5 Series

500RO11

Outdoor Split Geothermal Heat Pump

- R-410A Refrigerant
- 2, 3, 4, 5, 6 Ton Dual Capacity

5 Series 500RO11 Installation Manual

Installation Information

Water Piping Connections

Electrical Data

Startup Procedures

Troubleshooting

Preventive Maintenance



PROUD MEMBER

Intertek

Water Source HP
ANSI/AHRI/ASHRAE/ISO13256-1

ENERGY STAR PARTNER

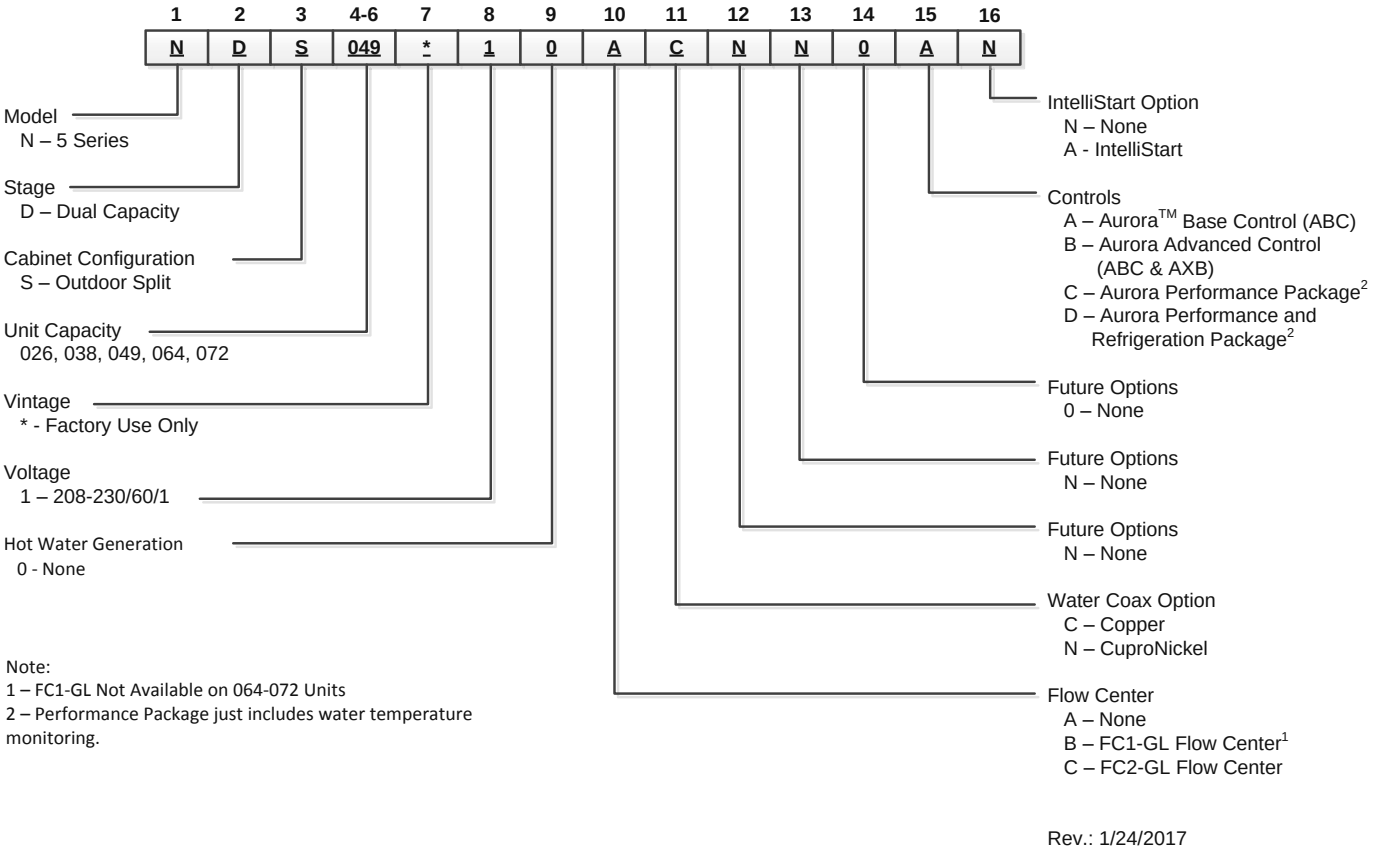
WaterFurnace
Smarter from the Ground Up™

IM2504SN 05/17

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Model Nomenclature



Note:
1 – FC1-GL Not Available on 064-072 Units
2 – Performance Package just includes water temperature monitoring.

Rev.: 1/24/2017

General Installation Information

Safety Considerations



WARNING: Before performing service or maintenance operations on a system, turn off main power switches to both units. Turn off accessory heater power switch if applicable. 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.

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, such as the following safety measures:

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

Moving and Storage

Move units in the normal “up” orientation. Units may be moved and stored per the information on the packaging. Do not stack more than three units in total height. Do not attempt to move units while stacked. 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.

Split Unit Location

Locate the split compressor section away from areas that may disturb the customer and in a way that allows easy removal of the access panels and the top of the cabinet. Provide sufficient room to make water, electrical and refrigerant line connections and allow space for service personnel to perform maintenance. The NDS split is approved for outdoor installation when properly installed.

Air Coil Location

Refer to the air handler manufacturer’s instructions for the blower coil unit for details on installing the air handling portion of the system.

Condensate Drain

Follow the blower coil manufacturer’s instructions.

Duct System

All blower coil units/air coils must be installed as specified by the manufacturer’s installation instructions; however, the following recommendations should be considered to minimize noise and service problems.

An air filter must always be installed upstream of the air coil on the return air side of the air handler or furnace. If there is limited access to the filter rack for normal maintenance, it is suggested that a return air filter grill be installed. Be sure that the return duct is properly installed and free of leaks to prevent dirt and debris from bypassing the filter and plugging the air coil.

In applications using galvanized metal ductwork, a flexible duct connector is recommended on both the supply and return air plenums to minimize vibration from the blower. To maximize sound attenuation of the unit blower, the supply and return plenums should include an internal duct liner of 1-inch thick glass fiber or be constructed of ductboard. Insulation is usually not installed in the supply branch ducts. Ducts in unconditioned areas should be wrapped 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 air handler is connected to existing ductwork, a previous check should have been made to assure that the duct system has the capacity to handle the air required for the unit application. If ducting is too small, as in replacement of heating only systems, larger ductwork should be installed. All existing ductwork should be checked for leaks and repairs made accordingly. The duct systems and diffusers should be sized to handle the design airflow quietly. If air noise or excessive airflow is a problem, the blower speed can be changed to a lower speed to reduce airflow. This will reduce the performance of the unit slightly in heating; however, it will increase the temperature rise across the air coil. Airflow must still meet minimum requirements.

Equipment Selection

The following guidelines should be used when mating a 5 Series Split to an air handler/coil.

- Select R-410A components only.
- Match the air handler to the air handler coil data table.
- Indoor matching adjustable TXV is factory installed on every SAH air handler/coil. Fixed orifice or cap tube systems should not be used.
- Minimum of two (2) blower speeds

Utilizing Existing Coil or Air Handler

It is recommended that a new R-410A air handler be installed with a 5 Series Split considering the long term

General Installation Information cont.

benefits of reliability, warranty, etc. versus the short term installation cost savings. However, the existing air handler may be retained provided the following:

- Coil currently is R-410A rated
- Coil uses a TXV. No capillary or fixed orifice systems should be used
- A life expectancy of more than 7 years remaining for the air handler and components
- Flush air coil and line set

When utilizing the existing air coil or line set, only flushing compounds that vaporize should be used; which means they are packaged in a pressurized disposable cylinder. It is preferable to use a flushing agent that removes oil, water, and acid, plus, is biodegradeable and non-toxic. The flushing agent should be safe to use with both HCFC and HFC refrigerants. Once a flushing agent has been selected, follow the instructions provided with the product.

The first step should be purging the lines or air coil with nitrogen. Purging with nitrogen first will remove some of the particulate and residual oil which will allow the flushing agent to work better. Never blow the flushing agent through a compressor, filter drier, or txv as it will cause the components to fail.

When flushing is complete and the final system is assembled, an acid check should be preformed on the system. Acid test kits are available from most HVACR distributors.

Connection to Air Coil

Typical Split System Application - Remote Blower Coil and Typical Split System Heat Pump Coil Add-on Fossil Fuel Furnace illustrations show typical 5 Series Split installations. The Line Set Sizes table shows typical line set diameters and maximum length. Line sets over 60 feet are not recommended. If the line set is kinked or deformed and cannot be reformed, the bad section of pipe should be replaced. A restricted line set will affect unit performance. As in all R-410A equipment, a reversible liquid line filter drier is required to ensure all moisture is removed from the system. This drier should be replaced whenever “breaking into” the system for service. All line sets should be insulated with a minimum of 1/2” closed cell insulation. All exterior insulation should be painted with UV resistant paint or covering to ensure long insulation life.

Air Handler Installation

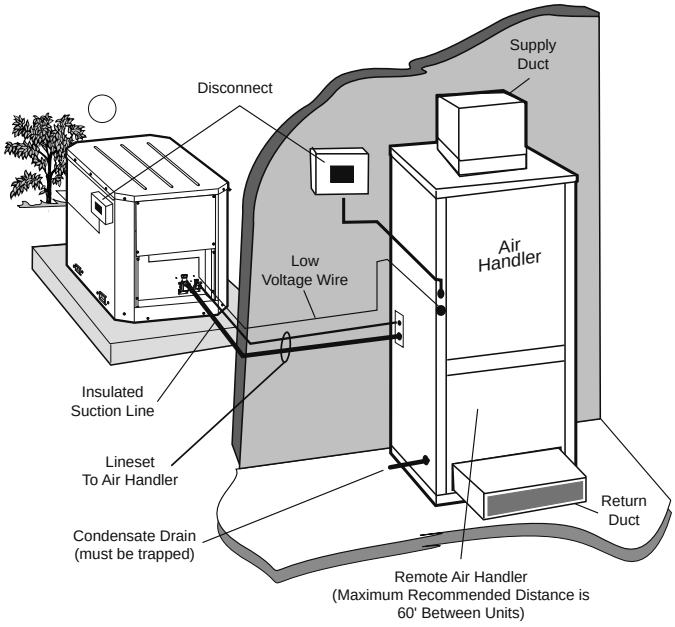
Air handlers used with dual capacity units must be capable of operating with a minimum of 2 blower speeds. Refer to the manufacturer’s instructions for the blower coil unit for details on installing the air handling portion of the system. All blower coil units/air coils must be installed as specified by the manufacturer’s installations instructions. However, the following recommendations should be considered to minimize noise and service problems.

An air filter must always be installed upstream of the air coil on the return air side of the air handler or furnace. If there is limited access to the filter rack for normal maintenance, it is suggested that a return air filter grille be installed. Be sure that the return duct is properly installed and free of leaks to prevent dirt and debris from bypassing the filter and plugging the air coil.

Ensure that the line set size is appropriate to the capacity of the unit (refer to Line Set Sizes table). Line sets should be routed as directly as possible, avoiding unnecessary bends or turns. All wall penetrations should be sealed properly. Line set should not come into direct contact with water pipes, floor joists, wall studs, duct work, floors, walls and brick. Line set should not be suspended from joists or studs with a rigid wire or strap which comes into direct contact with the tubing. Wide hanger strips which conform to the shape of the tubing are recommended. Isolate hanger straps from line set insulation by using metal sleeves bent to conform to the shape of insulation. Line set insulation should be pliable, and should completely surround the refrigerant line.

NOTE: Improper installation of equipment may result in undesirable noise levels in the living areas.

Typical Split System Application - Remote Blower Coil



General Installation Information cont.

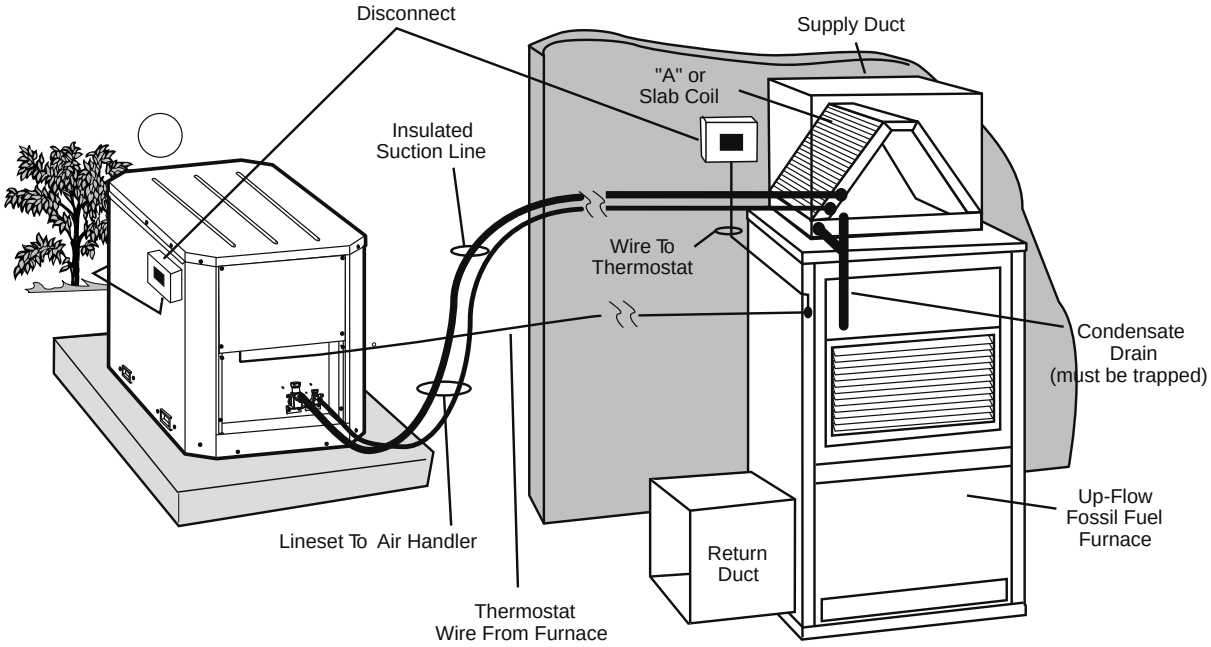
Dual Fuel Systems

5 Series units can be connected to fossil fuel furnaces that include an A-coil or slab coil. Dual fuel installations utilize the 5 Series heat pump for heating until the point that auxiliary heat is called for on the thermostat. At that point, the furnace will be enabled and the heat pump will be disabled. The 5 Series heat pump provides air conditioning through the furnace's refrigerant coils.

Refer to the furnace manufacturer's installation manual for the furnace installation, wiring and coil insertion. A WaterFurnace Dual Fuel thermostat or a field-installed DPST relay is required. See the Typical Split System Heat Pump Coil Add-on Fossil Fuel Furnace illustration for typical Dual Fuel application.

In add-on 5 Series Split applications, the coil should be located in the supply side of the furnace to avoid condensation damage to the furnace heat exchanger. A high temperature limit should be installed upstream of the coil to de-energize the compressor whenever the furnace is operating. Without this switch, the 5 Series Split will trip out on high pressure. A dual fuel thermostat can remove the Y1 and Y2 calls when a W call is energized to allow gas furnace backup on a 5 Series Split application. Refer to the Thermostat Wiring section for details.

Typical Split System Heat Pump Coil Add-on Fossil Fuel Furnace



Water Quality

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

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

Water Treatment

Do not use untreated or improperly treated water. Equipment damage may occur. The use of improperly treated or untreated water in this equipment may result in scaling, erosion, corrosion, algae or slime. Purchase of a pre-mix antifreeze could significantly improve system reliability if the water quality is controlled and there are additives in the mixture to inhibit corrosion. There are many examples of such fluids on the market today such as Environol™ 1000 (pre-mix ethanol), and others. The services of a qualified water treatment specialist should be engaged to determine what treatment, if any, is required. The product warranty specifically excludes liability for corrosion, erosion or deterioration of equipment.
The heat exchangers and water lines in the units are copper or cupronickel tube. There may be other materials in the buildings piping system that the designer may need to take into consideration when deciding the parameters of the water quality. If antifreeze or water treatment solution is to be used, the designer should confirm it does not have a detrimental effect on the materials in the system.

Contaminated Water

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

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

Water Piping

Residential NDS split units are supplied standard with GeoLink swivel connections with P.T. ports.

CAUTION: Water piping exposed to outside temperatures may be subject to freezing.

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.

Closed Loop - Earth coupled Systems (Outdoor Installations)

Locate unit on an air pad with access hole as shown below. When mounting on an existing concrete pad, holes must be bored through to accommodate 1-1/4-inch P.E. pipe with 1/2-inch insulation.

Connecting To Earth Loop

The earth loop trench should be continued directly under the unit as shown in the Typical Split System Outdoor Installation Using Closed Loop. Make the connections to optional fittings from the loop circulator pump(s) and ensure proper backfill to support the loop pipe during trench settling. All 1-1/4-inch piping should be insulated with a minimum of 1/2-inch closed cell insulation from below the ground surface to the loop circulator.

IMPORTANT: A freeze detection thermostat is installed in the unit to automatically start loop circulator pump if loop temperature drops below 20°F. Loop freeze detection should also be maintained to the lowest temperature the insulated loop may encounter in the case of power failure.

Open Loop (Indoor Installations)

NDS Splits can be installed on an open loop system, but only indoors. All NDS Splits are supplied with GeoLink swivel connectors. The swivel connectors will also accept a 1 in. O.D. copper pipe (sweat) which can be connected in an open loop system.

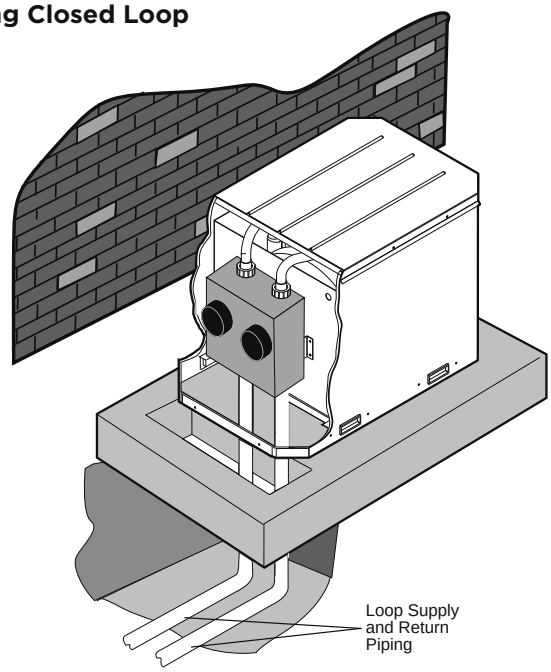
Water Piping cont.

