Greensource CDi Series SM Model

Greensource

SM024 | SM036 | SM048 | SMO60 | SM070

BOSCH

Installation, Operation and Maintenance Manual

8-733-942-411 (2017/07)

CONTENTS

KEY TO SYMBOLS

Warnings

Warnings in this document are identified by a warning triangle printed against a grey background. Keywords at the start of the warning indicate the type and seriousness of the ensuing risk if measures to prevent the risk are not taken.

The following keywords are defined and can be used in this document:

- **DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION** indicates a hazardous situation which, if not avoided, could result in minor to moderate injury.
- **NOTICE** is used to address practices not related to personal injury.

Important Information

This symbol indicates important information where there is no risk to property or people.

SAFETY WARNINGS

WARNING: Installation and servicing of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service the equipment.

WARNING: Before performing service or maintenance operations on the system, turn off main power to the unit. Electrical shock could cause personal injury or death.

WARNING: When working on equipment, always observe precautions described in the literature, tags, and labels attached to the unit. Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing, and place a fire extinguisher close to the work area.

NOTICE: To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must be serviced only by technicians who meet local, state, and federal proficiency requirements.

NOTICE: All refrigerant discharged from this unit must be recovered WITHOUT EXCEPTION. Technicians must follow industry accepted guidelines and all local, state, and federal statutes for the recovery and disposal of refrigerants. If a compressor is removed from this unit, refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, refrigerant lines of the compressor must be sealed after it is removed.

NOTICE: To avoid equipment damage, DO NOT use these units as a source of heating or cooling during the construction process. Doing so may affect the unit's warranty. The mechanical components and filters will quickly become clogged with construction dirt and debris, which may cause system damage.

STANDARD PACKAGE

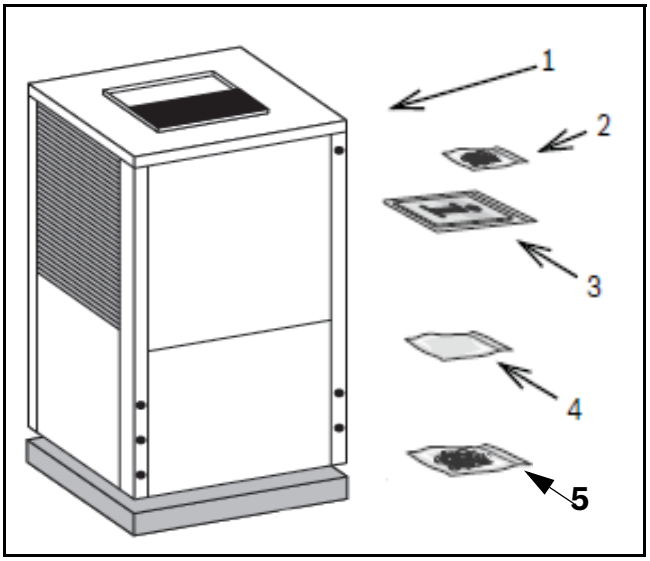


Figure # 1

[1] SM Series Water-to-Air Heat Pump
[2] Corner Caps Package (HZ units only)
[3] Installation and Operation Manual
[4] Hanging Bracket kit (HZ units only)
[5] Field Installed Swivel Fittings (VT and CF units only)

