# Versatec® VS
VARIABLE SPEED

## Commercial
## Water Source/Geothermal Heat Pump

- R-410A Refrigerant
- 10-15 Tons

Versatec Variable Speed 10-15 Ton Installation Manual

Installation Information

Water Piping Connections

Electrical

Startup Procedures

Troubleshooting

Preventive Maintenance

c UL us LISTED
Heat Pump
E347094

WaterFurnace®
Commercial Solutions

IM2751AU 02/20

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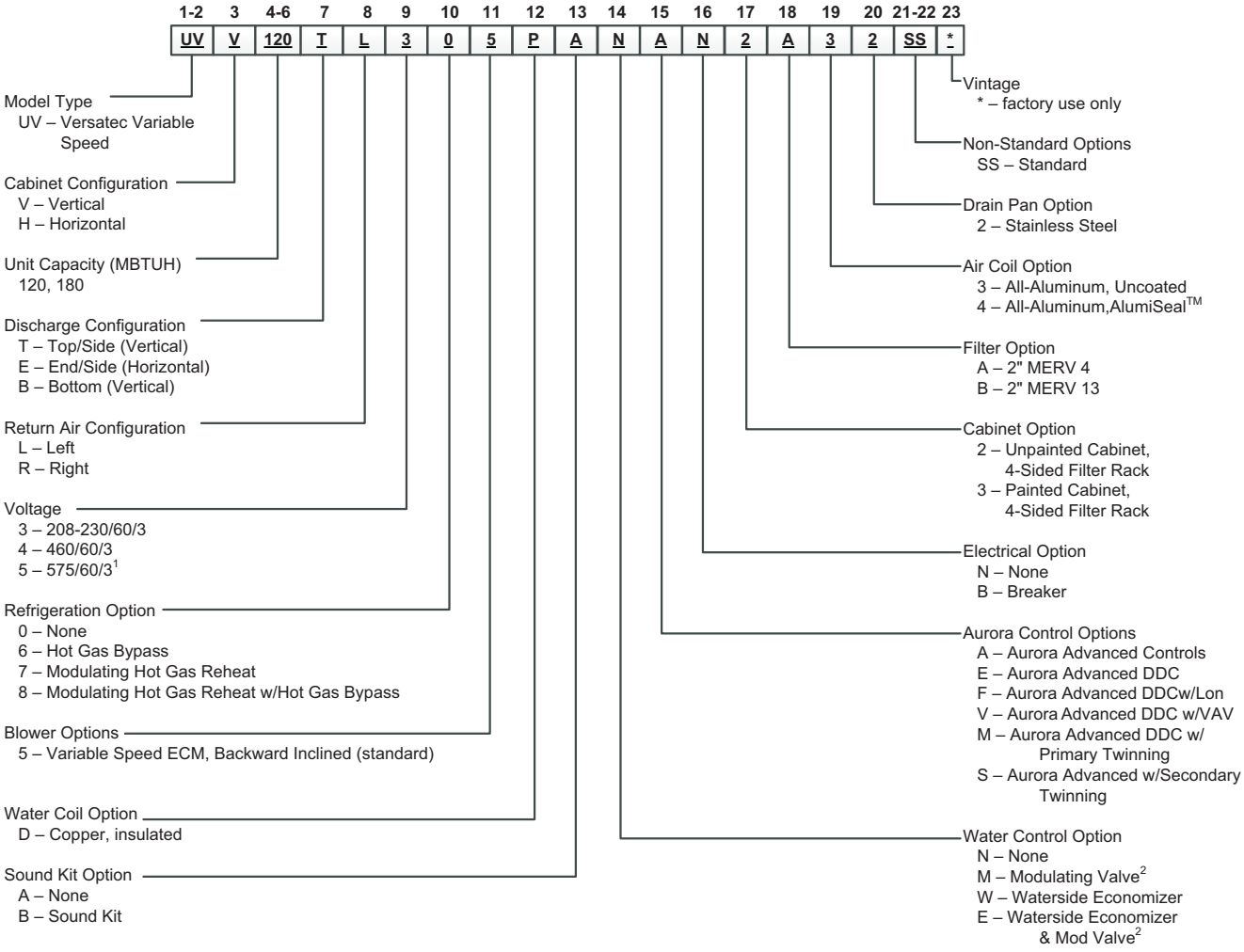
# Model Nomenclature




Notes:
1 – 575V includes factory installed step down transformer on plenum fan.
2 – not available on UVV/UVH180 with 208-230V/60/3 .
3 – Only available on controls option.

Rev.: 19 November 2019

# Electrical Availability

### VS ECM

| Voltage | Model | |
|---|---|---|
| | 120 | 180 |
| 208-230/60/3 | • | • |
| 460/60/3 | • | • |
| 575/60/3 | * | * |

08/01/2019

Legend:
NA = Not Available
• = Voltage available in this size
* = With step down transformer on fan motor

# General Installation Information

## Safety Considerations

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

Installing and servicing heating and air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair or service heating and air conditioning equipment. Untrained personnel can perform the basic maintenance functions of cleaning coils and cleaning and replacing filters. All other operations should be performed by trained service personnel. When working on heating and air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing operations and have a fire extinguisher available.

### Moving and Storage

Move units in the normal “up” orientation. Horizontal units may be moved and stored per the information on the packaging. Do not stack more than three units in total height. When the equipment is received, all items should be carefully checked against the bill of lading to be sure all crates and cartons have been received. Examine units for shipping damage, removing the units from the packaging if necessary. Units in question should also be internally inspected. If any damage is noted, the carrier should make the proper notation on the delivery receipt, acknowledging the damage.

### Unit Location

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

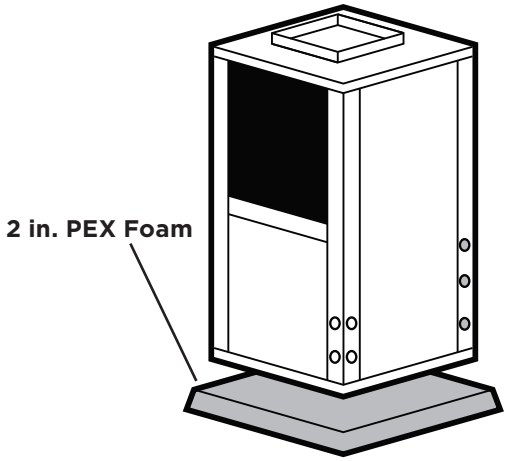
**WARNING: To avoid equipment damage and possible voiding of warranty, be sure that properly sized strainers are installed upstream of both brazed plate heat exchangers to protect them against particles in the fluid.**

## Installing Vertical Units

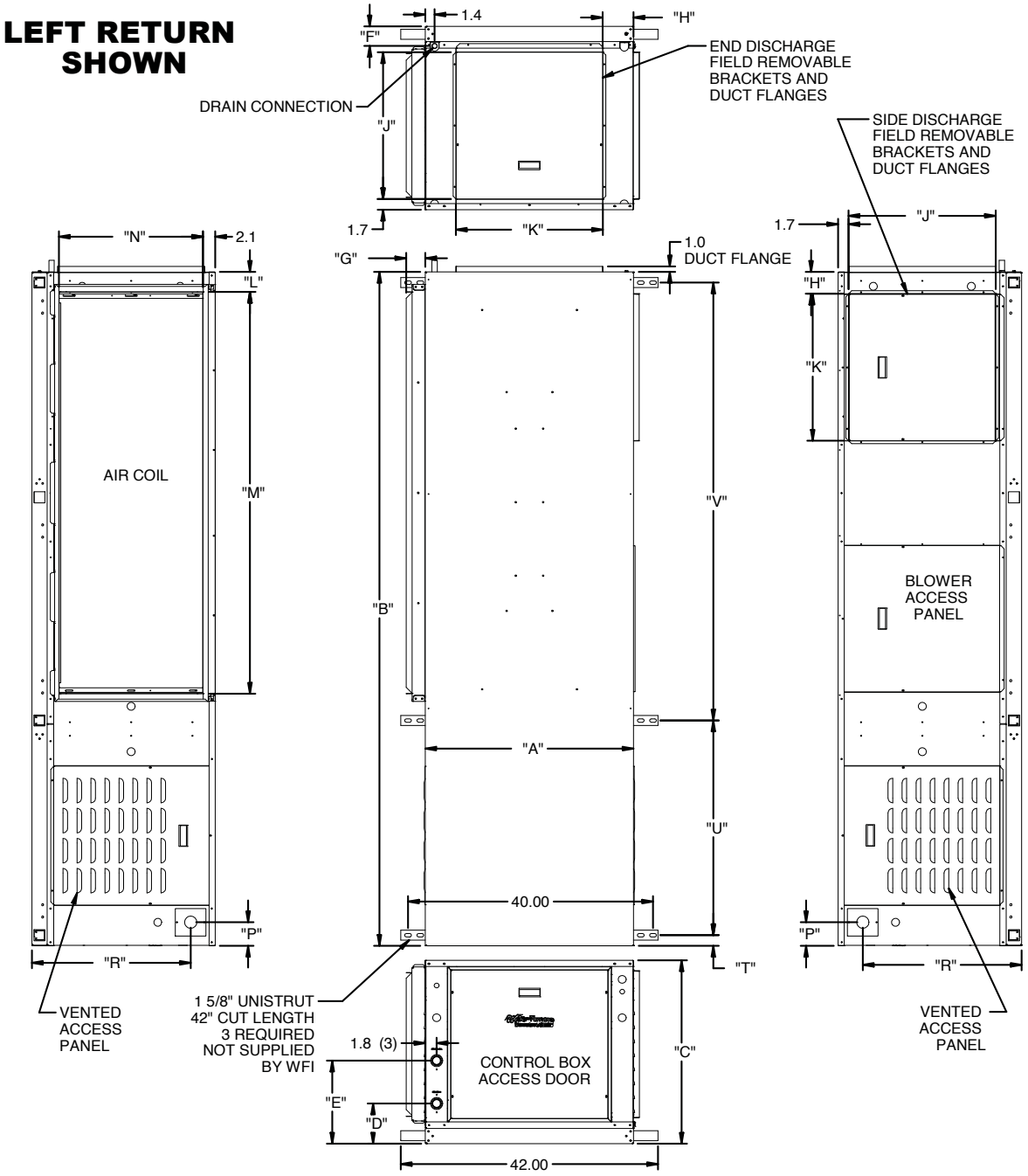
Prior to setting the unit in place, remove and discard the compressor hold down shipping bolt located at the front of the compressor mounting bracket.

Vertical units are available in left or right air return configurations. Top flow vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to provide isolation between the unit and the floor. It is not necessary to anchor the unit to the floor (see figure below).

***Vertical Unit Mounting***



# Dimensional Data



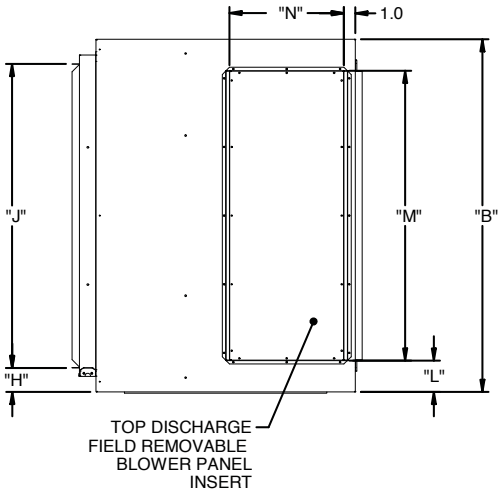

## Large Variable Speed - Horizontal Dimensional Data

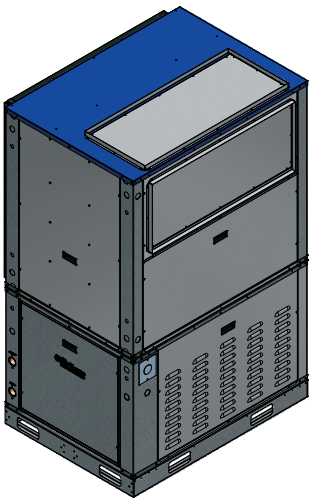
| Horizontal Models | | Overall Cabinet | | | Water Connections | | | | | Discharge Connection | | | Return Connection* using deluxe filter rack | | | Electrical Connections | | Unistrut Hanging | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 5 | | | | | | | | | | | | | |
| | | A | B | C | D | E | F | Loop | G | H | J | K | L | M | N | P | R | T | U | V |
| | | Width | Depth | Height | In | Out | Cond-ensate | Water FPT | Filter Rack Width | From Edge | Supply Height | Supply Width | From Edge | Return Depth | Return Height | From Edge | Height | From Edge | Unistrut/ Unistrut | Unistrut/ Unistrut |
| 120 | in. | 34.0 | 89.0 | 29.9 | 8.1 | 15.1 | 3.2 | 2" | 3.1 | 5.0 | 24.0 | 24.0 | 4.3 | 47.6 | 23.5 | 3.9 | 25.9 | 1.7 | 24.6 | 61.0 |
| | cm. | 86.4 | 226.1 | 75.9 | 20.6 | 38.4 | 8.1 | 50.8 mm | 7.9 | 12.7 | 61.0 | 61.0 | 10.9 | 120.9 | 59.7 | 9.9 | 65.8 | 4.3 | 62.5 | 154.9 |
| 180 | in. | 34.0 | 110.0 | 29.9 | 8.1 | 15.1 | 3.2 | 2" | 3.1 | 5.0 | 24.0 | 24.0 | 4.3 | 65.6 | 23.5 | 3.9 | 25.9 | 1.7 | 35.1 | 71.5 |
| | cm. | 86.4 | 279.4 | 75.9 | 20.6 | 38.4 | 8.1 | 50.8 mm | 7.9 | 12.7 | 61.0 | 61.0 | 10.9 | 166.6 | 59.7 | 9.8 | 65.8 | 4.3 | 89.2 | 181.6 |

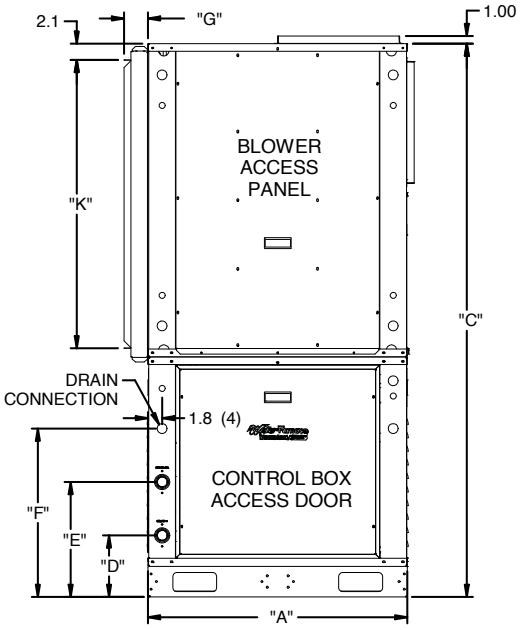
*Dimensions for return connections are for the deluxe filter rack that is suitable for ducted return applications.

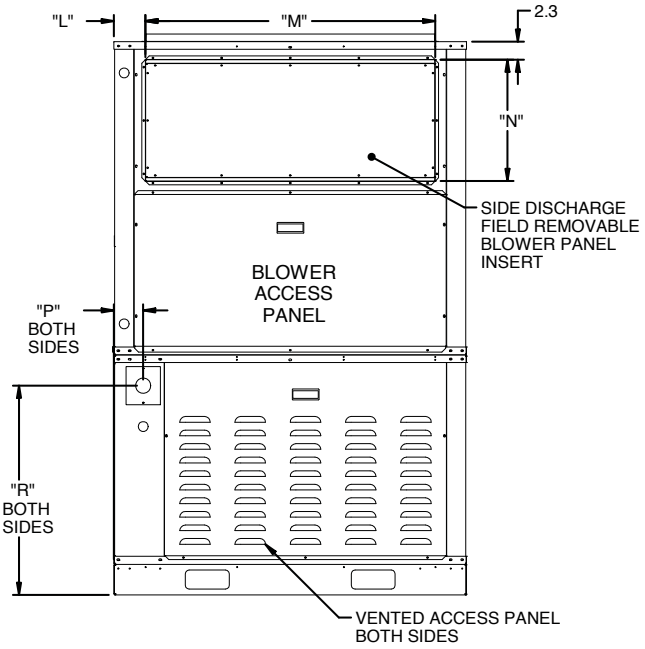
# Dimensional Data cont.

**LEFT RETURN SHOWN**





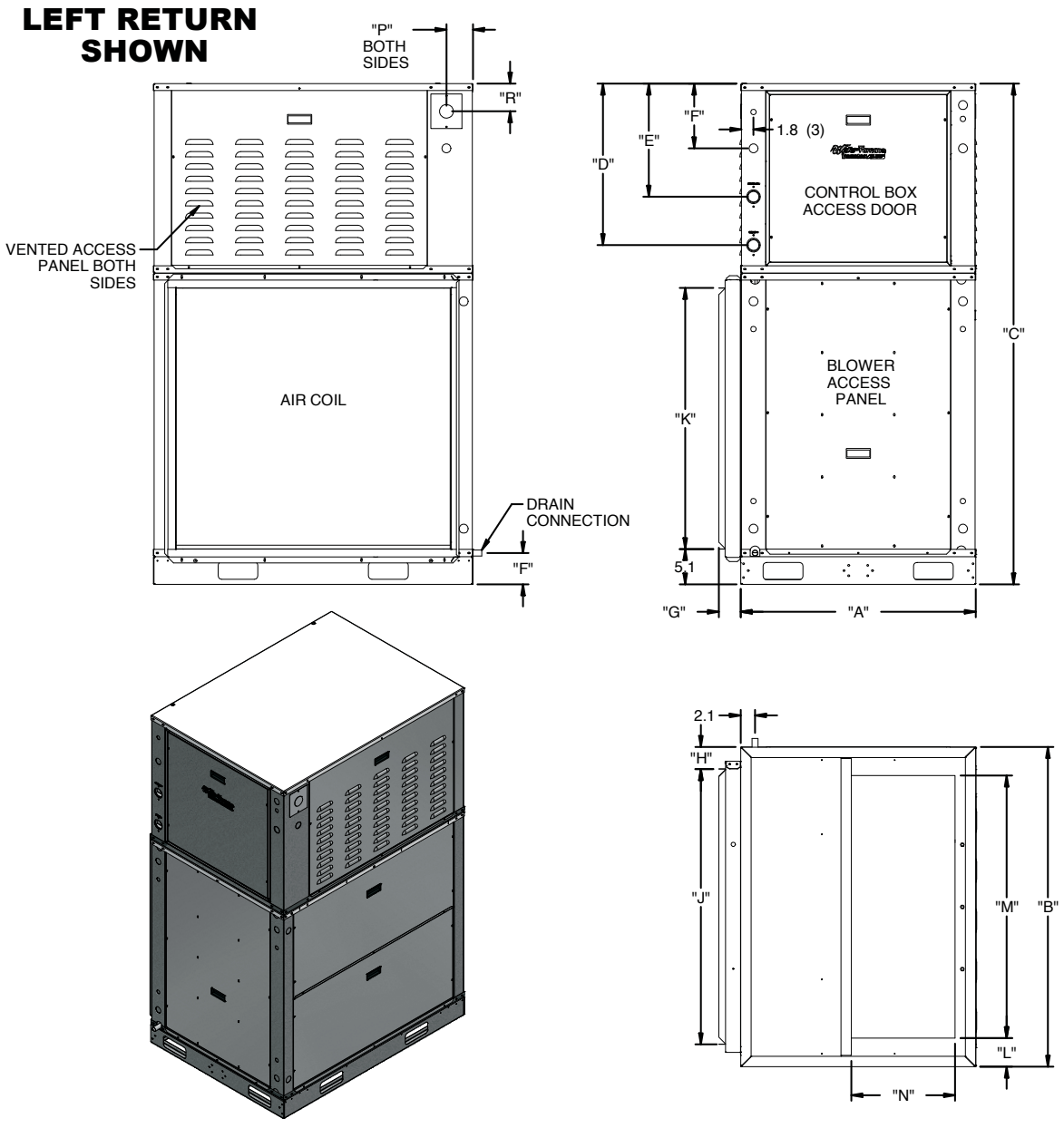




## Large Variable Speed - Vertical Dimensional Data

| Vertical Models | | Overall Cabinet | | | Water Connections | | | | Return Connection* | | | | Discharge Connection | | | Electrical Connections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | | using deluxe filter rack | | | | | | | | |
| | | A | B | C | D | E | F | Loop | G | H | J | K | L | M | N | P | R |
| | | Width | Depth | Height | In | Out | Cond-ensate | Water FPT | Filter Rack | From Edge | Return Depth | Return Height | From Edge | Supply Width | Supply Height | From Edge | Height |
| 120 | in. | 34.0 | 36.3 | 72.5 | 8.1 | 15.1 | 22.1 | 2" | 3.1 | 3.2 | 29.9 | 37.8 | 4.1 | 28.0 | 16.0 | 3.9 | 27.4 |
| | cm. | 86.4 | 92.2 | 184.2 | 20.6 | 38.4 | 56.1 | 50.8 mm | 7.9 | 8.1 | 75.9 | 96.0 | 10.4 | 71.1 | 40.6 | 9.9 | 69.6 |
| 180 | in. | 34.0 | 46.3 | 72.5 | 8.1 | 15.1 | 22.1 | 2" | 3.1 | 3.2 | 39.9 | 37.8 | 4.1 | 38.0 | 16.0 | 3.9 | 27.4 |
| | cm. | 86.4 | 117.5 | 184.2 | 20.6 | 38.4 | 56.1 | 50.8 mm | 7.9 | 8.1 | 101.3 | 96.0 | 10.4 | 96.5 | 40.6 | 9.9 | 69.6 |