Flow Center Installation

Flow centers FC1-GL or FC2-GL, as needed, may be internally mounted on the NDS splits, Two stub tubes with barbs are pre connected to the coax. Two tubes with brass fittings, to adapt to the flow center, 2 hoses to connect between the two sets of tubes, and four hose clamps are included with each NDS unit. The brass adapter fittings have plastic swivel connectors that also accept 1 in. O.D. copper pipe (sweat).

NOTE: For ease of installation, attach provided hoses to coax first and then trim to fit to elbows on flow center.

Typical Split System Outdoor Installation Using Closed Loop



Multiple Units on One Flow Center

NOTE: This feature is only available in the Aurora Advanced Control package (AXB board), NOT the Aurora Base Control (ABC).

When two units are connected to one loop pumping system, pump control is automatically achieved by connecting the SL terminals on connector P2 in both units with 2-wire thermostat wire. These terminals are polarity dependant (see Figure 5b). The loop pump(s) may be powered from either unit, whichever is more convenient. If either unit calls, the loop pump(s) will automatically start. The use of two units on one flow center is generally limited to a total of 20 gpm capacity.

It is recommended that water solenoid valves be installed on heat pumps that share a flow center. This is to allow water flow through only the heat pump that has a demand. Circulating fluid through a heat exchanger of a system that is not operating could be detrimental to the long term reliability of the compressor.

NOTE: To achieve this same feature when heat pumps have only the Aurora Base Control, follow Figure 5a. Installer will be required to supply fuses, two relays, and wiring.

Figure 5a: Primary/Secondary Wiring with Aurora Base Control (No AXB Board)

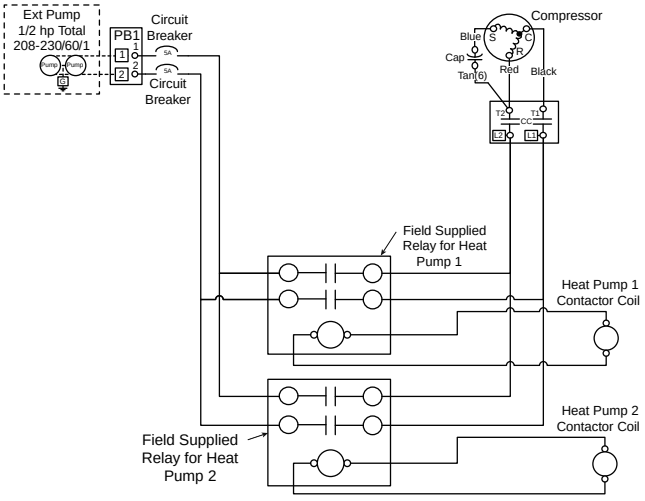
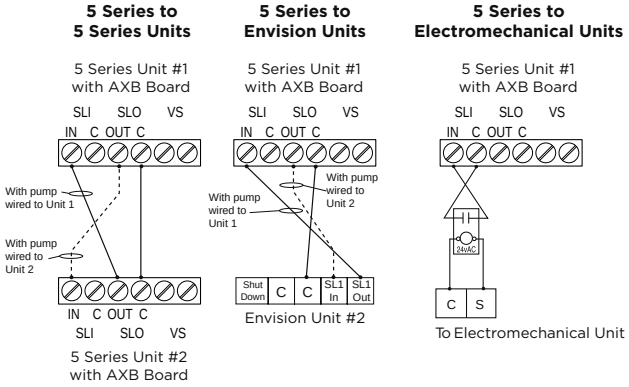


Figure 5b: Primary/Secondary Hook-up



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.

Unit Power Connection

Connect the incoming line voltage wires to L1 and L2 of the contactor as shown in Figure 13B for single-phase unit. Consult the Unit Electrical Data in this manual for correct fuse sizes.

Insert power wires through knockouts on lower left side of cabinet (Figure 13A). Route wires to the right side of the control box and connect to contactor and ground (Figure 13B).

Accessory Relay

A set of “dry” contacts has been provided to control accessory devices, such as water solenoid valves on open loop installations, electronic air cleaners, humidifiers, etc. This relay contact should be used only with 24 volt signals and not line voltage power. The relay has both normally open and normally closed contacts and can operate with either the fan or the compressor. Use DIP switch SW2-4 and 5 to cycle the relay with blower, compressor, or control a slow opening water valve. The relay contacts are available on terminals #2 and #3 of P2.

When powering high VA draw components such as electronic air cleaners or VM type open loop water valves, R should be taken ‘pre-fuse’ from the ‘R’ quick connect on the ABC board and not the ‘post-fuse’ ‘R’ terminal on the thermostat connection. If not, blown ABC fuses might result.

Figure 13A:
Wire access (control box open)

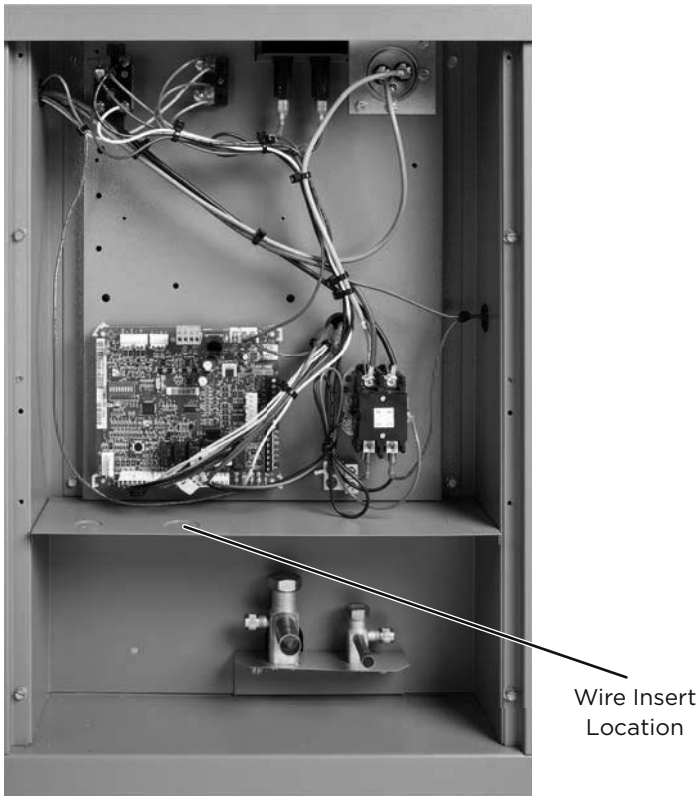
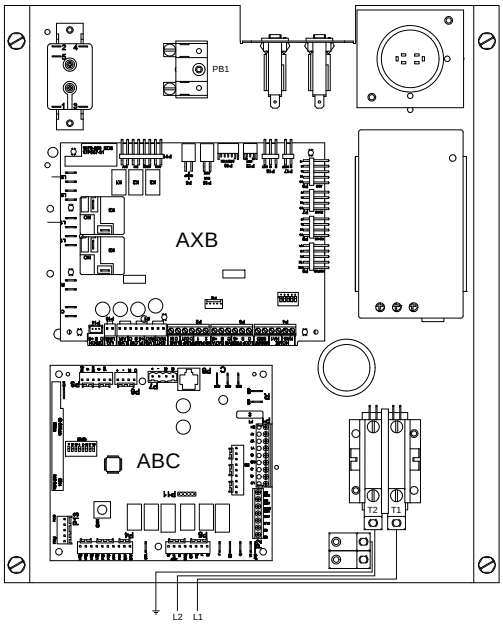


Figure 13B:
Line Voltage 208-230/60/1 control box



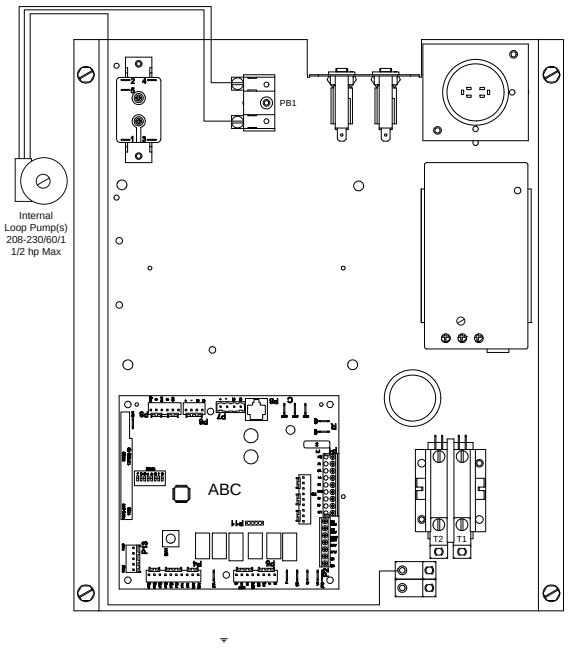
Electrical Connections cont.

Pump Power Wiring

See Figure 14 for electrical connections from control box to pumps.

FC1/FC2 style flow centers with fixed speed pumps connect to PB1 in the control box.

Figure 14: Pump Wiring 208-230/60/1



Electrical Data

Model	Rated Voltage	Voltage Min/Max	Compressor				Ext Loop FLA	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
			MCC	RLA	LRA	LRA*				
026	208-230/60/1	187/253	18.2	11.6	58.3	21.0	5.4	17.0	19.9	30
038	208-230/60/1	187/253	23.8	15.2	83.0	30.0	5.4	20.6	24.4	40
049	208-230/60/1	187/253	33.0	21.1	104.0	37.0	5.4	26.5	31.8	50
064	208-230/60/1	187/253	42.3	27.1	152.9	54.0	5.4	32.5	39.3	70
072	208-230/60/1	187/253	46.3	29.6	179.2	63.0	5.4	35.0	42.4	75

Rated voltage of 208-230/60/1.
HACR circuit breaker in USA only.
All fuses Class RK-5
* With optional IntelliStart

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Electronic Thermostat Installation

Position the thermostat subbase against the wall so that it is level and the thermostat wires protrude through the middle of the subbase. Mark the position of the subbase mounting holes and drill holes with a 3/16-inch bit. Install supplied anchors and secure base to the wall. Thermostat wire must be 8-conductor (4 or 5 conductor for communicating thermostats), 20-AWG (minimum) wire. Strip the wires back 1/4-inch (longer strip lengths may cause shorts) and insert the thermostat wires into the connector as shown. Tighten the screws to ensure secure connections. The thermostat has the same type connectors, requiring the same wiring. See instructions enclosed in the thermostat for detailed installation and operation information.

NOTE: Aurora Base Control (ABC) DIP switch SW2-7 is required to be in the "OFF" position for the control to operate with FaultFlash or ComforTalk thermostats. SW2-7 in the "ON" position configures the control to operate with typical thermostats (continuous lockout signal). There must be a wire connecting Y2 on the Aurora controller to 2nd stage compressor on the thermostat for proper operation.

Standard Non-Communicating Control Option A
Field low voltage point to point wiring:

From Thermostat	To Air Handler	To Compressor Section
C	C	C
R	R	R
G	G	
O	O	O
Y1	Y1	Y1
Y2	Y2	Y2
W2	W	
L	L	L

Air Handler transformer must be 75VA.

5/3/2017

Communicating Thermostat Control Option A
Field low voltage point to point wiring:

From Communicating Thermostat	To ABC P7 in Compressor Section
C	C
R	R
-	-
+	+

Air Handler transformer must be 75VA.

From ABC Outputs	To Air Handler
C	C
R	R
G	G
CC	Y1
CC2	Y2
EH1	W
	O
	L

5/3/2017

Non-Communicating Thermostat Control Option C
Field low voltage point to point wiring:

From Thermostat	To ABC in Compressor Section
C	C
R	R
G	G
O	O
Y1	Y1
Y2	Y2
W2	W
L	L

From ABC P7 in Compressor Section	To PB2 in Air Handler
C	C
R	R
-	-
+	+

Air Handler transformer must be 100VA.

3/7/2017

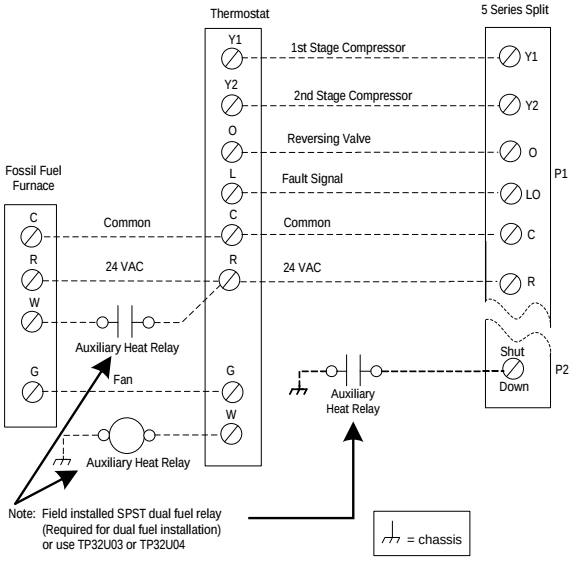
Communicating Thermostat Control Option C
Field low voltage point to point wiring:

From Communicating Thermostat	To Air Handler PB3	To Compressor Section ABC Board
C	C	C
R	R	R
-	-	-
+	+	+

Air Handler transformer must be 100VA.

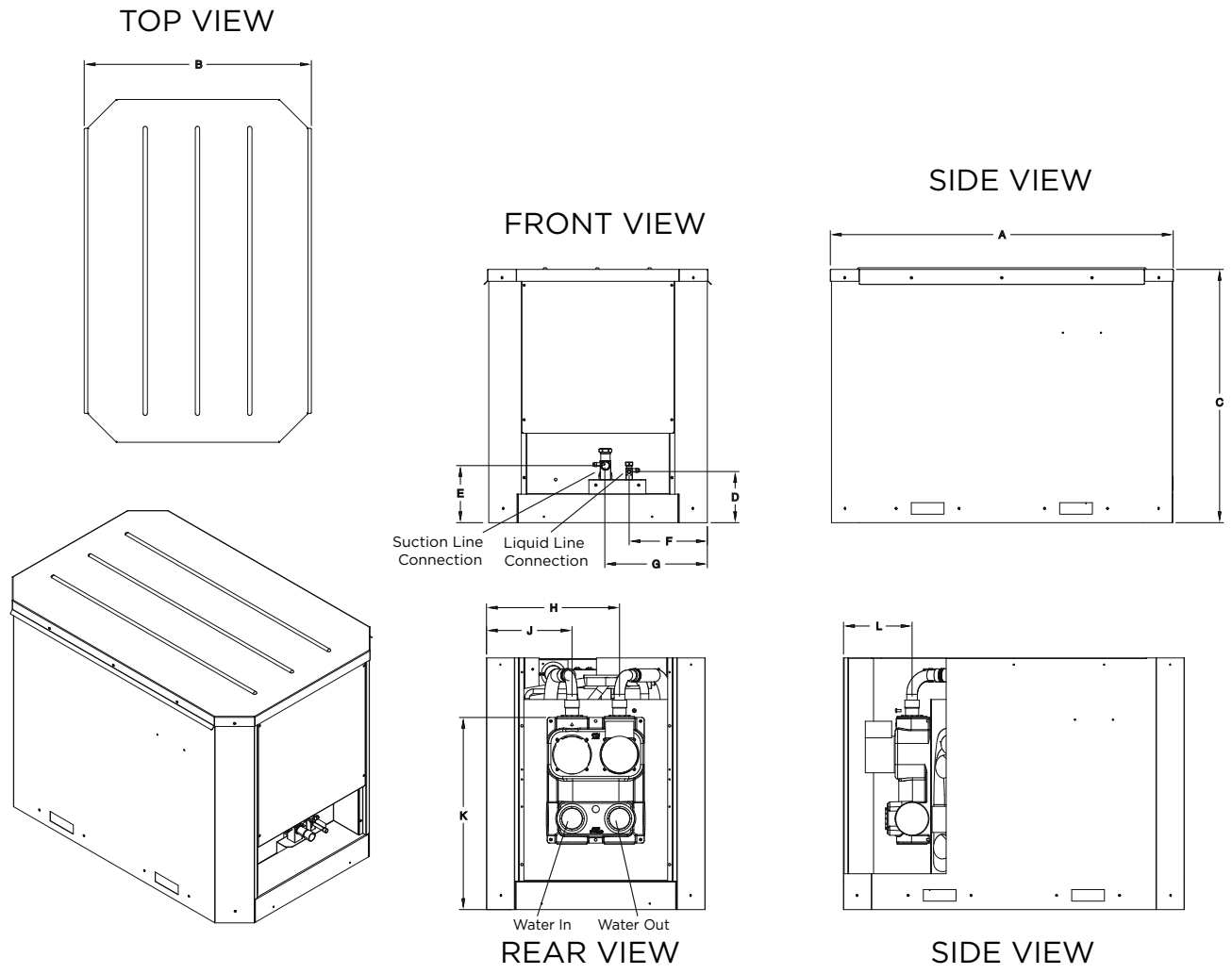
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Thermostat Wiring for Dual Fuel Applications



Dimensional Data

Cabinet Dimensions and Refrigerant Piping Connections



Model		A	B	C	D	E	F	G	H	J	K	L
026 thru 072	in	36.0	23.9	26.7	5.4	6.0	8.2	10.8	14.0	9.0	20.2	7.2
	[cm]	[91.4]	[60.7]	[67.8]	[13.7]	[15.2]	[20.8]	[27.4]	[35.6]	[22.9]	[51.3]	[18.3]

Physical Data

Model	026	038	049	064	072
Compressor (1 each)	Dual Capacity Scroll				
Factory Charge R-410A, oz [kg]	52 [1.47]	56 [1.59]	90 [2.55]	92 [2.61]	104 [2.95]
Coax and Water Piping					
Water Connections Size - Swivel- in [mm]	GeoLink Swivel Connectors				
Brass Service Valve - Liquid Line - in [mm]	3/8 [9.525]				
Brass Service Valve - Suction Line - in [mm]	5/8 [15.875]	3/4 [19.05]		7/8 [22.225]	
Coax and Piping Water Volume - gal [l]	0.7 [2.6]	1.3 [4.9]	1.6 [6.1]	1.6 [6.1]	1.6 [6.1]
Weight - Operating, lb [kg]	189 [86]	236 [107]	250 [113]	271 [123]	290 [132]
Weight - Packaged, lb [kg]	209 [95]	256 [116]	270 [122]	291 [132]	310 [141]

All units have TXV expansion devices, and 1/2 in. [12.2 mm] and 3/4 in. [19.1 mm] electrical knockouts.
Brass service valves are sweat type valves.