MODEL NOMENCLATURE

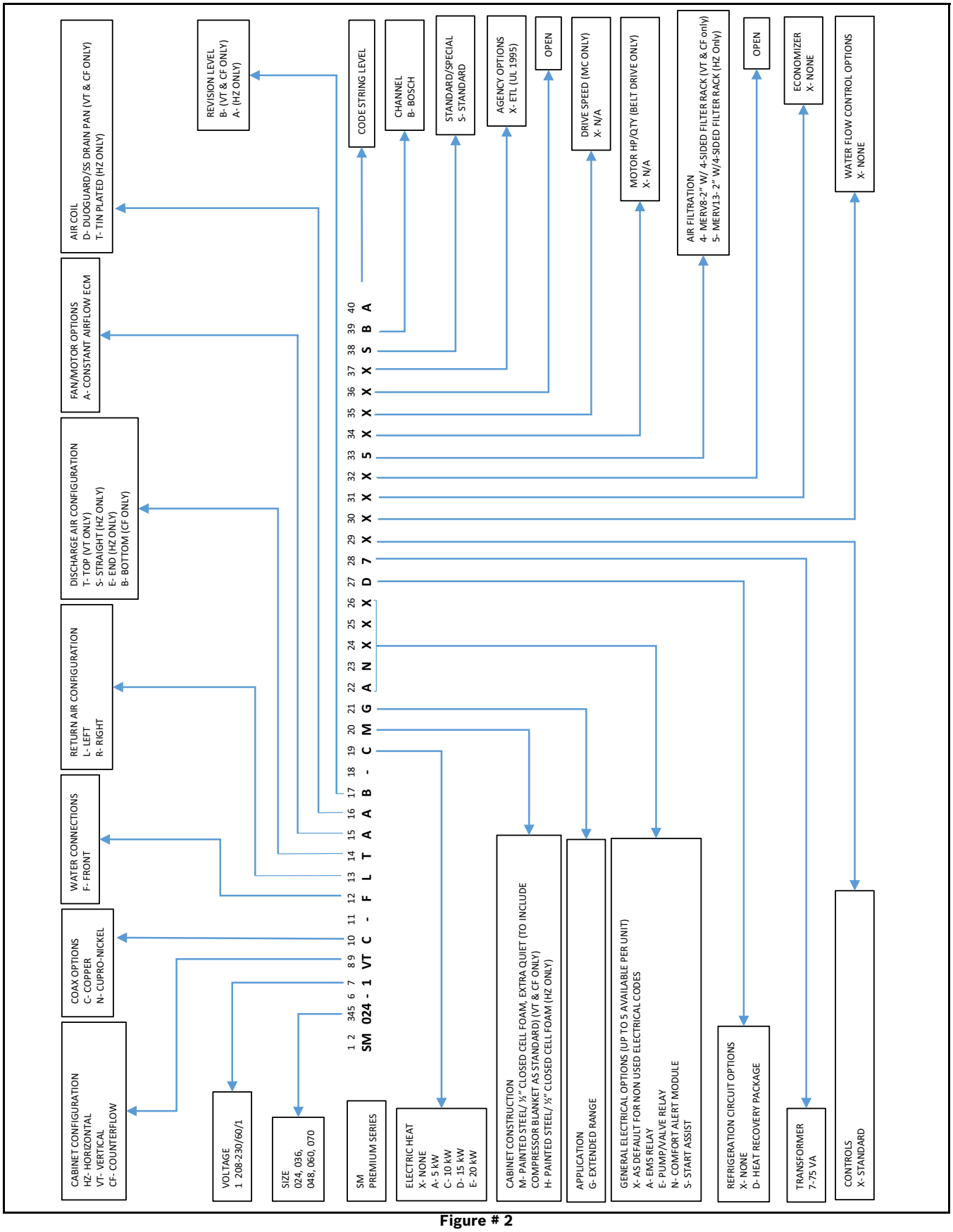


Figure # 2

GENERAL DESCRIPTION

SM Series Water-to-Air Heat Pumps provide the best combination of performance and efficiency available. All units are performance certified to American Heating and Refrigeration Institute (AHRI) ISO Standard 13256-1. All SM Water-to-Air Heat Pumps conform to UL1995 standard and are certified to CAN/CSA C22.2 No 236 by Intertek-ETL. The Water-to-Air Heat Pumps are designed to operate with entering fluid temperature between 20°F to 80°F in the heating mode and between 40°F to 110°F in the cooling mode for continuous operations.

Heat Pump operating under extreme conditions will have limitations on air/fluid flow rates and/or temperatures.

Please refer to Bosch SM series Engineering Submittal Sheet for detailed information on extreme operating conditions.

50° F Minimum Entering Water Temperature (EWT) is recommended for well water applications with sufficient water flow to prevent freezing. Antifreeze solution is required for all closed loop applications and EWT below 45°F. Cooling Tower/Boiler and Geothermal applications should have sufficient antifreeze solution to protect against extreme conditions and equipment failure. Frozen water coils are not covered under warranty. Other equivalent methods of temperature control are acceptable.

SM Series Water-to-Air Heat Pumps are available in Vertical (VT), Horizontal (HZ) and Counter-Flow (CF) configurations. HZ units can be field configured from end blow to straight or vice versa using a field installed accessory kit.

Several factory installed options are available: Electric Heat, Heat Recovery Package, Smart Start Assist, Auxiliary Pump Relay, and Comfort Alert Module. Electric Heat and Smart Start Assist are also available as field installed accessories. See Pg# 24 for more details.

Safety devices are built into each unit to provide the maximum system protection possible when properly installed and maintained. Each unit has an externally mounted LCD status display, allowing unit diagnosis without opening the cabinet.

