0	102.0	4.78	4.4					1200	33.2	26.5	0.80	1.87	39.6	17.8	2.4	
	12.0	3.5	8.1	1150	51.4	3.21	40.5	111.4	4.69	4.9		9.0	2.0	4.6	1000	32.2	24.9	0.77	1.76	38.2	18.3	2.0	
				1500	53.2	3.20	42.3	102.8	4.87	4.5					1200	33.6	27.6	0.82	1.83	39.8	18.4	2.3	
80	6.0	1.3	2.9	1150	51.0	3.18	40.1	111.1	4.70	5.2	80	4.5	0.6	1.3	1000	29.6	23.5	0.79	2.14	36.9	13.8	2.9	
				1500	52.8	3.16	42.0	102.6	4.90	4.9					1200	30.8	26.2	0.85	2.21	38.4	14.0	3.1	
	9.0	1.9	4.5	1150	53.9	3.31	42.7	113.4	4.78	5.4		6.5	1.3	2.9	1000	30.5	23.8	0.78	2.07	37.5	14.7	2.7	
				1500	55.8	3.27	44.6	104.4	4.99	5.0					1200	31.7	26.4	0.83	2.13	38.9	14.9	3.0	
	12.0	3.4	7.8	1150	55.5	3.35	44.1	114.7	4.86	5.6		9.0	1.9	4.5	1000	30.8	24.4	0.79	2.02	37.7	15.2	2.5	
				1500	57.4	3.30	46.1	105.4	5.10	5.1					1200	32.1	27.1	0.84	2.09	39.2	15.4	2.8	
90	6.0	1.2	2.8	1150	54.3	3.29	43.1	113.7	4.84	5.9	90	4.5	0.6	1.3	1000	28.3	23.4	0.83	2.40	36.4	11.8	3.7	
				1500	56.2	3.24	45.2	104.7	5.09	5.5					1200	29.3	26.0	0.89	2.46	37.6	11.9	3.9	
	9.0	1.9	4.3	1150	57.7	3.44	46.0	116.5	4.92	6.1		6.5	1.2	2.8	1000	29.1	23.7	0.82	2.33	37.0	12.5	3.4	
				1500	59.8	3.38	48.3	106.9	5.19	5.7					1200	30.2	26.3	0.87	2.39	38.3	12.6	3.7	
	12.0	3.3	7.5	1150	59.6	3.49	47.7	117.9	5.01	6.3		9.0	1.9	4.3	1000	29.8	24.0	0.81	2.33	37.7	12.8	3.2	
				1500	61.6	3.40	50.0	108.0	5.31	5.8					1200	30.5	26.5	0.87	2.34	38.5	13.0	4.1	
100	6.0	1.2	2.7	Operation not recommended							100	4.5	0.5	1.2	1000	26.8	23.2	0.87	2.73	36.1	9.8	4.4	
	9.0	1.8	4.2									6.5	1.2	2.7	1000	27.7	23.5	0.85	2.68	36.8	10.3	4.1	
	12.0	3.1	7.3									1200	28.6	26.1	0.91	2.72	37.9	10.5	4.5				
												1000	28.0	23.4	0.84	2.63	37.0	10.6	3.8				
110	6.0	1.1	2.6								9.0	1.8	4.2	1200	28.9	25.9	0.90	2.68	38.0	10.8	4.3		
														1000	25.3	23.0	0.91	3.06	35.8	8.3	5.6		
	9.0	1.7	4.0								1200	26.0	25.5	0.98	3.10	36.6	8.4	5.9					
											1000	26.3	23.2	0.88	3.03	36.7	8.7	5.2					
120	6.0	1.1	2.5								9.0	1.7	4.0	1200	27.0	25.8	0.96	3.05	37.4	8.9	5.6		
														1000	26.6	22.9	0.86	2.98	36.7	8.9	4.8		
	9.0	1.7	3.8								1200	27.3	25.3	0.93	3.01	37.6	9.1	5.3					
											1000	24.4	22.1	0.90	3.60	36.7	6.8	6.7					
120	6.0	1.1	2.5								9.0	1.7	3.8	1200	25.0	24.1	0.97	3.69	37.5	6.8	7.1		
														1000	24.7	22.3	0.90	3.41	36.4	7.3	6.2		
	9.0	1.7	3.8								1200	25.2	24.2	0.96	3.49	37.1	7.2	6.7					
											1000	25.0	22.3	0.89	3.30	36.2	7.6	6.4					
12.0	2.9	6.7	1200	25.5	24.2	0.95	3.40	37.1	7.5	7.1													

Performance capacities shown in thousands of Btuh. 3/27/2020

## Performance Data cont.

### NVZ042 - 100% Full Load

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F							EWT °F	Flow gpm	WPD		COOLING - EAT 80/67 °F										
		PSI	FT	Airflow cfm	HC MBtuh	Power kW	HE MBtuh	LAT °F	COP	HWC MBtuh			PSI	FT	Airflow cfm	TC MBtuh	SC MBtuh	S/T Ratio	Power kW	HR MBtuh	EER	HWC MBtuh			
20	9.0	1.9	4.3	Operation not recommended							20	6.0	0.9	2.2	Operation not recommended										
	12.0	3.5	8.1									8.5	1.6	3.8											
	15.0	5.0	11.6	1600	36.8	3.84	23.7	91.3	2.81	3.5		11.0	2.5	5.7											
30	9.0	1.8	4.2	1600	37.8	3.68	25.3	91.9	3.01	3.5	30	6.0	0.9	2.1	1200	38.7	24.1	0.62	1.40	43.5	27.6	-			
				1800	39.1	3.74	26.4	90.1	3.07	3.2					1400	39.4	26.5	0.67	1.46	44.4	27.0	-			
				1600	40.9	3.85	27.7	93.7	3.11	3.7					1200	39.2	24.3	0.62	1.34	43.8	29.4	-			
	12.0	3.4	7.9	1800	42.1	3.88	28.9	91.7	3.19	3.2		8.5	1.6	3.7	1400	39.9	26.6	0.67	1.41	44.7	28.3	-			
				1600	42.7	3.93	29.3	94.7	3.18	3.9					1200	39.4	24.3	0.62	1.30	43.9	30.4	-			
				1800	43.4	3.93	30.0	92.3	3.24	3.4					1400	40.4	26.6	0.66	1.36	45.0	29.7	-			
40	9.0	1.8	4.1	1600	43.0	3.81	30.0	94.9	3.31	3.8	40	6.0	0.9	2.0	1200	42.3	28.0	0.66	1.61	47.8	26.2	-			
				1800	44.4	3.84	31.3	92.8	3.39	3.5					1400	43.1	30.6	0.71	1.68	48.9	25.7	-			
				1600	46.4	3.96	32.9	96.8	3.44	4.2					8.5	1.5	3.6	1200	42.8	28.3	0.66	1.53	48.0	27.9	-
	12.0	3.3	7.6	1800	48.0	3.96	34.5	94.7	3.56	3.7		1400	43.6	30.9				0.71	1.61	49.1	27.1	-			
				1600	47.9	3.98	34.3	97.7	3.53	4.4		11.0	2.3	5.3				1200	43.1	28.3	0.66	1.49	48.2	29.0	-
				1800	49.6	4.01	35.9	95.5	3.62	3.9					1400	44.1	30.9	0.70	1.56	49.4	28.4	-			
50	9.0	1.7	3.9	1600	48.2	3.94	34.8	97.9	3.59	4.4	50	6.0	0.9	2.0	1200	45.1	29.6	0.66	2.04	52.1	22.1	-			
				1800	49.7	3.94	36.3	95.6	3.70	4.0					1400	46.5	35.0	0.75	2.13	53.8	21.9	-			
				1600	51.9	4.06	38.1	100.1	3.75	4.8					8.5	1.5	3.5	1200	46.1	29.8	0.65	1.77	52.1	26.1	-
	12.0	3.2	7.4	1800	53.9	4.04	40.2	97.7	3.91	4.4		1400	47.5	35.1				0.74	1.85	53.8	25.6	-			
				1600	53.9	4.09	40.0	101.2	3.86	5.1		11.0	2.2	5.2				1200	46.4	29.8	0.64	1.66	52.1	27.9	-
				1800	55.7	4.09	41.7	98.7	3.99	4.6					1400	47.8	35.1	0.73	1.75	53.8	27.3	-			
60	9.0	1.7	3.8	1600	53.3	4.09	39.4	100.8	3.82	5.2	60	6.0	0.8	1.9	1200	43.4	28.8	0.66	2.25	51.1	19.3	2.6			
				1800	55.2	4.06	41.4	98.4	3.98	4.7					1400	44.7	34.0	0.76	2.35	52.8	19.0	2.7			
	12.0	3.1	7.2	1600	57.7	4.19	43.4	103.4	4.04	5.6		8.5	1.4	3.3	1200	44.1	29.0	0.66	2.00	50.9	22.1	2.4			
				1800	59.9	4.14	45.8	100.8	4.24	5.1					1400	45.5	34.2	0.75	2.09	52.6	21.8	2.6			
	15.0	4.4	10.3	1600	60.1	4.23	45.7	104.8	4.17	6.0		11.0	2.2	5.0	1200	44.6	29.1	0.65	1.90	51.1	23.5	2.2			
				1800	62.3	4.18	48.0	102.0	4.37	5.4					1400	46.0	34.3	0.75	1.98	52.7	23.2	2.4			
70	9.0	1.6	3.7	1600	58.4	4.24	44.0	103.8	4.04	6.0	70	6.0	0.8	1.8	1200	41.6	28.0	0.67	2.46	50.0	16.9	3.4			
				1800	65.4	4.20	51.1	103.6	4.56	5.5					1400	44.0	33.1	0.75	2.42	52.3	18.2	3.6			
	12.0	3.0	6.9	1600	63.4	4.31	48.7	106.7	4.31	6.5		8.5	1.4	3.2	1200	42.1	28.3	0.67	2.23	49.7	18.9	3.1			
				1800	65.9	4.24	51.4	103.9	4.56	6.0					1400	43.4	33.3	0.77	2.33	51.3	18.7	3.4			
	15.0	4.3	9.9	1600	63.7	4.28	49.1	106.9	4.36	6.9		11.0	2.5	4.9	1200	42.8	28.4	0.66	2.13	50.0	20.1	2.8			
				1800	68.8	4.26	54.3	105.4	4.73	7.2					1400	44.1	33.4	0.76	2.21	51.6	20.0	3.2			
80	9.0	1.5	3.6	1600	61.8	4.38	46.8	105.8	4.13	7.1	80	6.0	0.8	1.8	1200	38.4	27.1	0.70	2.73	47.7	14.1	4.5			
				1800	64.2	4.31	49.5	103.0	4.37	6.5					1400	39.6	31.8	0.80	2.85	49.3	13.9	4.8			
	12.0	2.9	6.7	1600	67.1	4.43	52.0	108.8	4.44	7.6		8.5	1.4	3.1	1200	38.6	27.4	0.71	2.53	47.3	15.2	4.1			
				1800	69.8	4.32	55.1	105.9	4.73	7.0					1400	39.8	32.2	0.81	2.63	48.8	15.1	4.4			
	15.0	4.2	9.6	1600	70.5	4.48	55.2	110.8	4.61	8.1		11.0	2.0	4.7	1200	39.5	27.6	0.70	2.42	47.8	16.3	3.8			
				1800	73.4	4.36	58.5	107.7	4.93	7.5					1400	40.7	32.4	0.80	2.53	49.3	16.1	4.2			
90	9.0	1.5	3.4	1600	65.2	4.53	49.7	107.7	4.21	8.4	90	6.0	0.7	1.7	1200	35.2	26.1	0.74	2.99	45.4	11.8	6.0			
				1800	67.7	4.44	52.6	104.8	4.48	7.7					1400	36.3	30.7	0.84	3.12	46.9	11.7	6.3			
	12.0	2.8	6.5	1600	70.9	4.56	55.3	111.0	4.55	8.9		8.5	1.3	3.0	1200	35.2	26.4	0.75	2.84	44.9	12.4	5.3			
				1800	73.8	4.41	58.7	108.0	4.90	8.2					1400	36.2	31.1	0.86	2.94	46.2	12.3	5.8			
	15.0	4.0	9.3	1600	74.8	4.61	59.0	113.3	4.75	9.5		11.0	2.0	4.5	1200	36.1	29.2	0.81	2.79	45.6	12.9	5.0			
				1800	77.9	4.46	62.7	110.1	5.12	8.7					1400	37.3	31.4	0.84	2.84	47.0	13.1	6.3			
100	9.0	1.4	3.3	Operation not recommended							100	6.0	0.7	1.7	1200	32.6	24.4	0.75	3.32	43.9	9.8	7.0			
	12.0	2.7	6.2									1400	33.6	28.7	0.85	3.46	45.4	9.7	7.5						
	15.0	3.9	8.9									1200	32.4	24.7	0.76	3.23	43.4	10.0	6.7						
110	9.0	1.4	3.2								110	6.0	0.7	1.6	1400	33.4	29.1	0.87	3.36	44.8	9.9	7.3			
															12.0	2.6	6.0	1200	33.6	25.1	0.75	3.11	44.2	10.8	6.3
																		1400	34.6	29.5	0.85	3.25	45.6	10.6	7.1
120	9.0	1.3	3.1	120	6.0	0.7	1.5	1200	30.0	22.7	0.76	3.64	42.4	8.2	9.0										
								12.0	2.5	5.8	1400	30.8	26.7	0.87	3.79	43.7	8.1	9.8							
											15.0	3.6	8.2	1200	29.5	23.0	0.78	3.62	41.9	8.2	8.6				
120	9.0	1.3	3.1	120	8.5	1.2	2.8	1400	30.5	27.1	0.89	3.77	43.4	8.1	9.4										
								12.0	2.5	5.8	1200	30.9	23.4	0.76	3.51	42.9	8.8	8.2							
											1400	31.8	27.5	0.86	3.66	44.3	8.7	9.2							
	120	9.0	1.3	3.1	120	8.5	1.2	2.7	1200	26.7	23.9	0.90	4.35	41.5	6.1	11.9									
									12.0	2.5	5.8	1400	27.2	26.1	0.96	4.45	42.4	6.1	12.4						
												15.0	3.6	8.2	1200	27.0	24.1	0.89	4.11	41.0	6.6	11.1			
120	9.0	1.3	3.1	120	8.5	1.2	2.7	1400	27.5	26.2	0.95	4.21	41.9	6.5	12.0										
								15.0	3.6	8.2	1200	27.2	24.1	0.89	3.97	40.8	6.8	10.2							
120	9.0	1.3	3.1	120	8.5	1.2	2.7	1400	27.8	26.2	0.94	4.10	41.8	6.8	11.4										