*Dimensions for return connnections are for the deluxe filter rack that is suitable for ducted return applications

# Dimensional Data cont.

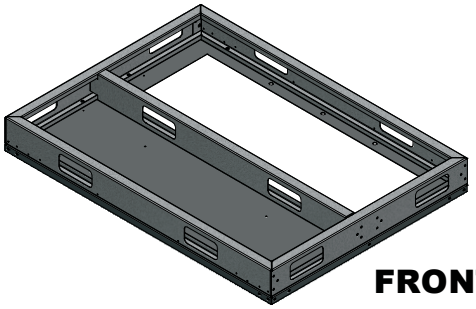



## Large Variable Speed - Vertical Bottom Flow Dimensional Data

| Vertical Bottom Flow Models | | Overall Cabinet | | | Water Connections | | | | Return Connection* | | | | Discharge Opening | | | Electrical Connections | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | | using deluxe filter rack | | | | | | | | |
| | | A | B | C | D | E | F | Loop | G | H | J | K | L | M | N | P | R |
| | | Width | Depth | Height | In | Out | Cond-ensate | Water FPT | Filter Rack | From Edge | Return Depth | Return Height | From Edge | Supply Width | Supply Height | From Edge | Height |
| 120 | in. | 34.0 | 36.3 | 72.5 | 23.4 | 16.4 | 4.5 | 2" | 3.1 | 3.2 | 29.9 | 37.8 | 4.1 | 28.0 | 15.0 | 3.9 | 4.0 |
| | cm. | 86.4 | 92.2 | 184.2 | 59.4 | 41.7 | 11.4 | 50.8 mm | 7.9 | 8.1 | 75.9 | 96.0 | 10.4 | 71.1 | 38.1 | 9.9 | 10.2 |
| 180 | in. | 34.0 | 46.3 | 72.5 | 23.4 | 16.4 | 4.5 | 2" | 3.1 | 3.2 | 39.9 | 37.8 | 4.1 | 38.0 | 15.0 | 3.9 | 4.0 |
| | cm. | 86.4 | 117.5 | 184.2 | 59.4 | 41.7 | 11.4 | 50.8 mm | 7.9 | 8.1 | 101.3 | 96.0 | 10.4 | 96.5 | 38.1 | 9.9 | 10.2 |

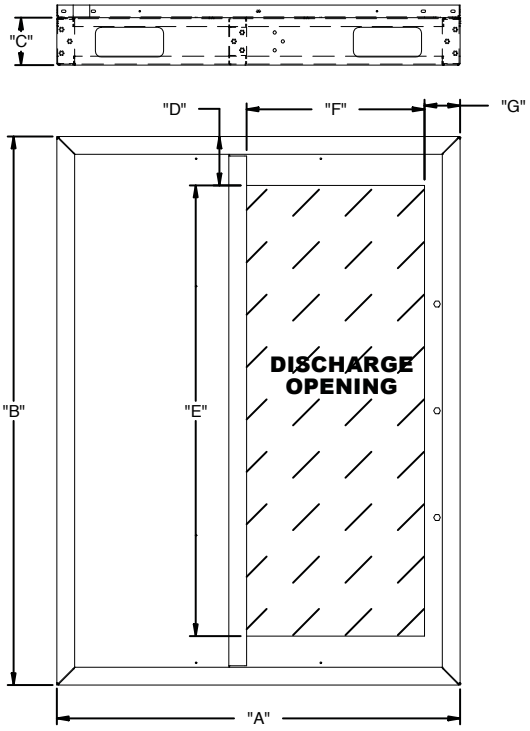
*Dimensions for return connnections are for the deluxe filter rack that is suitable for ducted return applications

# Dimensional Data cont.

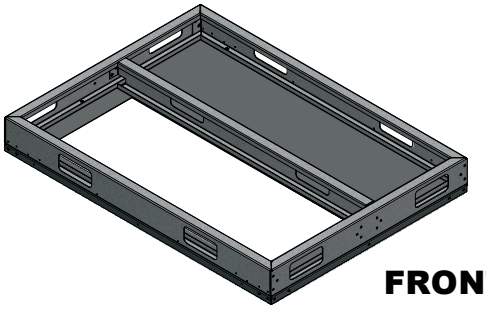


FRONT

## LEFT RETURN

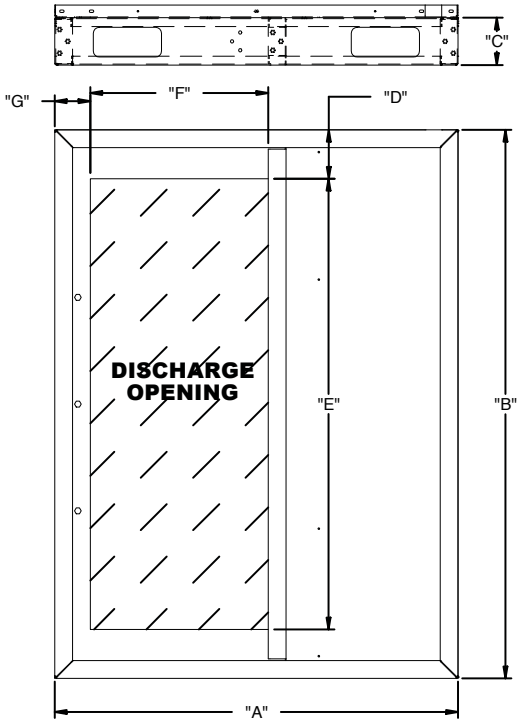



FRONT



FRONT

## RIGHT RETURN




FRONT

| Vertical Bottom Flow Models | | Overall | | | Discharge Opening | | | |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G |
| | | Width | Depth | Height | From Edge | Supply Width | Supply Height | From Edge |
| 120 | in. | 34.0 | 36.3 | 4.0 | 4.1 | 28.0 | 15.0 | 3.0 |
| | cm. | 86.4 | 92.2 | 10.2 | 10.4 | 71.1 | 38.1 | 7.6 |
| 180 | in. | 34.0 | 46.3 | 4.0 | 4.1 | 38.0 | 15.0 | 3.0 |
| | cm. | 86.4 | 117.5 | 10.2 | 10.4 | 96.5 | 38.1 | 7.6 |

**Weight Distribution Table**

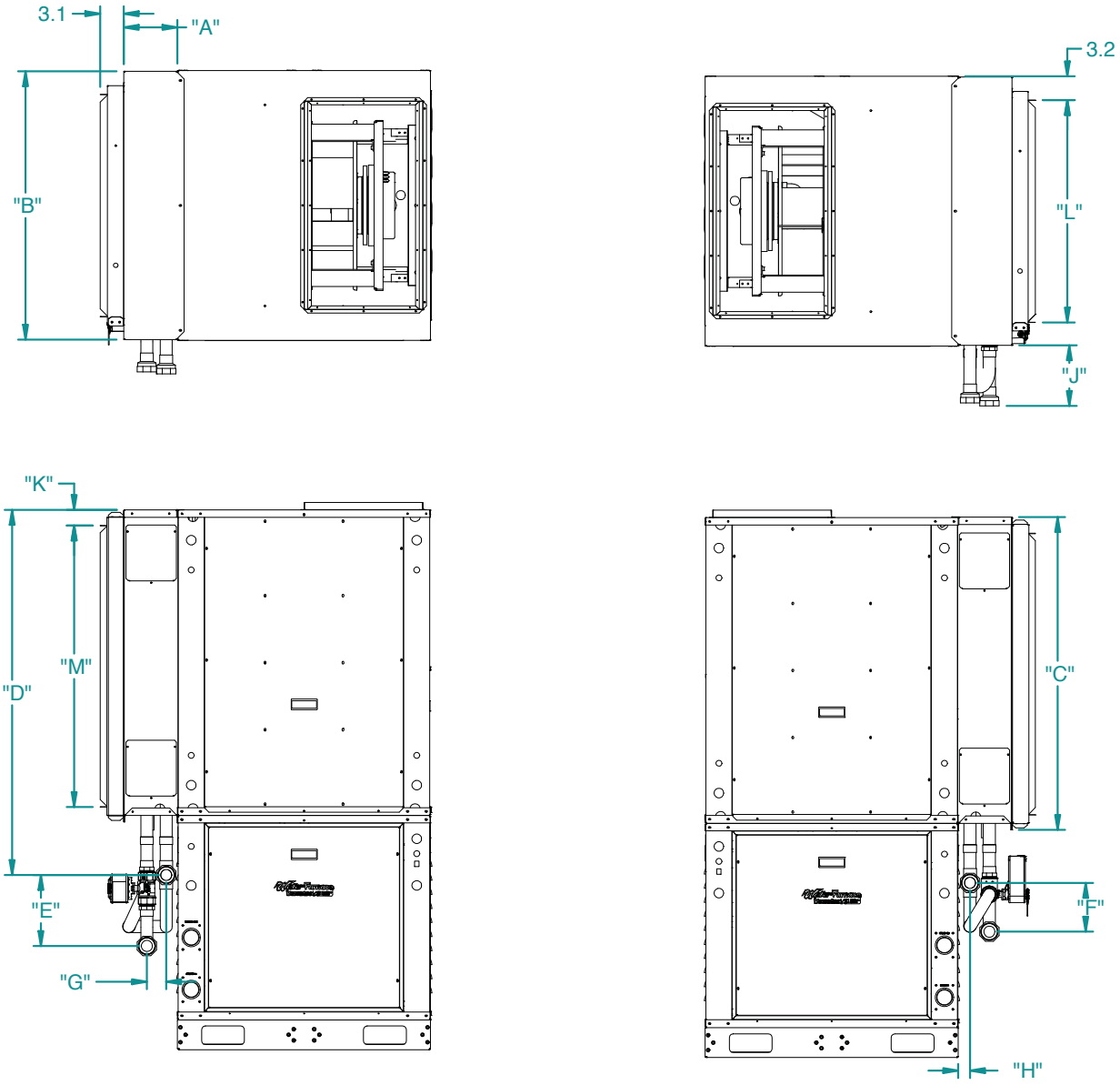
| Model | Vertical Shipping Weight | Horizontal Shipping Weight | Horizontal Weight Distribution | | | |
|---|---|---|---|---|---|---|
| | | | Front | | Back | |
| | | | D | E | F | G |
| 120 | 792 | 807 | 193 | 203 | 188 | 194 |
| | (359) | (366) | (88) | (92) | (85) | (88) |
| 180 | 926 | 1308 | 331 | 330 | 309 | 303 |
| | (420) | (593) | (150) | (150) | (140) | (137) |

Weights are listed in lbs. (kg).
Distributed weights for left return units

7/25/18

# Dimensional Data cont.

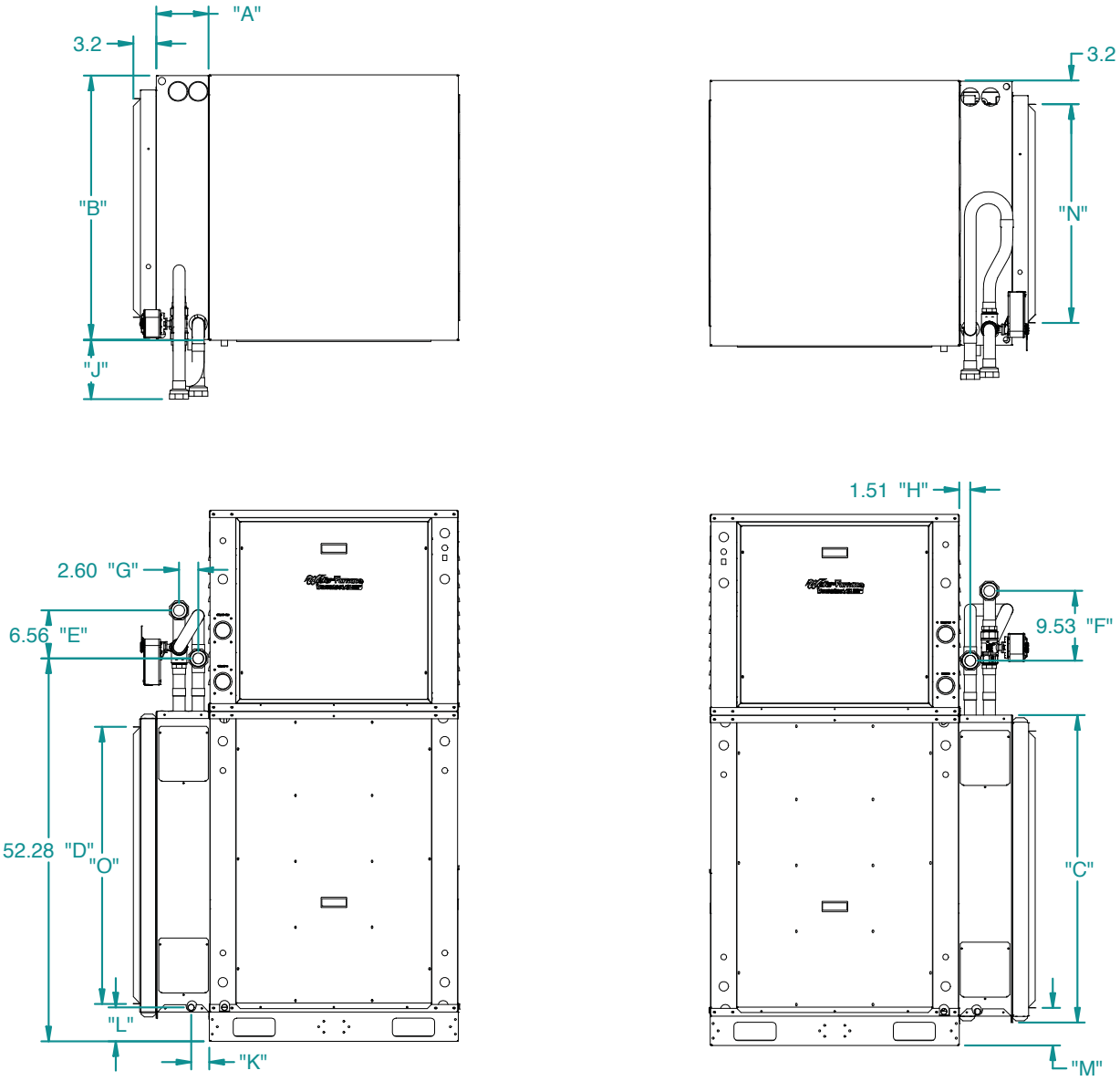
## Waterside Economizer Option




| Vertical Economizers- Top Flow | | Overall Cabinet | | | Water Lines | | | | | | | Filter Rack | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | J | Loop | K | L | M |
| | | Width | Depth | Height | From TOP | Length LR | Length RR | Width | From Edge | Depth | Water FPT | From Top | Return Depth | Return Height |
| 120 | in. | 7.2 | 36.0 | 42.0 | 49.0 | 9.5 | 6.6 | 2.6 | 1.6 | 8.0 | 1 1/2" | 2.1 | 29.9 | 37.8 |
| | cm. | 18.3 | 91.4 | 106.7 | 124.5 | 24.1 | 16.8 | 6.6 | 4.1 | 20.3 | 38.1 mm | 5.3 | 75.9 | 96.0 |
| 180 | in. | 7.2 | 46.0 | 42.0 | 48.5 | 9.5 | 6.6 | 2.6 | 1.6 | 8.0 | 1 1/2" | 2.1 | 39.9 | 37.8 |
| | cm. | 18.3 | 116.8 | 106.7 | 123.2 | 24.1 | 16.8 | 6.6 | 4.1 | 20.3 | 38.1 mm | 5.3 | 101.3 | 96.0 |

# Dimensional Data cont.

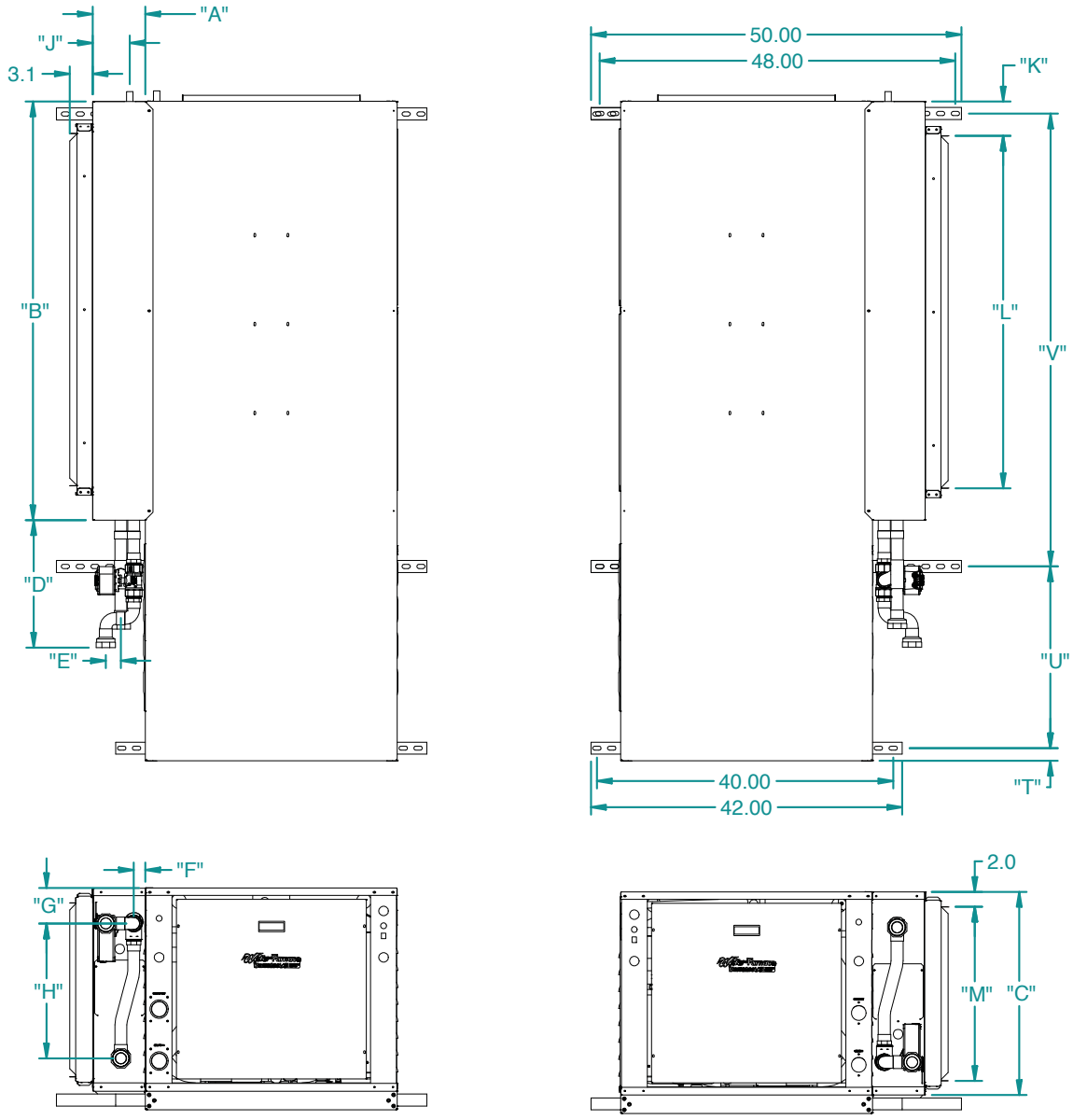
## Waterside Economizer Option




| Vertical Economizers- Bottom Flow | | Overall Cabinet | | | Water Lines | | | | | | | Drain Pan | | Filter Rack | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | J | Loop | K | L | M | N | O |
| | | Width | Depth | Height | From BTM | Length LR | Length RR | Width | From Edge | Depth | Water FPT | From Edge | From Bottom | From Bottom | Return Depth | Return Height |
| 120 | in. | 7.1 | 36.0 | 42.0 | 52.3 | 6.6 | 9.5 | 2.6 | 1.5 | 8.0 | 1 1/2" | 2.5 | 4.6 | 5.1 | 29.9 | 37.8 |
| | cm. | 18.0 | 91.4 | 106.7 | 132.8 | 16.8 | 24.1 | 6.6 | 3.8 | 20.3 | 38.1 mm | 6.4 | 11.7 | 13.0 | 75.9 | 96.0 |
| 180 | in. | 7.2 | 46.1 | 42.0 | 52.3 | 6.6 | 9.5 | 2.6 | 1.5 | 8.0 | 1 1/2" | 2.5 | 4.6 | 5.1 | 39.9 | 37.8 |
| | cm. | 18.3 | 117.1 | 106.7 | 132.8 | 16.8 | 24.1 | 6.6 | 3.8 | 20.3 | 38.1 mm | 6.4 | 11.7 | 13.0 | 101.3 | 96.0 |