Basic Horizontal unit layout and connections are shown in Figure #3. Refer to Dimensional Drawings for further detail, as well as Vertical and Counter Flow unit details. Pg# 55 through Pg# 58

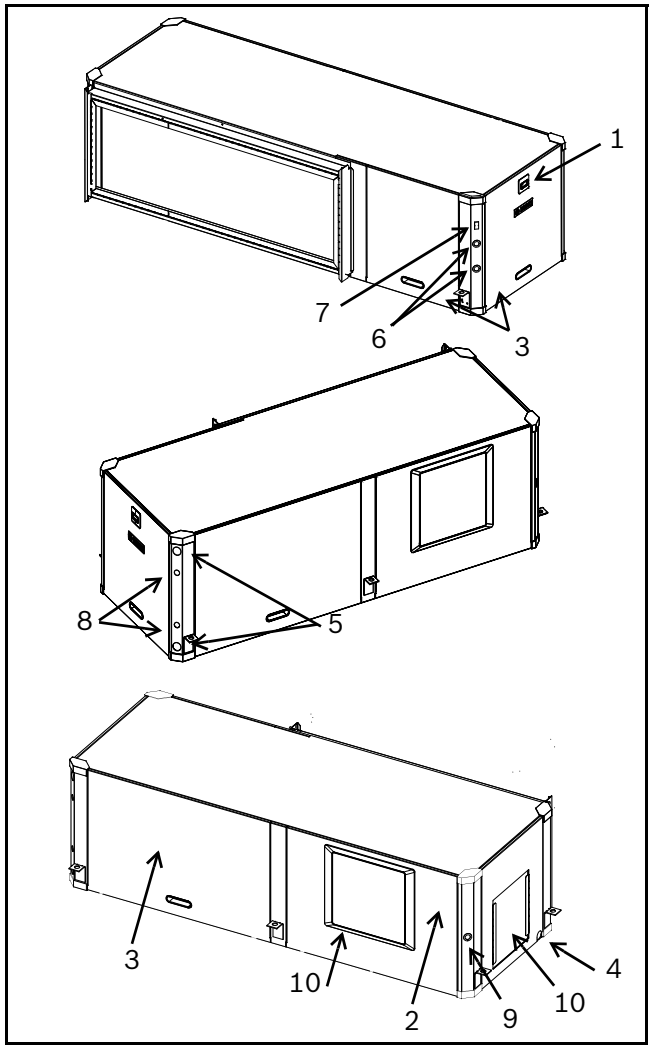


Figure # 3

[1] LED Unit Diagnostic Display
[2] Air handler access panel
[3] Condensing section access panel
[4] Condensate drain connection
[5] Water connection Swivel type (VT/CF-Field installed HZ factory installed)

Refer to piping on page #15

[6] Heat Recovery water connection (Optional)
[7] Heat Recovery disconnect switch (Optional)
[8] Electrical connection knockout
[9] Electric Heat electrical connection knockout (Optional)
[10] Blower outlet (Based on discharged air configuration)

MOVING AND STORAGE

If the equipment is not needed for immediate installation upon its arrival at the job site, it should be left in its shipping carton and stored in a clean, dry area. Units must only be stored or moved in the normal upright position as indicated by the “UP” arrows on each carton at all times.

NOTICE: Never lift or move units by filter racks, external piping or attached options/ accessories.

WARNING: Follow instructions for stacking limit for transit as well as storage as per unit packaging label.

INITIAL INSPECTION

Please inspect the product carefully for any defects or discrepancies.
Should you identify any issues, contact the Bosch Wholesaler / Distributor you purchased the unit from.

LOCATION

Locate the unit in an indoor area that allows easy removal of the filter and access panels, and has enough room for service personnel to perform maintenance or repair. Provide sufficient room to make fluid, electrical, and duct connection(s). If the unit is located in a confined space such as a closet, provisions must be made for return air to freely enter the face of unit’s air coil. On horizontal units, allow adequate room below the unit for a condensate drain trap and do not locate the unit above supply piping.
Service clearance for SM units up to 6 tons includes the following recommendations. 18” minimum, 24” optimum in front of the blower access panel for access to the blower and blower motor. 24” minimum, 36” optimum in front of the front access panel for access to electrical components, compressor, and service valves.

NOTICE: These units are not approved for outdoor installation; therefore, they must be installed inside the structure in a conditioned space. Do not locate in areas that are subject to freezing.

CONFIGURABILITY

HORIZONTAL CONFIGURABILITY

The Horizontal Configuration water source heat pump is designed to have a field configurable blower orientation: end blow and straight through.
An accessory kit is required to complete this conversion.

NOTICE: Discharge air configuration change is not possible on Heat Pumps equipped with Electric Heat Option.