# Performance Data cont.

## NVZ050 - 50% Part Load

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F							EWT °F	Flow gpm	WPD		COOLING - EAT 80/67 °F														
		PSI	FT	Airflow cfm	HC MBtuh	Power kW	HE MBtuh	LAT °F	COP	HWC MBtuh			PSI	FT	Airflow cfm	TC MBtuh	SC MBtuh	S/T Ratio	Power kW	HR MBtuh	EER	HWC MBtuh							
20	3.7	0.1	0.3	Operation not recommended							20	3.2	0.1	0.3	Operation not recommended														
	5.1	0.6	1.4									4.6	0.5	1.1															
	7.5	1.2	2.7									6.0	0.8	1.9															
30	3.7	0.1	0.3	850	23.8	2.32	15.0	95.0	2.90	4.0	30	3.2	0.1	0.3	750	23.2	15.5	0.67	0.64	24.3	34.6	-							
				980	24.7	2.35	15.7	92.4	2.96	3.6					850	23.7	17.0	0.72	0.67	24.8	33.8	-							
				850	23.7	2.35	14.8	94.8	2.84	4.1					750	23.6	15.7	0.66	0.61	24.5	36.8	-							
	5.1	0.6	1.3	980	24.6	2.38	15.5	92.3	2.90	3.7		4.6	0.5	1.1	850	23.9	17.1	0.72	0.64	25.0	35.5	-							
				850	25.3	2.48	16.1	96.8	2.91	4.1					750	23.7	15.7	0.66	0.59	24.6	38.2	-							
				980	25.4	2.38	16.3	93.1	3.00	3.5					850	24.3	17.1	0.71	0.62	25.2	37.3	-							
40	3.7	0.1	0.3	850	28.2	2.39	19.1	99.7	3.35	4.2	40	3.2	0.1	0.3	750	27.0	18.4	0.68	0.86	28.6	30.0	-							
				980	29.1	2.40	19.9	96.5	3.43	3.8					850	27.5	20.1	0.73	0.89	29.3	29.4	-							
				850	28.4	2.42	19.2	99.9	3.32	4.3					750	27.3	18.6	0.68	0.81	28.8	32.0	-							
	5.1	0.6	1.3	980	29.2	2.43	19.9	96.7	3.40	3.9		4.6	0.4	1.0	850	27.8	20.3	0.73	0.85	29.4	31.1	-							
				850	29.4	2.43	20.0	100.9	3.41	4.4					750	27.5	18.6	0.67	0.79	28.9	33.2	-							
				980	30.2	2.44	20.8	97.5	3.50	4.0					850	28.1	20.3	0.72	0.83	29.6	32.5	-							
50	3.7	0.1	0.2	850	32.6	2.45	23.2	104.4	3.77	4.5	50	3.2	0.1	0.2	750	31.0	20.5	0.66	1.04	33.0	28.4	-							
				980	33.5	2.45	24.1	100.7	3.88	4.2					850	31.9	23.2	0.73	1.10	34.1	27.7	-							
				850	33.1	2.50	23.6	105.0	3.76	4.7					750	31.0	20.6	0.67	1.00	33.0	29.5	-							
	5.1	0.5	1.2	980	33.9	2.48	24.3	101.0	3.87	4.3		4.6	0.4	1.0	850	31.9	23.4	0.73	1.05	34.0	29.0	-							
				850	34.1	2.52	24.5	106.0	3.85	4.8					750	31.1	20.6	0.66	0.98	33.0	30.2	-							
				980	34.9	2.50	25.3	101.9	3.96	4.4					850	32.0	23.4	0.73	1.03	34.0	29.6	-							
60	3.7	0.1	0.2	850	36.4	2.53	26.6	108.4	4.08	4.3	60	3.2	0.1	0.2	750	30.0	20.0	0.67	1.26	32.9	22.7	2.4							
				980	37.2	2.51	27.5	104.0	4.21	3.9					850	30.9	22.6	0.73	1.32	34.0	22.3	2.6							
				850	37.5	2.57	27.6	109.6	4.14	4.4					750	30.2	20.2	0.67	1.22	32.9	23.5	2.3							
	5.1	0.5	1.2	980	38.1	2.54	28.3	104.9	4.27	4.0		4.6	0.4	1.0	850	31.1	22.8	0.73	1.27	33.9	23.2	2.5							
				850	38.4	2.60	28.4	110.5	4.20	4.6					750	30.3	20.2	0.67	1.20	32.9	24.1	2.2							
				980	39.0	2.56	29.1	105.7	4.33	4.1					850	31.2	22.8	0.73	1.25	34.0	23.8	2.4							
70	3.7	0.1	0.2	850	40.1	2.61	30.0	112.4	4.38	4.8	70	3.2	0.1	0.2	750	29.1	19.5	0.67	1.48	32.8	18.7	3.3							
				980	39.4	2.57	29.3	106.0	4.34	4.4					850	29.6	22.1	0.74	1.66	33.9	17.0	3.4							
				850	41.8	2.65	31.5	114.2	4.49	5.0					750	29.3	19.7	0.67	1.44	32.8	19.4	3.1							
	5.1	0.5	1.2	980	42.3	2.59	32.2	108.8	4.64	4.6		4.6	0.4	0.9	850	30.2	22.2	0.74	1.50	33.9	19.1	3.3							
				850	42.6	2.68	32.2	115.1	4.53	5.2					750	29.4	19.8	0.67	1.41	32.8	19.9	2.9							
				980	43.1	2.62	32.9	109.5	4.68	4.8					850	30.3	22.3	0.73	1.47	33.9	19.7	3.1							
80	3.7	0.1	0.2	850	43.5	2.68	30.1	112.7	4.29	5.7	80	3.2	0.1	0.2	750	27.2	19.5	0.68	1.75	31.9	14.8	3.4							
				980	43.9	2.62	30.6	107.4	4.43	5.2					850	28.0	21.7	0.74	1.81	32.9	14.7	3.7							
				850	46.0	2.72	32.2	115.2	4.46	5.9					750	27.5	19.7	0.68	1.71	32.0	15.3	3.1							
	5.1	0.5	1.1	980	46.2	2.64	32.6	109.4	4.62	5.4		4.6	0.4	0.9	850	28.3	22.0	0.74	1.77	33.0	15.2	3.5							
				850	46.5	2.76	32.5	115.7	4.45	6.1					750	27.6	19.8	0.68	1.68	32.1	15.7	2.9							
				980	46.7	2.68	33.0	109.8	4.60	5.6					850	28.5	22.2	0.74	1.74	33.1	15.6	3.3							
90	3.7	0.1	0.2	850	46.9	2.75	30.2	113.1	4.21	6.6	90	3.2	0.1	0.2	750	25.4	19.4	0.69	2.02	31.0	11.9	4.8							
				980	47.0	2.68	30.5	107.5	4.33	6.1					850	26.1	21.6	0.74	2.08	32.0	12.0	5.1							
				850	50.1	2.80	32.7	116.0	4.42	6.9					750	25.6	19.6	0.69	1.98	31.2	12.4	4.4							
	5.1	0.5	1.1	980	50.1	2.70	33.0	109.9	4.59	6.3		4.6	0.4	0.9	850	26.4	21.9	0.75	2.04	32.1	12.3	4.9							
				850	50.4	2.84	32.8	116.3	4.38	7.1					750	25.9	19.7	0.76	1.97	31.4	12.5	4.1							
				980	50.3	2.74	33.1	110.1	4.54	6.5					850	26.7	22.1	0.74	2.01	32.3	12.6	4.6							
100	3.7	0.1	0.2	Operation not recommended							100	3.2	0.1	0.2	750	24.1	18.5	0.73	2.32	30.9	9.9	6.2							
	5.1	0.4	1.0									4.6	0.4	0.8	850	24.8	20.4	0.78	2.38	31.7	9.9	6.8							
	7.5	0.9	2.1									6.0	0.6	1.5	750	24.4	18.7	0.72	2.29	31.0	10.2	5.8							
110	3.7	0.1	0.2								110	3.2	0.1	0.2	850	25.1	20.7	0.78	2.35	31.9	10.2	6.4							
															750	24.6	18.9	0.73	2.26	31.1	10.4	5.4							
												850	25.4	20.9	0.78	2.31	32.1	10.5	6.0										
	5.1	0.4	1.0								4.6	0.3	0.8	750	22.8	17.5	0.77	2.62	30.7	8.3	8.4								
120	3.7	0.1	0.2								120	3.2	0.1	0.2	850	23.5	19.3	0.82	2.67	31.5	8.4	8.9							
															750	23.1	17.7	0.77	2.60	30.9	8.5	7.9							
												5.1	0.4	1.0	4.6	0.6	1.4	850	23.8	19.5	0.82	2.65	31.7	8.6	8.6				
	7.5	0.8	1.9	6.0	0.6	1.3	750	23.4	18.0	0.77	2.56	31.0	8.7	7.3															
120	3.7	0.1	0.2								120	3.2	0.1	0.2	850	24.2	19.7	0.82	2.61	31.9	8.8	8.1							
															750	21.4	17.4	0.81	3.18	31.3	6.4	11.5							
												5.1	0.4	1.0	4.6	0.3	0.8	850	21.9	17.5	0.81	3.01	30.9	6.9	10.4				
	7.5	0.8	1.9	6.0	0.6	1.3	850	22.1	19.0	0.86	3.08	31.6	6.8	11.1															
120	3.7	0.1	0.2								120	3.2	0.1	0.2	850	21.9	17.5	0.80	2.91	30.8	7.2	9.1							
															850	22.4	19.0	0.85	3.00	31.5	7.1	10.2							
												5.1	0.4	1.0	4.6	0.3	0.8	850	21.9	17.5	0.81	3.01	30.9	6.9	10.4				
	7.5	0.8	1.9	6.0	0.6	1.3	850	22.4	19.0	0.85	3.00	31.5	7.1	10.2															