5/24/13

Model Nomenclature - Air Handler



1-3	4-6	7	8-9	10	11	12	13	14	15	16
SAH	036	*	00	1	A	R	1	S	1	*

Model
SAH – Series Air Handler

Unit Capacity
Refrigeration (DX)
022 MBTUH
026 MBTUH
030 MBTUH
036 MBTUH
042 MBTUH
048 MBTUH
060 MBTUH
066 MBTUH

Vintage
* = Factory Use Only

Electric Heat
00 – None
05 – 5kW (022 – 036 only) No Breakers
10 – 10kW (036 – 066 only) No Breakers
15 – 15kW (042 – 066 only) with Breakers
20 – 20kW (060 - 066 only) with Breakers

Build
*Factory Use Only

Position
1 – Multi-position

Future Options
S – Standard

Voltage
1-208-230/60/1

Air Coil
R – Refrigerant

Controls/ Motor
A – Standard/ 5 Speed ECM
C – Aurora AHB/ Variable Speed ECM[1]

TXV
1 – Factory Installed

Note: To field convert the SAH to bottomflow air discharge. The SAHBCK kit must be ordered separately.
Note: Air flow on the 060 and 066 units in the horizontal configurations should be limited to 1900 cfm in cooling mode, or condensate blow off may occur.

1. Only available with Aurora controls in the compressor section.

Rev.: 2/27/2017

Physical Data - Air Handler

Air Handler Model Number (Refrigerant)		022	026	030	036	042	048	060	066
Evaporator Coil	Air Coil Total Face Area, ft2 [m2]	3.89 [0.36]			4.86 [0.45]	5.83 [0.54]		6.81 [0.63]	
	Tube outside diameter - in. [mm]	3/8 [9.52]							
	Number of rows	3							
	Fins per inch	12							
	Suction line connection - in. [mm] sweat	5/8 [15.87]			3/4 [19.05]			7/8 [22.23]	
	Liquid line connection - in. [mm] sweat	3/8 [9.52]						1/2 [12.7]	
Refrigerant		R-410a							
Nominal cooling capacity - tons [kW]		1.8 [6.44]	2.1 [7.59]	2.5 [8.79]	3 [10.55]	3.5 [12.30]	4 [14.06]	5 [17.58]	5.5 [19.33]
Condensate drain connection - (FPT) in. [mm]		3/4 [19.05]							
Blower Wheel Size (Dia x W), in. [mm]		9 X 7 [229 x 178]]			10 X 8 [254 x 203]	11 x 10 [279 x 254]			
Blower motor type/speeds		Variable Speed ECM/ 5 Speed ECM							
Blower motor output - hp [W]		1/2 [373]				1 [746]			
Filter Standard - 1" [51mm] Field Supplied.		16 X 20 [406 X 508]			20 X 20 [508 x 508]	22 X 20 [559 x 508]			
Electrical characteristics (60hz)		208/230 - 1ph							
Shipping weight - lbs. [kg]		147 [66.7]			168 [76.2]	198 [89.6]		206 [93.4]	
Operating weight - lbs. [kg]		139 [63.0]			150 [68.0]	180 [81.6]		188 [85.3]	

1/31/2017

Compatibility Table - Air Handler

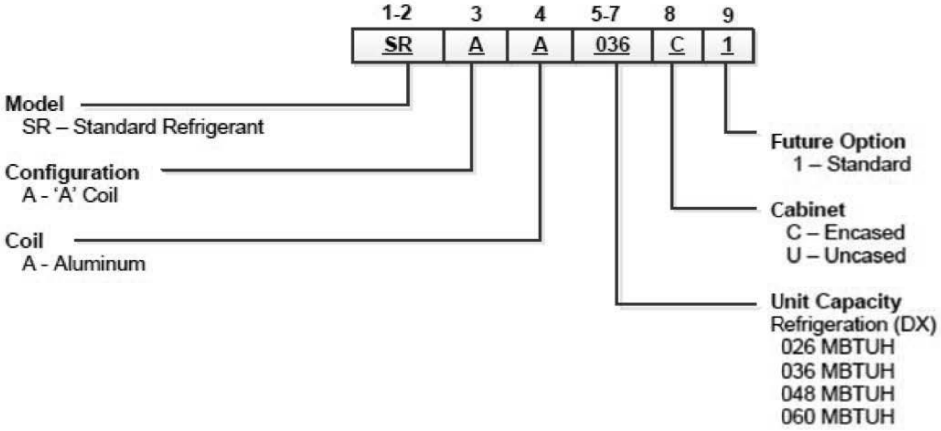
Air Handler Sizing Selection

The Air Handlers are designed for R-410A refrigerant and should be matched with split compressor section according to the table below.

Air Handler	Outdoor Split Model (Dual Capacity)	Rated Airflow(CFM)	Electric Heat (kW)
SAH026***1*R1S1*	026	850	5
SAH036***1*R1S1*	038	1200	5, 10
SAH048***1*R1S1*	049	1500	10, 15
SAH060***1*R1S1*	064	1800	10, 15, 20
SAH066***1*R1S1*	072	2000	10, 15, 20

3/16/2017

Model Nomenclature - Coil





Refrigerant Coil Compatibility

Encased/Uncased Coil	Outdoor Split Model (Dual Capacity)	Recommended Airflow (CFM)
SR**026C*	026	800
SR**036C*	038	1200
SR**048C*	049	1500
SR**060C*	064	1800
SR**060C*	072	2000

3/16/2017

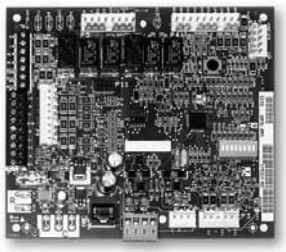
SR Coil Physical Characteristics

Air Handler Model Number (Refrigerant)		026			036	048		060	
Evaporator Coil	Air Coil Total Face Area, ft2 [m2]	3.89 [0.36]			4.86 [0.45]	5.83 [0.54]		6.81 [0.63]	
	Tube outside diameter - in. [mm]	3/8 [9.52]							
	Number of rows	3							
	Fins per inch	12							
	Suction line connection - in. [mm] sweat	5/8 [15.87]			3/4 [19.05]			7/8 [22.23]	
	Liquid line connection - in. [mm] sweat	3/8 [9.52]						1/2 [12.7]	
Refrigerant		R-410a							
Nominal cooling capacity - tons [kW]		1.8 [6.44]	2.1 [7.59]	2.5 [8.79]	3 [10.55]	3.5 [12.30]	4 [14.06]	5 [17.58]	5.5 [19.33]
Condensate drain connection - (FPT) in. [mm]		3/4 [19.05]							
Filter Standard - 1" [51mm] Field Supplied.		16 X 20 [406 X 508]			20 X 20 [508 x 508]	22 X 20 [559 x 508]			

3/7/17

The Aurora™ Control System

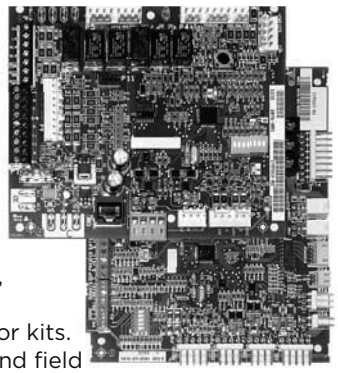
Aurora 'Base' Control



The Aurora 'Base' Control (ABC) System is a complete residential and commercial comfort system that brings all aspects of the HVAC system into one cohesive module network. The ABC features microprocessor control and HP, LP, condensate (with AHB in air handler) and freeze detection, over/under voltage faults, along with communicating thermostat capability for complete fault detection text at the thermostat.

Aurora uses the Modbus communication protocol to communicate between modules. Each module contains the logic to control all features that are connected to the module. The Aurora 'Base' Control (ABC) has two Modbus channels. The first channel is configured as a master for connecting to devices such as a communicating thermostat, expansion board, or other slave devices. The second channel is configured as a slave for connecting the Aurora Interface Diagnostics Tool (AID Tool).

Aurora 'Advanced' Control



The Aurora 'Advanced' Control expands on the capability of the Aurora 'Base' Control (ABC) System by adding the Aurora Expansion Board (AXB). The additional features include compressor current monitoring, loop pump linking, and also allows for optional energy, refrigeration, and performance monitoring factory installed add-on sensor kits. The AXB also features a second field configurable accessory relay, and two home automation inputs that are AID configurable for different types of alarms from sump pumps to home security. The Smart Grid input is AID configurable with many options to react to Utility controlled relay operation for ON Peak optimization. For IntelliZone2 compatibility the SAH Air Handler must have control option C (AHB Board) or the compressor section must have an AXB board. IntelliZone2 may be connected to P7 on either the AXB or AHB boards.

NOTE: The software on the ABC and AXB control boards is unique to the operation of the Geo-split. Refer to the Aurora Toolbox for the current software versions.

Aurora Control Features	Description	Aurora 'Base'	Aurora 'Advanced'
Microprocessor Compressor Control	Microprocessor control of compressor for timings with FP1, HP, LP, Condensate, assignable Acc relay	•	•
Advanced Microprocessor Features	Smart Grid, Home Automation Alarm Inputs, and Accessory2 Relay (HRV/ERV)	-	•
Base Loop Pump Control	Compressor Contactor powers Loop Pump with inline circuit breaker and no loop pump linking capability.	•	See below
Advanced Speed Pump Control	Microprocessor and separate power relay for loop pump and inline circuit breakers and loop pump linking.	-	•
Compressor Monitoring	Control monitors compressor starts for high current, missing leg etc.	-	•
Smart Grid/Utility Input	Allows simple input to externally enable of occupied/ unoccupied mode for basic utility time of use programs.	-	Dry Contact x1
Home Automation Alarm Input	Allows simple input to signal sump, security, or smoke/CO sensor alarms from other home automation or security systems. The two inputs can be field configured to a number of options and logic.	-	Dry Contactx2
HAN/Smart Grid Com (AWL and Portal) Kit	Allows direct communication of the Aurora to Smart Meters, Home Automation Network and Internet.	-	Optional AWL
IntelliZone2® Compatibility	IntelliZone2 communicates Modbus to the heat pump via the AXB or AHB boards.	With Optional AXB Kit and IntelliZone2	Optional IntelliZone2
IntelliZone2 • 24V Compatibility	Communicates to the heat pump via 24VAC (AXB and AHB not required)	•	-

The Aurora Control System cont.

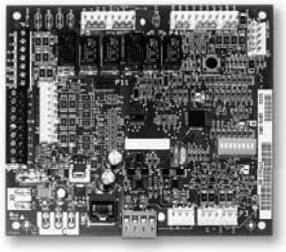
Service Device	Description	Aurora 'Base'	Aurora 'Advanced'
 **Aurora Interface and Diagnostics (AID) Tool**	Allows setup, monitoring and troubleshooting of any Aurora Control. **NOTE:** Although the ABC has basic compatibility with all Aurora, new product features may not be available on older AID Tools. To simplify the basic compatibility ensure the version of AID is at least the same or greater than the ABC software version.	For Service (Ver. 1.xx or greater)	For Service (Ver. 2.xx or greater)

Add On Control Feature Kits (field or factory installed)	Description	Aurora 'Base'	Aurora 'Advanced'
Geo Energy Monitoring Kit	Monitors realtime power consumption of compressor, blower, aux heat and pump. Requires thermostat TPCM32UO3A, TPCM32UO4A, or TPCC32UO1. AXB required. AHB required in air handler for blower and auxiliary heat power consumption monitoring.	-	Standard
Refrigeration Monitoring Kit	Monitors realtime pressures, temperatures, superheat, and subcooling. AXB required. AHB required in air handler for LAT (leaving air temperature).	-	Optional Sensor Kit
Performance Monitoring Kit	Monitors air and water temperatures. AXB required.	-	Optional Sensor Kit
Data Logging (AWL) Kit	Allows data logging of up to 12 months. AXB required. Can also be temporarily installed.	-	Optional
HAN/Smart Grid Com (AWL and Portal) Kit	Allows direct communication of the Aurora to Smart Meters, HAN, and internet. AXB required.	-	Optional
AXB Kit for loop pump linking, variable speed pump, IntelliZone2	Added to 5 Series for key features of advanced loop control/linking, IntelliZone2 communication, and variable speed pump control.	Optional (Field Kit)	Standard

Add On Thermostats and Zoning	Description	Aurora 'Base'	Aurora Advanced
 **TP32U03/04 - MonoChrome Traditional Y1, Y2 Thermostat**	Elite Stat with full English fault codes and alerts, traditional Y1, Y2 thermostat. Not compatible with AWL.	Optional	Optional
 **TP32S01/02 - Traditional Y1, Y2 Thermostat**	Traditional Y1, Y2 thermostat. Not compatible with AWL.	Optional	Optional
 **TPCM32U03A/04A - MonoChrome Communicating Thermostat**	Elite Stat with full English fault codes and alerts, communicating thermostat. Monochrome thermostat allows instantaneous energy measurement only. Compatible with AWL.	Optional	Optional
 **TPCC32U01 - Color Touchscreen Communicating Thermostat**	4.3 in. color touchscreen communicating thermostat with full English fault codes and alerts. Color thermostat allows instantaneous energy measurement and 13 month energy usage history. Compatible with AWL.	Optional	Optional
IntelliZone2 • 24V Zoning Compatibility	IntelliZone2 • 24V is a non-communicating zoning system requiring Y1, Y2 signals that controls up to 4 zones (dual capacity) and 2 zones (single speed.) For systems without the optional AXB and AHB boards.	Optional (5-Speed ECM)	Optional (IntelliZone2 Preferred)
 **IntelliZone2® Zoning**	IntelliZone2® is a communicating zoning system that includes color main thermostat and up to 6 zones (with variable speed, 4 zones (with dual capacity), and 2 zones (with single speed). There are 4 thermostat options (MasterStat, TPCC32U01, SensorStat, ZoneStat). Compatible with AWL. System must have either AXB or AHB board.	-	Optional (IntelliZone2 Preferred)

The Aurora 'Base' Control System cont.

Aurora 'Base' 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.

Control Features

Software ABC Geo-Split Version 3.0

Single or Dual Capacity Compressors

Either single or dual capacity compressors can be operated.

Other Control Features

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

Field Selectable Options via Hardware

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

Test Mode

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

Reset Configuration Mode

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

DIP Switch (SW2)

SW2-1 FP1 Selection – Low water coil temperature limit setting for freeze detection. On = 30°F; Off = 15°F.
SW2-2 FP2 Selection – On = 30°F; Off = N/A
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

The Aurora 'Base' Control System cont.

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

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

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

SW2-6 CC Operation – selection of single or dual capacity compressor. On = Single Stage; Off = Dual Capacity
SW2-7 Lockout and Alarm Outputs (P2) – selection of a continuous or pulsed output for both the LO and ALM Outputs. On = Continuous; Off = Pulsed
SW2-8 *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.

Safety Features

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

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

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

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

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

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

Lockout With Emergency Heat - if the control is locked out in the heating mode, and a Y2 or W input is received, the control will operate in the emergency heat mode while the compressor is locked out. The first emergency heat output will be energized 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 ECM blower will shift to "G" speed and PSC blower motor output will remain on.

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

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

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

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.

The Aurora 'Base' Control System cont.

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

Operation Description

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

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

Heating Operation

Heating, 1st Stage (Y1) (Dual Capacity Compressor and Variable Speed ECM) - The blower is started on "G" speed immediately and the compressor is energized 10 seconds after the Y1 input is received. The ECM blower motor is switched to low speed 15 seconds after the Y1 input.

Heating, 1st Stage (Y1) (Dual Capacity Compressor and 5 Speed ECM) - The blower is started on "Y1" speed immediately and the compressor is energized 10 seconds after the Y1 input is received.

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

Heating, 2nd Stage (Y1, Y2) (Dual Capacity Compressor and 5 Speed ECM) - The compressor will be staged to full capacity 20 seconds after Y2 input is received. The 5 speed ECM blower will shift to Y2 speed immediately.

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

Heating, 3rd Stage (Y1, Y2, W) (Dual Capacity Compressor and 5 Speed ECM) - The first stage of electric heat is energized 10 seconds after the W command is received. Blower will increase to "W' speed immediately. If the demand continues the second stage of electric heat will be energized after 5 minutes.

Emergency Heat (W) - The blower will be started on "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

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

Cooling, 1st Stage (Y1, O) (Dual Capacity Compressor and Variable Speed ECM) - The blower is started on "G" speed immediately and the compressor is energized 10 seconds after the Y1 input is received. The ECM blower motor is switched to low speed 15 seconds after the Y1 input.

Cooling, 1st Stage (Y1, O) (Dual Capacity Compressor and 5 Speed ECM) - The blower is started on "Y1" speed immediately and the compressor is energized 10 seconds after the Y1 input is received.

Cooling, 2nd Stage (Y1, Y2, O) (Dual Capacity Compressor and Variable Speed ECM) - The compressor will be staged to full capacity 20 seconds after Y2 input is received. The ECM blower will shift to high speed 15 seconds after the Y2 input is received.

Cooling, 2nd Stage (Y1, Y2, O) (Dual Capacity Compressor and 5 Speed ECM) - The compressor will be staged to full capacity 20 seconds after Y2 input is received. The 5 speed ECM blower will shift to Y2 speed immediately.

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.

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.

The Aurora 'Base' Control System cont.

Aurora 'Base' 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.

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
(Future Use)	Flash Code 3
(Future Use)	Flash Code 4
Load Shed	Flash Code 5
ESD	Flash Code 6
(Future Use)	Flash Code 7

Configuration LED (LED2, Yellow)

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

Fault LED (LED1, Red)

	Red Fault LED	LED Flash Code*	Lockout	Reset/ Remove
ABC Basic Faults	Normal - No Faults	OFF	–	
	Fault - Input	1	No	Auto
	Fault - High Pressure	2	Yes	Hard or Soft
	Fault - Low Pressure	3	Yes	Hard or Soft
	Fault - Freeze Detection FP2	4	Yes	Hard or Soft
	Fault - Freeze Detection FP1	5	Yes	Hard or Soft
	Fault - Condensate Overflow	7	Yes	Hard or Soft
	Fault - Over/Under Voltage	8	No	Auto
	Fault - FP1 Sensor Error	11	Yes	Hard or Soft
	Fault - CritComErr	19	NO	Auto

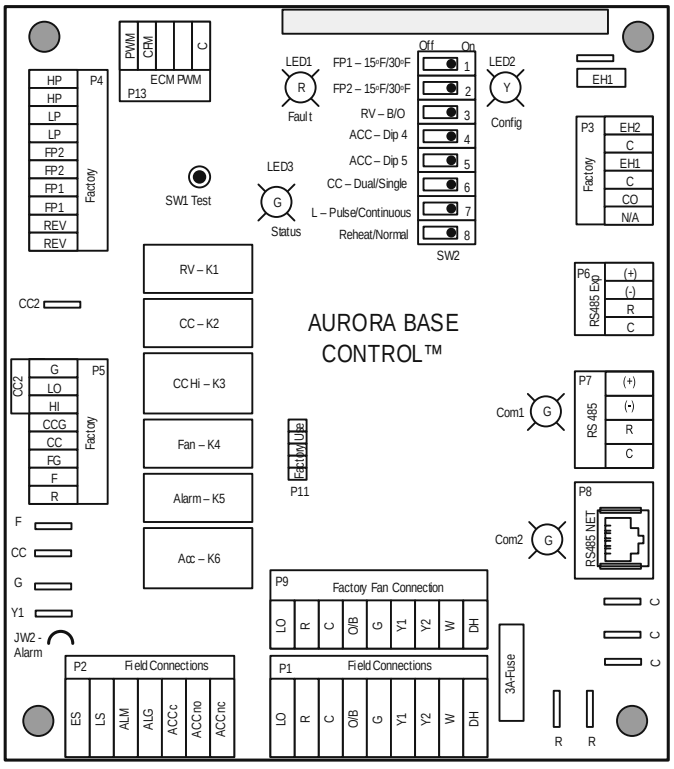
NOTE: All codes >11 use long flash for tens digit and short flash for the ones digit. 20, 30, 40, 50, etc. are skipped.