# Dimensional Data cont.

## Waterside Economizer Option




| Horizontal Economizers | | Overall Cabinet | | | Water Lines | | | | | | | Filter Rack | | | Base Railing | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | J | Loop | K | L | M | T | U | V |
| | | Width | Depth | Height | Depth | Width | From Edge | From Top | Length | Drain Pan | Water FPT | From Edge | Return Depth | Return Height | From Edge | Comp. Sect. | A.H. Sect. |
| 120 | in. | 7.1 | 56.5 | 27.4 | 17.2 | 2.0 | 1.6 | 4.8 | 18.2 | 5.0 | 1 1/2" | 4.7 | 47.6 | 23.5 | 1.7 | 24.5 | 61.1 |
| | cm. | 18.0 | 143.5 | 69.6 | 43.7 | 5.1 | 4.1 | 12.2 | 46.2 | 12.7 | 38.1 mm | 11.9 | 120.9 | 59.7 | 4.3 | 62.2 | 155.2 |
| 180 | in. | 7.1 | 72.5 | 27.4 | 17.2 | 2.0 | 1.6 | 4.8 | 18.2 | 5.0 | 1 1/2" | 3.3 | 65.6 | 23.5 | 1.7 | 35.1 | 71.5 |
| | cm. | 18.0 | 184.2 | 69.6 | 43.7 | 5.1 | 4.1 | 12.2 | 46.2 | 12.7 | 38.1 mm | 8.4 | 166.6 | 59.7 | 4.3 | 89.2 | 181.6 |

# Installation Notes

## Typical Unit Installation

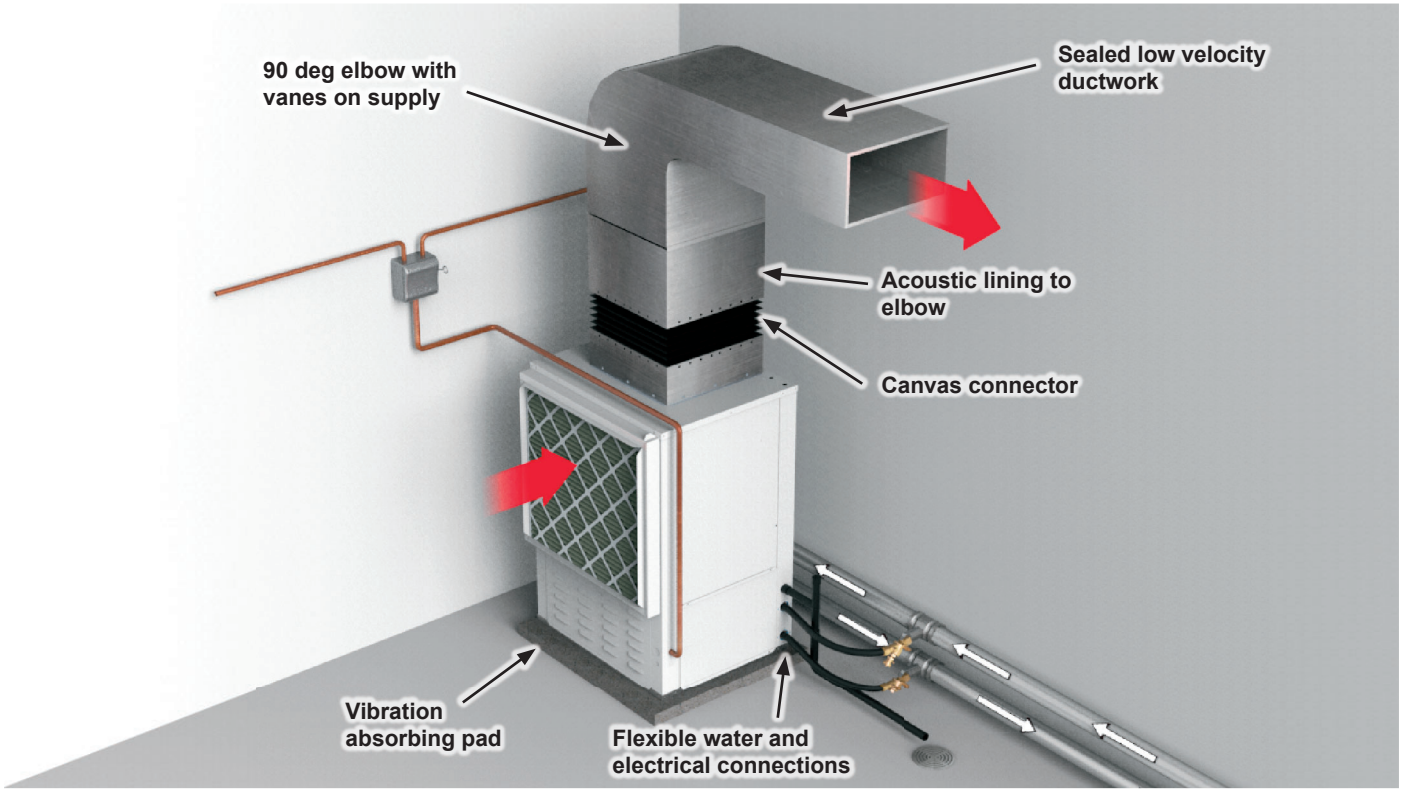
### Unit Location

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

### Water Piping

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

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



# Installation Notes cont.

### Installing Horizontal Units

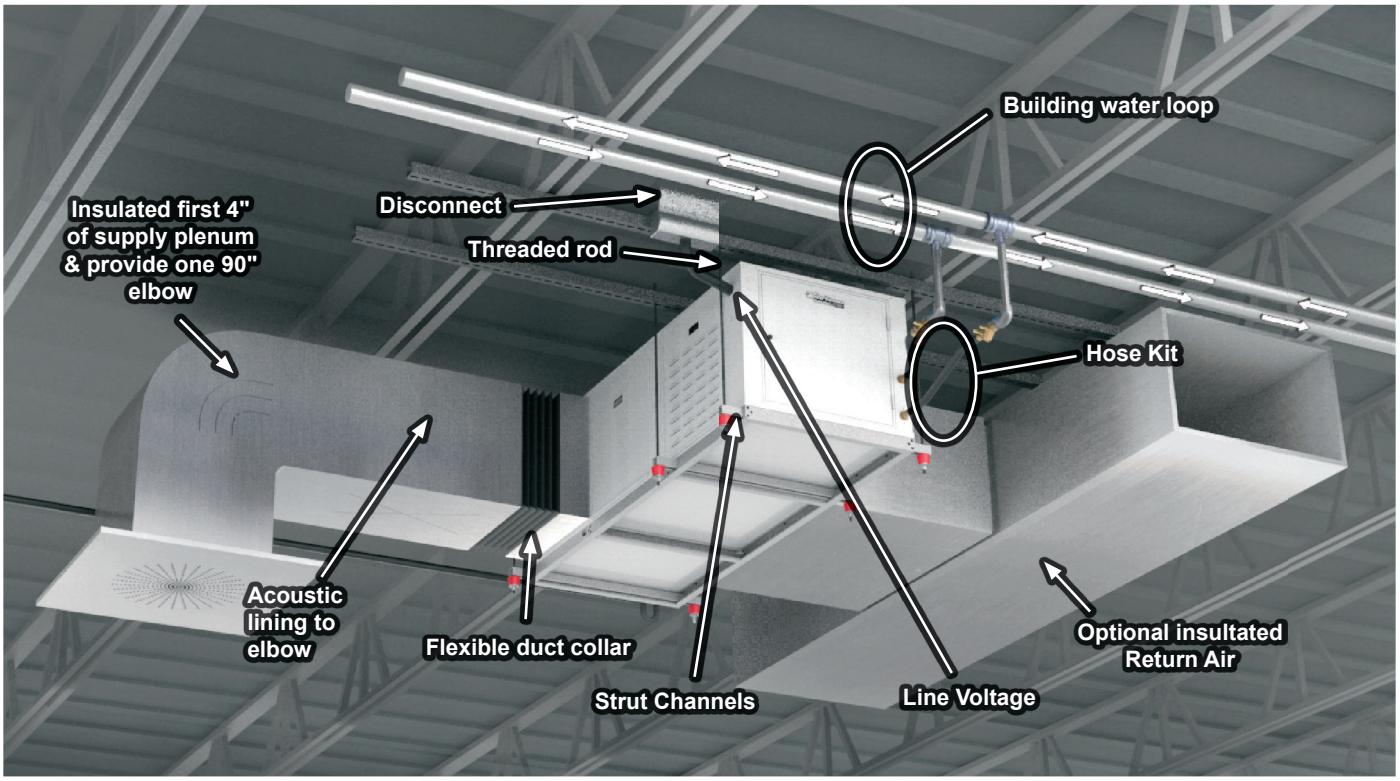
Remove and discard the compressor hold down shipping bolt located at the front of the compressor mounting bracket prior to setting the unit in place. Horizontal units are available with side or end discharge.

**NOTE:** Left (Right) Return Side Discharge can be converted to Left (Right) Return End Discharge or vice versa, without additional custom sheet metal parts. Horizontal units are normally suspended from a ceiling by six 1/2 in. diameter threaded rods. The rods are usually attached to the unit by hanger bracket kits furnished with each unit.

Lay out and install the threaded rods and 1 5/8" strut channel as shown in the Horizontal Dimensional Data. The unit should be pitched approximately 1/4 in. toward the drain in both directions to facilitate the removal of condensate.

Some applications require the installation of horizontal units on an attic floor. In this case, the unit should be set in a full size secondary drain pan on top of a vibration absorbing pad. The secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling. The secondary drain pan is usually placed on a plywood base isolated from the ceiling joists by additional layers of vibration absorbing material.

**CAUTION: Do not use rods smaller than 1/2 in. diameter since they may not be strong enough to support the unit. The rods must be securely anchored to the ceiling.**



# Installation Notes cont.

## Acoustical Considerations and Equipment Sound Performance

### Sound Performance

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

### Recommendations for Noise Reduction

**Horizontal Unit Location**

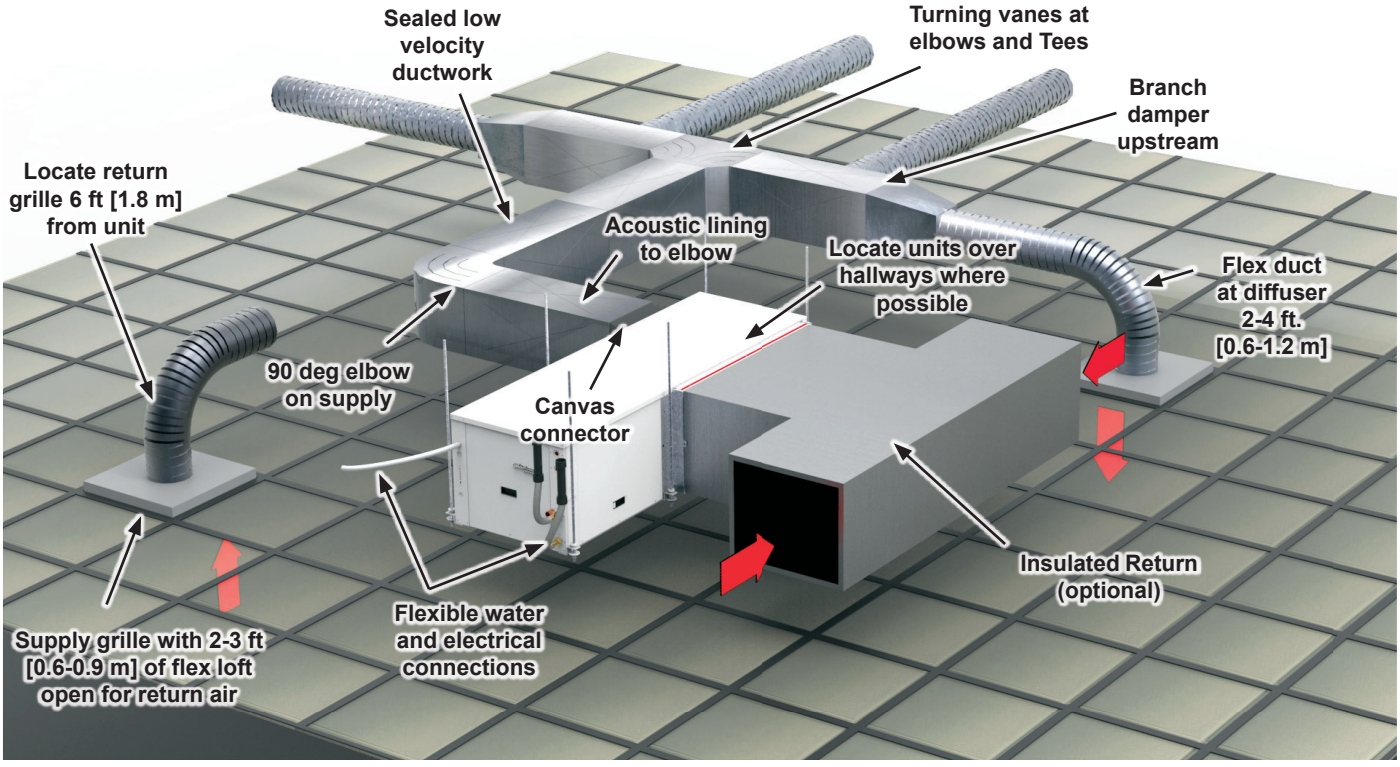
- Specify equipment with quietest sound power ratings
- Do not locate units above areas with a required NC 40 or less
- Space WSHP at least 10 ft (3m) apart to avoid noise summing of multiple units in a space.
- Maximize the height of the unit above the ceiling (horizontal).
- Suspend unit with isolation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

**Vertical Unit Location**

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

**Ductwork**

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



# Duct System

An air outlet collar is provided on vertical top flow units and all horizontal units to facilitate a duct connection. A flexible connector is recommended for discharge and return air duct connections on metal duct systems. Uninsulated duct should be insulated with a minimum of 1-inch duct insulation. Application of the unit to uninsulated ductwork in an unconditioned space is not recommended as the unit's performance will be adversely affected.

If the unit is connected to existing ductwork, check the duct system to ensure that it has the capacity to accommodate the air required for the unit application. If the duct is too small, as in the replacement of heating only systems, larger ductwork should be installed. All existing ductwork should be checked for leaks and repaired if necessary.

The duct system should be sized to handle the design airflow quietly and efficiently. To maximize sound attenuation of the unit blower, the supply and return plenums should include an internal duct liner of fiberglass or constructed of ductboard for the first few feet. On systems employing a sheet metal duct system, canvas connectors should be used between the unit and the ductwork. If air noise or excessive airflow is a problem, the blower speed can be changed.

# Water Piping

The proper water flow must be provided to each unit whenever the unit operates. To assure proper flow, use pressure/temperature ports to determine the flow rate. These ports should be located at the supply and return water connections on the unit. The proper flow rate cannot be accurately set without measuring the water pressure drop through the refrigerant-to-water heat exchanger.

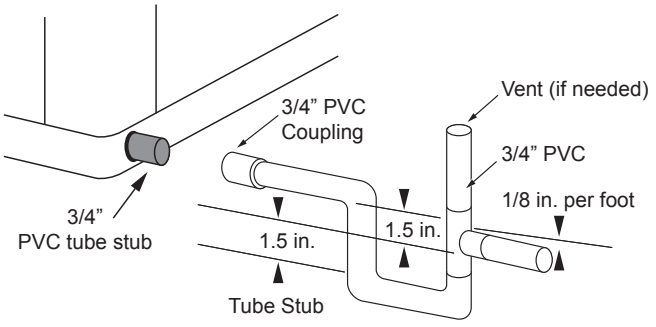
All source water connections on commercial units are fittings that accept a male pipe thread (MPT). Insert the connectors by hand, then tighten the fitting with a wrench to provide a leakproof joint. When connecting to an open loop (groundwater) system, thread any copper MPT fitting into the connector and tighten in the same manner as described above.

# Condensate Drain

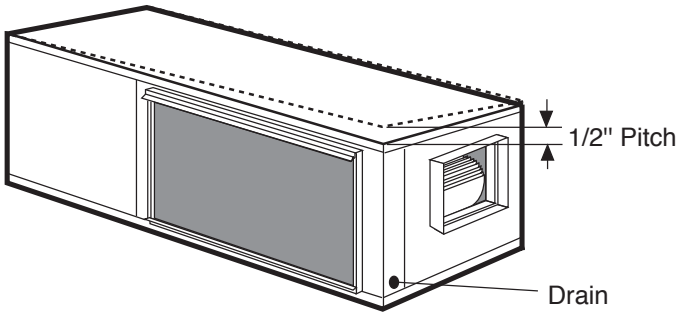
On vertical units, the internal condensate drain assembly consists of a drain tube which is connected to the drain pan, a 3/4 in. PVC female adapter and a flexible connecting hose. The female adapter may exit either the front or the side of the cabinet. The adapter should be glued to the field-installed PVC condensate piping. On vertical units, a condensate hose is inside all cabinets as a trapping loop; therefore, an external trap is not necessary.

On horizontal and bottom flow units, a PVC stub or stainless steel tube is provided for condensate drain piping connection. An external trap is required (see below). If a vent is necessary, an open stand pipe may be applied to a tee in the field-installed condensate piping.

***Horizontal Drain Connection (Composite Drain Pan)***




***Unit Pitch for Drain***



# Water Quality

In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, a closed loop system is recommended. The heat exchanger coils in ground water systems may, over a period of time, lose heat exchange capabilities due to a buildup of mineral deposits inside. These can be cleaned, but only by a qualified service mechanic, as special solutions and pumping equipment are required. Hot water generator coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional flushing. Failure to adhere to the guidelines in the water quality table could result in loss of warranty.

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

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

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

2/22/12

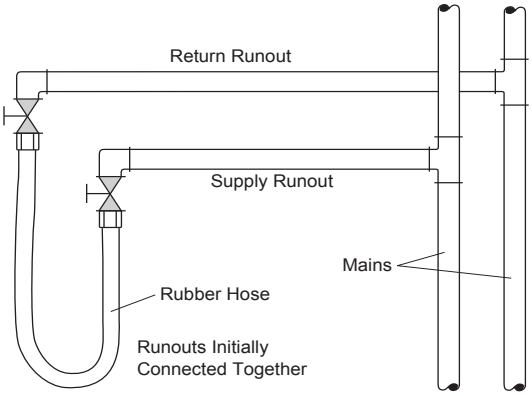
# System Cleaning and Flushing

## Cleaning and Flushing

Prior to start up of any heat pump, the water circulating system must be cleaned and flushed of all dirt and debris.

If the system is equipped with water shutoff valves, the supply and return runouts must be connected together at each unit location (This will prevent the introduction of dirt into the unit, see Flushing with Water Shutoff Valve Equipped Systems illustration). The system should be filled at the water make-up connection with all air vents open. After filling, vents should be closed.

***Flushing with Water Shutoff Valve Equipped Systems***




The contractor should start the main circulator with the pressure reducing valve makeup open. Vents should be checked in sequence to bleed off any trapped air and to verify circulation through all components of the system.

As water circulates through the system, the contractor should check and repair any leaks found in the piping system. Drain(s) at the lowest point(s) in the system should be opened for initial flush and blowdown, making sure water fill valves are set at the same rate. Check the pressure gauge at the pump suction and manually adjust the make-up water valve to hold the same positive pressure both before and after opening the drain valves. Flushing should continue for at least two hours, or longer if required, until drain water is clean and clear.

The supplemental heater and/or circulator pump, if used, should be shut off. All drains and vents should be opened to completely drain the system. Short-circuited supply and return runouts should now be connected to the unit supply and return connections.

Refill the system with clean water. Test the system water for acidity and treat as required to leave the water slightly alkaline (pH 7.5 to 8.5). The specified percentage of antifreeze may also be added at this time. Use commercial grade antifreeze designed for HVAC systems only. Environol™ brand antifreeze is recommended.

Once the system has been filled with clean water and antifreeze (if used), precautions should be taken to protect the system from dirty water conditions. Dirty water will result in system-wide degradation of performance, and solids may clog valves, strainers, flow regulators, etc. Additionally, the heat exchanger may become clogged which reduces compressor service life and can cause premature unit failure.

In boiler/tower application, set the loop control panel set points to desired temperatures. Supply power to all motors and start the circulating pumps. After full flow has been established through all components including the heat rejector (regardless of season), air vented and loop temperatures stabilized, each of the units will be ready for check, test and start up and for air and water balancing.

## Ground Source Loop System Checkout

Once piping is completed between the unit pumping system and ground loop, final purging and charging of the loop is needed. A high pressure pump is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop itself. Antifreeze solution is used in most areas to prevent freezing. Flush the system adequately to remove as much air as possible; then pressurize the loop to a static pressure of 40-50 PSI (summer) or 50-75 PSI (winter). This is normally adequate for good system operation. Loop static pressure may decrease soon after initial installation, due to pipe expansion and loop temperature change. Running the unit for at least 30 minutes after the system has been completely purged of air will allow for the “break-in” period. It may be necessary to adjust static loop pressure (by adding water) after the unit has run for the first time. Loop static pressure will also fluctuate with the seasons. Pressures will be higher in the winter months than during the cooling season. This fluctuation is normal and should be considered when charging the system initially.