## Performance Data cont.

### NVZ050 - 100% Full Load

EWT °F	Flow gpm	WPD		HEATING - EAT 70°F							EWT °F	Flow gpm	WPD		COOLING - EAT 80/67 °F								
		PSI	FT	Airflow cfm	HC MBtuh	Power kW	HE MBtuh	LAT °F	COP	HWC MBtuh			PSI	FT	Airflow cfm	TC MBtuh	SC MBtuh	S/T Ratio	Power kW	HR MBtuh	EER	HWC MBtuh	
20	9.0	2.0	4.6	Operation not recommended							20	9.0	0.8	1.9	Operation not recommended								
	13.5	4.6	10.5									11.5	2.0	4.6									
	18.0	7.2	16.7									14.0	3.2	7.3									
30	9.0	1.9	4.5	1800	47.3	5.16	29.6	94.3	2.68	5.5	30	9.0	0.8	1.8	1400	46.9	29.7	0.63	1.88	53.4	25.0	-	
				2200	52.7	5.23	34.8	92.2	2.95	5.0		11.5	1.9	4.5	1600	47.8	32.5	0.68	1.96	54.5	24.4	-	
	13.5	4.4	10.2	1800	55.1	5.02	38.0	98.3	3.22	5.7					1400	47.6	29.9	0.63	1.79	53.7	26.6	-	
				2200	56.6	5.34	38.4	93.8	3.11	5.2					1600	48.4	32.7	0.68	1.88	54.8	25.7	-	
	18.0	7.0	16.2	1800	54.5	5.34	36.3	98.0	2.99	5.9					1400	47.8	29.9	0.63	1.73	53.7	27.6	-	
			2200	57.2	5.39	38.8	94.1	3.11	5.3	1600	49.0	32.7	0.67	1.82	55.2	26.9	-						
40	9.0	1.9	4.3	1800	58.7	5.23	40.8	100.2	3.29	6.0	40	9.0	0.8	1.8	1400	51.0	33.0	0.65	2.15	58.4	23.8	-	
				2200	60.0	5.44	41.4	95.2	3.23	5.6		11.5	1.9	4.3	1600	52.0	36.1	0.69	2.24	59.7	23.3	-	
	13.5	4.3	9.9	1800	62.4	5.31	44.2	102.1	3.44	6.3					1400	51.6	33.3	0.65	2.04	58.6	25.3	-	
				2200	63.8	5.54	44.9	96.8	3.38	5.8					1600	52.6	36.4	0.69	2.14	59.9	24.6	-	
	18.0	6.8	15.7	1800	63.3	5.40	44.9	102.6	3.44	6.5					1400	52.0	33.3	0.64	1.98	58.8	26.3	-	
			2200	64.8	5.59	45.7	97.3	3.39	5.9	1600	53.2	36.4	0.68	2.07	60.3	25.7	-						
50	9.0	1.8	4.2	1800	65.8	5.48	47.1	103.9	3.52	6.8	50	9.0	0.7	1.7	1400	55.2	36.2	0.66	2.27	62.9	24.3	-	
				2200	67.2	5.65	47.9	98.3	3.48	6.3		11.5	1.8	4.2	1600	56.3	39.4	0.70	2.41	64.5	23.3	-	
	13.5	4.2	9.6	1800	69.6	5.59	50.6	105.8	3.65	7.0					1400	55.7	36.5	0.66	2.22	63.3	25.1	-	
				2200	71.0	5.73	51.5	99.9	3.63	6.4					1600	56.8	39.8	0.70	2.36	64.9	24.1	-	
	18.0	6.6	15.2	1800	70.8	5.65	51.5	106.4	3.67	7.2					1400	56.3	36.9	0.66	2.18	63.7	25.8	1.7	
			2200	72.3	5.79	52.5	100.4	3.66	6.6	1600	57.4	40.1	0.70	2.32	65.3	24.7	1.9						
60	9.0	1.8	4.1	1800	74.2	5.77	54.5	108.2	3.76	7.6	60	9.0	0.7	1.7	1400	52.7	35.4	0.67	2.54	61.3	20.8	3.0	
				2200	75.8	5.87	55.8	101.9	3.78	7.0		11.5	1.8	4.1	1600	54.0	38.5	0.71	2.70	63.2	20.0	3.1	
	13.5	4.0	9.3	1800	77.6	5.87	57.6	109.9	3.87	7.8					1400	53.2	35.7	0.67	2.49	61.7	21.4	2.8	
				2200	79.3	5.95	59.0	103.4	3.91	7.2					1600	54.6	38.8	0.71	2.64	63.6	20.7	3.0	
	18.0	6.4	14.7	1800	79.3	5.94	59.0	110.8	3.91	8.1					1400	53.7	36.1	0.67	2.44	62.1	22.0	2.6	
			2200	81.1	6.01	60.6	104.1	3.96	7.4	1600	55.1	39.2	0.71	2.60	64.0	21.2	2.8						
70	9.0	1.7	3.9	1800	82.5	6.06	61.9	112.5	3.99	8.5	70	9.0	1.6	1.6	1400	50.2	34.6	0.69	2.81	59.8	17.9	3.8	
				2200	83.4	6.10	62.6	105.1	4.01	7.9		11.5	2.6	3.9	1600	52.3	38.2	0.73	3.08	62.8	17.0	4.0	
	13.5	3.9	9.0	1800	85.6	6.15	64.6	114.0	4.08	8.8					1400	50.7	34.9	0.69	2.75	60.1	18.4	3.5	
				2200	87.5	6.16	66.5	106.8	4.16	8.1					1600	52.3	37.9	0.72	2.93	62.3	17.9	3.8	
	18.0	6.2	14.3	1800	87.7	6.22	66.5	115.1	4.13	9.1					1400	51.2	35.2	0.69	2.71	60.4	18.9	3.2	
			2200	89.8	6.22	68.6	107.8	4.23	8.3	1600	52.8	38.3	0.73	2.88	62.6	18.3	3.6						
80	9.0	1.6	3.8	1800	88.0	6.19	66.9	115.3	4.17	9.6	80	9.0	0.7	1.6	1400	47.2	33.7	0.71	3.22	58.2	14.7	4.9	
				2200	90.0	6.15	69.0	107.9	4.29	8.9		11.5	1.6	3.8	1600	48.9	36.6	0.75	3.43	60.7	14.3	5.2	
	13.5	3.8	8.7	1800	90.1	6.27	68.7	116.3	4.21	9.9					1400	47.7	34.0	0.71	3.16	58.5	15.1	4.5	
				2200	92.2	6.20	71.1	108.8	4.36	9.1					1600	49.4	37.0	0.75	3.36	60.9	14.7	4.8	
	18.0	6.0	13.8	1800	92.8	6.34	71.2	117.8	4.29	10.2					1400	48.2	34.4	0.71	3.10	58.7	15.5	4.2	
			2200	95.2	6.27	73.8	110.0	4.45	9.4	1600	50.0	37.4	0.75	3.31	61.2	15.1	4.6						
90	9.0	1.6	3.7	1800	93.4	6.31	71.9	118.1	4.34	10.7	90	9.0	0.7	1.5	1400	44.2	32.9	0.74	3.63	56.6	12.2	6.4	
				2200	95.7	6.22	74.5	110.3	4.51	9.9		11.5	1.6	3.7	1600	46.2	35.7	0.77	3.87	59.4	11.9	6.7	
	13.5	3.6	8.4	1800	94.7	6.38	72.9	118.7	4.35	11.1					1400	44.7	33.1	0.74	3.56	56.9	12.6	5.7	
				2200	97.0	6.24	75.7	110.8	4.55	10.2					1600	46.6	36.1	0.77	3.79	59.5	12.3	6.2	
	18.0	5.7	13.3	1800	97.9	6.46	75.9	120.4	4.44	11.4					1400	45.7	34.1	0.75	3.65	58.2	12.5	5.4	
			2200	100.5	6.31	79.0	112.3	4.67	10.6	1600	47.1	36.4	0.77	3.73	59.8	12.6	6.5						
100	9.0	1.5	3.5	Operation not recommended							100	9.0	0.6	1.5	1400	41.3	31.9	0.77	4.13	55.4	10.0	8.1	
												1600	43.3	34.7	0.80	4.40	58.3	9.8	8.6				
	13.5	3.5	8.1									11.5	1.5	3.5	1400	41.7	32.2	0.77	4.05	55.5	10.3	7.8	
												1600	43.7	35.0	0.80	4.31	58.4	10.1	8.4				
18.0	5.5	12.8	14.0								2.4	5.6	1400	42.1	32.6	0.77	3.97	55.7	10.6	7.4			
			1600								44.2	35.4	0.80	4.24	58.6	10.4	8.2						
110	9.0	1.5	3.4								110	9.0	0.6	1.4	1400	38.3	30.9	0.81	4.63	54.1	8.3	10.1	
												1600	40.4	33.6	0.83	4.93	57.2	8.2	10.9				
	13.5	3.4	7.8									11.5	1.5	3.4	1400	38.8	31.2	0.81	4.53	54.2	8.6	9.7	
												1600	40.8	33.9	0.83	4.83	57.3	8.5	10.5				
18.0	5.3	12.3	14.0								2.3	5.4	1400	39.1	31.6	0.81	4.45	54.3	8.8	9.3			
			1600								41.2	34.3	0.83	4.75	57.4	8.7	10.3						
120	9.0	1.4	3.3								120	9.0	0.6	1.3	1400	33.6	30.0	0.90	5.65	52.8	5.9	13.0	
												1600	34.3	32.8	0.96	5.78	54.0	5.9	13.5				
	13.5	3.2	7.5									11.5	1.4	3.3	1400	34.0	30.3	0.89	5.34	52.2	6.4	12.2	
				1600	34.6	32.9	0.95	5.48	53.3	6.3		13.1											
18.0	5.1	11.8	14.0	2.2	5.2	1400	34.3	30.3	0.88	5.17	51.9	6.6	11.3										
			1600	35.0	32.9	0.94	5.33	53.2	6.6	12.5													