Aurora 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 ECM airflow settings. The AID Tool simply plugs into the exterior of the cabinet in the AID Tool port.

ABC Control Board Layout



The Aurora 'Advanced' Control System

Aurora 'Advanced' Control Features



The Aurora 'Advanced' Control system expands on the capability of the Aurora 'Base' Control (ABC) by adding the Aurora Expansion Board (AXB). All of the preceding features of the Aurora 'Base' Control are included. The following control description is of the additional features and capability of the Aurora advanced control.



It is highly recommended the installing/servicing contractor obtain an Aurora Interface and Diagnostic Tool (AID) and specialized training before attempting to install or service an Aurora 'Advanced' control system.

The additional AXB features include the following:

AXB DIP Switch

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

Compressor Monitoring

The AXB includes two current transducers to monitor the compressor current and starting characteristics. Open circuits or welded contactor faults will be detected. A fault will produce an E10 code.

IntelliZone2 Zoning Compatibility (Optional IntelliZone2 Communicating Zoning)

A dedicated input to connect and communicate with the IntelliZone2 (IZ2) zoning system is necessary. With the split systems using the Aurora controls this can be accomplished by connecting the IZ2 to P7 on the compressor section AXB or P7 on the Air Handler AHB. These ports are dedicated for communicating proprietary ModBus protocol and only one of these boards is necessary for compatibility with the IZ2.
NOTE: IntelliZone2 relay panel must be installed indoors.

AWL – Aurora Weblink (optional accessory)

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

- Remote access to thermostat settings, schedules, etc. with your smartphone, tablet or laptop
- Receive Lockout/Fault info via text or e-mail
- View heat pump energy usage from the Internet for the day, week, month, year or real-time
- Internet AID Tool capability allows remote troubleshooting for the technician
- Remote AID Tool capability at the heat pump with smartphone, tablet or laptop for the technician
- Allows data acquisition of the heat pump through the Internet, see graphs of performance and chart historical data for the technician
- Stores historical data on SD card

NOTE: The AWL should be installed indoors and the Ethernet cable supplied with the AWL should be run inside conduit to the outdoor unit and connected to the ABC P8 (RS485 NET). Cable should not be in conduit that includes high voltage wires. If the cable supplied with the AWL is not long enough you may purchase standard Cat6 Ethernet cable locally or order our part number 11P951-01, 100′ Cat6 cable. The maximum Cat6 cable length should be kept to 150′ or less.

The Aurora 'Advanced' Control System cont.

Modulating Water Valve

This output is provided to drive a modulating water valve (only compatible with our 4MWVK or WWKVS) 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. 75% 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 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.

Advanced Communication Ports

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

Smart Grid-On Peak (SG) Input

The 'On Peak' input was designed to allow utilities to utilize simple radio controlled switches to control the On Electric Peak behavior of the Water-to-Air, and Variable Speed Geothermal Heat Pumps. With a closed contact signal, this input will limit the operation and thus the power consumption of the unit by one of the below selections. The AID Tool will allow configuration of this input for the action of:

- No Action
- Disable compressor operation until removed
- Go to On Peak thermostat settings until removed [Requires Com T-Stat] (Future Release)
- Compressor limited to 50% or low cap until removed [dual capacity or variable speed only] (Future Release)
- Disable compressor operation for 1/2 hr (can be removed immediately) (Future Release)

Then Flash Code 7 on the Green LED for the 'On Peak' mode. And On Peak will display on communicating thermostats.

Home Automation 1 and 2 Inputs

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

Home Automation 1 - E23 HA1

With a closed dry contact signal, this input will cause an alarm and Alert Code 23 to indicate on the stat or flash on ABC. The AID Tool will allow configuration of this input between the following selections:

- No Action
- Home Automation Fault [no lockout info only]
  - Output from home automation system
- Security Alarm [no lockout info only]
  - Output from home security
- Sump Alarm Fault [no lockout info only]
  - Switch output from sump sensor
- Smoke/CO Alarm Fault [no lockout info only]
  - Switch output from Smoke/CO sensor
- Dirty Filter Alarm [no lockout info only]
  - Output from dirty filter sensor

Home Automation 2 – E24 HA2

With a closed dry contact signal, this input will cause an alarm and Alert Code 24 to indicate on the stat or flash on ABC. The AID Tool will allow configuration of this input between the following selections:

- No Action
- Home Automation Fault [no lockout info only]
  - Output from home automation system
- Security Alarm [no lockout info only]
  - Output from home security
- Sump Alarm Fault [no lockout info only]
  - Switch output from sump sensor
- Smoke/CO Alarm Fault [no lockout info only]
  - Switch output from Smoke/CO sensor
- Dirty Filter Alarm [no lockout info only]
  - Output from dirty filter sensor

Monitoring Sensor Kits

Energy Monitoring (Standard Sensor Kit on 'Advanced' models)

The Energy Monitoring Kit uses the existing two compressor sensors so that the power usage of the heat pump can be measured. Control option 'C' in the SAH Series Air handier has the necessary sensors for measuring power consumption of the blower motor and auxiliary heat. So for viewing total power usage the compressor section will need control options B, C, or D and the SAH Series Air Handler will need to be ordered with control option C. The AID Tool provides configuration detail for the power adjustment and a line voltage calibration procedure to improve the accuracy, and a power adjustment setting that allows the compressor power to be adjusted to match the unit's line voltage using the provided tables. This information can be displayed on the AID Tool or selected communicating thermostats. The TPCM32U03A/04A(*) will display instantaneous energy use while the color touchscreen TPCC32U01(*) will in addition display a 13 month history in graph form. Refer to Unit Start Up Energy Monitoring for configuration details.

The Aurora 'Advanced' Control System cont.

Dual Capacity Power Adjustment

Model	Unit Capacity	Voltage		
		208	230	250
026	Full Load	0.99	0.99	0.96
	Part Load	0.99	0.99	0.93
038	Full Load	0.99	0.97	0.91
	Part Load	0.99	0.94	0.83
049	Full Load	0.94	0.91	0.85
	Part Load	0.91	0.84	0.75
064	Full Load	0.95	0.9	0.79
	Part Load	0.92	0.83	0.71
072	Full Load	0.94	0.86	0.73
	Part Load	0.92	0.81	0.65

Refrigerant Monitoring (optional sensor kit)

The optional Refrigerant Monitoring Kit includes two pressure transducers, and two temperature sensors, heating liquid line, suction temperature and existing cooling liquid line (FP1). These sensors allow the measurement of discharge and suction pressures, suction and liquid line temperatures as well as superheat and subcooling. This information will only be displayed on the AID Tool.

Performance Monitoring (optional sensor kit)

The optional Performance Monitoring Kit includes two temperature sensors, entering and leaving water. The SAH Air Handler when ordered with control option C will include the LAT (leaving air temperature) sensor.

Special Modes and Applications

Communicating Digital Thermostats

The Aurora controls system also features either mono-chromatic or color touch screen graphic display thermostats for user interface. These displays not only feature easy to use graphical interface but display alerts and faults in plain English. Many of the features discussed here may not be applicable without these thermostats.

Aurora 'Advanced' 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.

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

Fault LED (LED1, Red)

	Red Fault LED	LED Flash Code *	Lockout	Reset/ Remove	Fault Condition Summary
ABC Basic Faults	Normal - No Faults	Off	-		
	Fault-Input	1	No	Auto	Tstat input error. Autoreset upon condition removal.
	Fault-High Pressure	2	Yes	Hard or Soft	HP switch has tripped (>600 psi)
	Fault-Low Pressure	3	Yes	Hard or Soft	Low Pressure Switch has tripped (<40 psi for 30 continuous sec.)
	Fault-Freeze Detection FP2	4	Yes	Hard or Soft	Freeze protection sensor has tripped (<15 or 30 degF for 30 continuous sec.)
	Fault-Freeze Detection FP1	5	Yes	Hard or Soft	Freeze protection sensor has tripped (<15 or 30 degF for 30 continuous sec.)
	Fault-Condensate Overflow	7	Yes	Hard or Soft	Condensate switch has shown continuity for 30 continuous sec.
	Fault-Over/Under Voltage	8	No	Auto	Instantaneous voltage is out of range. **Controls shut down until resolved.
	Fault-FP1 Sensor Error	11	Yes	Hard or Soft	FP1 Sensor Open or Shorted
ABC & AXB Advanced Faults	Fault-Compressor Monitor	10	Yes	Hard or Soft	Open Crkt, Run, Start or welded cont
	Non-CriticAXB SnsrErr	13	No	Auto	Any Other Sensor Error
	CriticAXBSnsrErr	14	Yes	Hard or Soft	Sensor Error for EEV or HW
	Alert-HotWtr	15	No	Auto	HW over limit or logic lockout. HW pump deactivated.
	Fault-VarSpdPump	16	No	Auto	Alert is read from PWM feedback.
	Non-CritComErr	18	No	Auto	Any non-critical com error
	Fault-CritComErr	19	No	Auto	Any critical com error. Auto reset upon condition removal
	Alarm - Low Loop Pressure	21	No	Auto	Loop pressure is below 3 psi for more than 3 minutes
	Alarm - Home Automation 1	23	No	Auto	Closed contact input is present on Dig 2 input - Text is configurable
	Alarm - Home Automation 2	24	No	Auto	Closed contact input is present on Dig 3 input - Text is configurable

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

Reference Calculations

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

Legend

ABBREVIATIONS AND DEFINITIONS:

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

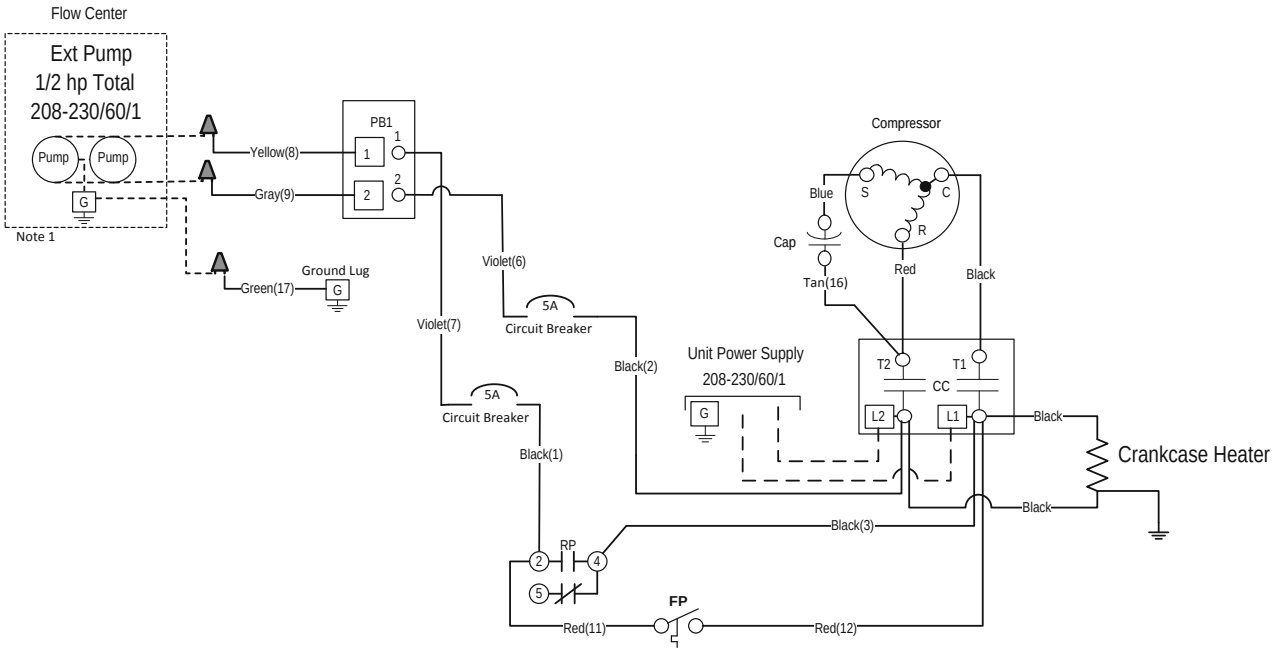
Operating Limits

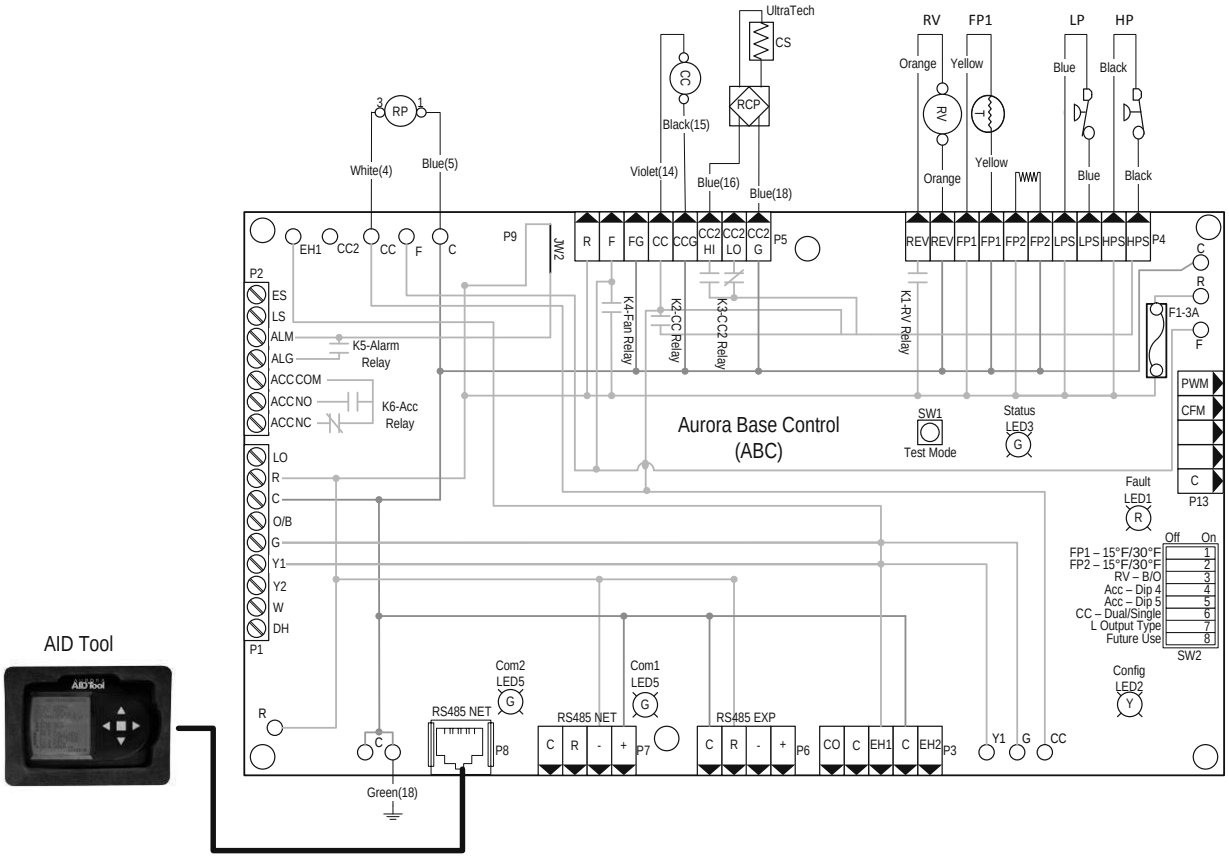
Operating Limits	Cooling	Heating
Air Limits		
Minimum ambient air, DB	-10°F [-23.3°C]	-10°F [-23.3°C]
Rated ambient air, DB	80.0 [26.7°C]	70°F [21.1°C]
Maximum ambient air, DB	120 [48.8°C]	85°F [29°C]
Water Limits		
Minimum entering water	30°F [-1°C]	20°F [-6.7°C]
Normal entering water	50-110°F [10-43°C]	30-70°F [-1 to 21°C]
Maximum entering water	120°F [49°C]	90°F [32°C]
Normal water flow	1.5 to 3.0 gpm per ton [1.6 to 3.2 l/m per kW]	

NOTES: 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.

Wiring Schematics

Dual Capacity Split - 208-230/60/1





Wiring Schematics cont.

Dual Capacity Split - 208-230/60/1 cont.