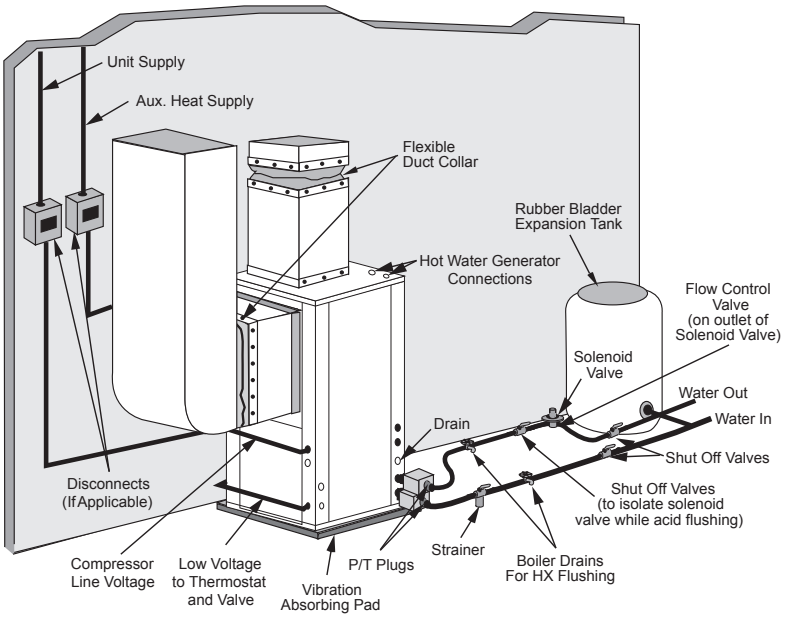
Ensure the pump provides adequate flow through the unit by checking pressure drop across the heat exchanger. Usually 2.25-3.0 gpm of flow per ton of cooling capacity is recommended in earth loop applications.

# Open Loop Ground Water Systems

Typical open loop piping is shown below. Always maintain water pressure in the heat exchanger by placing water control valves at the outlet of the unit to prevent mineral precipitation. Use a closed, bladder-type expansion tank to minimize mineral formation due to air exposure. Insure proper water flow through the unit by checking pressure drop across the heat exchanger and comparing it to the figures in unit capacity data tables in the specification catalog. 1.5-2 gpm of flow per ton of cooling capacity is recommended in open loop applications. Due to only minor differences in flow rate from low to high, only one solenoid valve should be used. The valve should be sized for full flow.

Discharge water from the unit is not contaminated in any manner and can be disposed of in various ways, depending on local codes, i.e. recharge well, storm sewer, drain field, adjacent stream or pond, etc. Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning departments to assure compliance in your area.

***Open System - Groundwater Application***




# Freeze Detection

For Aurora Base Control, set SW2-1, FP1, on the printed circuit board for applications using a closed loop antifreeze solution to 15°F [-9.4°C]. On applications using an open loop/ground water system (or closed loop no antifreeze), set this dip switch to 30°F [-1.1°C], the factory default setting. (Refer to the Dip Switch Field Selection table).

# Electrical Connections

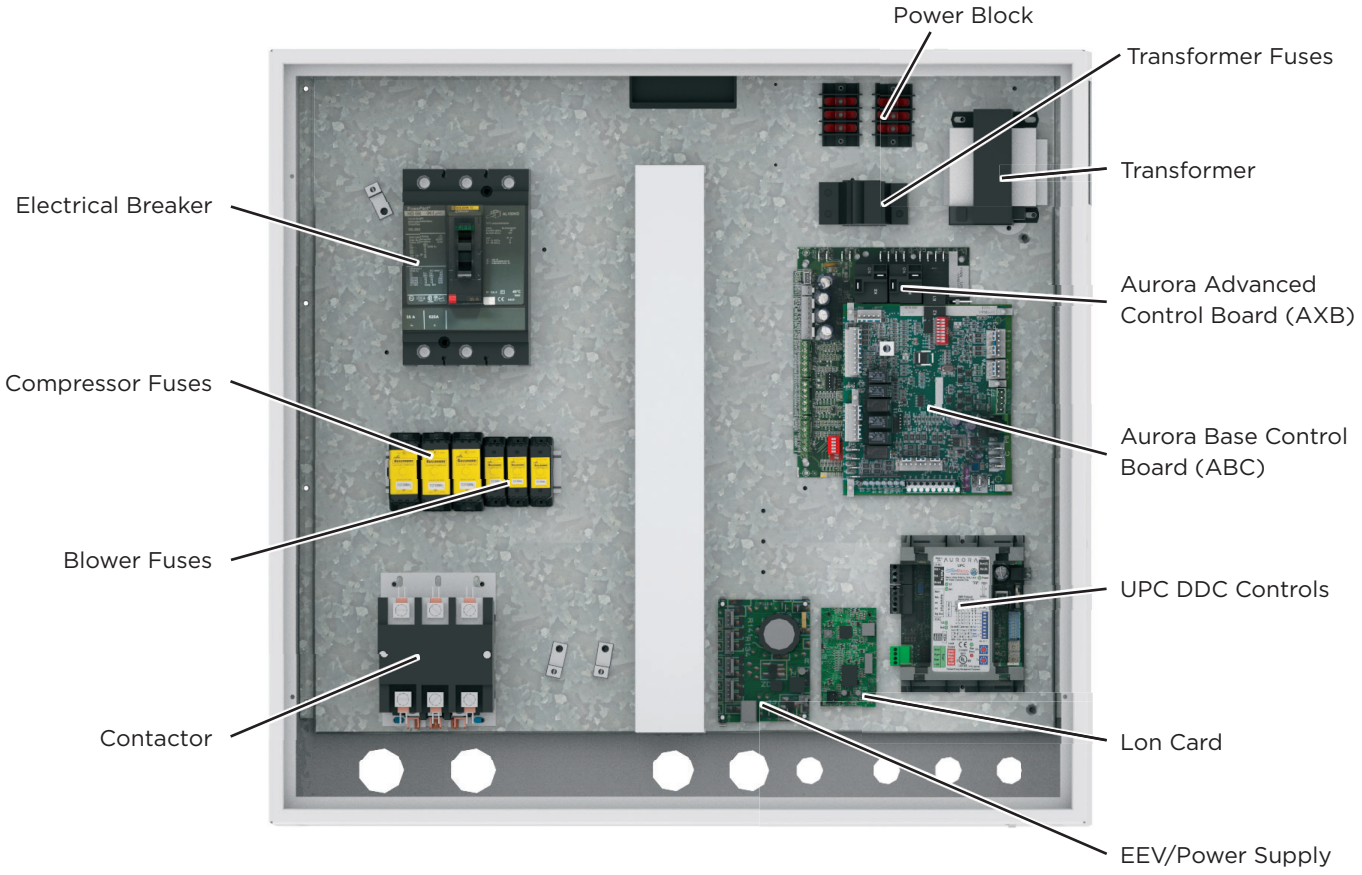
## General

Be sure the available power is the same voltage and phase as that shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

## 208 Volt Operation

All 208/230 volt units are factory wired for 230 volt operation. For 208 volt operation, the red and blue transformer wires must be switched on terminal strip PS.

**Aurora Base Control Box**



# Electrical Data

**ECM Motor**

| Model | Rated Voltage | Voltage Min/Max | Compressor | | | Blower Motor FLA | Total Unit FLA | Min Circ Amp | Max Fuse/ HACR Breaker |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCC** | RLA | LRA* | | | | |
| **120** | 208-230/60/3 | 187/253 | 56.0 | 33.1 | 60.0 | 9.2 | 42.3 | 50.6 | 80 |
| | 460/60/3 | 414/506 | 30.0 | 17.7 | 35.0 | 6.8 | 24.5 | 28.9 | 45 |
| **180** | 208-230/60/3 | 187/253 | 84.0 | 49.6 | 100.0 | 9.2 | 58.8 | 71.2 | 110 |
| | 460/60/3 | 414/506 | 60.0 | 35.5 | 60.0 | 6.8 | 47.1 | 56.7 | 80 |

HACR circuit breaker in USA only 8/26/19

* - Based on AC input current protection to compressor drive.

** Max Continious Input Current

# Blower Performance Data

**Model 120**

| Fan Speed | Fan RPM | Airflow [scfm] at External Static Pressure [in. wg.] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
| 1 | 600 | 1526 | 1349 | **1166** | **978** | **786** | **588** | | | | | | | | | | | | | | | |
| 2 | 700 | 1835 | 1711 | 1566 | 1400 | **1214** | **1008** | **781** | | | | | | | | | | | | | | |
| 3 | 800 | 2145 | 2030 | 1895 | 1740 | 1564 | 1368 | **1151** | **934** | **718** | **501** | | | | | | | | | | | |
| 4 | 900 | 2454 | 2341 | 2214 | 2075 | 1923 | 1758 | 1580 | 1389 | **1198** | **1007** | **817** | **626** | | | | | | | | | |
| 5 | 1000 | 3008 | 2903 | 2791 | 2670 | 2542 | 2405 | 2260 | 2107 | 1946 | 1777 | 1607 | 1438 | **1269** | **1100** | **930** | **761** | | | | | |
| 6 | 1100 | 3323 | 3229 | 3129 | 3022 | 2909 | 2788 | 2662 | 2528 | 2388 | 2241 | 2087 | 2007 | 1926 | 1846 | 1766 | 1685 | 1605 | | | | |
| 7 | 1250 | 3773 | 3684 | 3594 | 3502 | 3408 | 3311 | 3210 | 3106 | 2997 | 2882 | 2762 | 2636 | 2737 | 2613 | 2490 | 2366 | 2242 | 2119 | | | |
| 8 | 1400 | 4270 | 4180 | 4093 | 4007 | 3921 | 3835 | 3748 | 3658 | 3566 | 3471 | 3370 | 3265 | 3153 | 3034 | 2923 | 2812 | 2701 | 2590 | 2479 | | |
| 9 | 1500 | 4582 | 4499 | 4419 | 4342 | 4265 | 4189 | 4112 | 4033 | 3951 | 3865 | 3773 | 3674 | 3569 | 3454 | 3330 | 3206 | 3082 | 2957 | 2833 | | |
| 10 | 1600 | 4877 | 4801 | 4737 | 4673 | 4604 | 4528 | 4446 | 4361 | 4277 | 4198 | 4123 | 4050 | 3972 | 3875 | 3737 | 3530 | 3322 | 3114 | 2907 | 2699 | 2492 |
| 11 | 1700 | 5200 | 5121 | 5058 | 5000 | 4939 | 4872 | 4799 | 4722 | 4644 | 4567 | 4495 | 4427 | 4362 | 4294 | 4213 | 4102 | 3942 | 3781 | 3620 | 3350 | 3080 |
| 12 | 1800 | 5531 | 5462 | 5393 | 5318 | 5243 | 5152 | 5061 | 4981 | 4901 | 4823 | 4745 | 4680 | 4615 | 4538 | 4460 | 4374 | 4288 | 4045 | 3801 | 3558 | 3314 |

Fan selection is accomplished through the Aurora Controls and allows four online selections of continuous fan (G), stage 1 (Lo), stage 2 (Hi), and with electric heat (AUX). 11/16/17

Continuous Fan (G) can be set at any airflow.

Stage 1 (Lo) setting can be located anywhere other than BOLD highlighted points.

Stage 2 (Hi) setting should be located in shaded portion.

Elect heat Airflow (AUX) airflow setting should be configured for the minimum airflow needed to support the heater. Please consult heater manual.

Factory settings for UV*120 are continuous fan (G) speed 1, Minimum Load Stage 1(Lo)= Speed 3, Full Load Stage 2 (Hi) = Speed 8 and with Electric Heat Operation (AUX) = Speed 11 .

**Model 180**

| Fan Speed | Fan RPM | Airflow [cfm] at External Static Pressure [in. wg.] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
| 1 | 900 | 2454 | 2341 | 2214 | 2075 | **1923** | **1758** | **1580** | **1389** | | | | | | | | | | | | | |
| 2 | 1000 | 2978 | 2881 | 2773 | 2669 | 2531 | 2407 | 2253 | 2087 | **1908** | **1679** | **1432** | | | | | | | | | | |
| 3 | 1100 | 3288 | 3202 | 3121 | 3012 | 2908 | 2800 | 2679 | 2521 | 2385 | 2230 | 2050 | **1839** | **1617** | **1281** | | | | | | | |
| 4 | 1200 | 3587 | 3507 | 3433 | 3343 | 3249 | 3145 | 3037 | 2926 | 2791 | 2659 | 2490 | 2364 | 2218 | 2037 | **1825** | **1568** | | | | | |
| 5 | 1300 | 3901 | 3835 | 3761 | 3664 | 3594 | 3507 | 3418 | 3319 | 3202 | 3104 | 2969 | 2864 | 2735 | 2581 | 2417 | 2230 | 2098 | **1928** | | | |
| 6 | 1400 | 4244 | 4182 | 4120 | 4057 | 3974 | 3896 | 3809 | 3727 | 3629 | 3536 | 3455 | 3326 | 3224 | 3110 | 2983 | 2833 | 2718 | 2581 | 2440 | 2293 | |
| 7 | 1550 | 4812 | 4738 | 4664 | 4587 | 4504 | 4438 | 4372 | 4291 | 4226 | 4134 | 4046 | 3962 | 3870 | 3780 | 3707 | 3579 | 3501 | 3404 | 3305 | 3204 | 3101 |
| 8 | 1700 | 5329 | 5262 | 5195 | 5139 | 5082 | 5020 | 4958 | 4895 | 4831 | 4752 | 4673 | 4601 | 4529 | 4455 | 4380 | 4294 | 4222 | 4145 | 4068 | 3990 | 3911 |
| 9 | 1800 | 5666 | 5607 | 5548 | 5481 | 5414 | 5353 | 5291 | 5221 | 5151 | 5086 | 5020 | 4953 | 4886 | 4811 | 4735 | 4671 | 4596 | 4523 | 4450 | 4375 | 4300 |
| 10 | 1900 | 6018 | 5957 | 5895 | 5833 | 5770 | 5712 | 5654 | 5589 | 5524 | 5463 | 5402 | 5340 | 5278 | 5208 | 5138 | 5047 | 4976 | 4907 | 4837 | 4766 | 4695 |
| 11 | 2000 | 6350 | 6287 | 6224 | 6165 | 6105 | 6045 | 5985 | 5923 | 5861 | 5799 | 5736 | 5672 | 5607 | 5541 | 5475 | 5414 | 5347 | 5281 | 5214 | 5148 | 5080 |
| 12 | 2160 | 6862 | 6805 | 6748 | 6698 | 6647 | 6588 | 6529 | 6477 | 6425 | 6364 | 6303 | 6249 | 6194 | 6131 | 6068 | 5987 | 5920 | 5854 | 5787 | 5721 | 5653 |

Fan selection is accomplished through the Aurora Controls and allows four online selections of continuous fan (G), stage 1 (Lo), stage 2 (Hi), and with electric heat (AUX). 11/12/17

Continuous Fan (G) can be set at any airflow.

Stage 1 (Lo) setting can be located anywhere other than BOLD highlighted points.

Stage 2 (Hi) setting should be located in shaded portion.

Elect heat Airflow (AUX) airflow setting should be configured for the minimum airflow needed to support the heater. Please consult heater manual.

Factory settings for UV*180 are continuous fan (G) speed 1, Part Load Stage 1(Lo)= Speed 3, Full Load Stage 2 (Hi) = Speed 10 and with Electric Heat Operation (AUX) = Speed 11 .

# Blower Performance Data cont.

## Setting Blower Speed - Variable Speed ECM

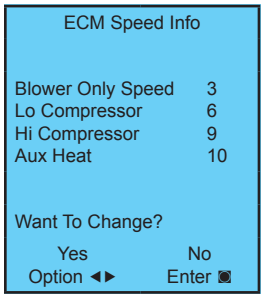
The ABC board's Yellow Config LED will flash the current ECM blower speed selections for G, low, and high continuously with a short pause in between. The speeds can also be confirmed with the AID Tool under the Setup/ ECM Setup screen. The Aux will not be flashed but can be viewed in the AID Tool. The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

### Variable speed ECM Setup without an AID Tool

The blower speeds for G only, Low (Y1), and High (Y2/ Aux) can be adjusted directly at the Aurora ABC board which utilizes the push button (SW1) on the ABC board. This procedure is outlined in the ECM Configuration Mode portion of the Aurora 'Base' Control System section. The Aux cannot be set manually without an AID Tool.

### Variable speed ECM Setup with an AID Tool

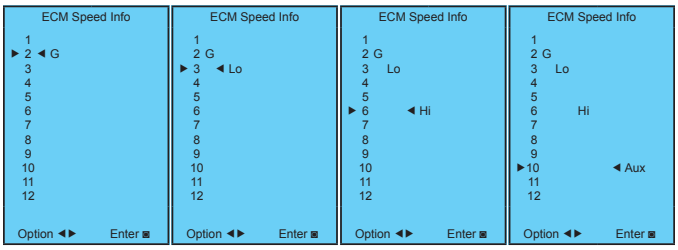
A much easier method utilizes the AID Tool to change the airflow using the procedure below. First navigate to the Setup screen and then select ECM Setup. This screen displays the current ECM settings. It allows the technician to enter the setup screens to change the ECM settings.




Change the highlighted item using the ◄ and ► buttons and then press the ◙ button to select the item.

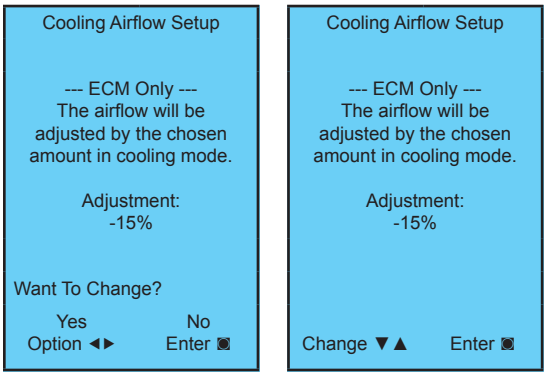
Selecting YES will enter ECM speed setup, while selecting NO will return to the previous screen.

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




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 from the heating airflow. Change the adjustment percentage using the ▲ and ▼ buttons. Press the ◙ button to save the change.




# Setting Blower Speed - Variable Speed ECM - UPC Controls

Variable speed ECM blower motors have 12 selectable speeds and are factory set for optimum performance. When applicable, the speed settings may also be adjusted through the Building Automation System (BAS).

**CAUTION: Disconnect all power before performing this operation.**

# Wiring Schematics

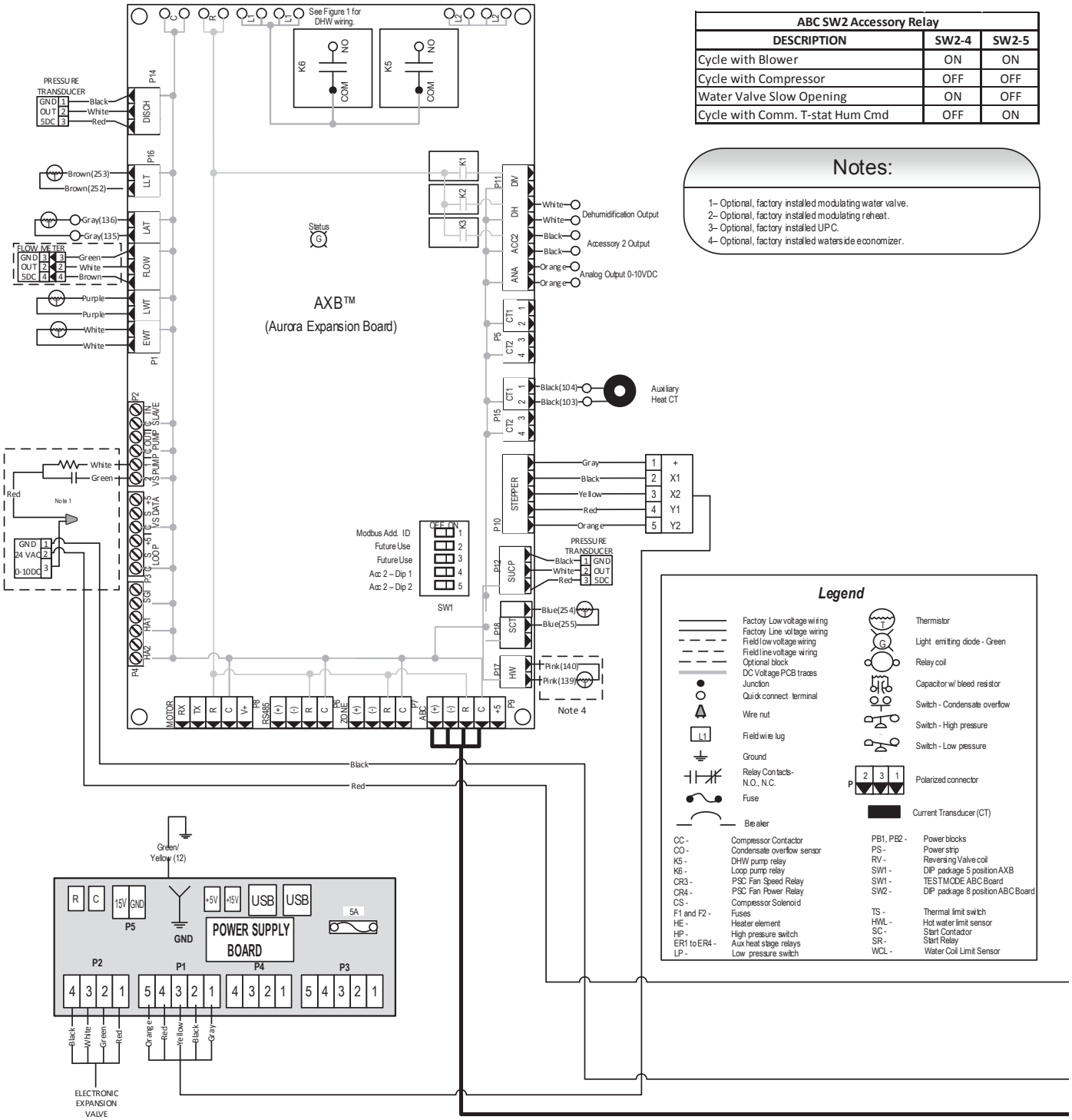
## Commercial Variable Speed - 120-180 Series