The diagram illustrates the wiring for the Aurora Expansion Board (AXB™). Key components and connections include:

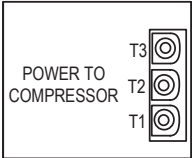
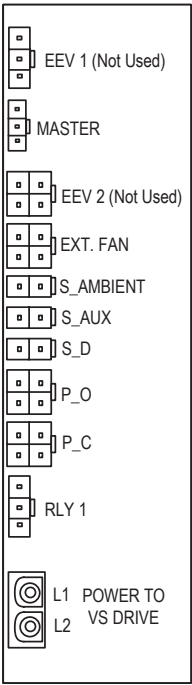
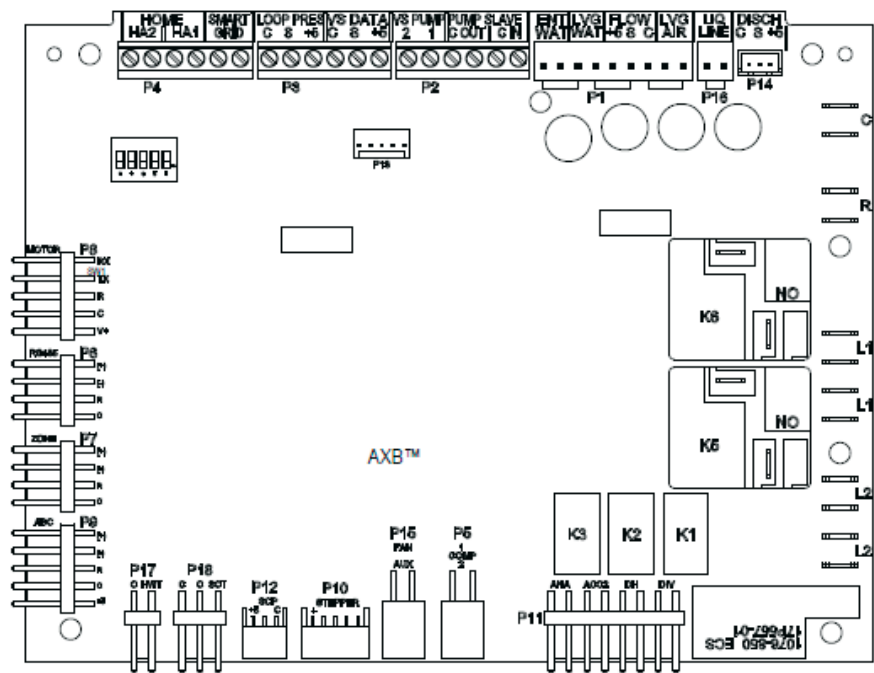
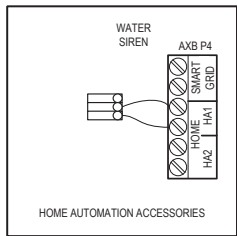
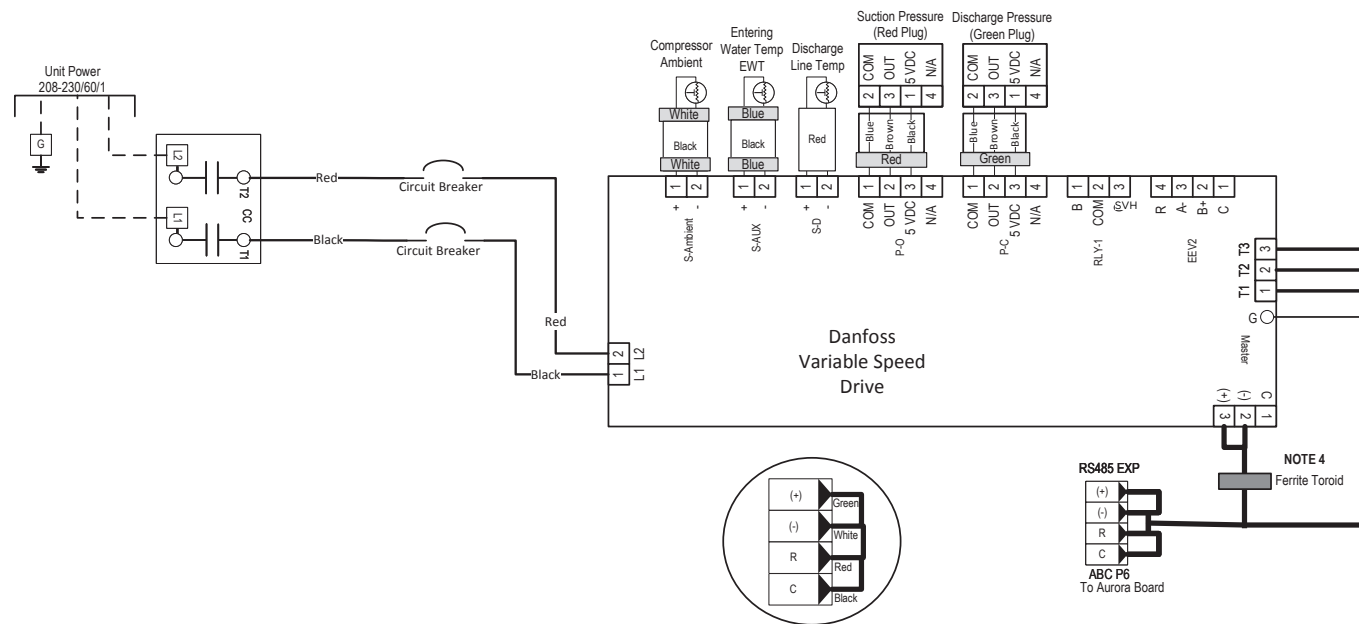
- Ext Pump 1/2 hp Total:** Connected to terminals 1 and 2 via a pump unit.
- Variable Speed Pump:** Connected to terminals 3 and 4 via a pump unit.
- Flow Meter:** Connected to terminals 5 and 6 via a pump unit.
- Modbus Add. ID:** A 5-pin connector for future use.
- SW1:** A switch connected to terminals 7 and 8.
- STEPPER:** A 5-pin connector for a stepper motor.
- SC1:** A 5-pin connector for a sensor.
- SW2:** A switch connected to terminals 9 and 10.
- Hot Water Option:** A 2-pin connector for a hot water sensor.
- Unit Power:** A 2-pin connector for unit power.
- Unit Power 208-230/60/1:** A 2-pin connector for unit power.
- Unit Power 208-230/60/1:** A 2-pin connector for unit power.
- Unit Power 208-230/60/1:** A 2-pin connector for unit power.

46



Compressor Section Wiring Schematics cont.