Aurora LED Flash Codes			
Slow Flash	1 second on and 1 second off		
Fast Flash	100 milliseconds on and 100 milliseconds off		
Flash Code	100 milliseconds on and 400 milliseconds off with a 2 second pause before repeating		
Random Start Delay (Alternating Colors)		Configuration LED (LED2, Yellow)	
Status LED (LED1, Green)	Fast Flash	No Software Overide	OFF
Configuration LED (LED2, Yellow)	Fast Flash	DIP Switch Overide	Slow Flash
Fault LED (LED3, Red)	Fast Flash		
Fault LED (LED1, Red)		Status LED (LED3, Green)	
Normal Mode	OFF	Normal Mode	ON
Input Fault Lockout	Flash Code 1	Control is Non-Functional	OFF
High Pressure Lockout	Flash Code 2	Test Mode	Slow Flash
Low Pressure Lockout	Flash Code 3	Lockout Active	Fast Flash
Future Use	Flash Code 4	Dehumidification Mode	Flash Code 2
Freeze Detection – FP1	Flash Code 5	Future Use	Flash Code 3
Reserved	Flash Code 6	Future Use	Flash Code 4
Condensate Overflow Lockout	Flash Code 7	Load Shed	Flash Code 5
Over/Under Voltage Shutdown	Flash Code 8	ESD	Flash Code 6
Future Use	Flash Code 9	Future Use	Flash Code 7
Future Use	Flash Code 10		
FP1 and FP2 Sensor Error	Flash Code 11		

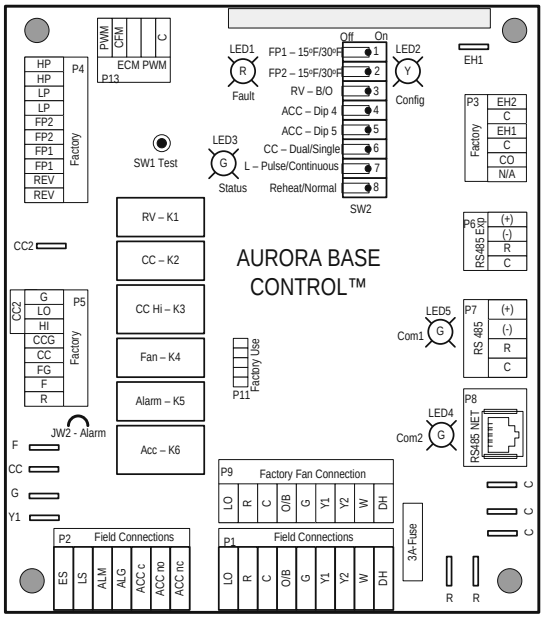
Aurora Timing Events		
Event	Normal Mode	Test Mode
Random Start Delay	5 to 80 seconds	1 second
Compressor On Delay	5 seconds	< 1 second
Compressor Minimum On Time	2 minutes	5 seconds
Compressor Short Cycle Delay	4 minutes	15 seconds
Blower Off Delay	30 seconds	2 seconds
Fault Recognition Delay – High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

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

Legend

Factory Low voltage wiring		Thermistor	
Factory Line voltage wiring		Light emitting diode - Green	
Field low voltage wiring		Relay coil	
Field line voltage wiring		Capacitor w/ bleed resistor	
Optional block		Switch - Condensate overflow	
DC Voltage PCB traces		Switch - High pressure	
Junction		Switch - Low pressure	
Quick connect terminal		Polarized connector	
Wire nut		Current Transducer (CT)	
Field wire lug			
Ground			
Relay Contacts- N.O., N.C.			
Fuse			
Breaker			

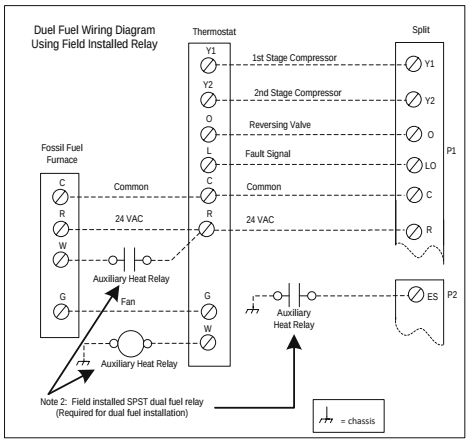
CC -	Compressor Contactor	PB1, PB2 -	Power blocks
CO -	Condensate overflow sensor	PS -	Power strip
K5 -	DHW pump relay	RV -	Reversing Valve coil
K6 -	Loop pump relay	SW1 -	DIP package 5 position AXB
CR3 -	PSC Fan Speed Relay	SW1 -	TEST MODE ABC Board
CR4 -	PSC Fan Power Relay	SW2 -	DIP package 8 position ABC Board
CS -	Compressor Solenoid	RP -	Relay – Loop Pump
F1 and F2 -	Fuses	TS -	Thermal limit switch
FP1 -	Freeze protection sensor	HWL -	Hot water limit sensor
HP -	High pressure switch	SC -	Start Contactor
FP -	Freeze protection switch	SR -	Start Relay
LP -	Low pressure switch	WCL -	Water Coil Limit Sensor



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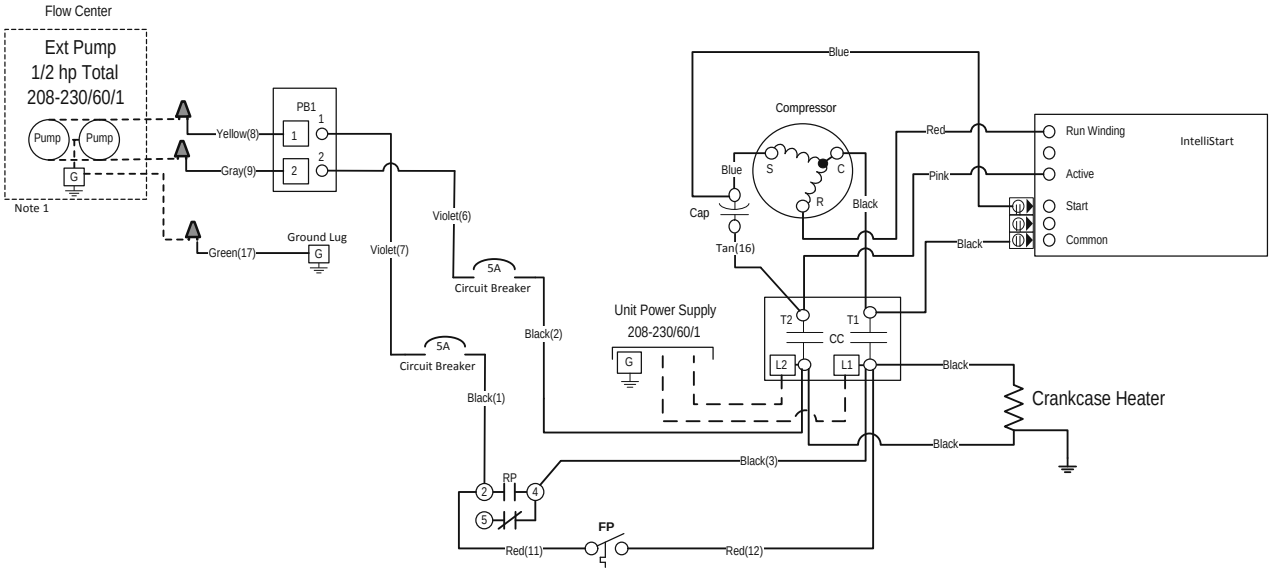
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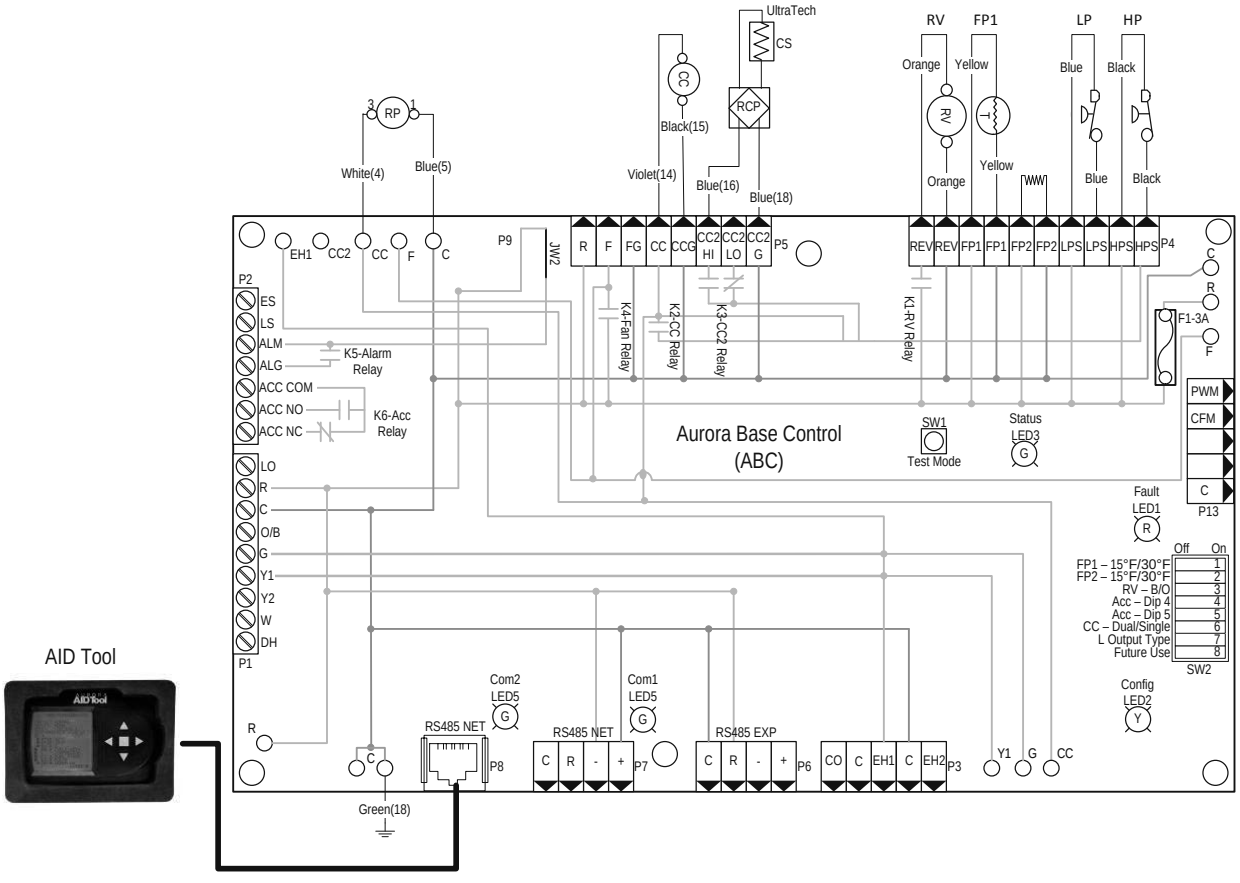
1 – Flow Center may be either factory or field installed.
2 – Field installed SPST relay required for duel fuel applications.



Wiring Schematics cont.

Dual Capacity Split with IntelliStart - 208-230/60/1





Wiring Schematics cont.

Dual Capacity Split with IntelliStart - 208-230/60/1 cont.

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

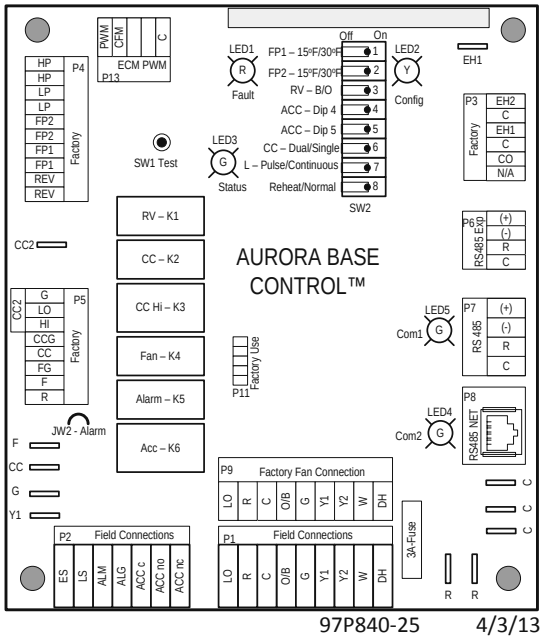
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Event	Normal Mode	Test Mode
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Fault Recognition Delay – High Pressure	Less than 1 second	Less than 1 second
Start-Up Bypass – Low Pressure	2 minutes	30 seconds
Fault Recognition Delay – Low Pressure	30 seconds	30 seconds
Start-Up Bypass – Low Water Coil Limit	2 minutes	30 seconds
Fault Recognition Delay – Low Water Coil Limit	30 seconds	30 seconds
Fault Recognition Delay – Condensate Overflow	30 seconds	30 seconds
Thermostat Call Recognition Time	2 seconds	2 seconds
Water Valve Slow Open Delay	90 seconds	90 seconds

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

Legend

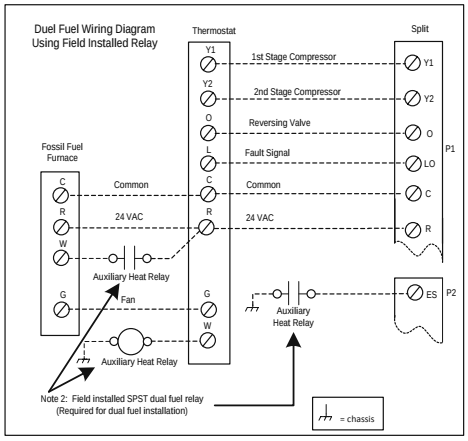
Factory Low voltage wiring		Thermistor	
Factory Line voltage wiring		Light emitting diode - Green	
Field low voltage wiring		Relay coil	
Field line voltage wiring		Capacitor w/ bleed resistor	
Optional block		Switch - Condensate overflow	
DC Voltage PCB traces		Switch - High pressure	
Junction		Switch - Low pressure	
Quick connect terminal		Polarized connector	
Wire nut		Current Transducer (CT)	
Field wire lug			
Ground			
Relay Contacts- N.O., N.C.			
Fuse			
Breaker			

CC -	Compressor Contactor	PB1, PB2 -	Power blocks
CO -	Condensate overflow sensor	PS -	Power strip
K5 -	DHW pump relay	RV -	Reversing Valve coil
K6 -	Loop pump relay	SW1 -	DIP package 5 position AXB
CR3 -	PSC Fan Speed Relay	SW1 -	TEST MODE ABC Board
CR4 -	PSC Fan Power Relay	SW2 -	DIP package 8 position ABC Board
CS -	Compressor Solenoid	RP -	Relay – Loop Pump
F1 and F2 -	Fuses	TS -	Thermal limit switch
FP1 -	Freeze protection sensor	HWL -	Hot water limit sensor
HP -	High pressure switch	SC -	Start Contactor
FP -	Freeze protection switch	SR -	Start Relay
LP -	Low pressure switch	WCL -	Water Coil Limit Sensor



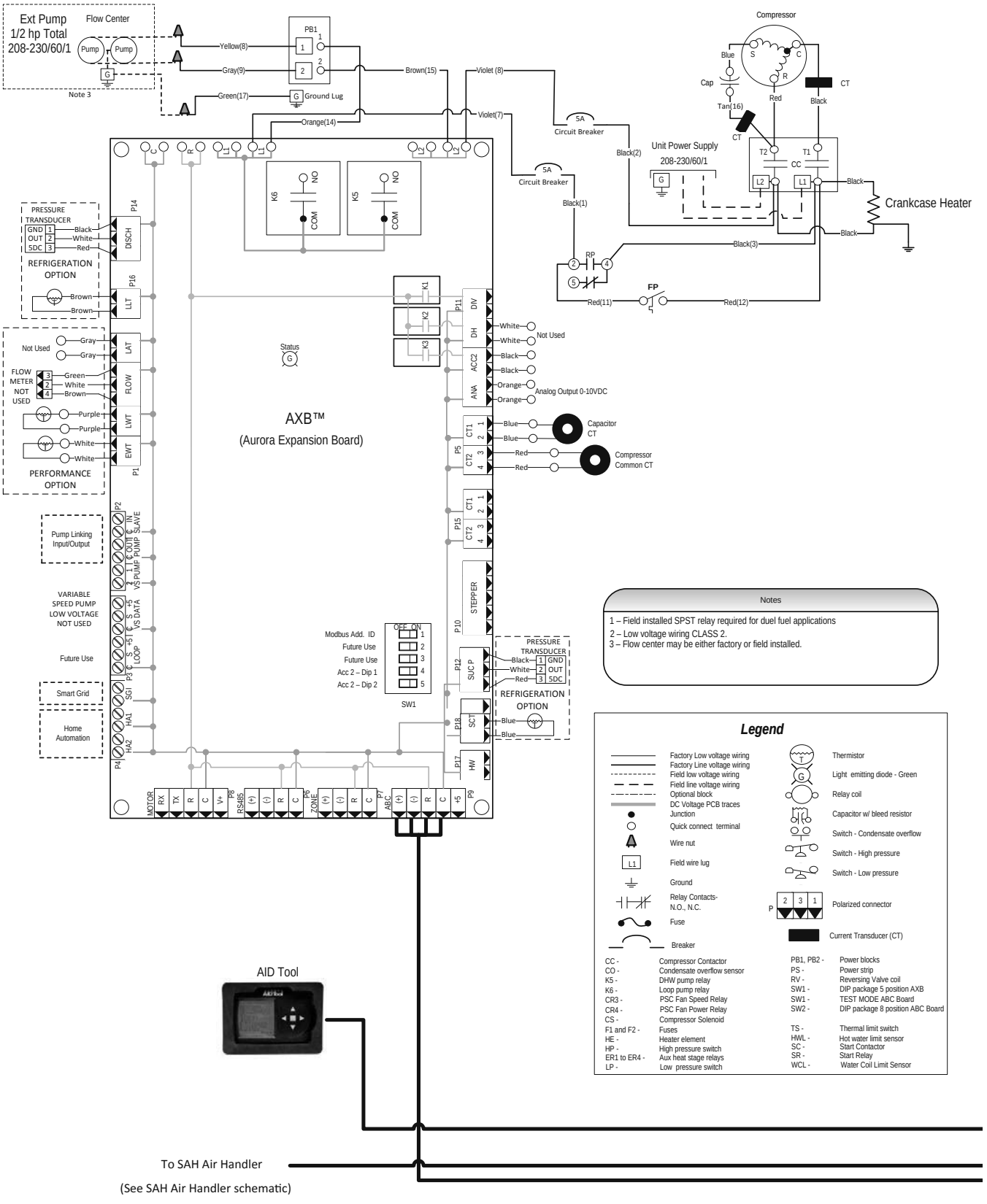
Notes

1 – Flow Center may be either factory or field installed.
2 – Field installed SPST relay required for duel fuel applications.



Wiring Schematics cont.

Dual Capacity Split with Aurora Advanced - 208-230/60/1



Notes

1 – Field installed SPST relay required for duel fuel applications
2 – Low voltage wiring CLASS 2.
3 – Flow center may be either factory or field installed.