| 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 |

| 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 |

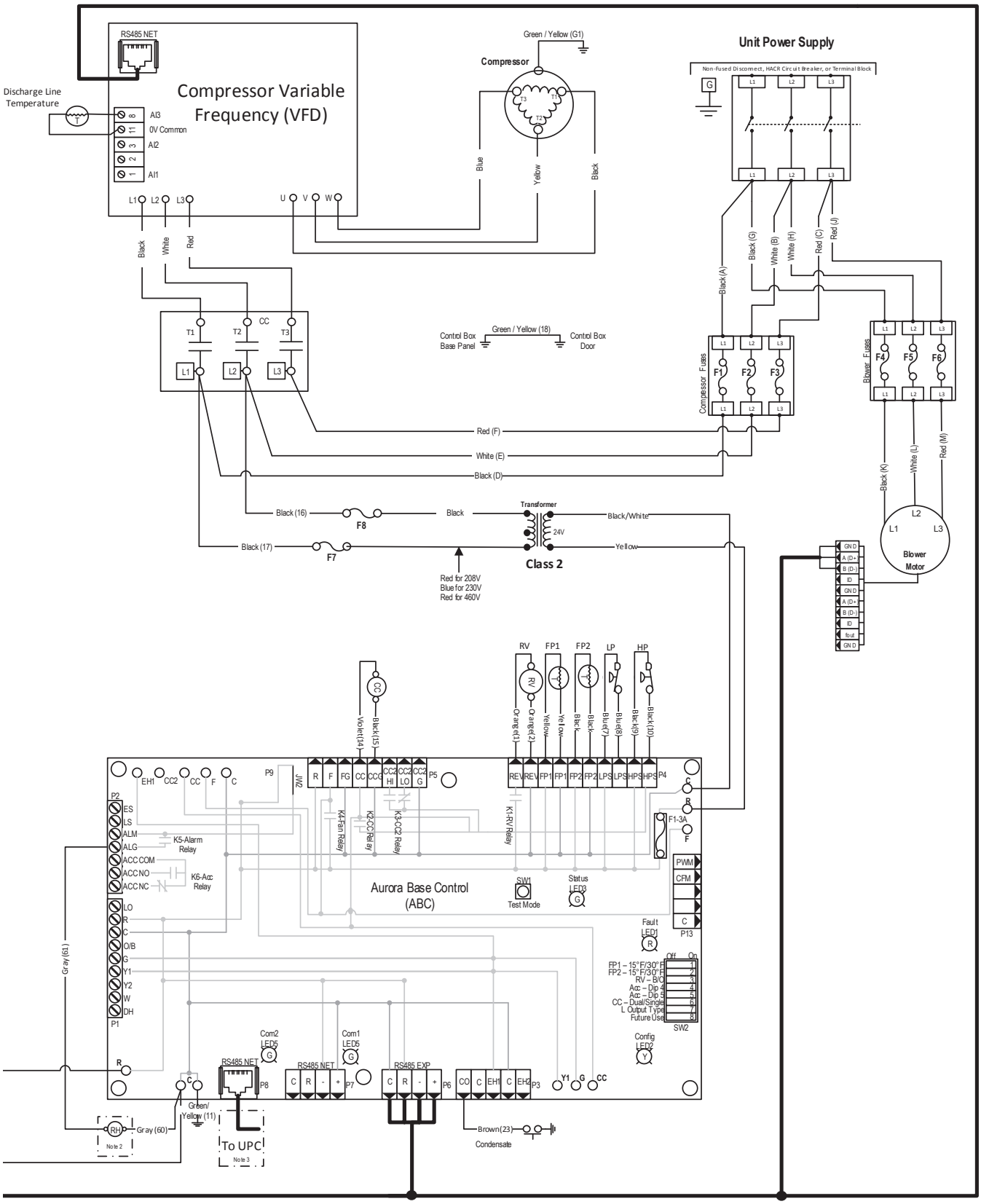
**Notes:**

1– Optional, factory installed modulating water valve.
2– Optional, factory installed modulating reheat.
3– Optional, factory installed UPC.
4– Optional, factory installed waterside economizer.



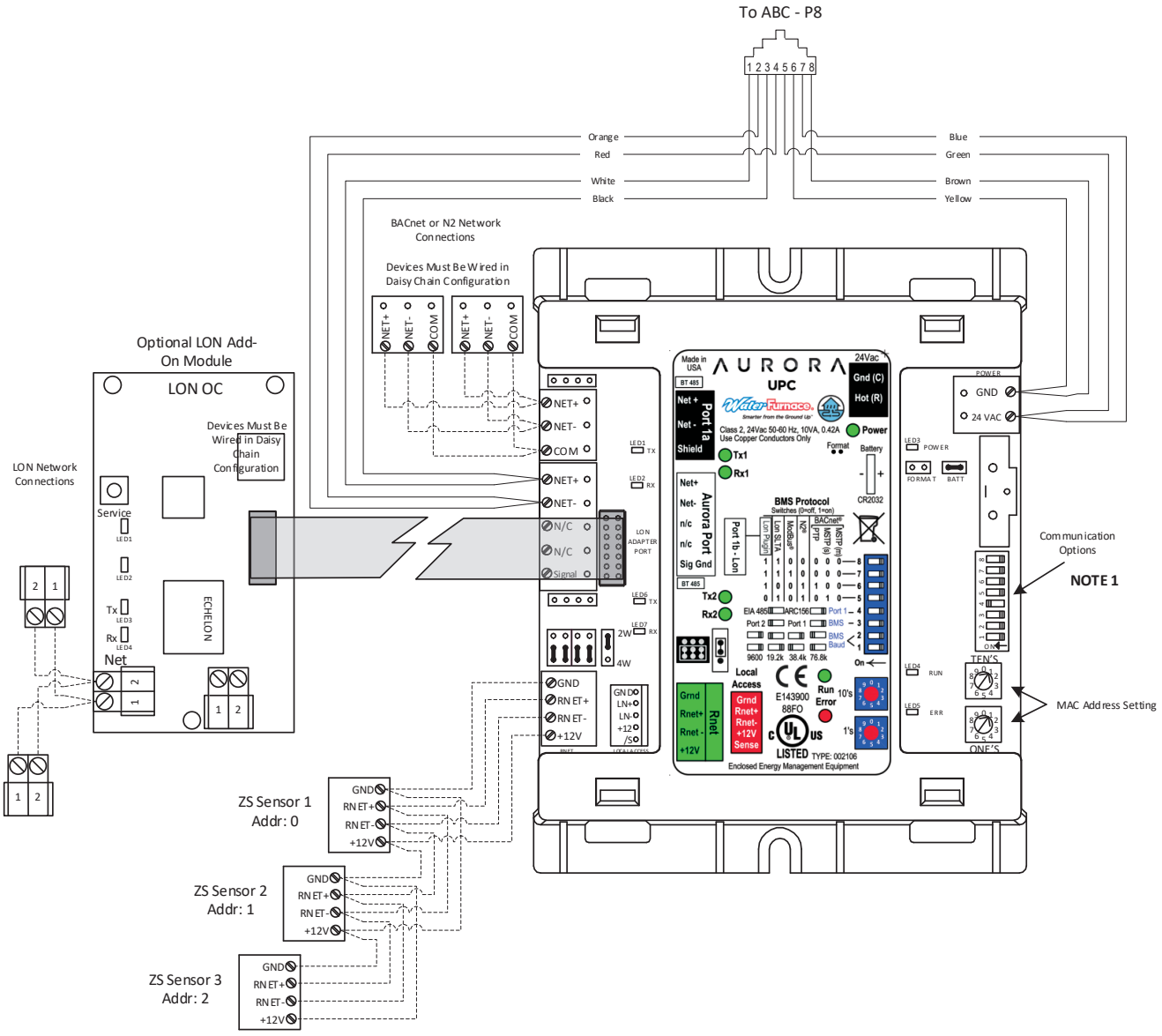
# Wiring Schematics cont.

## Commercial Variable Speed - 120-180 Series



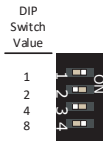
# Wiring Schematics cont.

## Commercial Variable Speed




### 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.




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

### Notes

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

### Legend

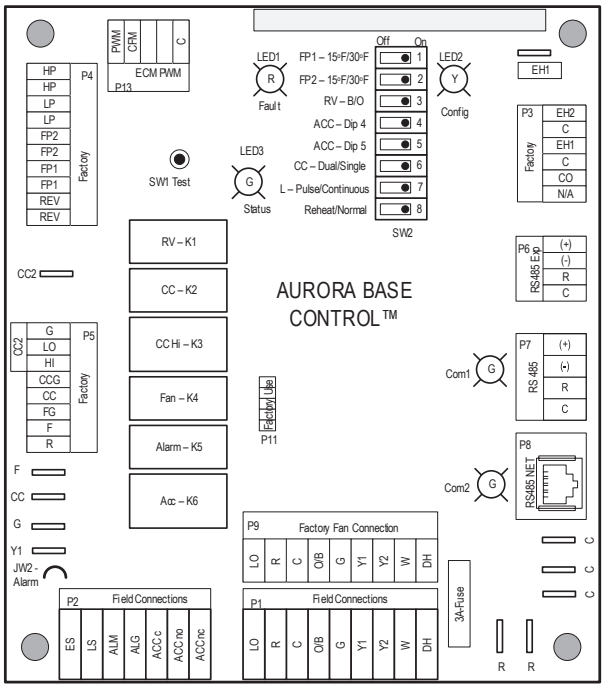
Factory Low Voltage Wiring

Field Low Voltage Wiring

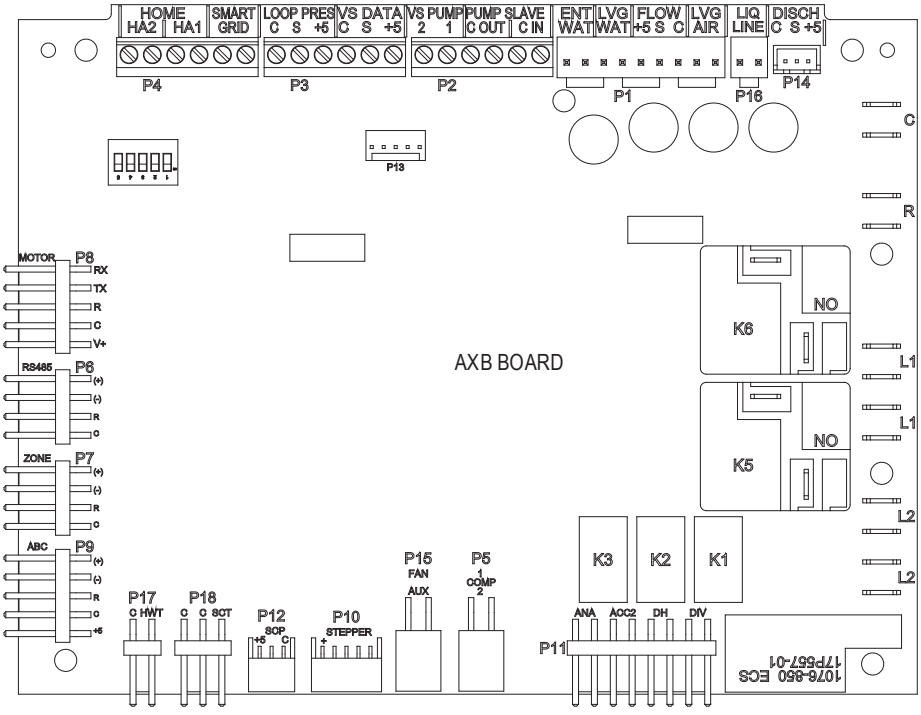
12345678 RJ45 Connector

# Wiring Schematics cont.

## Commercial Variable Speed

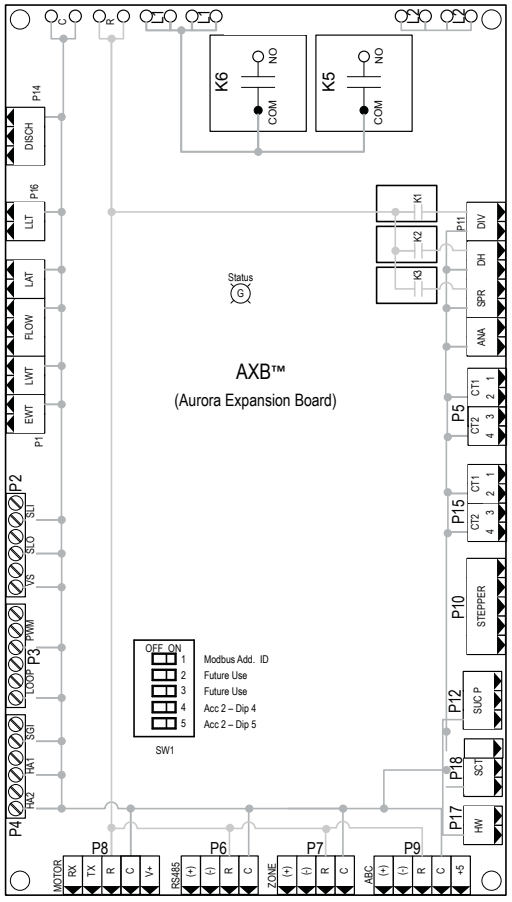


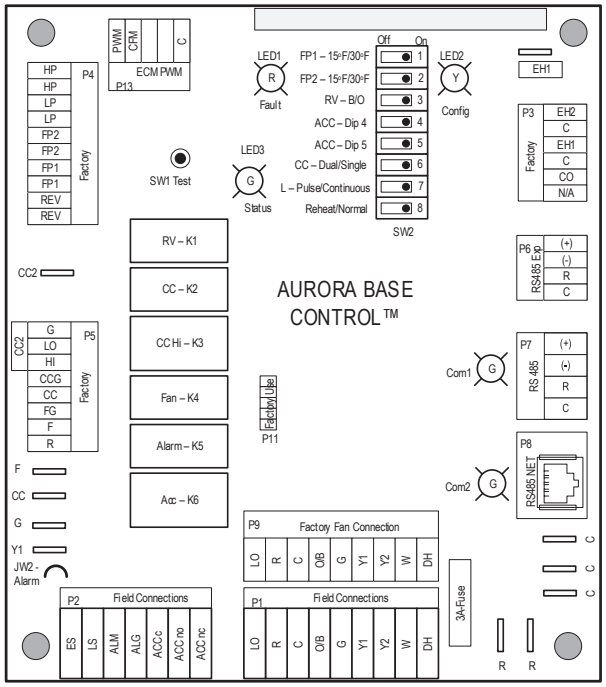

| Aurora LED Flash Codes | | | |
|---|---|---|---|
| Slow Flash | 1 second on and 1 second off | | |
| Fast Flash | 100 milliseconds on and 100 milliseconds off | | |
| Flash Code | 100 milliseconds on and 400 milliseconds off with a 2 second pause before repeating | | |
| **Fault LED (LED 1, Red)** | | **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 Detection- FP2 | Flash Code 4 | No Software Overide | OFF |
| Freeze Detection - FP1 | Flash Code 5 | DIP Switch Overide | Slow Flash |
| Reserved | 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 |
| Compressor Monitoring | Flash Code 10 | 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 Temperature 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 | Fault - Loss of Charge | Flash Code 71 |
| Derate - Outer Power Limit | Flash Code 46 | Safe Mode - Suction Temperature Sensor | Flash Code 72 |
| Safe Mode - EEV (Indoor) Communication | Flash Code 47 | Safe Mode - LAT Temperature Sensor | Flash Code 73 |
| Safe Mode - EEV (Outdoor) Communication | Flash Code 48 | Safe Mode - Max Operating Pressure | Flash Code 74 |



# Wiring Schematics cont.

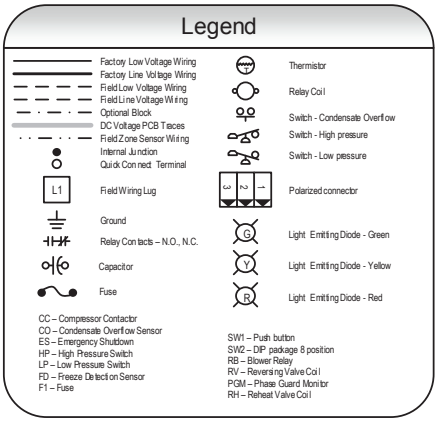
## Commercial Variable Speed




| 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 |

| 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 |



# Controls - Aurora Advanced Variable Speed Control

## Aurora Controls

The Aurora Control System is a complete commercial comfort system that can bring all aspects of the HVAC system into one cohesive module network. The Aurora System is available in two configurations: Aurora Base Control and Aurora Advanced Control both with optional Aurora UPC for DDC applications.

| Control | General Description | Application | Display/Interface | Protocol |
|---|---|---|---|---|
| **Aurora Base Control**  | The ABC microprocessor provides all the features necessary to operate today's standard WSHPs that utilize dual capacity compressors and variable speed ECM/5 speed ECM blower motors. This control can communicate to a handheld diagnostic tool to help the installing contractor or service technician with equipment setup and service. By utilizing Modbus RTU communication protocol, the ABC board can communicate with additional devices on the Aurora network | Used for residential and commercial applications that use single or dual capacity compressors with PSC, 5-speed ECM, or variable speed ECM blower motors. This base control can also communicate to the AID Tool to display faults, inputs/outputs, and software revision. Commercial features such as slow opening water valve and random start are also capable with the ABC board. | Optional AID tool can be used for field service. | Standalone |
| **Aurora Advanced Control (ABC/AXB)**  | Aurora Advanced Control adds the Aurora AXB expansion board and provides added I/O and standard features such as refrigerant, performance or energy monitoring. | • ***Refrigeration Monitoring*** **–** provides Suction and discharge pressure, Suction, liquid line temps and superheat and subcooling.<br>• ***Performance Monitoring*** **–** provides entering and leaving loop water temperatures, loop flow rate as well as heat of extraction or rejection rate into the loop.<br>• ***Energy Monitoring*** **–** provides real-time power measurement (Watt) of compressor, fan, auxiliary heat and zone pump.<br>• Plus many more I/O options | Optional AID tool can be used for field service. | Standalone |
| **Aurora Base/ Aurora Advanced Control w/UPC BACnet or N2**  | The Aurora Unitary Protocol Converter (UPC) is an integrated solution and communicates directly with the Aurora Heat Pump Controls and allows access/control of a variety of internal Aurora heat pump operations such as sensors, relay operation, faults and other information. In turn, the UPC then converts internal Aurora Modbus protocol to BACnet MS/TP, or N2 protocols and communicates to the BAS system. This provides the great benefit of complete control integration and a myriad of information available to the BAS from the heat pump control. Plus it also allows individual unit configuration such as ECM fan speeds or freeze protection setting directly over the BAS without the need for access to the actual heat pump. | The Aurora UPC is implemented with the Aurora heat pump control into our latest water source heat pumps. All Internal Aurora points are accessible to the UPC via firmware providing an integrated solution. All zone temperatures and zone sensors are connected to the UPC on an RNet bus, simplifying hook up at the unit. RNet sensors can include a combination of zone temperature and humidity, CO2, and VOC sensors. The UPC includes built-in support for a custom configurable keypad/display unit. | Optional Aurora Touch Interface | BACnet MS/ TP or N2 Open (DIP selectable) |
| **Aurora Base/ Aurora Advanced Control w/UPC LonWorks**  | The Aurora Unitary Protocol Converter (UPC) is an integrated solution and communicates directly with the Aurora Heat Pump Controls and allows access/control of a variety of internal Aurora heat pump operations such as sensors, relay operation, faults and other information. In turn, the UPC then converts internal Aurora Modbus protocol to LONWorks protocol and communicates to the BAS system. | The Aurora UPC is implemented with the heat pump control into our latest water source heat pumps. All Internal Aurora points are accessible to the UPC via firmware providing an integrated solution. All zone temperatures and zone sensors are connected to the UPC on an RNet bus, simplifying hook up at the unit. RNet sensors can include a combination of zone temperature and humidity, CO2, and VOC sensors. The UPC includes built-in support for a custom configurable keypad/display unit. | Optional Aurora Touch Interface | LonWorks |

# Controls - Aurora Advanced Variable Speed Control cont.

## Aurora 'Advanced Variable Speed' Control

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

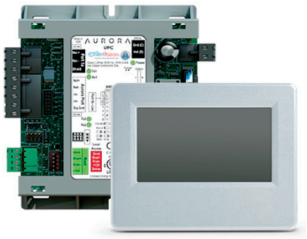
The Aurora Advanced VS Control provides all baseline operation of 7 faults (HP, LP, and LOC, coax freeze protection, air coil freeze protection, over/under voltage, and condensate overflow), as well as compressor speed, fan speed, and lockout management through a single Aurora Base Control board (ABC). The control features all heat pump operational timings, configurations, sensors, and fault history that can be viewed using the AID tool.