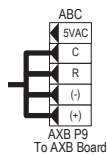
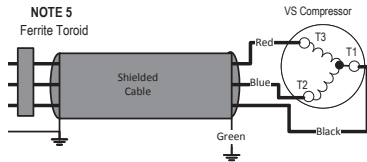
Aurora Variable Speed Indoor Split





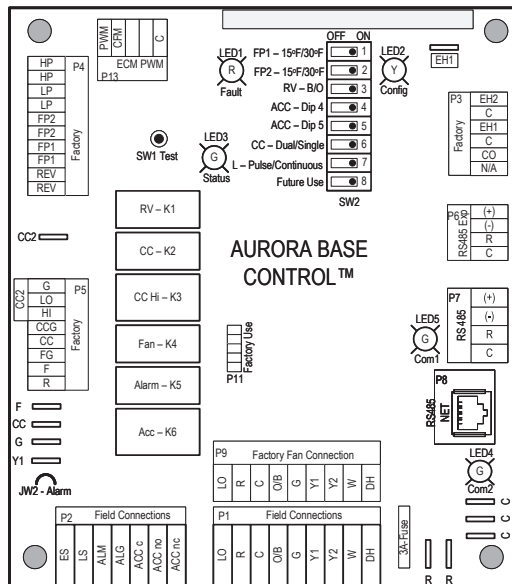
# Compressor Section Wiring Schematics cont.

## Aurora Variable Speed Indoor Split



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

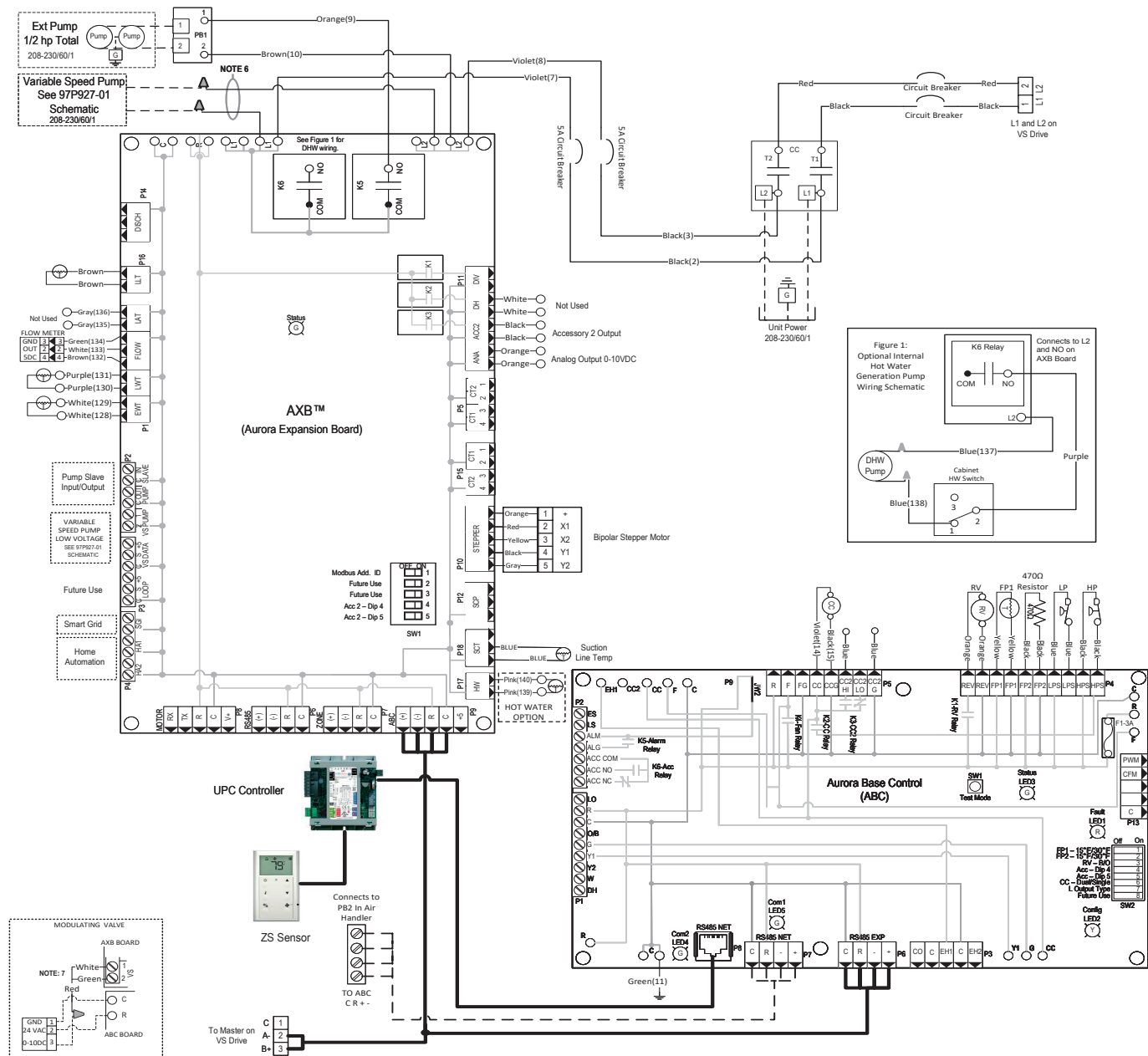
AXB Accessory 2 DIP Settings		
SW1-4	SW1-5	DESCRIPTION
ON	ON	Cycles with Blower
OFF	ON	Cycles with CC first stage compressor or compressor spd 1-12
ON	OFF	Cycles with CC2 second stage of compressor or comp spd 7-12
OFF	OFF	Cycles with DH from ABC board



Aurora LED Flash Codes			
Slow Flash	1 second on and 1 second off		
Fast Flash	100 milliseconds on and 100 milliseconds off		
Flash Code	100 milliseconds on and 400 milliseconds off with a 2 second pause before repeating		
Fault LED (LED 1, Red)		Random Start Delay (Alternating Colors)	
Normal Mode	OFF	Status LED (LED1, Green)	Fast Flash
Input Fault Lockout	Flash Code 1	Configuration LED (LED 2, Yellow)	Fast Flash
High Pressure Lockout	Flash Code 2	Fault LED (LED 3, Red)	Fast Flash
Low Pressure Lockout	Flash Code 3	Configuration LED (LED 2, Yellow)	
Freeze Protection - FP2	Flash Code 4	No Software Override	OFF
Freeze Protection - FP1	Flash Code 5	DIP Switch Override	Slow Flash
Loss of Charge	Flash Code 6	Status LED (LED 3, Green)	
Condensate Overflow Lockout	Flash Code 7	Normal Mode	ON
Over/Under Voltage Shutdown	Flash Code 8	Control is Non - Functional	OFF
Future Use	Flash Code 9	Test Mode	Slow Flash
		Lockout Active	Fast Flash
Fault - FP1 and FP2 Sensor Error	Flash Code 11	Dehumidification Mode	Flash Code 2
Future Use	Flash Code 12	Future Use	Flash Code 3
Non-Critical AXB Sensor Error	Flash Code 13	Future Use	Flash Code 4
Critical AXB Sensor Error	Flash Code 14	Load Shed	Flash Code 5
Alarm - Hot Water	Flash Code 15	ESD	Flash Code 6
Fault Variable Speed Pump	Flash Code 16	Future Use	Flash Code 7
Future Use	Flash Code 17	Fault LED (LED 1, Red) Cont.	
Non-Critical Communication Error	Flash Code 18	Safe Mode - Ambient Temp Sensor	Flash Code 49
Fault - Critical Communication Error	Flash Code 19	Fault - Discharge Temperature Sensor	Flash Code 51
Alarm - Low Loop Pressure	Flash Code 21	Fault - Suction Pressure Sensor	Flash Code 52
Fault - Communication ECM Fan Motor Error	Flash Code 22	Fault - Condensing Pressure Sensor	Flash Code 53
Alarm - Home Automation 1	Flash Code 23	Fault - Low Supply Voltage	Flash Code 54
Alarm - Home Automation 2	Flash Code 24	Fault - Compressor Out of Envelope	Flash Code 55
Fault - EEV Error	Flash Code 25	Fault - Over Current	Flash Code 56
Derate - Drive Temperature	Flash Code 41	Fault - Over/Under Voltage	Flash Code 57
Derate - High Discharge Temperature	Flash Code 42	Fault - High Drive Temperature	Flash Code 58
Derate - Low Suction Temperature	Flash Code 43	Fault - Drive Internal Error MOC/AOC	Flash Code 59
Derate - Low Condensing Pressure	Flash Code 44	Fault - Multiple Safe Modes	Flash Code 61
Derate - High Condensing Pressure	Flash Code 45	EEV2 Fault - Loss of Charge	Flash Code 71
Derate - Outer Power Limit	Flash Code 46	EEV2 Safe Mode - Suc Temp Sensor	Flash Code 72
Safe Mode - EEV (Indoor) Communication	Flash Code 47	EEV2 Safe Mode - LAT Temp Sensor	Flash Code 73
Safe Mode - EEV (Outdoor) Communication	Flash Code 48	EEV2 Safe Mode - Max Op Pressure	Flash Code 74
		EEV1 Fault - Loss of Charge	Flash Code 75
		EEV1 Safe Mode - Suction Temp Sensor	Flash Code 76
		EEV1 Safe Mode - LAT Temp Sensor	Flash Code 77
		EEV1 Safe Mode - Max Op Pressure	Flash Code 78

# Compressor Section Wiring Schematics cont.

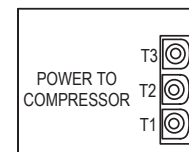
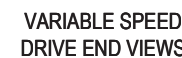
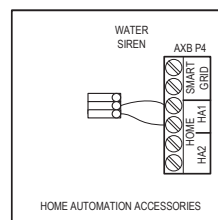
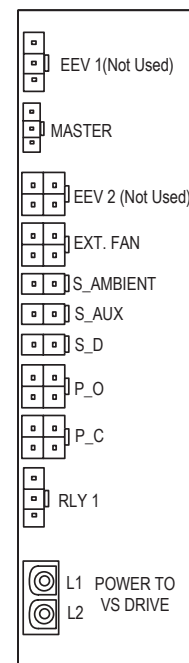
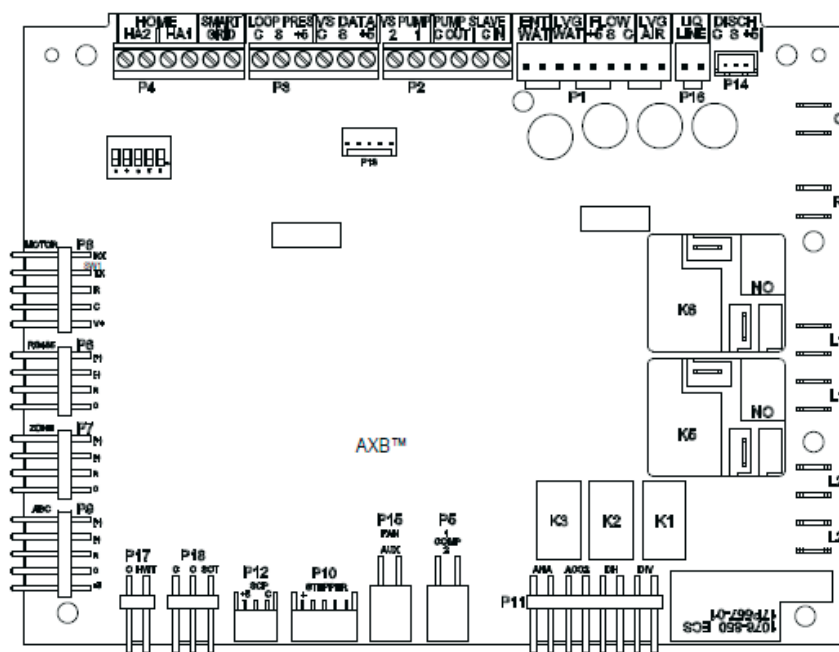
## Aurora Variable Speed Indoor Split with UPC