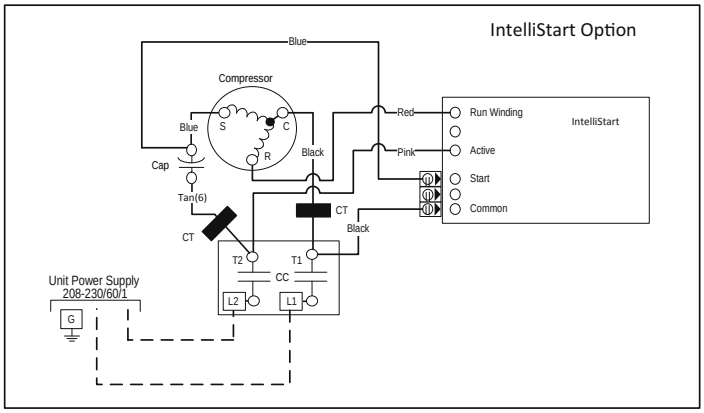
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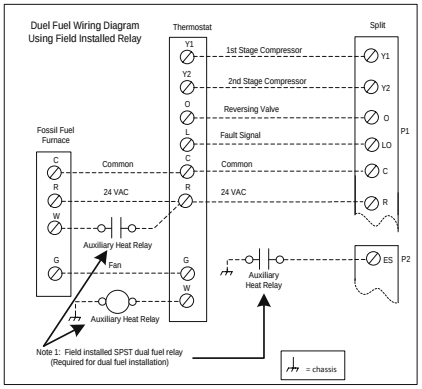
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Factory Line voltage wiring	Light emitting diode - Green
Field low voltage wiring	Relay coil
Field line voltage wiring	Capacitor w/ bleed resistor
Optional block	Switch - Condensate overflow
DC Voltage PCB traces	Switch - High pressure
Junction	Switch - Low pressure
Quick connect terminal	Polarized connector
Wire nut	Current Transducer (CT)
Field wire lug	
Ground	
Relay Contacts- N.O., N.C.	
Fuse	
Breaker	

CC -	Compressor Contactor	PB1, PB2 -	Power blocks
CO -	Condensate overflow sensor	PS -	Power strip
K5 -	DHW pump relay	RV -	Reversing Valve coil
K6 -	Loop pump relay	SW1 -	DIP package 5 position AXB
CR3 -	PSC Fan Speed Relay	SW1 -	TEST MODE ABC Board
CR4 -	PSC Fan Power Relay	SW2 -	DIP package 8 position ABC Board
CS -	Compressor Solenoid		
F1 and F2 -	Fuses	TS -	Thermal limit switch
HE -	Heater element	HWL -	Hot water limit sensor
HP -	High pressure switch	SC -	Start Contactor
ER1 to ER4 -	Aux heat stage relays	SR -	Start Relay
LP -	Low pressure switch	WCL -	Water Coil Limit Sensor

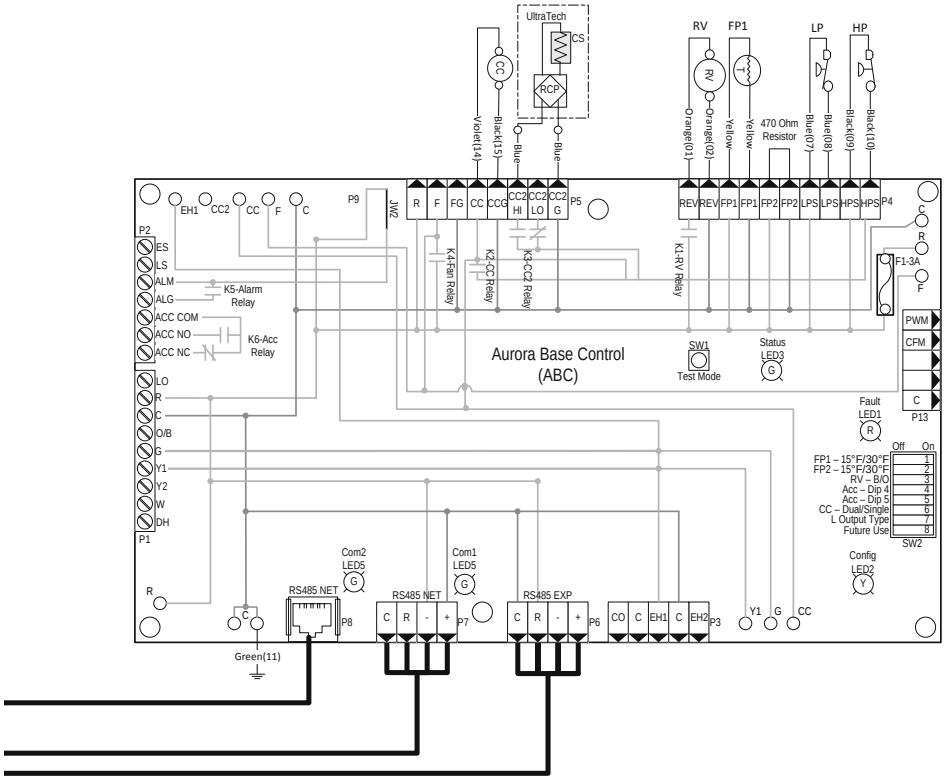
Wiring Schematics cont.

Dual Capacity Split with Aurora Advanced - 208-230/60/1 cont.





Aurora LED Flash Codes			
Slow Flash	1 second on and 1 second off		
Fast Flash	100 milliseconds on and 100 milliseconds off		
Flash Code	100 milliseconds on and 400 milliseconds off with a 2 second pause before repeating		
Random Start Delay (Alternating Colors)		Configuration LED (LED2, Yellow)	
Status LED (LED1, Green)	Fast Flash	No Software Overide	OFF
Configuration LED (LED2, Yellow)	Fast Flash	DIP Switch Overide	Slow Flash
Fault LED (LED3, Red)	Fast Flash		
Fault LED (LED1, Red)		Status LED (LED3, Green)	
Normal Mode	OFF	Normal Mode	ON
Input Fault Lockout	Flash Code 1	Control is Non-Functional	OFF
High Pressure Lockout	Flash Code 2	Test Mode	Slow Flash
Low Pressure Lockout	Flash Code 3	Lockout Active	Fast Flash
Future Use	Flash Code 4	Dehumidification Mode	Flash Code 2
Freeze Detection – FP1	Flash Code 5	Future Use	Flash Code 3
Reserved	Flash Code 6	Future Use	Flash Code 4
Condensate Overflow Lockout	Flash Code 7	Load Shed	Flash Code 5
Over/Under Voltage Shutdown	Flash Code 8	ESD	Flash Code 6
Future Use	Flash Code 9	Future Use	Flash Code 7
Future Use	Flash Code 10		
FP1 and FP2 Sensor Error	Flash Code 11		



Refrigeration

Leak Testing

The refrigeration line set must be pressurized and checked for leaks before purging and charging the unit. To pressurize the line set, attach refrigerant gauges to the service ports and add an inert gas (nitrogen or dry carbon dioxide) until pressure reaches 60 to 90 PSIG. Never use oxygen or acetylene to pressure test. Use an electronic leak detector or a good quality bubble solution to detect leaks on all connections made in the field. Check the service valve ports and stem for leaks and all connections made in the field. If a leak is found, repair it and repeat the above steps. For safety reasons do not pressurize the system above 150 psi. Purge pressure from line set. The system is now ready for evacuating and charging.

System Evacuation

Ensure that the line set and air coil are evacuated before opening service valves to the split unit. The line set must be evacuated to at least 200 microns to remove the moisture and air that may still be in the line set and coil. Evacuate the system through both service ports to prevent false readings on the gauge because of pressure drop through service ports.

Charge Amount When Using Air Handler

The 5 Series Split is shipped with a facotry pre-charge. This volume of refrigerant is not sufficient to run the system and additional refrigerant must be added. If using an SAH Air Handler please refer to the table in this section for charge amounts to be added. The “Factory Charge” column is the charge amount the compressor section/split is shipped with from the factory. The “Charge Amount with SAH Air Handler” column is the total amount of charge for the SAH Air Handler + Compressor section/split. This column does not factor in additional refrigerant needed for the line set. The installer of the system must add charge appropriately for the specific length of the line set. A 3/8 in. liquid line is calculated at 0.50 oz. of charge per linear foot, and a 1/2 in. liquid line is calculated at 1.0 oz. of charge per linear foot using R-410A refrigerant. The suction line will not hold “liquid” and should be ignored for the charge calculation.

Example: NDS038/SAH036 with 20 ft. of 3/8 in. liquid line. Remember that when using the SAH Air Handler, the column “Charge Amount with SAH Air Handler” will be used. Now calculate for the additional 20 ft. ineset.
Additional refrigerant to be added = (20 ft. x 0.5 oz.) = 10 oz.

Solution: 10 oz. should be added to the recommended charge of 86 oz. found in the “Charge Amount with SAH Air Handler” column for a total charge of 96 oz.

After initial charge, the system should be operated and the system subcooling and superheat verified to the Unit Operating Parameters table.

If an air handler manufactured by others is used then refrigerant should be added to the 5 Series Split factory pre-charge. Refrigerant should be added for liquid line length. This should result in a slightly under-charged system exhibiting low subcooling and high superheat. As charge is added, the subcooling should rise and the superheat should fall.

Charging the System

Charge Method – After purging and evacuating the line set, fully open the service valves counterclockwise. Add R-410A (liquid) into the liquid line service port until the pressure in the system reaches approximately 200 PSIG. Never add liquid refrigerant into the suction side of a compressor. Start the unit and measure superheat and subcooling. Keep adding refrigerant until the unit meets the superheat and subcooling values in the Operating Parameters tables.

Checking Superheat and Subcooling

Determining Superheat

1. Measure the temperature of the suction line at the point where the expansion valve bulb is clamped.
2. Determine the suction pressure in the suction line by attaching refrigeration gauges to the schrader connection on the suction side of the compressor.
3. Convert the pressure obtained in Step 2 to the saturation temperature by using the Pressure Temperature Conversion Chart for R-410A.
4. Subtract the temperature obtained in Step 3 from Step 1. The difference is the amount of superheat for the unit. Refer to the Operating Parameters tables for superheat ranges at specific entering water conditions.

Superheat Adjustment

TXVs are factory set to a specific superheat; however, the superheat should be adjusted for the application. To adjust the TXV to other superheat settings:

1. Remove the seal cap from the bottom of the valve.
2. Turn the adjustment screw clockwise to increase superheat and counterclockwise to decrease superheat. One complete 360° turn changes the superheat approximately 1-2°F, regardless of refrigerant type. You may need to allow as much as 30 minutes after the adjustment is made for the system to stabilize.
3. Once the proper superheat setting has been achieved, replace and tighten the seal cap.

Refrigeration cont.

WARNING: There are 12 total (360°) turns on the superheat adjustment stem from wide open to fully closed. When adjusting the superheat stem clockwise (superheat increase) and the stop is reached, any further clockwise turning adjustment will damage the valve.

Determining Subcooling

1. Measure the temperature of the liquid line on the small refrigerant line (liquid line) just outside the split cabinet. This location will be adequate for measurement in both modes unless a significant temperature drop in the liquid line is anticipated.
2. Measure the liquid line pressure by attaching refrigerant gauges to the schrader connection on the liquid line service valve.
3. Convert the pressure obtained in Step 2 to the saturation temperature by using the Pressure Temperature Conversion Chart for R-410A.
4. Subtract the temperature in Step 1 from the temperature in Step 3. The difference will be the subcooling value for that unit. Refer to the Operating Parameters tables for subcooling ranges at specific enter water conditions.

Line Set Sizes

Unit Size	Air Handler	20 feet		40 feet		60 feet		Split Factory Charge (oz.)	*Charge Amount with SAH Air Handler (oz.)
		Suction	Liquid	Suction	Liquid	Suction	Liquid		
022	SAH022	5/8” OD	3/8” OD	5/8” OD	3/8” OD	3/4” OD	3/8” OD	56	76
030	SAH030	5/8” OD	3/8” OD	3/4” OD	3/8” OD	3/4” OD	3/8” OD	56	82
036	SAH036	5/8” OD	3/8” OD	3/4” OD	3/8” OD	3/4” OD	1/2” OD	56	96
042	SAH042	3/4” OD	3/8” OD	3/4” OD	3/8” OD	7/8” OD	1/2” OD	74	104
048	SAH048	3/4” OD	3/8” OD	7/8” OD	3/8” OD	7/8” OD	1/2” OD	90	112
060	SAH060	7/8” OD	1/2” OD	7/8” OD	1/2” OD	1-1/8” OD	1/2” OD	92	119
070	SAH066	7/8” OD	1/2” OD	7/8” OD	1/2” OD	1-1/8” OD	1/2” OD	108	135
026	SAH026	5/8” OD	3/8” OD	3/4” OD	3/8” OD	3/4” OD	1/2” OD	52	72
038	SAH036	5/8” OD	3/8” OD	3/4” OD	3/8” OD	3/4” OD	1/2” OD	56	96
049	SAH048	3/4” OD	3/8” OD	7/8” OD	3/8” OD	7/8” OD	1/2” OD	90	112
064	SAH060	7/8” OD	1/2” OD	7/8” OD	1/2” OD	1-1/8” OD	1/2” OD	96	119
072	SAH066	7/8” OD	1/2” OD	7/8” OD	1/2” OD	1-1/8” OD	1/2” OD	104	133
CAPACITY MULTIPLIER		1.00		0.985		0.97			

Notes: * The “Charge Amount with SAH Air Handler” column is based on the charge amount for a SAH Air Handler + Compressor Section/Split. 1/13/2017
Additional charge will need to be added accordingly for line set length.
After charge is added, additional adjustments can be made to get appropriate subcooling and superheat measurements.
Additional charge for R410A is 0.50 oz. per ft. for 3/8” and 1.0 oz. per ft. for 1/2” tube.
Longer line sets will significantly reduce capacity and efficiency of the system as well as adversely effect the system reliability due to poor oil return.

Pressure/Temperature Conversion Chart for R-410A

PRESSURE (PSIG)	TEMP °F
60	8.5
62	9.9
64	11.2
66	12.5
68	13.8
70	15.1
72	16.3
74	17.5
76	18.7
78	19.8
80	21.0
82	22.1
84	23.2
86	24.3
88	25.4
90	26.5
92	27.5
94	28.6
96	29.6
98	30.6
100	31.6
102	32.6
104	33.5
106	34.5
108	35.4
110	36.4
112	37.3
114	38.2
116	39.1
118	40.0
120	40.9
122	41.7
124	42.6
126	43.4
128	44.3
130	45.1
132	45.9
134	46.7
136	47.5
138	48.3
140	49.1
142	49.9
144	50.7
146	51.5
148	52.2
150	53.0
152	53.7
154	54.5
156	55.2
158	55.9
160	56.6
162	57.4
164	58.1
166	58.8
168	59.5
170	60.2
172	60.8
174	61.5
176	62.2
178	62.9

PRESSURE (PSIG)	TEMP °F
180	63.5
182	64.2
184	64.8
186	65.5
188	66.1
190	66.8
192	67.4
194	68.0
196	68.7
198	69.3
200	69.9
202	70.5
204	71.1
206	71.7
208	72.3
210	72.9
212	73.5
214	74.1
216	74.7
218	75.3
220	75.8
222	76.4
224	77.0
226	77.5
228	78.1
230	78.7
232	79.2
234	79.8
236	80.3
238	80.9
240	81.4
242	81.9
244	82.5
246	83.0
248	83.5
250	84.1
252	84.6
254	85.1
256	85.6
258	86.1
260	86.6
262	87.1
264	87.7
266	88.2
268	88.7
270	89.2
272	89.6
274	90.1
276	90.6
278	91.1
280	91.6
282	92.1
284	92.6
286	93.0
288	93.5
290	94.0
292	94.5
294	94.9
296	95.4
298	95.8

PRESSURE (PSIG)	TEMP °F
300	96.3
302	96.8
304	97.2
306	97.7
308	98.1
310	98.6
312	99.0
314	99.5
316	99.9
318	100.4
320	100.8
322	101.2
324	101.7
326	102.1
328	102.5
330	103.0
332	103.4
334	103.8
336	104.2
338	104.7
340	105.1
342	105.5
344	105.9
346	106.3
348	106.7
350	107.2
352	107.6
354	108.0
356	108.4
358	108.8
360	109.2
362	109.6
364	110.0
366	110.4
368	110.8
370	111.2
372	111.6
374	112.0
376	112.3
378	112.7
380	113.1
382	113.5
384	113.9
386	114.3
388	114.7
390	115.0
392	115.4
394	115.8
396	116.2
398	116.5
400	116.9
402	117.3
404	117.6
406	118.0
408	118.4
410	118.7
412	119.1
414	119.5
416	119.8
418	120.2

PRESSURE (PSIG)	TEMP °F
420	120.6
422	120.9
424	121.3
426	121.6
428	122.0
430	122.3
432	122.7
434	123.0
436	123.4
438	123.7
440	124.1
442	124.4
444	124.8
446	125.1
448	125.4
450	125.8
452	126.1
454	126.5
456	126.8
458	127.1
460	127.5
462	127.8
464	128.1
466	128.5
468	128.8
470	129.1
472	129.4
474	129.8
476	130.1
478	130.4
480	130.7
482	131.1
484	131.4
486	131.7
488	132.0
490	132.3
492	132.7
494	133.0
496	133.3
498	133.6
500	133.9
502	134.2
504	134.5
506	134.9
508	135.2
510	135.5
512	135.8
514	136.1
516	136.4
518	136.7
520	137.0
522	137.3
524	137.6
526	137.9
528	138.2
530	138.5
532	138.8
534	139.1
536	139.4
538	139.7

PRESSURE (PSIG)	TEMP °F
540	140.0
542	140.3
544	140.6
546	140.9
548	141.2
550	141.4
552	141.7
554	142.0
556	142.3
558	142.6
560	142.9
562	143.2
564	143.5
566	143.7
568	144.0
570	144.3
572	144.6
574	144.9
576	145.1
578	145.4
580	145.7
582	146.0
584	146.2
586	146.5
588	146.8
590	147.1
592	147.3
594	147.6
596	147.9
598	148.2
600	148.4
602	148.7
604	149.0
606	149.2
608	149.5

Unit Startup

Before Powering Unit, Check the Following:

NOTE: Remove and discard the compressor hold down shipping bolt located at the front of the compressor mounting bracket.

- **Dip switches are set correctly.**
- **Transformer in air handler switched to 208V if applicable.**
- **High voltage is correct and matches nameplate.**
- Fuses, breakers and wire size correct.
- 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.
- Blower rotates freely in Air Handler
- Blower speed is correct.
- Air filter/cleaner is clean and in position.
- Service/access panels are in place.
- Return air temperature is between 50-80°F heating and 60-95°F cooling.
- Check air coil cleanliness to ensure optimum performance. Clean as needed according to maintenance guidelines. To obtain maximum performance the air coil should be cleaned before startup. A 10% solution of dishwasher detergent and water is recommended for both sides of coil, a thorough water rinse should follow.

Powering The Controls

Initial Configuration of the Unit

Before operating the unit, apply power and complete the following Aurora Startup procedure for the controls configuration. An AID Tool is recommended for setup, configuration and troubleshooting, especially with an Aurora 'Advanced' Control. AID Tool version 2.06 or greater is preferred.

1. **Configure Aurora Screen**
   a. In advanced controls - Confirm AXB is added and communicating.
   b. Air Handler- if air handler has AHB you will need to add AHB and confirm it is communicating.
   c. In advanced controls - If using a communicating thermostat confirm the communicating thermostat is added and communicating. Set thermostat mode to off.
   d. In advanced controls - Confirm IntelliZone2, if installed, is added and communicating. Set Zoning system to off mode.

2. **Aurora Setup Screen**
   a. ECM Setup for Heating Airflow (SAH Air Handler with AHB controls only) – select "G", low, high and aux blower speeds as appropriate for the unit and electric heat.
   b. Cooling Airflow % - sets the cooling airflow % from heating airflow. Factory setting is -15%.
   c. Sensor Kit Setup
      i. Select blower energy (SAH Air Handler AHB Controls Only) – ECM or 5-Speed ECM
      ii. Activate energy option
      iii. Fan and Aux heat current sensor activation (SAH Air Handler AHB Controls Only)
      iv. Line Voltage calibration – Voltmeter required to calibrate line voltage during heat or cooling. Refer to Line Voltage Calibration in this manual for more details.
   e. Smart Grid Setup – Select Action option for utility received on-peak signal
   f. Home Automation 1 & 2 Setup – Select type of sensor for two home automation inputs.