In addition to the baseline operation, Aurora Advanced VS Control adds the extended I/O of the Aurora Expansion Board (AXB) to the mix. This extended I/O includes energy monitoring as a standard feature where current transducers measure current and power of the fan motor. Compressor power is monitored by the compressor drive and communicated to the Aurora Controls. Refrigerant monitoring is standard on all variable speed models and reports refrigerant temperatures and pressures in order to calculate superheat and subcooling. The optional performance monitoring kit includes entering and leaving water temperatures along with source water flow rate via a vortex shedding flow meter.

The Aurora Advanced VS Control uses an internal PID control and communicates via Modbus to the variable speed compressor drive and electronic expansion valve to provide capacity and superheat control of the system. All faults codes from the compressor drive are mapped to the Aurora system which are then displayed through the AID tool.

### Optional Aurora UPC

When coupled with the optional Aurora UPC, the system can communicate all of these same heat pump parameters to the BAS as network points using either BACnet, N2 or Lon protocols. This means that not only are heat pump parameters visible by the BAS, many configuration settings, such as airflow and freeze detection settings, can also be changed from the BAS system saving commissioning costs. This provides both cost advantages and features not typically found on WSHP controls. All configuration, sensor and servicing can be accessed thru the AuroraTouch color service tool. This integration allows heat pump monitoring sensors, status and service diagnosis faults to be communicated thru the DDC direct to the building automation system (BAS), giving building supervisors detailed and accurate information on every piece of equipment without removing an access panel!



## Control Features

***Software ABC Standard Version 3.0***

### Variable Speed Compressors

Only Copeland EV2 Variable Speed compressors can be operated.

## Aurora Advanced VS Control Features

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

## Control Features

***Software ABC VS Version 3.0 Variable Capacity Compressors***

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

# Controls - Aurora Advanced Variable Speed Control cont.

### Variable Speed ECM Blower Motor

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

### 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 25 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 discharge temperature and current sensors of the drive.

### Electronic Expansion Valve (EEV)

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

### Variable Speed Pump

This input and output are provided to drive and monitor a variable speed pump. The VS pump output is a PWM signal to drive the variable speed pump. The minimum and maximum level are set using the AID Tool. 50% and 100% are the default settings respectively. The VS data input allows a separate PWM signal to return from the pump giving fault and performance information. Fault received from the variable speed pump will be displayed as E16.

### Modulating Water Valve

This output is provided to drive a modulating water valve. Through advanced design the 0-10VDC valve can be driven directly from the VS Pump output. The minimum and maximum level are set in the same way as the VS pump using the AID Tool. 50% and 100% are the default settings respectively.

### Loop Pump Linking

This input and output are provided so that two units can be linked together with a common flow center. When either unit has a call for loop outputs, both unit's loop pump relays and variable speed pumps are energized. The flow center then can simply be wired to either unit. The output from one unit should be routed to the input of the other. If daisy chained, up to 16 heat pumps can be wired and linked together in this fashion.

### Advanced Communication Ports

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

## Monitoring Sensors

### Energy Monitoring

Energy Monitoring is standard in all models and includes two current transducers (blower and electric heat) so that the complete power usage of the heat pump can be measured. Compressor power is measured by the variable speed drive. 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, selected communicating thermostats or communicated thru the optional Aurora UPC BAS communications board.

### Refrigerant Monitoring

Refrigerant Monitoring is standard in all models includes two pressure transducers, and three temperature sensors, heating liquid line, suction temperature and existing cooling liquid line (FP1). These sensors allow the measurement of discharge and suction pressures, suction and liquid line temperatures as well as superheat and subcooling. This information can be displayed on the AID Tool or communicated thru the optional Aurora UPC BAS communications board.

### Performance Monitoring

***(Requires Flow Meter)***

The optional Performance Monitoring includes three temperature sensors, entering and leaving water, leaving air temperature and a water flow rate sensor. Heat of extraction and rejection will be calculated. This requires configuration using the AID Tool for selection of water or antifreeze and is displayed on the AID tool or communicated thru the optional Aurora UPC BAS communications board.

# Controls - Aurora Advanced Variable Speed Control cont.

## Special Modes and Applications

### Communicating Digital Thermostats

The Aurora Advanced 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.

### 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 2°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 2°F below cooling setpoint, or more than 1°F above cooling setpoint (normal cooling takes over). In IntelliZone2 systems, active dehumidification is only enabled when system is operating on compressor speeds 4 or lower. Once active dehumidification is activated the main zone and any other active cooling zone will remain open.

## Field Hardware Selectable Options

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

Test/Configuration Button (See SW1 Operation Table)

### Test Mode

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

### Variable Speed ECM Configuration Mode

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

### 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 and 2-5** Access Relay Operation (P2)

| 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.

# Controls - Aurora Advanced Variable Speed Control cont.

### 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).**

***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.

# Controls - Aurora Advanced Variable Speed Control cont.

***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 1-12, 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.

# Controls - Aurora Advanced Variable Speed Control cont.

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

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

***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.

### 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 |

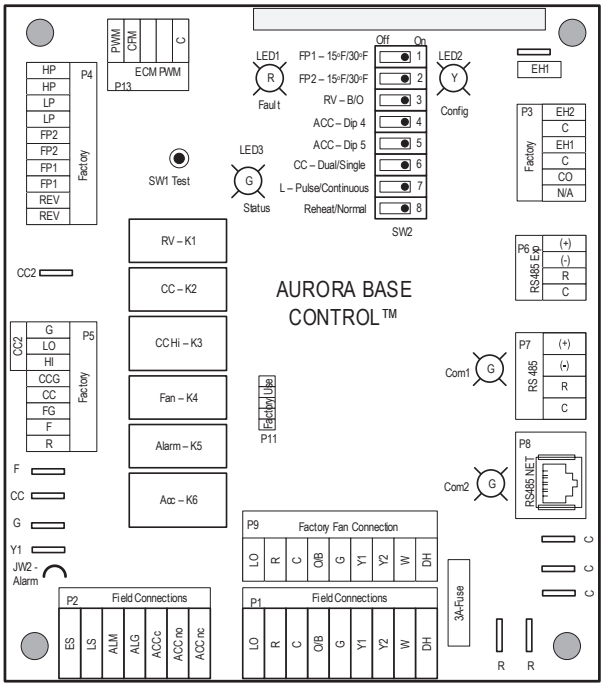
# Controls - Aurora Advanced Variable Speed Control cont.

| | Fault | Fault Code | LED Flash Code* | Lockout | Reset/ Remove | Fault Condition Summary | ABC Action: ABC Green Status LED | ABC Action: ABC Red Fault LED | AID Tool: Display and History | IZ2 and Stat Display: IZ2 & Thermostat Display |
|---|---|---|---|---|---|---|---|---|---|---|
| ABC & AXB Basic Faults | Normal - No Faults | Off | Off | | | | | | | |
| | Fault-Input | 1 | 1 | No | Auto | Tstat input error. Autoreset upon condition removal. | Normal | Code 1 | | |
| | Fault-High Pressure | 2 | 2 | Yes | Hard or Soft | HP switch has tripped (>600 psi) | Lockout | Code 2 | Lockout - E2 High Press | Lockout - E2 High Press |
| | Fault-Low Pressure | 3 | 3 | Yes | Hard or Soft | Low Pressure Switch has tripped (<40 psi for 30 continous sec.) | Lockout | Code 3 | Lockout - E3 Low Press | Lockout - E3 Low Press |
| | Fault-Freeze Detection FP2 | 4 | 4 | Yes | Hard or Soft | Freeze protection sensor has tripped (<15 or 30 degF for 30 continuous sec.) | Lockout | Code 4 | Lockout - E4 Freeze Detection FP2 | Lockout - E4 Freeze Detection FP2 |
| | Fault-Freeze Detection FP1 | 5 | 5 | Yes | Hard or Soft | Freeze protection sensor has tripped (<15 or 30 degF for 30 continuous sec.) | Lockout | Code 5 | Lockout - E5 Freeze Detection FP1 | Lockout - E5 Freeze Detection FP1 |
| | Fault-Loss of Charge | 6 | 6 | Yes | Hard or Soft | Low Pressure Switch open prior to compressor start (UPC Only) | Lockout | Code 6 | Lockout - E6 | Lockout - E6 |
| | Fault-Condensate Overflow | 7 | 7 | Yes | Hard or Soft | Condensate switch has shown continuity for 30 continuous sec. | Lockout | Code 7 | Lockout - E7 Condensate | Lockout - E7 Condensate |
| | Fault-Over/Under Voltage | 8 | 8 | No** | Auto | Instantaneous Voltage is out of range. **Controls shut down until resolved. | Lockout | Code 8 | Lockout - E8 Over/Under voltage | Lockout - E8 Over/Under voltage |
| | Fault-AirFlow/RPM | 9 | 9 | Yes | Hard or Soft | Not used | Lockout | Code 9 | Lockout - E9 Airflow/RPM | Lockout - E9 Airflow/RPM |
| | Fault-Compressor Monitor | 10 | 10 | Yes | Hard or Soft | Open Crkt, Run, Start or welded cont | Lockout | Code 10 | Lockout - E10 Compress Monitor | Lockout - E10 Compress Monitor |
| | Fault-FP1 & 2 Snsr Error | 11 | 11 | Yes | Hard or Soft | If FP1 or 2 Sensor Err | Lockout | Code 11 | Lockout - E11 FP1/FP2 Sensor Error | Lockout - E11 FP1/FP2 Sensor Error |
| ABC & AXB Advanced Faults | Error-Refrig Perform | 12 | 12 | - | - | Not Used | - | Code 12 | - | - |
| | Non-CriticAXBSnsrErr | 13 | 13 | No | Auto | Any Other Sensor Err | Normal | Code 13 | Alert - E13 Non-Critical AXB Sensor Error | Alert - E13 Non-Critical AXB Sensor Error |
| | CriticAXBSnsrErr | 14 | 14 | Yes | Hard or Soft | Sensor Err for EEV or HW | Lockout | Code 14 | Lockout - E14 Critical AXB Sensor Error | Lockout - E14 Critical AXB Sensor Error |
| | Alarm-HotWtr | 15 | 15 | No | Auto | HW over limit or logic lockout. HW pump deactivated. | Normal | Code 15 | Alert - E15 Hot Water Temp Limit | - |
| | Fault-VarSpdPump | 16 | 16 | No | Auto | Alert is read from PWM feedback. | Normal | Code 16 | Alert - E16 Var Spd Pump Err | Alert - E16 Var Spd Pump Err |
| | Fault-Zone Fault | 17 | 17 | No | Auto | IZ2 Com Fault. Autoreset upon condition removal. (Not Implemented) | Normal | Code 17 | Warning - E17 IZ2 Comm Error | Warning - E17 IZ2 Comm Error |
| | Non-CritComErr | 18 | 18 | No | Auto | Any non-critical com error | Normal | Code 18 | Alert - E18 Non-Critical Communication Error | Alert - E18 Non-Critical Communication Error |
| | Fault-CritComErr | 19 | 19 | No | Auto | Any critical com error. Auto reset upon condition removal | Normal | Code 19 | Alert - E19 Critical Communication Error | Alert - E19 Critical Communication Error |
| | UPC Communication Loss | 20 | - | Yes | Auto | UPC/ABC communication loss (UPC Only) | Normal | - | | |
| | Alarm - Low Loop Pressure | 21 | 21 | No | Auto | Loop pressure is below 3 psi for more than 3 minutes | Normal | Code 21 | Alert - E51 Low Loop Pressure | - |
| | Com ECM Fan Motor | 22 | 22 | - | - | Not used | - | Code 22 | - | - |
| | Alarm - Home Automation 1 | 23 | 23 | No | Auto | Closed contact input is present on Dig 2 input - Text is configurable | Normal | Code 23 | Alert - E23 Selected choice | Alert - E23 Selected choice |
| | Alarm - Home Automation 2 | 24 | 24 | No | Auto | Closed contact input is present on Dig 3 input - Text is configurable | Normal | Code 24 | Alert - E24 Selected Choice | Alert - E24 Selected Choice |
| | Fault - AXB EEV Error | 25 | 25 | Yes | Auto | AXB EEV Error | Normal | Code 25 | Lockout - E25 AXB EEV Error | Lockout - E25 AXB EEV Error |
| | Fault - Low Entering Water | 26 | 26 | No | Auto | Entering Water Temperature Below Fault Limit | Lockout | Code 26 | - | - |
| | Fault - High Entering Water | 27 | 27 | No | Auto | Entering Water Temperature Above Fault Limit | Lockout | Code 27 | - | - |
| | Fault - Low Leaving Water | 28 | 28 | No | Auto | Leaving Water Temperature Below Fault Limit | Lockout | Code 28 | - | - |
| | Fault - High Leaving Water | 29 | 29 | No | Auto | Leaving Water Temperature Above Fault Limit | Lockout | Code 29 | - | - |
| | UPC | 30 | - | No | Auto | Zone Temperature Sensor Unreliable (UPC Only) | Normal | - | - | - |
| Dual Compressor 2nd ABC | Fault - Source Flow Switch | 31 | 31 | No | Auto | Source Flow Switch Open | Lockout | Code 31 | - | - |
| | Fault - Load Flow Switch | 32 | 32 | No | Auto | Load Flow Switch Open | Lockout | Code 32 | - | - |
| | Reserved | 33 | 33 | - | - | Not Used | - | - | - | - |
| | Reserved | 34 | 34 | - | - | Not Used | - | - | - | - |
| | Reserved | 35 | 35 | - | - | Not Used | - | - | - | - |
| | Reserved | 36 | 36 | - | - | Not Used | - | - | - | - |
| | Reserved | 37 | 37 | - | - | Not Used | - | - | - | - |
| | Reserved | 38 | 38 | - | - | Not Used | - | - | - | - |
| | Reserved | 39 | 39 | - | - | Not Used | - | - | - | - |
| | | 40 | 40 | - | - | Not used | - | - | - | - |
| VS Drive | Derate-DriveTemp | 41 | 41 | No | Auto | Drive Temp has reached critical High Temp | Derated | Code 41 | Warning! Derated - E41 DriveTemp | Warning! Derated - E41 DriveTemp |
| | Derate-HiDisTemp | 42 | 42 | No | Auto | Compressor Discharge isexceeded limit for 90 continuous sec.. | Derated | Code 42 | Warning! Derated - E42 HiDisTemp | Warning! Derated - E42 HiDisTemp |
| | Derate-LoSucPres | 43 | 43 | No | Auto | Suction Pressure is critically low | Derated | Code 43 | Warning! Derated - E43 LoSucPres | Warning! Derated - E43 LoSucPres |
| | Derate-LoConPres | 44 | 44 | No | Auto | Condensing pressure is critically low | Derated | Code 44 | Warning! Derated - E44 LoConPress | Warning! Derated - E44 LoConPress |
| | Derate-HiConPres | 45 | 45 | No | Auto | Condensing pressure is critically high | Derated | Code 45 | Warning! Derated - E45 HiConPress | Warning! Derated - E45 HiConPress |
| | Derate-OutPwrLmt | 46 | 46 | No | Auto | Supply Voltage is <208V or Max Pwr is reached due to high pressure | Derated | Code 46 | Warning! Derated - E46 OutPwrLmt | Warning! Derated - E46 OutPwrLmt |
| | SafeMd-EEVIndCom | 47 | 47 | No | Auto | Com with EEV is interupted EEV has gone independent mode | SafeMode | Code 47 | Warning! SafeMode - E47 EEVIndCom | Warning! SafeMode - E47 EEVIndCom |
| | SafeMd-EEVOutCom | 48 | 48 | No | Auto | Com with EEV is interupted EEV has gone independent mode | SafeMode | Code 48 | Warning! SafeMode - E48EEVOutCom | Warning! SafeMode - E48EEVOutCom |
| | SafeMd-AmbTmpSnr | 49 | 49 | No | Auto | Ambient Temperature (Tamb) is <-76 or > 212 F and out of range or invalid | SafeMode | Code 49 | Warning! SafeMode - E49 | Warning! SafeMode - E49 |
| | Fault-DisTmpSnr | 51 | 51 | Yes | Hard or Soft | Discharge Sensor (Sd) is > 280 F or invalid (-76 to 392 F) | Lockout | Code 51 | Lockout! - E51 DisTmpSnr | Lockout! - E51 DisTmpSnr |
| | Fault-SucPrsSnr | 52 | 52 | Yes | Hard or Soft | Suction Pressure (P0) is invalid (0 to 232 psi) | Lockout | Code 52 | Lockout! - E52 SucPrsSnr | Lockout! - E52 SucPrsSnr |
| | Fault-ConPrsSnr | 53 | 53 | 10x then Yes | Hard or Soft | Low condensing pressure (PD) or invalid (0 to 870 psi) Retry 10x. | Norm then Lockout | Code 53 | Lockout! - E53 ConPrsSnr | Lockout! - E53 ConPrsSnr |
| | Fault-LowSupVolt | 54 | 54 | Yes | Hard or Soft | Supply Voltage is <175 V (190V to reset) or powered off/on too quickly (<30 sec.). | Lockout | Code 54 | Lockout! - E54 LowSupVolt | Lockout! - E54 LowSupVolt |
| | Fault-OutEnvelop | 55 | 55 | 10x then Yes | Hard or Soft | Comp Operating out of envelope (P0) more than 90 sec. Retry 10x. | Norm then Lockout | Code 55 | Lockout! - E55 OutEnvelop | - |
| | Fault-OverCurrnt | 56 | 56 | Yes | Hard or Soft | Over current tripped by phase loss, earth fault, short circuit or major drive fault. | Lockout | Code 56 | Lockout! - E56 OverCurrnt | Lockout! - E56 OverCurrnt |
| | Fault-Over/UnderVolt | 57 | 57 | Yes | Hard or Soft | DC Link Voltage to compressor is >253V or at minimum Volt. | Lockout | Code 57 | Lockout! - E57 Over/Under Volt | Lockout! - E57 Over/Under Volt |
| | Fault-HiDrivTemp | 58 | 58 | Yes | Hard or Soft | Drive Temp has reached critical High Temp >239 F | Lockout | Code 58 | Lockout! - E58HiDrivTemp | Lockout! - E58HiDrivTemp |
| | Fault-DrvIntErr MOC/AOC | 59 | 59 | Yes | Hard or Soft | The MOC has encountered an internal fault or an internal error. Probably fatal. | Lockout | Code 59 | Lockout! - E59 DrvIntErr | Lockout! - E59 DrvIntErr |
| | Fault-MultSafeMd | 61 | 61 | Yes | Hard or Soft | More than one SafeMode condition is present requiring lockout. | Lockout | Code 61 | Lockout! - E61 MultSafeMd | Lockout! - E61 MultSafeMd |
| | Fault - Low Temp | 62 | 62 | Yes | Auto | VS Drive Temperature Low | Lockout | Code 62 | E62 | E62 |
| | Fault - FautI Limit | 63 | 63 | Yes | Auto | VS Drive Fault Limit Reached | Lockout | Code 63 | E63 | E63 |
| | Fault - Drive Hardware | 64 | 64 | Yes | Hard or Soft | Drive Hardware Fault | Lockout | Code 64 | E64 | E64 |
| | Fault - Drive Soft Start | 65 | 65 | No | Auto | Soft Start did not succeed | Lockout | Code 65 | E65 | E65 |
| | Fault - Drive Locked Rotor | 66 | 66 | Yes | Hard or Soft | Locked Rotor or phasing error | Lockout | Code 66 | E66 | E66 |
| | Fault - Drive Micro | 67 | 67 | Yes | Hard | Drive Microprocessor Fault | Lockout | Code 67 | E67 | E67 |
| | Not Used | 68 | 68 | - | - | | - | - | | |
| | Invalid/Missing Comp ID | 69 | 69 | No | Auto | Compressor ID number in ABC does not match VS Drive ID or is set to 0. | Lockout | Code 69 | E69 | E69 |
| | | 70 | 70 | - | - | Not used | - | - | - | - |
| Ind/Pkg EEV2 | Fault-LossofCharge | 71 | 71 | Yes | Hard or Soft | High superheat and high EEV opening % for a long time will trigger a loss of charge fault | Lockout | Code 71 | Lockout! - E71 LossCharge | Lockout! - E71 LossCharge |
| | SafeMd-SucTmpSnr | 72 | 72 | No | Auto | Suction Temperature Sensor (??) is invalid (-76 to 392 F) | SafeMode | Code 72 | Warning! SafeMode - E72 SucTmpSnr | Warning! SafeMode - E72 SucTmpSnr |
| | SafeMd-LATSensor | 73 | 73 | No | Auto | Leaving Air Temperature Sensor (??) is invalid (-76 to 392 F) | Normal | Code 73 | Alert - E73 LAT Sensor | - |
| | SafeMd-MaxOpPres | 74 | 74 | No | Auto | Suction pressure has exceeded that maximum operating level for 90 sec. | SafeMode | Code 74 | Warning! SafeMode - E74 MaxOpPress | Warning! SafeMode - E74 MaxOpPress |
| Outdoor EEV1 | Fault-LossofCharge | 75 | 75 | Yes | Hard or Soft | High superheat and high EEV opening % for a long time will trigger a loss of charge fault | Lockout | Code 75 | Lockout! - E75 Loss Charge | Lockout! - E75 Loss Charge |
| | SafeMd-SucTmpSnr | 76 | 76 | No | Auto | Suction Temperature Sensor (??) is invalid (-76 to 392 F) | SafeMode | Code 76 | Warning! SafeMode - E76 SucTmpSnr | Warning! SafeMode - E76 SucTmpSnr |
| | SafeMd-LATSensor | 77 | 77 | No | Auto | Leaving Air Temperature Sensor (??) is invalid (-76 to 392 F) | Normal | Code 77 | Alert - E77 LATSensor | - |
| | SafeMd-MaxOpPres | 78 | 78 | No | Auto | Suction pressure has exceeded that maximum operating level for 90 sec. | SafeMode | Code 78 | Warning! SafeMode - E78 MaxOpPress | Warning! SafeMode - E78 MaxOpPress |
| | | 79-98 | 79-98 | - | - | Not used | - | - | - | - |
| | Power cycle | 99 | - | - | - | Count will increase each time power is applied to ABC | Normal | - | E99 | - |
| UPC Rooftop Sensor Faults | OAT Sensor Faulty | 101 | - | - | - | Outdoor Air Temperature Sensor reading invalid | - | - | - | - |
| | OAT Sensor Missing | 102 | - | - | - | Outdoor Air Temperature Sensor not communicating | - | - | - | - |
| | OAH Sensor Faulty | 103 | - | - | - | Outdoor Air Humidity Sensor reading invalid | - | - | - | - |
| | OAH Sensor Missing | 104 | - | - | - | Outdoor Air Humidity Sensor not communicating | - | - | - | - |
| | RAT Sensor Faulty | 105 | - | - | - | Return Air Temperature Sensor reading invalid | - | - | - | - |
| | RAT Sensor Missing | 106 | - | - | - | Return Air Temperature Sensor not communicating | - | - | - | - |
| | RAH Sensor Faulty | 107 | - | - | - | Return Air Humidity Sensor reading invalid | - | - | - | - |
| | RAH Sensor Missting | 108 | - | - | - | Return Air Humidity Sensor not communicating | - | - | - | - |
| Software Support Faults | Compressor Support Fault | 120 | - | - | - | Incorrect ABC/AXB software for HydroLink Control of compressors | Normal | - | - | - |
| | Blower Support Fault | 121 | | | | Incorrect ABC/AXB software for HydroLink Control of blower | Normal | - | - | - |
| | Pump Support Fault | 122 | | | | Incorrect ABC/AXB software for HydroLink Control of pump | Normal | - | - | - |