The diagram illustrates the electrical connections for a Danfoss Variable Speed Drive (VSD). It includes the following components and connections:

- Power Input:** Unit Power (208-230/160/1) is connected to a main switch (G) and then to a terminal block with terminals L1, L2, and G.
- Control and Protection:** Two circuit breakers are shown. One is connected to the L1 terminal and the other to the L2 terminal. The L1 circuit breaker is connected to the Red terminal of the terminal block. The L2 circuit breaker is connected to the Black terminal of the terminal block.
- Terminal Block:** The terminal block has terminals for L1, L2, and G. It also has terminals for Red and Black, which are connected to the L1 and L2 circuit breakers respectively.
- Sensors and Inputs:**
  - Compressor Ambient:** White (1), Black (2), and White (3) wires.
  - Entering Water Temp (EWT):** Blue (1), Blue (2), and Blue (3) wires.
  - Discharge Line Temp:** Red (1), Red (2), and Red (3) wires.
  - Suction Pressure (Red Plug):** COM (1), OUT (2), 5 VDC (3), and N/A (4) wires.
  - Discharge Pressure (Green Plug):** COM (1), OUT (2), 5 VDC (3), and N/A (4) wires.
  - Other Inputs:** B (1), RLY-1 (2), COM (3), O (4), R (5), A+ (6), B+ (7), and C (8) wires.
- Wiring Diagram:** The diagram shows the internal wiring of the VSD, including the terminal block, the main switch, and the circuit breakers. It also shows the connection of the sensors and inputs to the VSD.
- Notes:**
  - NOTE 4:** Ferrite Toroid
  - RS485 EXP:** (+), (-), R, and C wires.
  - ABC P6:** To Aurora Board









# Air Handler Wiring Schematics cont.

7 SeriesAir Handler Air Flow													
Model	Max ESP	Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Speed 6	Speed 7	Speed 8	Speed 9	Speed 10	Speed 11	Speed 12
033	0.75	250	400 G	550 L	650	750	850	1000	1150	1250 H	1350 Aux	1450	1600
042	0.75	250	450 G	650 L	800	950	1050	1200	1350	1450	1600 H	1750 Aux	1850
050	0.75	300	550 G	800 L	1000	1150	1300	1450	1600	1750	1900 H	2050 Aux	2200
**VS Compressor Speed				1-2	3-4		5-6	7-8		9-10	11-12		

11/29/2018

\*\* VS Compressor speed is given for the factory default cfm settings. When the cfm default settings are changed it will change the relationship to the compressor speed that is shown in the table. In cooling mode compressor speeds 10-12 are only available when SuperBoost mode is selected at the thermostat.

Factory settings are at recommended G, L, H and Aux positions

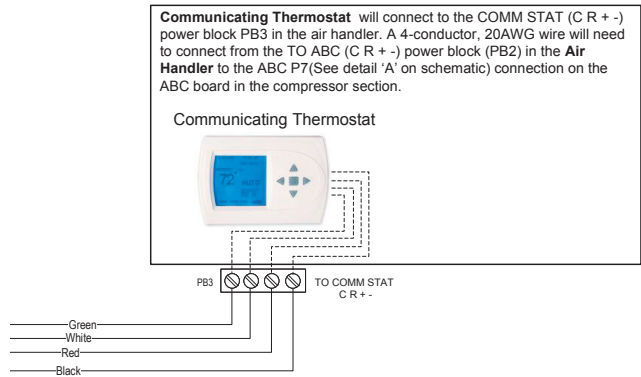
"G" may be located anywhere within the airflow table.

"L" setting should be located within the boldface CFM range

"H" setting MUST be located within the shaded CFM range

"Aux" setting MUST be equal to or greater than "H" setting

CFM is controlled within 5% up to the maximum ESP



**Note: On the AID Tool  
Configure Aurora Screen,  
confirm the AHB is added  
and communicating.**

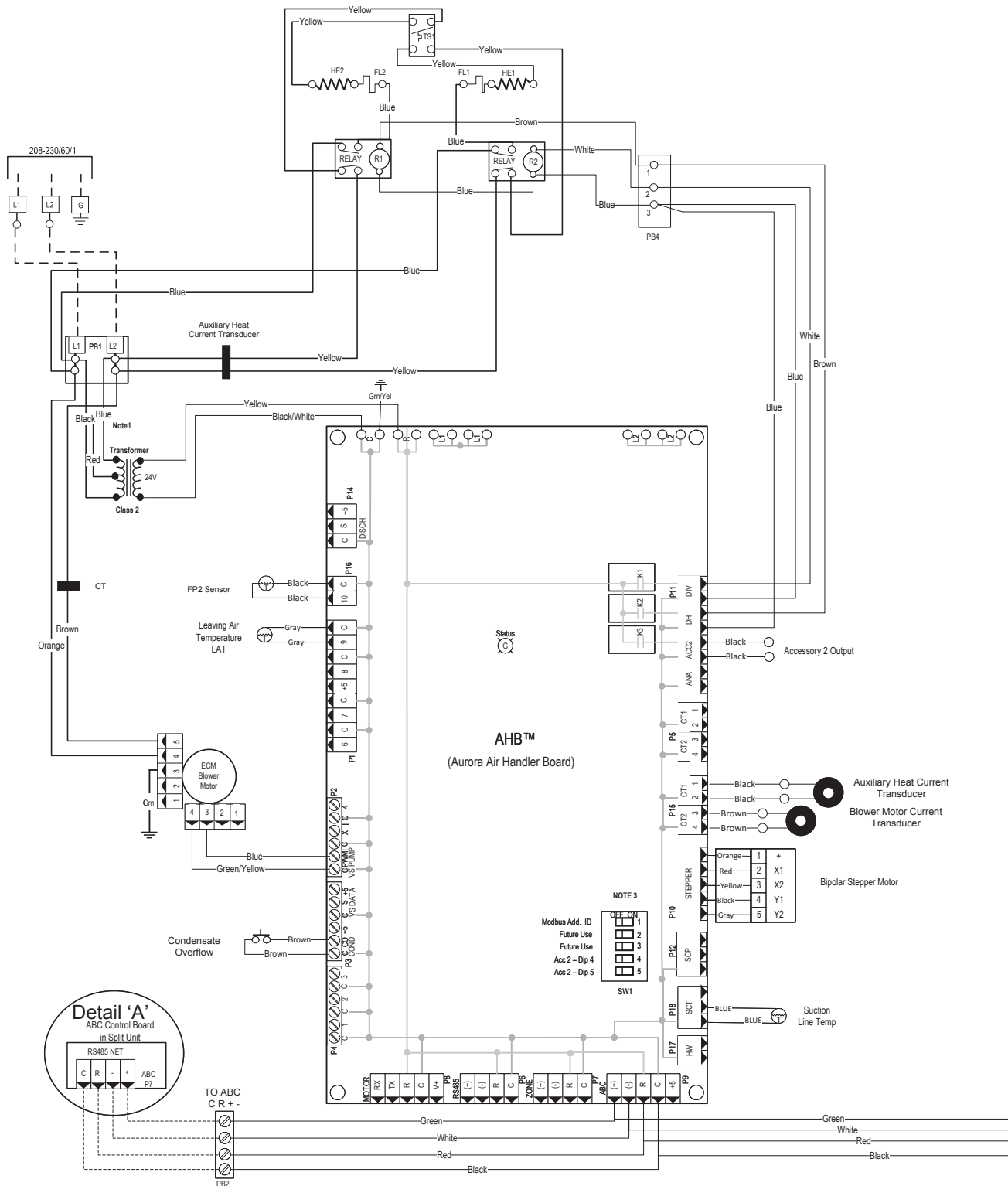
## Notes

- 1 - To operate in 208V mode replace the blue transformer wire connected to PB1-L2 with red transformer wire.
- 2 - Low voltage wiring CLASS 2.
- 3 - DIP switch 1 on SW1 must be set in the OFF position.

## Legend

Factory Low voltage wiring	Light emitting diode - Green
Factory Line voltage wiring	FL Fused Limit
Field low voltage wiring	SW1 DIP Switch - 4 Position
Field line voltage wiring	PB Power block
Optional block	HE Heater element
DC Voltage PCB traces	Current Transducer
Internal junction	
Quick connect terminal	P Polarized connector
Thermal Limit Switch	
Field wire lug	Breaker
Ground	
N.O., N.C.	

# Air Handler Wiring Schematics cont.



# Air Handler Wiring Schematics cont.

7 SeriesAir Handler Air Flow													
Model	Max ESP	Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Speed 6	Speed 7	Speed 8	Speed 9	Speed 10	Speed 11	Speed 12
033	0.75	250	400 G	550 L	650	750	850	1000	1150	1250 H	1350 Aux	1450	1600
042	0.75	250	450 G	650 L	800	950	1050	1200	1350	1450	1600 H	1750 Aux	1850
050	0.75	300	550 G	800 L	1000	1150	1300	1450	1600	1750	1900 H	2050 Aux	2200
**VS Compressor Speed				1-2	3-4		5-6	7-8		9-10	11-12		

11/29/2018

\*\* VS Compressor speed is given for the factory default cfm settings. When the cfm default settings are changed it will change the relationship to the compressor speed that is shown in the table. In cooling mode compressor speeds 10-12 are only available when SuperBoost mode is selected at the thermostat.