Configuring the Sensor Kits

Configuring the Sensor kits

The Aurora Advanced Control allows Refrigeration, Energy, and Performance Monitoring sensor kits. These kits can be factory or field installed. The following description is for field activation of a factory installation of the sensor kits.

Unit Startup cont.

Energy Monitoring (Standard Sensor Kit on most 'Advanced' models)

The Energy Monitoring Kit includes two current sensors on the compressor so that compressor power usage can be measured. On the SAH air handler, order control option 'C' which includes an AHB board so that blower and auxiliary heat power can be measured. This will give total power usage of the heat pump. The AID Tool provides configuration detail for the type of blower motor, a line voltage calibration procedure to improve the accuracy, and a power adjustment setting that allows the compressor power to be adjusted to match the unit's line voltage using the provided tables. This information can be displayed on the AID Tool or selected communicating thermostats. The TPCM32U03A/04A will display instantaneous energy use while the color touchscreen TPCC32U01 will in addition display a 13 month history in graph form. Ensure the Energy Kit has been enabled by accessing the 'Sensor Kit Setup" in the AID Tool and complete the following:

a. Select 'Blower Energy' – ECM/5-Speed ECM
b. Activate 'Energy Option' to activate the sensors on for compressor (2), fan and aux heat current sensor.
c. Select 'Pump' option of FC1, FC2, or open loop. This selects the pump watts used in the calculation. Pump watts are not measured but estimated.
d. Line Voltage Calibration – Voltmeter required to calibrate line voltage during heating or cooling. Refer to Line Voltage Calibration in this manual for more details.
    i. Turn on Unit in Heating or Cooling .
    ii. Use multimeter at L1 and L2 to measure line voltage
    iii. In the Sensor Kit Setup screen adjust the 'Base Voltage' to the nearest value to that is measured
    iv. Then use the 'Fine Adjust' to select the exact voltage being measured at L1 and L2.
    v. Exit 'Sensor Setup' Screen
e. Power Adjustment: Refer to the Dual Capacity Power Adjustment table in the Aurora 'Advanced' Control section of the literature
    i. On the Main Menu screen select Setup
    ii. Once in the Setup menu select the Power Adjustment Factor
    iii. Power Adjustment - allows you to enter the unit's compressor power setting for high and low speed operation. Refer to the tables and use the voltage that is closest to the unit's line voltage and set the power adjustment accordingly.
f. Energy monitoring can be read on any of the following components:
    i. AID Tool – instantaneous information only
    ii. TPCM32U03A/04A Communicating Thermostat (B/W) - instantaneous information only
    iii. TPCC32U01 Color Touchscreen Thermostat – Both Instantaneously and historical (13 months)
    iv. Symphony Web Portal via AWL device connected to Aurora

Refrigerant Monitoring (optional sensor kit)

The optional Refrigerant Monitoring Kit includes two pressure transducers, and three temperature sensors, heating liquid line, suction temperature and existing cooling liquid line (FP1). These sensors allow the measurement of discharge and suction pressures, suction and liquid line temperatures as well as superheat and subcooling. This information will only be displayed on the AID Tool. Ensure the Refrigerant Monitoring has been setup by accessing the 'Sensor Kit Setup" in the AID Tool and complete the following:
Once sensors are installed for discharge pressure, suction pressure, suction, liquid line cooling and liquid line heating no further setup is required.

a. Turn on Unit in Heating or Cooling .
b. Use the AID Tool to view the refrigerant performance in the 'Refrigerant Monitor' screen.
c. Refrigerant monitoring can be read on any of the following components:
    i. AID Tool – instantaneous information only
    ii. Symphony Web Portal via AWL device connected to Aurora

Performance Monitoring (optional sensor kit)

The optional Performance Monitoring Kit includes two temperature sensors for entering and leaving water. The SAH Series Air Handler when ordered with control option C will include the LAT (leaving air temperature) sensor. Ensure the Performance Monitoring Kit has been enabled by accessing the 'Sensor Kit Setup' in the AID Tool and complete the following:

a. Turn on Unit in Heating or Cooling .
b. Use the AID Tool to view the performance in the 'Performance Monitor' screen.
c. Performance monitoring can be read on any of the following components:
    i. AID tool - instantaneous information only
    ii. Symphony Web Portal via AWL device connected to Aurora.

Unit Startup cont.

Startup Steps

NOTE: Complete the Equipment Start-Up/Commissioning Check Sheet during this procedure. Refer to thermostat operating instructions and complete the startup procedure. Verify that the compressor shipping bolt has been removed.

1. Initiate a control signal to energize the blower motor. Check blower operation through the AID Tool.
2. Initiate a control signal to place the unit in the cooling mode. Cooling setpoint must be set below room temperature.
3. First stage cooling will energize after a time delay.
4. Be sure that the compressor and water control valve or loop pump(s) are activated.
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 unit performance data in catalog.
6. Check the temperature of both the supply and discharge water (see the Unit Operating Parameters tables).
7. Check for an air temperature drop of 15°F to 25°F across the air coil, depending on the fan speed and entering water temperature.
8. Decrease the cooling set point several degrees and verify high-speed blower operation.
9. Adjust the cooling setpoint 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 the heating mode. Heating set point must be set above room temperature.
11. First stage heating will energize after a time delay.
12. Check the temperature of both the supply and discharge water (see the Unit Operating Parameters tables).
13. Check for an air temperature rise of 12°F to 35°F across the air coil, depending on the fan speed and entering water temperature.
14. If auxiliary electric heaters are installed, increase the heating setpoint 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 setpoint below room temperature and verify that the compressor and water valve or loop pumps deactivate.
16. During all testing, check for excessive vibration, noise or water leaks. Correct or repair as required.
17. Set system to desired normal operating 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.

Correction Factor Tables

Air Flow Corrections (Dual Capacity Part Load)

Airflow		Cooling				Heating		
cfm Per Ton of Clg	% of Nominal	Total Cap	Sens Cap	Power	Heat of Rej	Htg Cap	Power	Heat of Ext
240	60	0.922	0.778	0.956	0.924	0.943	1.239	0.879
275	69	0.944	0.830	0.962	0.944	0.958	1.161	0.914
300	75	0.957	0.866	0.968	0.958	0.968	1.115	0.937
325	81	0.970	0.900	0.974	0.970	0.977	1.075	0.956
350	88	0.982	0.933	0.981	0.980	0.985	1.042	0.972
375	94	0.991	0.968	0.991	0.991	0.993	1.018	0.988
400	**100**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
425	106	1.007	1.033	1.011	1.008	1.007	0.990	1.010
450	113	1.013	1.065	1.023	1.015	1.012	0.987	1.018
475	119	1.017	1.099	1.037	1.022	1.018	0.984	1.025
500	125	1.020	1.132	1.052	1.027	1.022	0.982	1.031
520	130	1.022	1.159	1.064	1.030	1.025	0.979	1.034

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Air Flow Corrections (Dual Capacity Full Load and Single Speed)

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

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Cooling Capacity Corrections

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

NOTE: * Sensible capacity equals total capacity at conditions shown. 1/5/17

Heating Capacity Corrections

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

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Operating Parameters

First Stage Operation

Cooling -- No Desuperheater									
Entering Water Temp °F	Water Flow GPM/Ton	026 thru 064		072	072	026 thru 072			
		Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB
30	3.0	105-120	125-140	90-105	135-145	25-40	4-15	7-11	15-24
50	1.5	130-150	170-210	130-150	180-210	8-17	7-14	7-20	18-24
	3.0	128-153	175-195	125-140	185-205	10-20	3-10	9-14	18-25
70	1.5	130-150	235-270	135-150	240-280	6-16	4-16	9-18	18-25
	3.0	130-155	240-265	125-145	245-270	6-18	5-11	5-10	18-24
90	1.5	133-148	310-245	130-155	300-365	7-16	6-18	4-11	19-25
	3.0	138-155	320-350	130-165	305-350	7-18	7-14	5-10	17-22
120	1.5	143-158	460-485	135-145	475-505	7-16	6-18	4-11	19-25
	3.0	145-165	470-495	145-155	485-500	6-15	8-15	5-12	17-22

Heating -- No Desuperheater									
Entering Water Temp °F	Water Flow GPM/Ton	026 thru 064		072	072	026 thru 072			
		Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
20	3.0	60-75	255-275	55-65	275-290	8-16	4-5	2-8	15-24
30	1.5	78-100	275-325	85-105	315-345	6-11	4-16	2-8	20-29
	3.0	78-110	275-320	90-120	305-335	6-11	4-16	3-7	20-32
50	1.5	105-120	305-350	100-130	340-400	5-12	4-16	5-12	24-32
	3.0	110-125	300-360	110-125	345-395	9-15	2-14	4-9	20-34
70	1.5	140-155	305-355	130-165	370-430	5-12	2-14	8-12	24-39
	3.0	145-160	330-400	140-160	375-425	7-17	7-15	4-10	24-39
90	1.5	170-195	340-385	155-175	430-465	7-16	6-18	4-11	20-34
	3.0	175-200	350-390	160-180	440-470	7-18	7-14	5-10	24-38

Second Stage Operation

Cooling -- No Desuperheater									
Entering Water Temp °F	Water Flow GPM/Ton	026 thru 064		072	072	026 thru 072			
		Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Rise °F	Air Temp Drop °F DB
30	3.0	90-115	135-150	95-115	125-145	25-40	4-15	7-11	15-24
50	1.5	120-140	175-235	105-150	190-220	7-17	6-14	7-16	19-26
	3.0	115-140	170-220	110-130	185-210	7-20	4-11	7-12	20-24
70	1.5	121-136	245-280	105-150	240-290	9-15	6-18	7-12	19-25
	3.0	120-145	245-275	110-140	245-280	10-16	7-16	8-12	18-24
90	1.5	122-140	310-360	115-140	325-385	8-14	6-18	10-16	18-24
	3.0	135-150	310-365	120-135	330-365	8-14	7-15	6-12	17-23
120	1.5	135-155	470-515	130-155	485-520	7-16	6-18	4-11	19-25
	3.0	140-160	475-520	135-150	490-515	6-15	8-15	5-12	17-22

Heating -- No Desuperheater									
Entering Water Temp °F	Water Flow GPM/Ton	026 thru 064		072	072	026 thru 072			
		Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Superheat	Subcooling	Water Temp Drop °F	Air Temp Rise °F DB
20	3.0	45-65	245-280	45-55	265-275	8-16	4-5	2-8	15-24
30	1.5	72-89	295-340	70-100	320-370	7-18	10-20	4-13	18-24
	3.0	73-87	285-320	75-90	315-365	7-18	10-20	4-16	18-27
50	1.5	100-120	320-355	95-130	375-430	6-14	6-18	4-10	23-34
	3.0	105-120	315-355	100-125	370-420	6-14	6-18	4-9	20-37
70	1.5	142-158	340-370	130-165	400-470	6-12	4-15	6-15	28-38
	3.0	138-152	345-385	135-160	405-465	7-14	4-15	6-12	24-42
90	1.5	162-205	365-425	170-200	440-500	7-16	6-18	4-11	25-36
	3.0	160-195	370-430	175-195	450-490	7-18	7-14	5-10	28-40

Note: Cooling performance based on entering air temperatures of 80º F DB, 67º F WB. 3/22/2017
Heating performance based on entering air temperature of 70º F DB.

Pressure Drop

Dual Capacity

Model	GPM	Pressure Drop (psi)				
		30°F	50°F	70°F	90°F	110°F
026 full load	4	1.4	1.3	1.2	1.1	1.0
	6	3.3	3.1	2.9	2.7	2.5
	8	5.1	4.8	4.5	4.2	3.9
	10	7.2	6.9	6.6	6.3	6.0
026 part load	3	1.0	0.9	0.9	0.8	0.7
	5	2.5	2.3	2.2	2.0	1.9
	7	3.9	3.6	3.4	3.2	2.9
	9	6.2	5.9	5.7	5.5	5.2
038 full load	5	1.2	1.2	1.1	1.0	1.0
	7	2.5	2.3	2.2	2.0	1.9
	9	3.6	3.4	3.2	3.0	2.8
	11	5.2	5.0	4.8	4.6	4.4
038 part load	4	0.9	0.9	0.8	0.8	0.7
	6	2.0	1.9	1.8	1.7	1.6
	8	2.9	2.8	2.7	2.5	2.3
	10	4.1	4.0	3.8	3.6	3.4
049 full load	6	1.3	1.2	1.1	1.1	1.0
	9	2.7	2.6	2.4	2.2	2.1
	12	4.2	3.9	3.7	3.3	3.2
	15	6.0	5.7	5.5	5.2	5.0
049 part load	5	0.9	0.8	0.8	0.7	0.7
	8	2.2	2.0	1.9	1.7	1.6
	11	3.5	3.3	3.1	2.8	2.7
	14	5.1	4.9	4.7	4.4	4.2
064 full load	8	1.8	1.7	1.6	1.5	1.4
	12	4.1	3.8	3.6	3.4	3.1
	16	6.5	6.1	5.7	5.3	4.9
	20	9.7	9.2	8.6	8.2	7.6
064 part load	6	1.1	1.0	0.9	0.9	0.8
	10	3.3	3.1	2.9	2.7	2.5
	14	5.6	5.3	4.9	4.6	4.3
	18	8.4	8.1	7.7	7.4	7.1
072 full load	12	3.3	3.1	2.9	2.7	2.5
	15	5.0	4.7	4.4	4.1	3.8
	18	6.8	6.4	6.0	5.5	5.1
	21	8.4	8.0	7.6	7.1	6.8
072 part load	10	2.4	2.3	2.1	2.0	1.8
	13	4.0	3.7	3.5	3.3	3.0
	16	5.6	5.2	4.9	4.6	4.2
	19	7.1	6.8	6.5	6.2	5.9

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Compressor Resistance

Compressor Resistance Chart (Ohms)

Model	208-230/60/1	
	Run	Start
026	1.23-1.30	1.41-1.50
038	.829-.954	1.19-1.38
049	.590-.679	1.41-1.62
064	.455-.524	.558-.643
072	.344-.395	.495-.570

1/13/11

Thermistor Resistance

Thermistor Resistance Chart

Thermistor Temperature (°F)	Microprocessor Resistance (Ohms)
5	75757-70117
14	57392-53234
23	43865-40771
32	33809-31487
41	26269-24513
50	20570-19230
59	16226-15196
68	12889-12093
77	10310-9688
86	8300-7812
95	6723-6337
104	5480-5172
113	4490-4246
122	3700-3504
131	3067-2907
140	2554-2424
149	2149-2019

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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 TXV (Check Service Advisory)	High	Low	Normal/Low	High	High	Low	Low
Insufficient Compressor (Possible Bad Valves)	Low	High	Low	High	Normal/High	Low	Low
TXV - Bulb Loss of Charge	Low	Low	Low	High	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.						

7/6/10

Antifreeze Corrections

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

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

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

Antifreeze Correction Example

Antifreeze solution is Propylene Glycol 20% by weight. Determine the corrected heating and cooling performance at 30°F and 90°F respectively as well as pressure drop at 30°F for a 5 Series ND*026.

The corrected cooling capacity at 90°F would be: 22,600 MBtu/h x 0.969 = 21,900 MBtu/h

The corrected heating capacity at 30°F would be: 18,700 MBtu/h x 0.913 = 17,070 MBtu/h

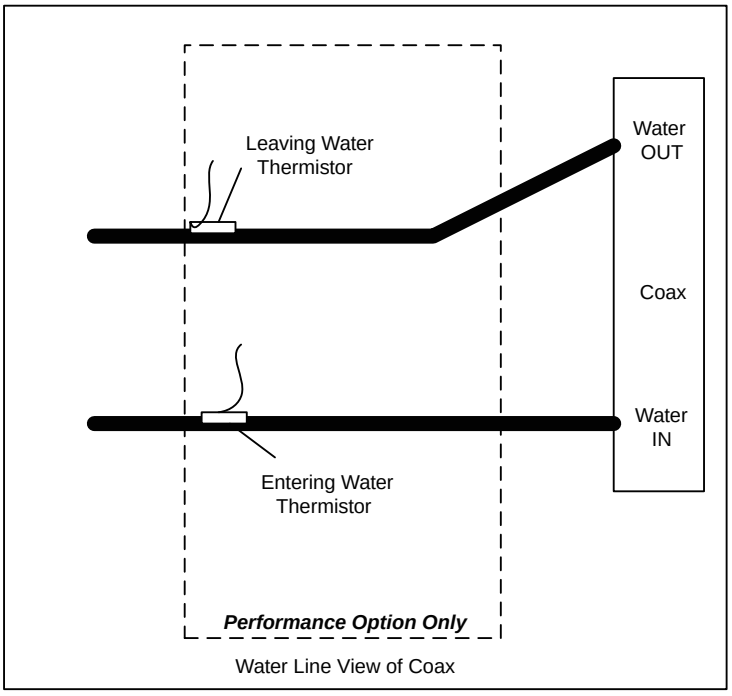
The corrected pressure drop at 30°F and 6 gpm would be: 7.6 feet of head x 1.433 = 10.90 feet of head