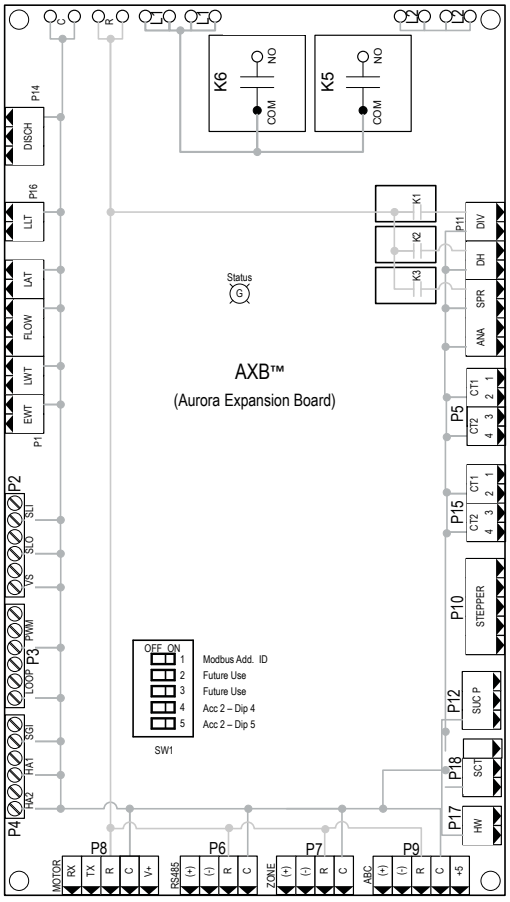
Note: *All codes >11 use long flash for tens digit and short flash for the ones digit. 20, 30, 40, 50 etc. will be skipped! Alert' is a noncritical sensor or function that has failed. Normal operation of the heat pump is maintained but service is desired at some point. 11/1/2017

# Controls - Aurora Advanced Variable Speed Control cont.

## ABC Control Board Layout

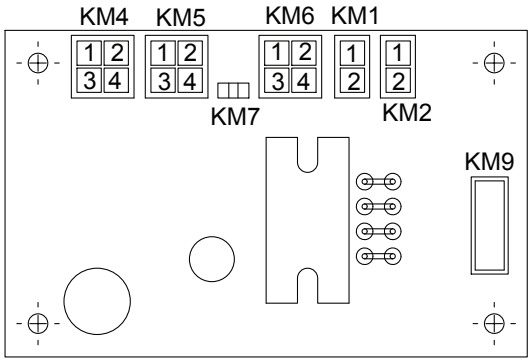



## AXB Control Board Layout

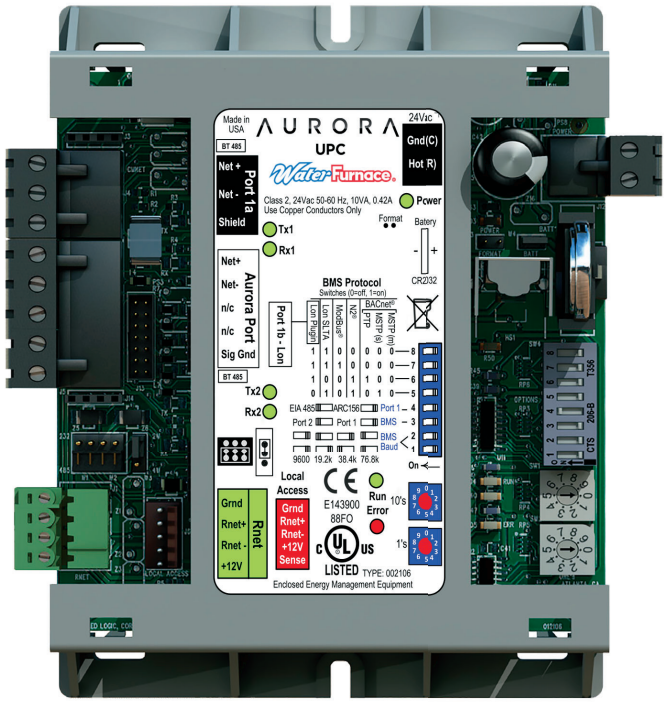



## Compressor Drive

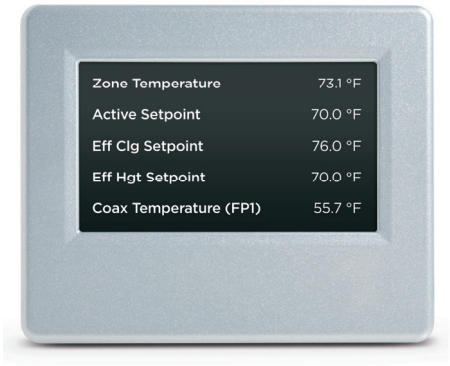
## EEV Board Layout



# Controls - UPC DDC Control (optional)




**Aurora UPC Controller**




**Aurora Touch Interface**

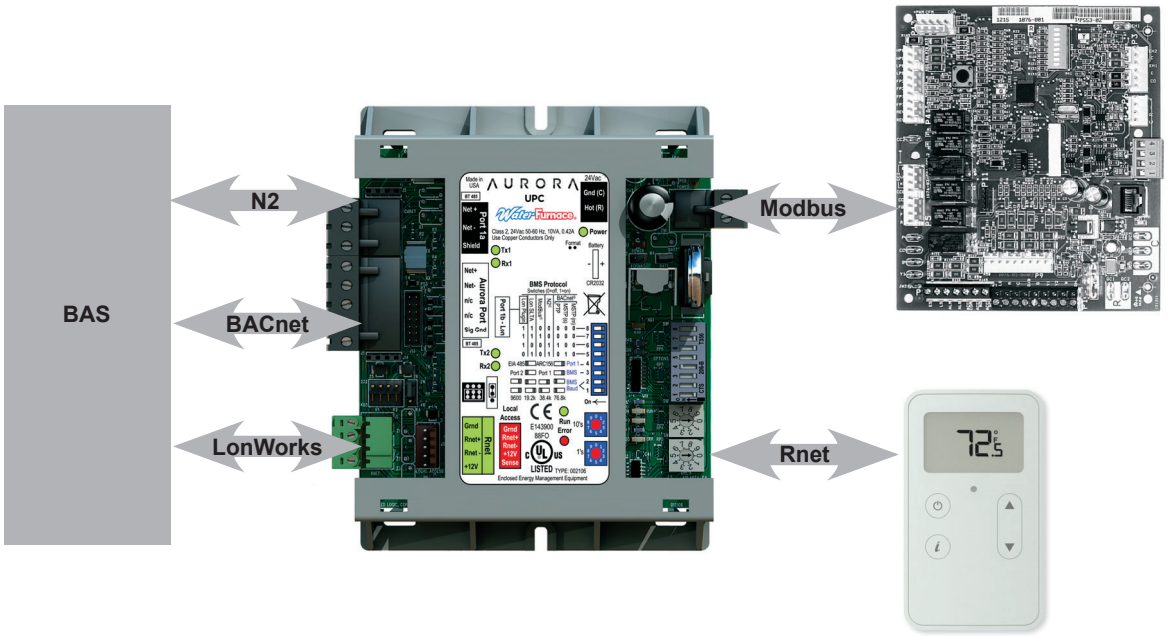
**ZS Series Sensors**

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

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

There are an extensive number of points that the UPC has available over the network for integration into the BAS. Control programmers need to carefully determine which points they want to add into the BAS database. A list of the BACnet points, N2 points, and LON SNVTs are available along with their individual point descriptions by contacting a factory service representative.

# Controls - UPC DDC Control (optional) cont.




## Aurora UPC Features

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

## Aurora UPC Optional Features

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

# Controls - UPC DDC Control (optional) cont.

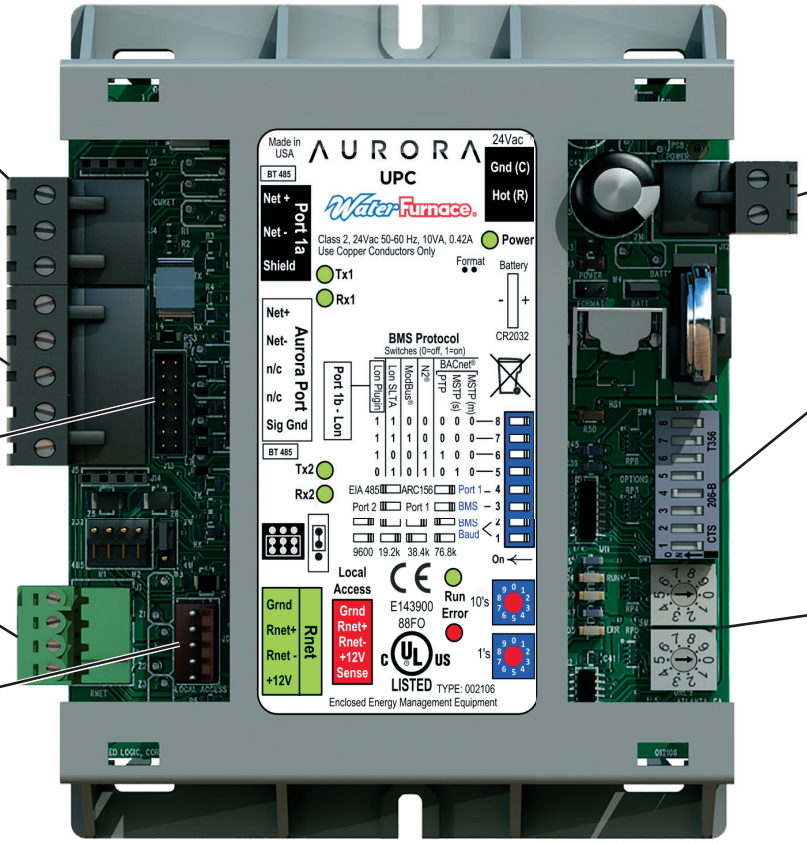
Port 1a is used to communicate to the Building Automation System (BAS). This port's settings are configured through the onboard dip switches.

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

Port 1b is used for the LonWorks plugin.

Rnet port is used for communicating zone sensors.

BACview or local laptop connection.




24Vac

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

Mac address is set by 2 rotary dials.

# Controls - UPC DDC Control (optional) cont.

1. ***Leaving Air Temperature (LAT) Sensor –*** This 10 kOhm NTC sensor is factory installed on all UPC equipped heat pumps. It typically is attached to wiring inside the blower cabinet on the suction side of the blower. This sensor is attached on ABC FP2 pins available as LAT AU-30.
2. ***Valve End Switch –*** This optional input is setup for a field installed flow valve end switch. This end switch input is attached at ABC Y2 and available at point BV-67.
3. ***Fan Proving Sensors –*** This optional factory installed current sensor is connected to confirm fan operation via the power wires. The sensor is attached at ABC G and available at point BV-33.
4. ***Occupancy Sensor -*** This standard feature includes a field installed and wired room sensor with occupancy sensor typically found in DDC systems. The RNet room sensors can be found thru your commercial representative. The occupancy Sensors are attached at ABC 0 and can be found at point BV-49.
5. ***Dirty Filter Switch –*** This optional field installed switch is connected to confirm dirty filter operation. The dirty filter switch can be found thru your commercial representative. The sensor is attached at ABC W and available at point BV-63.
6. ***Fault, Configuration, and Status Codes –*** The codes can be visible to the BAS if desired

## Aurora Advanced Fault Codes (ABC + AXB Expansion Board) Variable Speed

### Variable Speed Drive Additions

| | Red Fault LED | LED Flash Code * | Lockout | Reset/ Remove | Fault Condition Summary |
|---|---|---|---|---|---|
| ABC & AXB Basic Faults | Normal - No Faults | Off | - | | |
| | Fault-Input | 1 | No | Auto | Tstat input error. Autoreset upon condition removal. |
| | Fault-High Pressure | 2 | Yes | Hard or Soft | HP switch has tripped (>600 psi) |
| | Fault-Low Pressure | 3 | Yes | Hard or Soft | Low Pressure Switch has tripped (<40 psi for 30 continous sec.) |
| | Fault-Freeze Detection FP2 | 4 | Yes | Hard or Soft | Freeze protection sensor has tripped (<30 degF for 30 continuous sec.) |
| | Fault-Freeze Detection FP1 | 5 | Yes | Hard or Soft | Freeze protection sensor has tripped (<15 or 30 degF for 30 continuous sec.) |
| | Fault-Condensate Overflow | 7 | Yes | Hard or Soft | Condensate switch has shown continuity for 30 continuous sec. |
| | Fault-Over/Under Voltage | 8 | No** | Auto | Instantaneous Voltage is out of range. **Controls shut down until resolved. |
| | Fault-FP1 & 2 Snsr Error | 11 | Yes | Hard or Soft | If FP1 or 2 Sensor Err |

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

# Controls - UPC DDC Control (optional) cont.

## Aurora Base or Advanced Control Configuration and Status Codes

### Status LED (LED3, Green)

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

### Configuration LED (LED2, Yellow)

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

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

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

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

# Controls - UPC DDC Control (optional) cont.

## Aurora Advanced Control Configuration and Options

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

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

2. ***Analog Out –*** A standard 0-10VDC analog output is provided. This output can be used to drive modulating dampers etc.

3. ***Variable Speed Pump or Modulating Water Valve (If applicable) -*** This input and output are provided to drive and monitor a variable speed pump. The VS pump output is a PWM signal to drive the variable speed pump. The minimum and maximum level are set using the AID Tool. 75% and 100% are the default settings respectively. The VS data input allows a separate PWM signal to return from the pump giving fault and performance information. Fault received from the variable speed pump will be displayed as E16. ***Modulating Water Valve -*** This Variable speed PWM output is provided to optionally drive a modulating water valve. Through advanced design a 0-10VDC valve can be driven directly from the VS pump output. The minimum and maximum level are set in the same way as the VS pump using the AID Tool. 75% and 100% are the default settings respectively.

4. ***Loop Pump Linking (If applicable) -*** 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 pump, both unit's loop pump relays and variable speed pumps are energized. The flow center then can simply be wired to either unit. The output from one unit should be routed to the input of the other. If daisy chained up to 16 heat pumps can be wired and linked together in this fashion.

# Controls - UPC DDC Control (optional) cont.

## Aurora Advanced Control Optional Sensor Kits

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

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

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

# Controls - UPC DDC Control (optional) cont.

### ZS Series RNet Sensor Overview

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

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


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

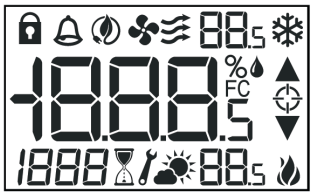
| Options | Part Number | Part Number | Part Number | Part Number |
|---|---|---|---|---|
| Temperature Only | ZSU | ZSUPL | ZSUP | ZSUPF |
| Temp with $CO^2$ | ZSU-C | ZSUPL-C | ZSUP-C | ZSUPF-C |
| Temp with Humidity | ZSU-H | ZSUPL-H | ZSUP-H | ZSUPF-H |
| Temp with Humidity, $CO^2$ | ZSU-HC | ZSUPL-HC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

# Controls - UPC DDC Control (optional) cont.

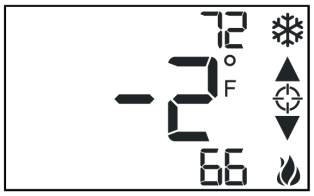
### RNet Sensor Physical and Electrical Data

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

**All Segments**



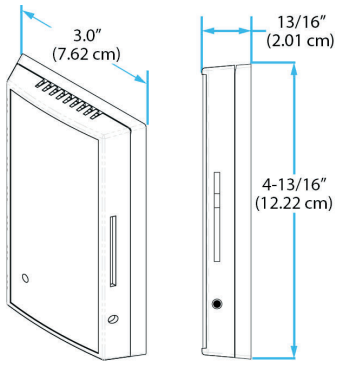
**Setpoint Adjust**



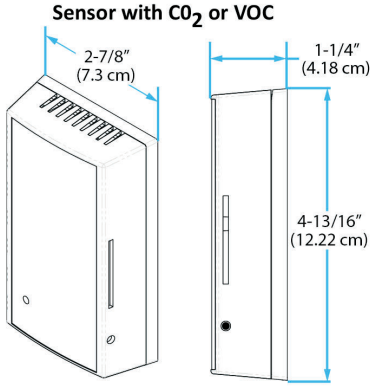

**Home Screen**


**Info Screen - $CO_2$**


**Temperature Only or Temperature with Humidity**




**Sensor with $CO_2$ or VOC**



# Unit Startup

## Before Powering Unit, Check The Following:

- Power supply matches nameplate specifications.
- Power supply fuses, breakers and wires are sized correctly.
- Switch the Transformer to 208V if applicable.
- Low voltage wiring complete.
- Piping completed and water system cleaned and flushed.
- Air is purged from closed loop system.
- Isolation valves are open, water control valves or loop pumps wired.
- Condensate line open and correctly pitched.
- Dip switches are set correctly.
- Blower wheel rotates freely and turns in the correct direction.
- Air filter/cleaner is clean and in position.
- Service/access panels are in place.
- Return air temperature is between 50-80oF heating and 60-95oF cooling.
- Evaluate air coil cleanliness to insure optimum performance. Clean as needed according to maintenance guidelines.

## Startup Steps

**NOTE:** Complete the Equipment Start-Up/Commissioning Check Sheet during this procedure. Refer to thermostat operating instructions and complete the startup procedure.

1. Initiate a control signal to energize the blower motor. Check the blower operation.
2. Be sure the water control valve or loop pump(s) are activated.
3. Initiate a control signal to place the unit in the cooling mode. Cooling set point must be set below room temperature.
4. Cooling will energize after time delay. Check for correct rotation of scroll compressor in three (3) phase applications. Incorrect rotation will cause low refrigerant pressures and possibly unusual noise. Switch any two power leads at the compressor or contactor to reverse rotation.
5. Verify that the water flow rate is correct by measuring the pressure drop through the heat exchanger using the P/T plugs and comparing to the pressure drop table.
6. Check the temperature of both the supply and discharge water (Refer to Operating Parameters tables).
7. Check for an air temperature drop of 15oF to 25oF across the air coil, depending on the blower speed and entering water temperature.
8. Decrease the cooling set point several degrees and verify variable speed blower operation.
9. Adjust the cooling set point above the room temperature and verify that the compressor and water valve or loop pumps deactivate.
10. Initiate a control signal to place the unit in heating mode. Heating set point must be set above room temperature.
11. Heating will energize after a time delay.
12. Check the temperature of both the supply and discharge water (Refer to Unit Operating Parameters tables).
13. Check for an air temperature rise of 20oF to 35oF across the air coil, depending on the blower speed and entering water temperature.
14. If auxiliary electric heaters are installed, increase the heating set point until the electric heat banks are sequenced on. All stages of the auxiliary heater should be sequenced on when the thermostat is in the Emergency Heat mode. Check amperage of each element.
15. Adjust the heating set point below room temperature and verify that the compressor and water valve or loop pumps deactivate.
16. During the testing, check for excessive vibration, noise or water leaks. Correct or repair as required.
17. Set system to desired normal operation mode and set temperature to maintain desired comfort level.
18. Instruct the owner/operator in the proper operation of the thermostat and system maintenance.