Factory settings are at recommended G, L, H and Aux positions

"G" may be located anywhere within the airflow table.

"L" setting should be located within the boldface CFM range

"H" setting MUST be located within the shaded CFM range

"Aux" setting MUST be equal to or greater than "H" setting

CFM is controlled within 5% up to the maximum ESP

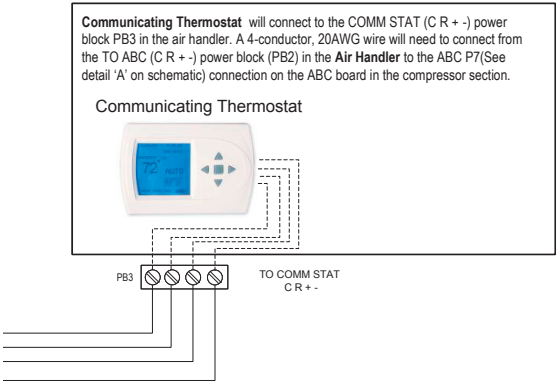
**Note: On the AID Tool  
Configure Aurora Screen,  
confirm the AHB is added  
and communicating.**

## Notes

- 1 - To operate in 208V mode replace the blue transformer wire connected to PB1-L2 with red transformer wire.
- 2 - Low voltage wiring CLASS 2.
- 3 - DIP switch 1 on SW1 must be set in the OFF position.

## Legend

- Factory Low voltage wiring
- Factory Line voltage wiring
- Field low voltage wiring
- Field line voltage wiring
- Optional block
- DC Voltage PCB traces
- Internal junction
- Quick connect terminal
- Thermal Limit Switch
- Field wire lug
- Ground
- N.O., N.C.
- Light emitting diode - Green
- Fused Limit
- SW1 DIP Switch - 4 Position
- Power block
- Heater element
- Current Transducer
- Polarized connector
- Breaker





## Air Handler Wiring Schematics cont.

7 Series Air Handler Air Flow													
Model	Max ESP	Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Speed 6	Speed 7	Speed 8	Speed 9	Speed 10	Speed 11	Speed 12
033	0.75	250	400 G	550 L	650	750	850	1000	1150	1250 H	1350 Aux	1450	1600
042	0.75	250	450 G	650 L	800	950	1050	1200	1350	1450	1600 H	1750 Aux	1850
050	0.75	300	550 G	800 L	1000	1150	1300	1450	1600	1750	1900 H	2050 Aux	2200
**VS Compressor Speed				1-2	3-4		5-6	7-8		9-10	11-12		

11/29/2018

\*\* VS Compressor speed is given for the factory default cfm settings. When the cfm default settings are changed it will change the relationship to the compressor speed that is shown in the table. In cooling mode compressor speeds 10-12 are only available when SuperBoost mode is selected at the thermostat.

Factory settings are at recommended G, L, H and Aux positions

"G" may be located anywhere within the airflow table.

"L" setting should be located within the boldface CFM range

"H" setting MUST be located within the shaded CFM range

"Aux" setting MUST be equal to or greater than "H" setting

CFM is controlled within 5% up to the maximum ESP

**Note: On the AID Tool  
Configure Aurora Screen,  
confirm the AHB is added  
and communicating.**

### Notes

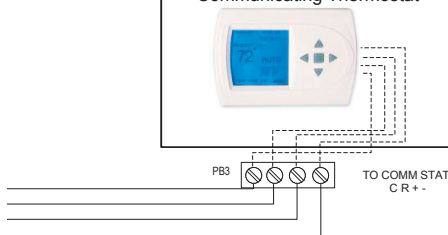
- 1 - To operate in 208V mode replace the blue transformer wire connected to PB1-L2 with red transformer wire.
- 2 - Use manufacturer's part number 19P502-01 (jumper bar assembly) when single source power is required.
- 3 - DIP switch 1 on SW1 must be set in the OFF position.
- 4 - Low voltage wiring CLASS 2

### Legend

Factory Low voltage wiring	Light emitting diode - Green
Factory Line voltage wiring	FL Fused Limit
Field low voltage wiring	SW1 DIP Switch - 4 Position
Field line voltage wiring	PB Power block
Optional block	HE Heater element
DC Voltage PCB traces	Current Transducer
Internal junction	Polarized connector
Quick connect terminal	Breaker
Thermal Limit Switch	
Field wire lug	
Ground	
N.O., N.C.	

**Communicating Thermostat** will connect to the COMM STAT (C R + -) power block PB3 in the air handler. A 4-conductor, 20AWG wire will need to connect from the TO ABC (C R + -) power block (PB2) in the **Air Handler** to the ABC P7 (See detail 'A' on schematic) connection on the ABC board in the compressor section.

Communicating Thermostat



### Dual Power Supply Connections

If two separate circuits are used to supply power to the auxiliary heat kit, the Installer will need to verify that each leg of the auxiliary heat circuit breakers are wired from the power supply correctly in order for the electric heat kit to operate properly. This can be done by measuring the supply side voltage of the auxiliary heat circuit breakers. Put a voltmeter on the L2 side of Circuit Breaker One and on the L2 side of Circuit Breaker Two. The voltmeter should read approximately 0 volts. If the meter reads high voltage, the auxiliary heat breakers need to be rewired so that breakers in the auxiliary heat kit match the wiring of the Disconnect Panel breakers. Meaning, L1 and L2 from one breaker in the disconnect panel must connect to L1 and L2 at one of the auxiliary heat circuit breakers and L1 and L2 from the other breaker in the disconnect panel must connect to L1 and L2 of the other auxiliary heat circuit breaker, making sure that the L1 and L2 from each disconnect breaker matches the L1 and L2 at each of the auxiliary heat breakers.





## Air Handler Wiring Schematics cont.

7 Series Air Handler Air Flow													
Model	Max ESP	Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Speed 6	Speed 7	Speed 8	Speed 9	Speed 10	Speed 11	Speed 12
033	0.75	250	400 G	550 L	650	750	850	1000	1150	1250 H	1350 Aux	1450	1600
042	0.75	250	450 G	650 L	800	950	1050	1200	1350	1450	1600 H	1750 Aux	1850
050	0.75	300	550 G	800 L	1000	1150	1300	1450	1600	1750	1900 H	2050 Aux	2200
**VS Compressor Speed				1-2	3-4		5-6	7-8		9-10	11-12		

11/29/2018

\*\* VS Compressor speed is given for the factory default cfm settings. When the cfm default settings are changed it will change the relationship to the compressor speed that is shown in the table. In cooling mode compressor speeds 10-12 are only available when SuperBoost mode is selected at the thermostat.

Factory settings are at recommended G, L, H and Aux positions

"G" may be located anywhere within the airflow table.

"L" setting should be located within the boldface CFM range

"H" setting MUST be located within the shaded CFM range

"Aux" setting MUST be equal to or greater than "H" setting

CFM is controlled within 5% up to the maximum ESP

### Dual Power Supply Connections

If two separate circuits are used to supply power to the auxiliary heat kit, the Installer will need to verify that each leg of the auxiliary heat circuit breakers are wired from the power supply correctly in order for the electric heat kit to operate properly. This can be done by measuring the supply side voltage of the auxiliary heat circuit breakers. Put a voltmeter on the L2 side of Circuit Breaker One and on the L2 side of Circuit Breaker Two. The voltmeter should read approximately 0 volts. If the meter reads high voltage, the auxiliary heat breakers need to be rewired so that breakers in the auxiliary heat kit match the wiring of the Disconnect Panel breakers. Meaning, L1 and L2 from one breaker in the disconnect panel must connect to L1 and L2 at one of the auxiliary heat circuit breakers and L1 and L2 from the other breaker in the disconnect panel must connect to L1 and L2 of the other auxiliary heat circuit breaker, making sure that the L1 and L2 from each disconnect breaker matches the L1 and L2 at each of the auxiliary heat breakers.

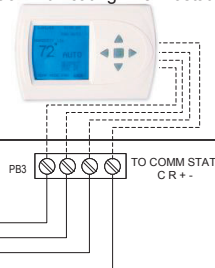
**Note: On the AID Tool  
Configure Aurora Screen,  
confirm the AHB is added  
and communicating.**

### Notes

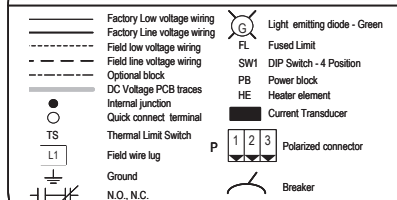
- 1 - To operate in 208V mode replace the blue transformer wire connected to PB14-12 with red transformer wire.
- 2 - Use manufacturer's part number 19P592-01 (jumper bar assembly) when single source power is required.
- 3 - DIP switch 1 on SW1 must be set in the OFF position.
- 4 - Low voltage wiring CLASS 2

**Communicating Thermostat** will connect to the COMM STAT (C R + -) power block PB3 in the air handler. A 4-conductor, 20AWG wire will need to connect from the TO ABC (C R + -) power block (PB2) in the **Air Handler** to the ABC P7 (See detail 'A' on schematic) connection on the ABC board in the compressor section.