Heat of Extraction/Rejection Data

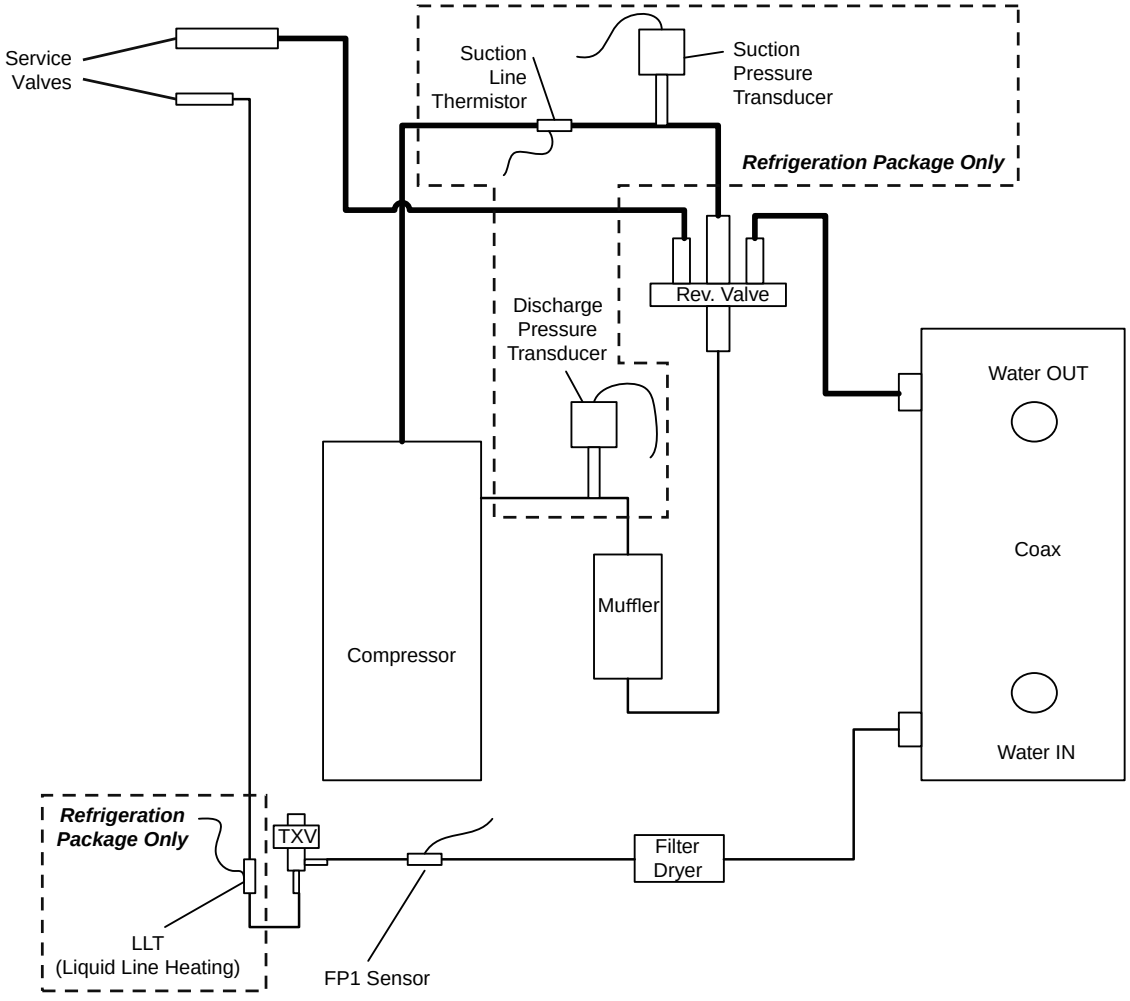
Model		GPM	Heat of Extraction (kBtuh)				Heat of Rejection (kBtuh)				
			30°F	50°F	70°F	90°F	30°F	50°F	70°F	90°F	110°F
026	Part Load	3.0		12.6	16.8	20.9		22.2	21.9	19.9	
		5.0	8.7	13.2	17.7	22.2	19.3	22.3	22.0	20.1	19.2
		7.0	9.5	13.9	18.2	22.3	19.4	22.7	22.3	20.2	19.4
	Full Load	4.0		17.2	21.3	23.3		29.9	29.5	27.4	
		6.0	13.1	17.9	22.5	27.0	24.6	30.2	29.9	27.8	27.3
		8.0	13.3	18.4	23.2	29.3	26.5	30.4	30.0	27.9	27.6
038	Part Load	4.0		18.3	24.3	29.9		31.9	32.0	29.7	
		6.0	12.7	19.1	25.7	31.8	26.3	32.1	32.1	29.8	28.5
		8.0	14.0	20.2	26.4	32.0	26.6	32.5	32.5	30.0	28.7
	Full Load	5.0		26.1	31.2	36.8		41.0	43.4	42.1	
		7.0	20.4	27.1	32.9	39.2	35.2	41.4	44.0	42.9	39.1
		9.0	20.8	27.9	33.9	40.7	35.4	41.6	44.2	43.3	39.2
049	Part Load	5.0		26.1	30.1	35.4		45.3	41.8	38.3	
		8.0	17.3	28.5	33.2	39.2	38.4	45.4	42.0	38.5	35.3
		11.0	18.2	29.9	35.0	41.8	38.5	45.6	42.3	39.5	36.1
	Full Load	6.0		32.3	39.4	45.6		58.0	57.2	53.3	
		9.0	26.4	35.3	43.6	50.7	48.5	58.6	57.8	53.6	49.6
		12.0	27.6	37.0	46.1	54.1	48.6	58.8	57.9	54.1	50.9
064	Part Load	6.0		30.1	39.1	46.5		56.4	54.3	50.3	
		10.0	20.4	30.5	41.1	50.1	48.5	56.7	54.4	50.5	47.9
		14.0	21.7	31.7	42.0	50.4	48.6	56.9	54.5	50.7	48.2
	Full Load	8.0		40.8	51.3	59.5		74.0	70.8	69.4	
		12.0	32.7	43.7	53.5	60.4	64.7	74.5	71.2	69.8	65.7
		16.0	32.9	44.5	55.1	62.8	64.8	75.0	71.6	71.8	65.9
072	Part Load	10.0		36.1	46.0	54.2		64.6	62.3	56.7	
		13.0	25.7	36.7	48.1	58.5	56.6	65.5	62.6	57.7	56.2
		16.0	28.4	38.1	49.0	58.8	56.7	66.0	62.8	59.5	56.4
	Full Load	12.0		47.4	63.5	71.4		83.2	77.7	74.4	
		15.0	38.3	50.7	66.2	72.5	72.5	83.7	78.0	74.6	71.4
		18.0	39.2	51.7	68.1	75.5	72.6	84.2	78.5	74.8	71.7

Note: operation not recommended in shaded areas. 1/4/2017

Troubleshooting



Water Line View of Coax



Troubleshooting cont.

Aurora Control System

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

To check the unit control board for proper operation:

1. Disconnect thermostat wires at the control board.
2. Jumper the desired test input (Y1, Y2, W, O or G) to the R terminal to simulate a thermostat signal.
3. If control functions properly:
    - Check for thermostat and field control wiring (use the diagnostic inputs mode).
4. If control responds improperly:
    - Ensure that component being controlled is functioning (compressor, blower, reversing valve, etc.).
    - Ensure that wiring from control to the component is correct.
    - Refer to the Aurora Base Control Application and Troubleshooting Guide and the Instruction Guide: Aurora Interface and Diagnostics (AID) Tool for additional information.

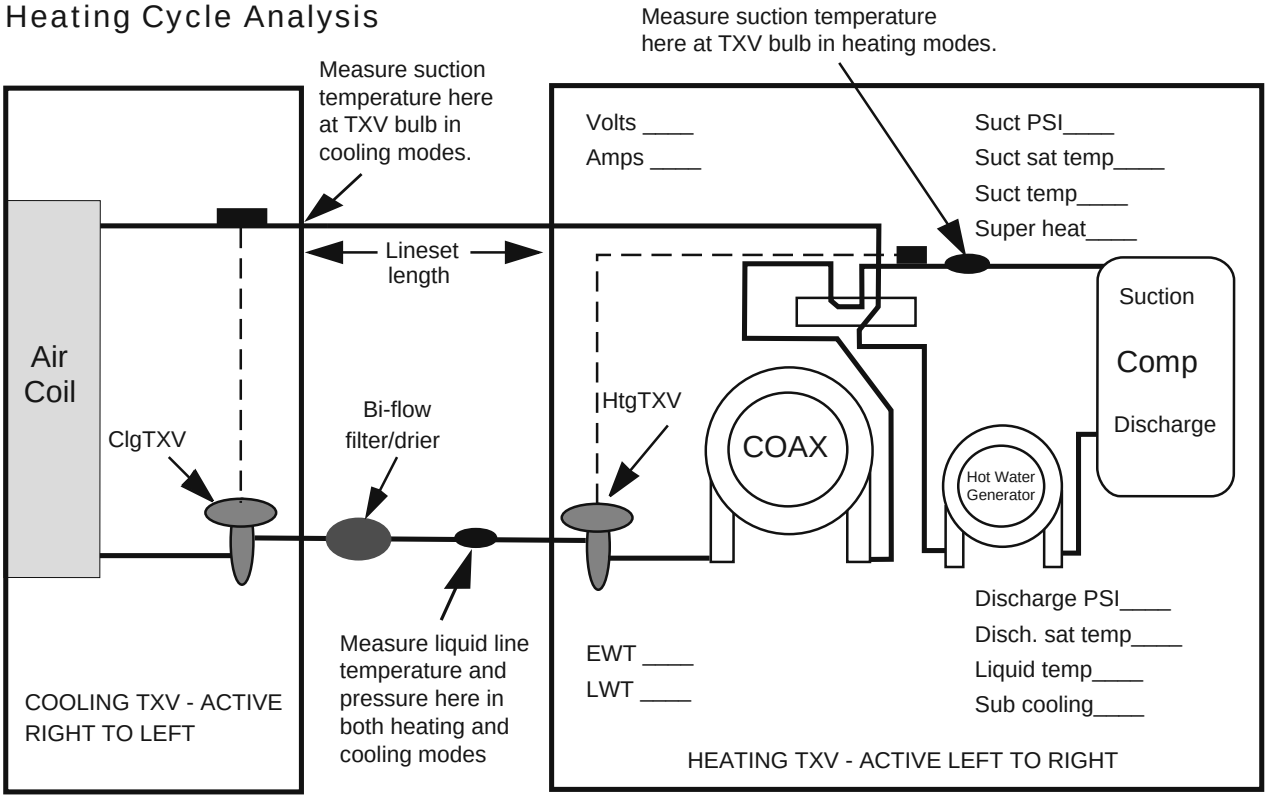
Refrigerant Systems

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 Unit 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

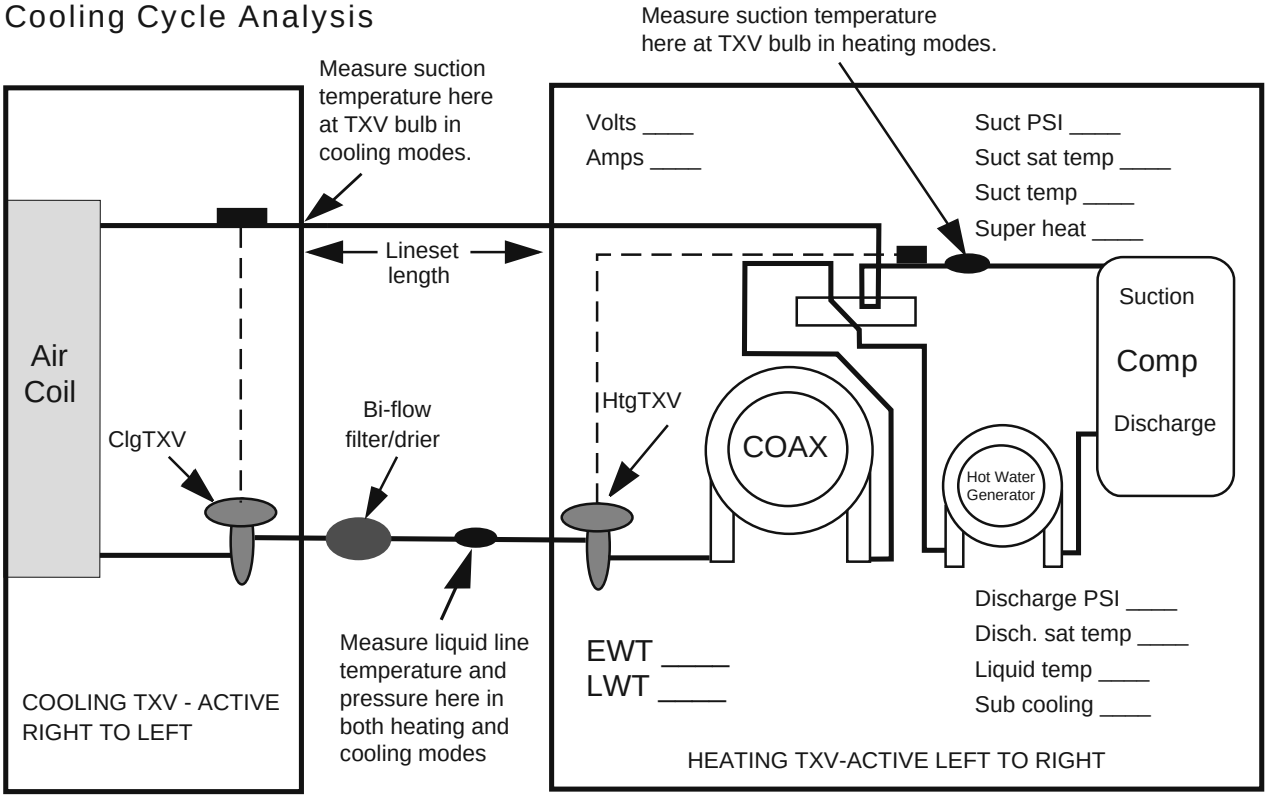
Heating Cycle Analysis



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.

Cooling Cycle Analysis



Troubleshooting cont.

Single Speed/Dual Capacity Startup/Troubleshooting Form

1. Job Information

Model # _____ Job Name: _____ Loop: Open / Closed

Serial # _____ Install Date: _____ Hot Water Generator: Y / N

2. Flow Rate in gpm	**SOURCE COAX**		**LOAD COAX (Water-to-Water)**	
	HEATING	COOLING	HEATING	COOLING
WATER IN Pressure:	a. _____ psi	a. _____ psi	a. _____ psi	a. _____ psi
WATER OUT Pressure:	b. _____ psi	b. _____ psi	b. _____ psi	b. _____ psi
Pressure Drop: a - b	c. _____ psi	c. _____ psi	c. _____ psi	c. _____ psi
Look up flow rate in table:	d. _____ gpm	d. _____ gpm	d. _____ gpm	d. _____ gpm

3. Temp. Rise/Drop Across Air Coil[1]	HEATING	COOLING
SUPPLY AIR Temperature:	e. _____ °F	e. _____ °F
RETURN AIR Temperature:	f. _____ °F	f. _____ °F
Temperature Difference:	g. _____ °F	g. _____ °F

4. Temp. Rise/Drop Across Coaxial Heat Exchanger	**SOURCE COAX**		**LOAD COAX (Water-to-Water)**	
	HEATING	COOLING	HEATING	COOLING
WATER IN Temperature:	h. _____ °F	h. _____ °F	h. _____ °F	h. _____ °F
WATER OUT Temperature:	i. _____ °F	i. _____ °F	i. _____ °F	i. _____ °F
Temperature Difference:	j. _____ °F	j. _____ °F	j. _____ °F	j. _____ °F

5. Heat of Rejection (HR)/Heat of Extraction (HE)

Brine Factor[2]: k. _____

	HEATING	COOLING
HR/HE = d x g x k	l. _____ Btu/h	l. _____ Btu/h

STEPS 6-9 NEED ONLY BE COMPLETED IF A PROBLEM IS SUSPECTED.

6. Watts	ENERGY MONITOR	
	HEATING	COOLING
Volts:	m. _____ Volts	m. _____ Volts
Total Amps (Comp. + Blower)[3]:	n. _____ Amps	n. _____ Amps
Watts = m x n x 0.85:	o. _____ Watts	o. _____ Watts

7. Capacity

	HEATING	COOLING
Cooling Capacity = l - (o x 3.413): Heating Capacity = l + (o x 3.413):	p. _____ Btu/h	p. _____ Btu/h

8. Efficiency

	HEATING	COOLING
Cooling EER = p / o: Heating COP = p / (o x 3.413):	q. _____ Btu/h	q. _____ Btu/h

9. Superheat (S.H.)/Subcooling (S.C.)

	HEATING	COOLING
Suction Pressure:	r. _____ psi	r. _____ psi
Suction Saturation Temperature:	s. _____ °F	s. _____ °F
Suction Line Temperature:	t. _____ °F	t. _____ °F
S.H. = t - s	u. _____ °F	u. _____ °F
Head Pressure:	v. _____ psi	v. _____ psi
High Pressure Saturation Temp:	w. _____ °F	w. _____ °F
Liquid Line Temperature[4]:	x. _____ °F	x. _____ °F
S.C. = w - x	y. _____ °F	y. _____ °F

Software Version
ABC: _____
AXB: _____
IZ2: _____
T'STAT: _____

NOTES: [1] Steps 3-9 should be conducted with the hot water generator disconnected.

[2] Use 500 for pure water, 485 for methanol or Environol™. (This constant is derived by multiplying the weight of one gallon of water (8.34) times the minutes in one hour (60) times the specific heat of the fluid. Water has a specific heat of 1.0.

[3] If there is only one source of power for the compressor and blower, amp draw can be measured at the source wiring connection.

[4] Liquid line is between the coax and the expansion device in the cooling mode; between the air coil and the expansion device in the heating mode.

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.

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.

Service Parts List

Part Description		Dual Capacity Split Units				
		NDS026	**NDS038**	**NDS049**	**NDS064**	**NDS072**
Compressor	Compressor	34P640-01	34P641-01	34P642-01	34P643-01	34P644-01
	Run Capacitor	16P002-19	16P002-20	16P002-18	16P002-31	
	Sound Jacket	92P504A16				
	Power Harness	11P781-01				
	Solenoid Harness	11P782-02				
Refrigeration Components	Accumulator	36P509-02	36P509-01			
	Coax	62P594-01	62I54201	62P543B01		
	TXV	33P628-01		33P628-03	33P628-04	33P628-05
	Reversing Valve	33P506-04	33P503-05	33P526-04		
	Filter Dryer	36P500B01			36P500B02	
	Service Valve Suction	33P554B02	33P554B03		33P554B04	
	Service Valve Liquid	33P554B01			33P554B05	
Electrical	Contactor	13P004A03				
	2 Pole Screw Term. Block	12P500A01				
	ABC Board	17X553-16				
	AXB Board	17X557-17				
	ABC/AXB Comm. Cable	11P837-01				
	Circuit Breaker 5amp, 250V	19P583-01				
Sensors & Safeties	High Pressure Transduce Kit	SK5SHPT				
	Low Pressure Transducer Kit	SK5SLPT				
	Current Sensor	12P557-01				
	Thermistor Suction Line	12P555-05				
	Thermistor Liquid Line Heating	12P555-03				
	Thermistor EWT	12P560-01				
	Thermistor LWT	12P560-02				
	Freeze Protection Thermistor	12P505-09				
	High Pressure Switch	SKHPE600				
	Low Pressure Switch	SKLPE40				

Part numbers subject to change 3/7/17

Revision Guide

Pages:	Description:	Date:	By:
All	First Published	30 Oct 2013	DS
4, 9	Added FC2-GL Flow Center Option	16 June 2014	MA
Misc.	Updated for new Air Handler	10 Mar 2017	JM
13	Electronic Thermostat Installation	3 May 2017	JM

Smarter from the Ground Up™

Manufactured by
WaterFurnace International, Inc.
9000 Conservation Way
Fort Wayne, IN 46809
www.waterfurnace.com

Product: **5 Series 500RO11**
Type: Outdoor Split Geothermal Heat Pump
Size: 2-6 Ton Dual Capacity
Document: Installation Manual

PROUD MEMBER

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ANSI/AHRI/ASHRAE/ISO13256-1

ENERGY STAR PARTNER

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IM2504SN 05/17