**NOTE:** Be certain to fill out and forward all warranty registration papers.

# Operating Limits

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

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

# Operating Parameters

| Entering Water Temp °F | Load | Cooling -- No Hot Water Generation | | | | | |
|---|---|---|---|---|---|---|---|
| | | Suction Pressure psig | Discharge Pressure psig | Superheat | Subcooling | Water Temp Rise °F | Air Temp Drop °F DB |
| 30 | Min | 120 - 125 | 115 - 130 | 12 - 16 | 3 - 8 | 4 - 8 | 17 - 23 |
| | Max | 100 - 115 | 115 - 130 | 15 - 20 | 8 - 12 | 8 - 12 | 17 - 23 |
| 50 | Min | 140 - 150 | 160 - 180 | 12 - 16 | 3 - 8 | 4 - 8 | 17 - 23 |
| | Max | 120 - 135 | 180 - 200 | 8 - 12 | 8 - 14 | 8 - 12 | 17 - 23 |
| 70 | Min | 145 - 155 | 210 - 230 | 8 - 12 | 6 - 12 | 4 - 8 | 17 - 23 |
| | Max | 133 - 143 | 250 - 260 | 8 - 12 | 8 - 14 | 8 - 12 | 17 - 23 |
| 90 | Min | 150 - 160 | 295 - 305 | 8 - 12 | 6 - 12 | 4 - 8 | 17 - 23 |
| | Max | 140 - 150 | 330 - 340 | 8 - 12 | 8 - 14 | 8 - 12 | 17 - 23 |
| 110 | Min | 155 - 165 | 370 - 400 | 4 - 8 | 6 - 12 | 4 - 8 | 17 - 23 |
| | Max | 148 - 153 | 390 - 420 | 8 - 12 | 8 - 14 | 8 - 12 | 17 - 23 |

| Entering Water Temp °F | Load | Heating -- No Hot Water Generation | | | | | |
|---|---|---|---|---|---|---|---|
| | | Suction Pressure psig | Discharge Pressure psig | Superheat | Subcooling | Water Temp Drop °F | Air Temp Rise °F DB |
| 30 | Min | 90 - 95 | 220 - 230 | 4 - 8 | 3 - 8 | 2 - 5 | 9 - 12 |
| | Max | 80 - 88 | 275 - 290 | 8 - 12 | 3 - 10 | 3 - 7 | 14 - 18 |
| 50 | Min | 130 - 145 | 235 - 260 | 8 - 12 | 3 - 5 | 5 - 9 | 9 - 12 |
| | Max | 105 - 120 | 290 - 315 | 8 - 12 | 3 - 10 | 5 - 9 | 20 - 24 |
| 70 | Min | 155 - 170 | 250 - 280 | 8 - 12 | 3 - 5 | 5 - 9 | 15 - 20 |
| | Max | 140 - 155 | 315 - 330 | 8 - 12 | 3 - 10 | 6 - 10 | 22 - 30 |
| 90 | Min | 180 - 190 | 270 - 300 | 8 - 12 | 3 - 5 | 5 - 9 | 15 - 20 |
| | Max | 160 - 170 | 340 - 380 | 8 - 12 | 3 - 10 | 6 - 10 | 22 - 30 |
| 110 | Min | | | | | | |
| | Max | | | | | | |

Note: Cooling performance based on entering air temperatures of 80º F DB, 67º F WB. 8/25/16
Heating performance based on entering air temperature of 70º F DB.

# Pressure Drop

### Coaxial Heat Exchanger

| Model | GPM | Pressure Drop (psid) | | | | |
|---|---|---|---|---|---|---|
| | | 30oF | 50oF | 70oF | 90oF | 110oF |
| 120 | 15 | 0.6 | 0.4 | 0.3 | 0.2 | 0.1 |
| | 20 | 1.3 | 1.1 | 0.8 | 0.6 | 0.4 |
| | 25 | 2.2 | 1.8 | 1.4 | 1.2 | 1.0 |
| | 30 | 3.4 | 2.7 | 2.2 | 1.9 | 1.4 |
| 180 | 22 | 1.5 | 1.4 | 1.2 | 1.1 | 0.7 |
| | 32 | 2.9 | 2.5 | 2.2 | 2.0 | 1.5 |
| | 39 | 3.9 | 3.4 | 3.0 | 2.7 | 2.1 |
| | 45 | 5.1 | 4.4 | 3.8 | 3.4 | 2.7 |

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# Reference Calculations

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

# Legend and Notes

**ABBREVIATIONS AND DEFINITIONS:**

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

**Notes (Refer to 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.
- Entering water temperatures below 40°F assumes 15% antifreeze solution.
- For non-standard EAT conditions, apply the appropriate correction factors on (Refer to Correction Factor Tables).
- Interpolation between EWT, gpm, and cfm data is permissible.

# Refrigerant Circuit Guideline

| Symptom | Head Pressure | Suction Pressure | Compressor Amp Draw | Superheat | Subcooling | Air Temp. Differential | Water Temp. Differential |
|---|---|---|---|---|---|---|---|
| Under Charged System (Possible Leak) | Low | Low | Low | High | Low | Low | Low |
| Over Charged System | High | High | High | Normal | High | Normal/Low | Normal |
| Low Air Flow Heating | High | High | High | High/Normal | Low | High | Low |
| Low Air Flow Cooling | Low | Low | Low | Low/Normal | High | High | Low |
| Low Water Flow Heating | Low/Normal | Low/Normal | Low | Low | High | Low | High |
| Low Water Flow Cooling | High | High | High | High | Low | Low | High |
| High Air Flow Heating | Low | Low | Low | Low | High | Low | Low |
| High Air Flow Cooling | Low | High | Normal | High | Low | Low | Normal |
| High Water Flow Heating | Normal | Low | Normal | High | Normal | Normal | Low |
| High Water Flow Cooling | Low | Low | Low | Low | High | Normal | Low |
| Low Indoor Air Temperature Heating | Low | Low | Low | Normal | High | Normal | Normal/High |
| Low Indoor Air Temperature Cooling | Low | Low | Low | Normal/Low | High | Low | Low |
| High Indoor Air Temperature Heating | High | High | High | Normal/High | Normal/Low | Low | Normal |
| High Indoor Air Temperature Cooling | High | High | High | High | Low | Low | High |
| Restricted EEC (Check Service Advisory) | High | Low | Normal/Low | High | High | Low | Low |
| Insufficient Compressor (Possible Bad Valves) | Low | High | Low | High | Normal/High | Low | Low |
| Scaled Coaxial Heat Exchanger Heating | Low | Low | Low | Normal/Low | High | Low | Low |
| Scaled Coaxial Heat Exchanger Cooling | High | High | High | Normal/Low | Low | Low | Low |
| Restricted Filter Drier | Check temperature difference (delta T) across filter drier. | | | | | | |

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# Compressor and Thermistor Resistance

## Compressor Resistance Chart

| Model | 208-230/60/3 | 460/60/3 |
|---|---|---|
| 120 | 0.681 | 0.681 |
| 180 | 0.203 | 0.203 |

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## Thermistor Resistance Chart

| Thermistor Resistance (10k Ohm) for FP1, FP2, HWL, LWT, LLT, and EWT | | Thermistor Resistance (1k Ohm) for compressor discharge line, suction line, LAT, and compressor ambient | |
|---|---|---|---|
| Temperature (°F) | Resistance (Ohms) | Temperature (°F) | 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 |
| | | 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 |

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# Troubleshooting

Should a major problem develop, refer to the following information for possible causes and corrective steps.

**If compressor won't run:**

1. The fuse may be open or the circuit breaker is tripped. Check electrical circuits and motor windings for shorts or grounds. Investigate for possible overloading. Replace fuse or reset circuit breakers after fault is corrected.
2. Supply voltage may be too low. Check it with a volt meter.
3. Control system may be faulty. Check control for correct wiring of thermostat or aquastat and check the 24 volt transformer for proper voltage.
4. Wires may be loose or broken. Replace or tighten.
5. The low pressure switch may have tripped due to one or more of the following:
    a) Heating
        1) Plugged heat exchanger on source side
        2) Water flow source side - (Low)
        3) Water too cold source side
        4) Low refrigerant
    b) Cooling
        1) Plugged heat exchanger on load side
        2) Water flow load side - (Low)
        3) Water too cold load side
        4) Low refrigerant
6. The high pressure switch may have tripped due to one or more of the following:
    a) Heating
        1) Plugged heat exchanger on load side
        2) Low water flow load side
        3) Water too warm load side
    b) Cooling
        1) Plugged heat exchanger on source side
        2) Low water flow on source side
        3) Water too warm source side
7. The compressor overload protection may be open.
8. The internal winding of the compressor motor may be grounded to the compressor shell. If so, replace the compressor.
9. The compressor winding may be open or shorted. Disconnect power. Check continuity with ohm meter. If the winding is open, replace the compressor.

**If sufficient cooling or heating is not obtained:**

1. Check control for improper location or setting.
2. Check for restriction in water flow.
3. Check refrigerant subcooling and superheat for proper refrigerant charge and expansion valve operation.
4. The reversing valve may be defective and creating a bypass of refrigerant. If the unit will not heat, check the reversing valve coil.

**If the unit operation is noisy:**

1. Check compressor for loosened mounting bolts. Make sure compressor is floating free on its isolator mounts. Check for tubing contact with the compressor or other surfaces. Readjust it by bending slightly.
2. Check screws on all panels.
3. Check for chattering or humming in the contactor or relays due to low voltage or a defective holding coil. Replace the component.
4. Check for proper installation of vibration absorbing material under the unit.
5. Check for abnormally high discharge pressures.
6. Compressor rotation incorrect

## Refrigerant Systems

To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Compare the change in temperature on the air side as well as the water side to the Operating Parameters tables. If the unit's performance is not within the ranges listed, and the airflow and water flow are known to be correct, gauges should then be installed and superheat and subcooling numbers calculated. If superheat and subcooling are outside recommended ranges, an adjustment to the refrigerant charge may be necessary.

**NOTE:** Refrigerant tests must be made with hot water generator turned "OFF". Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

# Startup and Troubleshooting Form

Company Name: _____ Company Phone No: _____
Technician Name: _____ Date: _____
Model No: _____ Serial No: _____
Owner's Name: _____ Open or Closed Loop: _____
Installation Address: _____ Installation Date: _____

Check One
❑ Start up/Check-out for new installation ❑ Troubleshooting Problem: _____

1. FLOW RATE IN GPM (COAXIAL HEAT EXCHANGER)

| | | |
|---|---|---|
| Water In Pressure: | a._____ | PSI |
| Water Out Pressure: | b._____ | PSI |
| Pressure Drop = a - b | c._____ | PSI |
| Convert Pressure Drop to Flow Rate (refer to *Pressure Drop* table) | d._____ | GPM |

2. TEMPERATURE RISE OR DROP ACROSS COAXIAL HEAT EXCHANGER

| | COOLING | | HEATING | |
|---|---|---|---|---|
| Water In Temperature: | e._____ | °F | e._____ | °F |
| Water Out Temperature: | f. _____ | °F | f. _____ | °F |
| Temperature Difference: | g._____ | °F | g._____ | °F |

3. TEMPERATURE RISE OR DROP ACROSS AIR COIL

| | COOLING | | HEATING | |
|---|---|---|---|---|
| Air In Temperature: | h._____ | °F | h._____ | °F |
| Air Out Temperature: | i. _____ | °F | i. _____ | °F |
| Temperature Difference: | j. _____ | °F | j. _____ | °F |

4. HEAT OF REJECTION (HR) / HEAT OF EXTRACTION (HE) CALCULATION

HR or HE = Flow Rate x Temperature Difference x Brine Factor*
d. (above) x g. (above) x 485 for Methanol or Environol, 500 for water*
Heat of Extraction (Heating Mode) = _____ btu/hr
Heat of Rejection (Cooling Mode) = _____ btu/hr
Compare results to Capacity Data Tables

Note: Steps 5 through 8 need only be completed if a problem is suspected

5. WATTS

| | COOLING | | HEATING | |
|---|---|---|---|---|
| Volts: | m._____ | VOLTS | m._____ | VOLTS |
| Total Amps (Comp. + Fan): | n. _____ | AMPS | n. _____ | AMPS |
| Watts = m. x n. x 0.85 | o. _____ | WATTS | o. _____ | WATTS |

6. CAPACITY

| | | |
|---|---|---|
| Cooling Capacity = HR. - (o. x 3.413) | p. _____ | btu/hr |
| Heating Capacity= HE. + (o. x 3.413) | p. _____ | btu/hr |

7. EFFICIENCY

| | | |
|---|---|---|
| Cooling EER = p. / o. | q. _____ | EER |
| Heating COP = p. / (o. x 3.413) | q. _____ | COP |

8. SUPERHEAT (S.H.) / SUBCOOLING (S.C.)

| | COOLING | | HEATING | |
|---|---|---|---|---|
| Suction Pressure: | r. _____ | PSI | r. _____ | PSI |
| Suction Saturation Temperature: | s. _____ | °F | s. _____ | °F |
| Suction Line Temperature: | t. _____ | °F | t. _____ | °F |
| Superheat = t. - s. | u. _____ | °F | u. _____ | °F |
| Head Pressure: | v. _____ | PSI | v. _____ | PSI |
| High Pressure Saturation Temp.: | w. _____ | °F | w. _____ | °F |
| Liquid Line Temperature*: | x. _____ | °F | x. _____ | °F |
| Subcooling = w. - x. | y. _____ | °F | y. _____ | °F |

* Note: Liquid line is between the coaxial heat exchanger and the expansion valve in the cooling mode; between the air coil and the expansion valve in the heating mode.

DEALER: _____

PHONE #: _____ DATE: _____

PROBLEM: _____

MODEL #: _____

SERIAL #: _____

WaterFurnace®

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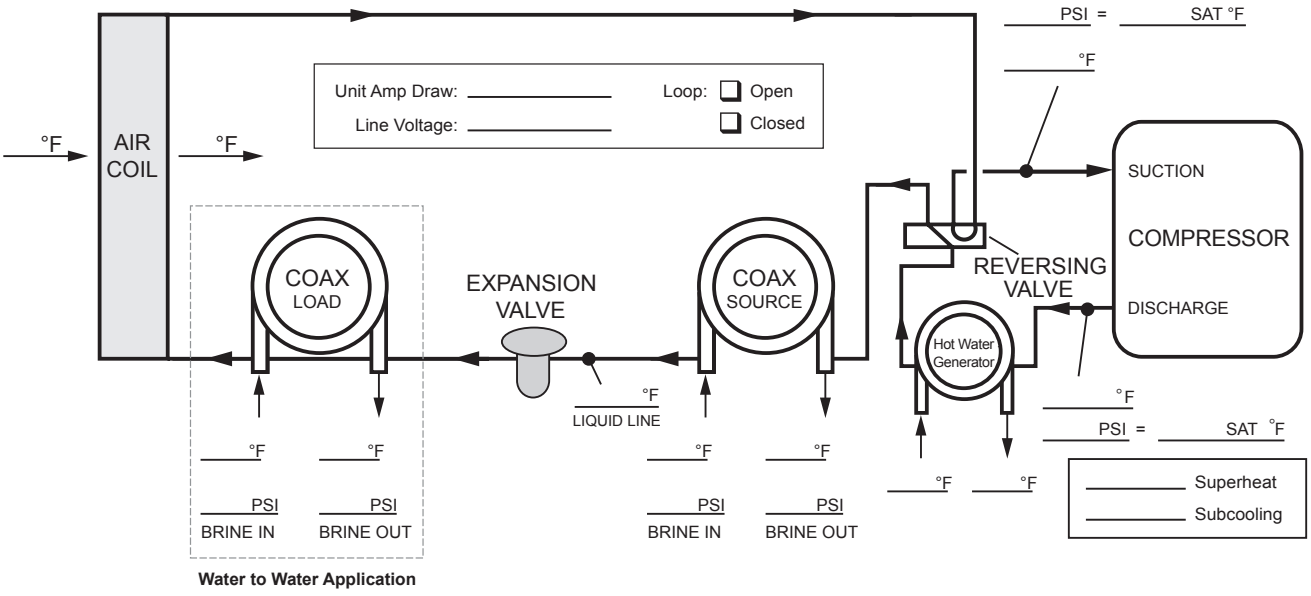
**Startup/Troubleshooting Form**

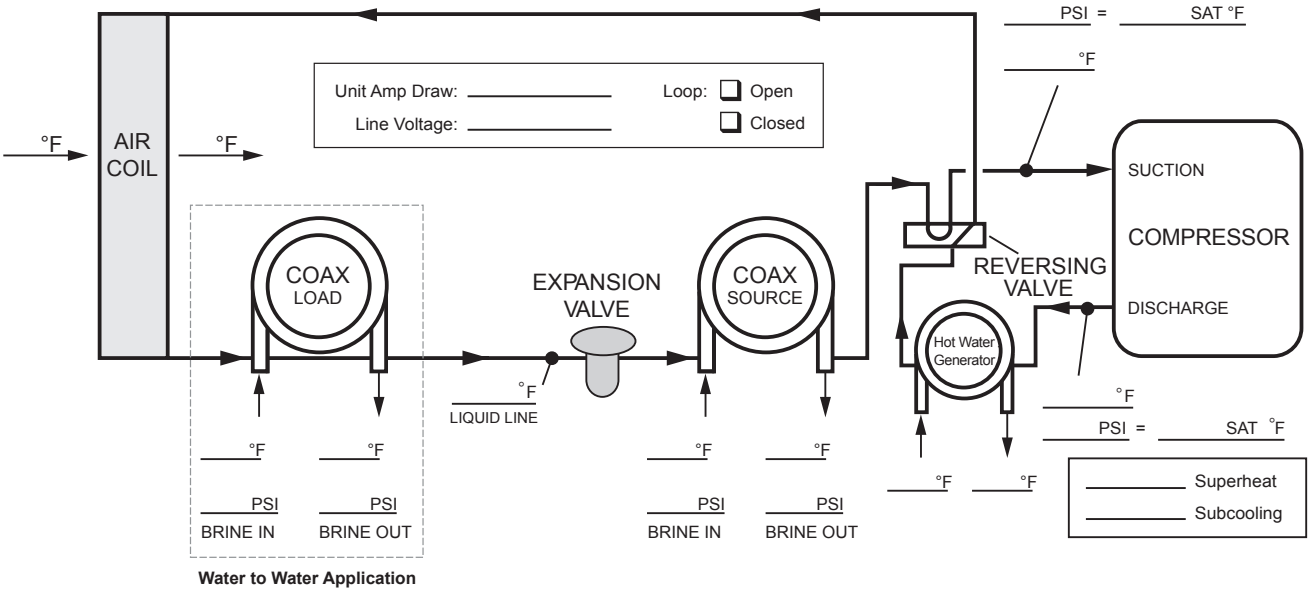
## COOLING CYCLE ANALYSIS




**Heat of Extraction/Rejection = GPM x 500 (485 for water/antifreeze) x ΔT**

**Note: DO NOT** hook up pressure gauges unless there appears to be a performance problem.

## HEATING CYCLE ANALYSIS



# Preventive Maintenance

## Water Coil Maintenance

1. Keep all air out of the water. An open loop system should be checked to ensure that the well head is not allowing air to infiltrate the water line. Lines should always be airtight.
2. Keep the system under pressure at all times. It is recommended in open loop systems that the water control valve be placed in the discharge line to prevent loss of pressure during off cycles. Closed loop systems must have positive static pressure.

**NOTE:** On open loop systems, if the installation is in an area with a known high mineral content (125 PPM or greater) in the water, it is best to establish with the owner a periodic maintenance schedule so the coil can be checked regularly. Should periodic coil cleaning be necessary, use standard coil cleaning procedures which are compatible with either the cupronickel or copper water lines. Generally, the more water flowing through the unit the less chance for scaling.

## Other Maintenance

### Filters

Filters must be clean to obtain maximum performance. They should be inspected monthly under normal operating conditions and be replaced when necessary. Units should never be operated without a filter.

### Condensate Drain

In areas where airborne bacteria produce a slime in the drain pan, it may be necessary to treat chemically to minimize the problem. The condensate drain can pick up lint and dirt, especially with dirty filters. Inspect twice a year to avoid the possibility of overflow.

### Blower Motors

Blower motors are equipped with sealed ball bearings and require no periodic oiling.

### Air Coil

The air coil must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum (with a brush attachment) clean. Care must be taken not to damage the aluminum fins while cleaning.

**CAUTION: Fin edges are sharp.**

# Replacement Procedures

## Obtaining Parts

When ordering service or replacement parts, refer to the model number and serial number of the unit as stamped on the serial plate attached to the unit. If replacement parts are required, mention the date of installation of the unit and the date of failure, along with an explanation of the malfunctions and a description of the replacement parts required.

## In-Warranty Material Return

Material may not be returned except by permission of authorized warranty personnel.  Contact your local distributor for warranty return authorization and assistance.

# Notes

# Revision Guide

| Pages: | Description: | Date: | By: |
|---|---|---|---|
| Misc. | Updated Waterside Economizer, nomenclature, hot gas reheat. | 29 Feb. 2020 | JM |
| 9, 21 | Add weights table, update electrical data | 21 Sept. 2018 | JM |
| All | Document Creation | 21 Nov., 2017 | JM |

Commercial Solutions

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| | |
|---|---|
| Product: | **Versatec Variable Speed Series** |
| Type: | Water Source/Geothermal Heat Pump |
| Size: | 10-15 Tons |
| Document: | Installation Manual |