### Communicating Thermostat

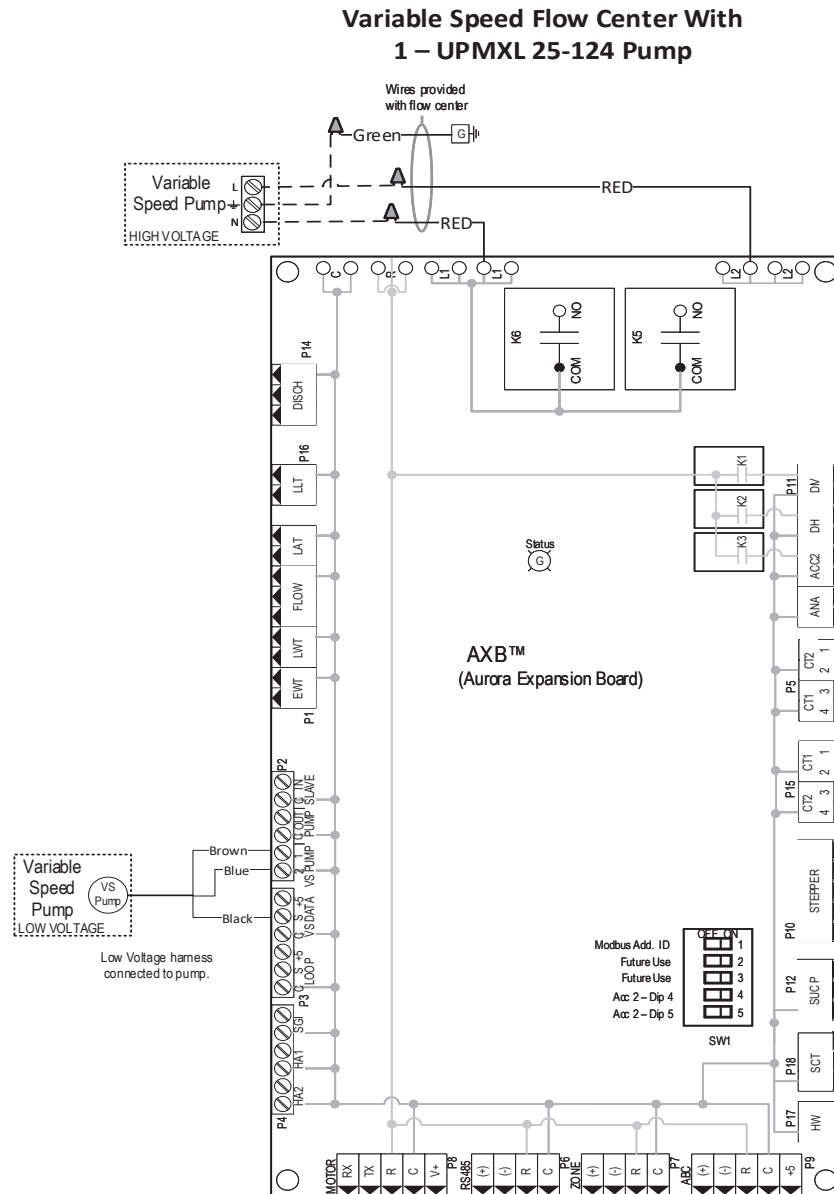


### Legend



## Air Handler Wiring Schematics cont.

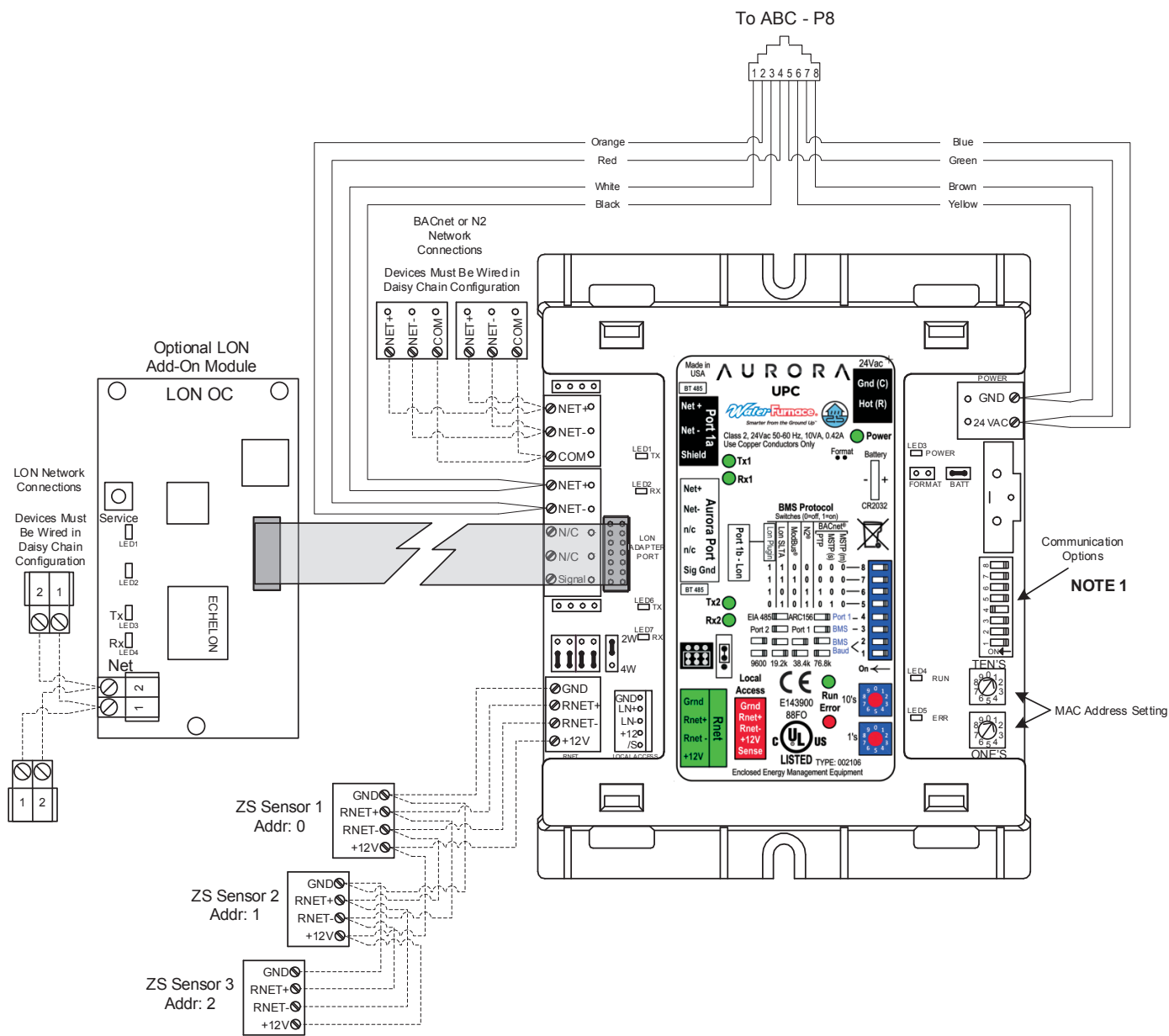
### Variable Speed Pump (UPMXL 25-124)





Compressor Section Wiring Schematics cont.

Aurora UPC



ZS Sensor Information

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

DIP Switch Value

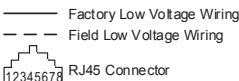


Each ZS sensor must have a unique address, but the addresses do not need to be sequential. Use the DIP switches on the back of the ZS sensor to set an address from 0 to 4. (0 is the factory default.) Each DIP switch has the value shown in the figure to the left. Turn on as many DIP switches as you need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

Notes

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

Legend



## Engineering Guide Specifications

### General

Furnish and install WaterFurnace Water Source Heat Pumps, as indicated on the plans. Equipment shall be completely assembled, piped and internally wired. Capacities and characteristics as listed in the schedule and the specifications that follow. The reverse cycle heating/cooling units shall be either suspended type with horizontal air inlet and discharge or floor mounted type with horizontal air inlet and vertical upflow, or downflow 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.

Three compressor compartment access panels shall be 'lift-out' removable. 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.

The air handler shall be provided with two large access panels and shall be removable with supply and return ductwork in place. The internal components layout shall provide for major service with the unit in-place for restricted access installations. The blower assembly access shall be slide-out serviceable via a 'works-in-a-drawer' design. The cabinet shall be convertible to horizontal or downflow applications by reconfiguring the cabinet using only a nut driver. The unit shall be 'zero clearance' approved on any of its external surfaces. A duct collar shall be provided for field installation on the supply air opening. The air handler shall be supplied with an integral return air filter rack (air filter is field supplied).

### Refrigerant Circuit

All units shall contain a sealed refrigerant circuit including a hermetic motor-compressor, oil separator, electronic expansion valve, reversing valve, coaxial 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. All air handlers shall provide an electronic expansion valve, enhanced fin and tube air-to-refrigerant heat exchanger of the "A" coil design. The finned tube coil shall be sized for low-face velocity and constructed of lanced aluminum fins bonded to aluminum tubes in a staggered pattern. The coil shall include a composite drain pan.

Both electronic expansion valves shall provide proper superheat over the entire liquid temperature range with minimal "hunting."

Refrigerant to air heat exchangers shall utilize aluminum 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.

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 an oversized direct drive centrifugal type with a dynamically balanced wheel. The housing and wheel shall be designed for quiet low outlet velocity operation and of galvanized or galvalume steel construction. Tight blower housing geometry shall not be permitted. The blower housing shall be removable from the cabinet without disconnecting the supply air ductwork for servicing of the blower motor through a 'works-in-a-drawer' design. The high efficiency blower motor shall be a variable speed ECM type. The blower motor shall be isolated from the housing by rubber grommets. The motor shall be permanently lubricated ball bearings and have thermal overload protection.

### Electrical

A control box shall be located within the compressor and air handler compartments (air handler shall contain a 100VA transformer) and the compressor compartment shall contain a 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

## Engineering Guide Specifications cont.

control, blower failure, high and low pressure switch monitoring, freeze detection, hot water limit thermistor sensing, condensate overflow sensing, auxiliary heat staging, lock-out 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 linking 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, performance and refrigerant monitoring kits will provide real time data including total power consumption, entering and leaving water temperature, flow rate and heat of extraction/rejection capacity data, refrigerant superheat and subcooling. 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 knock-outs for entrance of low and line voltage wiring. The blower motor and control box shall be harness plug wired for easy removal.

The air handler shall contain integral circuit breakers on all units employing 15 kW or 20 kW electric heat. The 100VA transformer shall be protected by internal circuit breaker.

An 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.

Option: An Aurora Unitary Protocol Converter (UPC) shall be included that communicates directly with the Aurora Heat Pump Control and allows access/control of a variety of internal Aurora heat pump operations such as sensors, relay operation, faults and other information. In turn, the UPC shall convert the internal Aurora Modbus protocol to BACnet MS/TP protocol for communication over a HAS system. Additional individual unit configuration items such as ECM fan speeds or freeze detection settings shall be directly available over the HAS without the need for access to the actual heat pump.

### 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. Refrigeration connections shall be made using sweat copper joints. The air handler condensate connections shall be a 3/4 in. NPT.

### 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.

#### 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 linking control so that two units may share one flow center.



## Revision Guide

---

<b>Pages:</b>	<b>Description:</b>	<b>Date:</b>	<b>By:</b>
Misc.	Remove EEV, new part number revision	25 Jan 2023	JM
26	Updated line set length	12 Dec 2020	MA
All	Document Created	Feb 2020	MA



Manufactured by  
WaterFurnace International, Inc.  
9000 Conservation Way  
Fort Wayne, IN 46809  
[www.waterfurnace.com](http://www.waterfurnace.com)