Conversion Kit Part Numbers Required		
Part #	**Straight Through To End**	**End To Straight Through**
SM024 HZ	8733942424	8733942425
SM036/048 HZ	8733942426	8733942427
SM060/070 HZ	8733942428	8733942429

.(Figure#4 and #5)

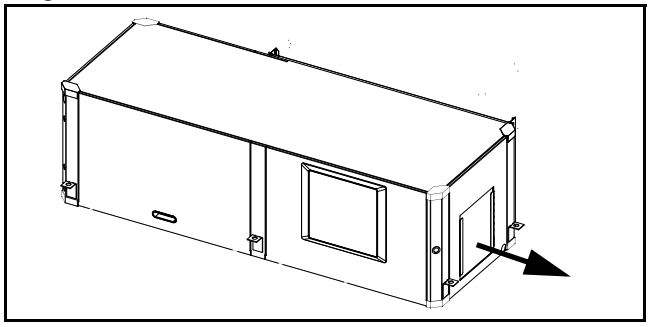


Figure # 4

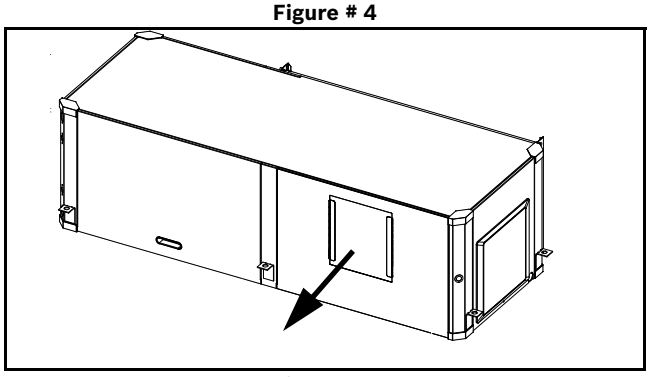


Figure # 5

Left-Hand and Right-hand Horizontal (HZ) units have different Blower Configuration instructions.
Left- Hand unit instructions refer to Pg#7 and Right-Hand unit instructions refer to Pg#9.

Internally mounted electric heat is only available in End Blow configuration.

Blower configuration changes should be done prior to unit being installed in the final location.

Required Tools

- 5/16" hex head driver
- 3/8" hex head driver
- 7/16" hex head driver
- Flathead screw driver
- Phillips screw driver
- 1/4” hex head driver
- Needle nose pliers
- 5/16”-1/4” ratchet wrench

Instructions - Left-Hand Unit (SM0**-1HZ-*L*-**)

1. Remove and retain end and side panels.(Figure #6)

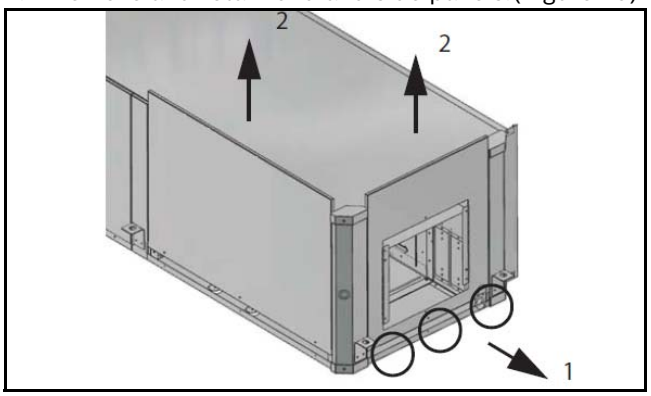


Figure # 6

2. Disconnect blower motor wiring and ground wire fastened to blower housing.(Figure#7)

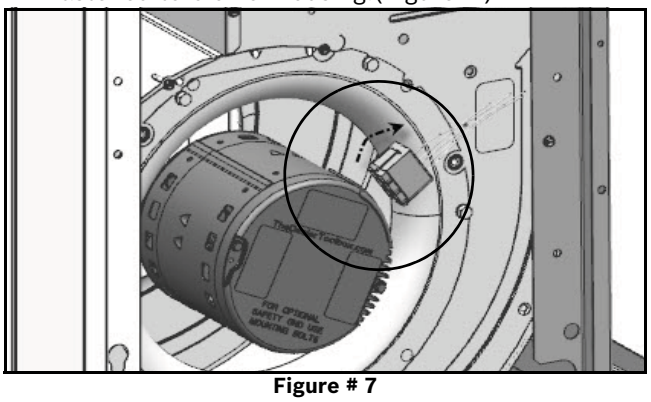


Figure # 7

3. Remove and retain bracket by removing (3) screws. (Figure #8)

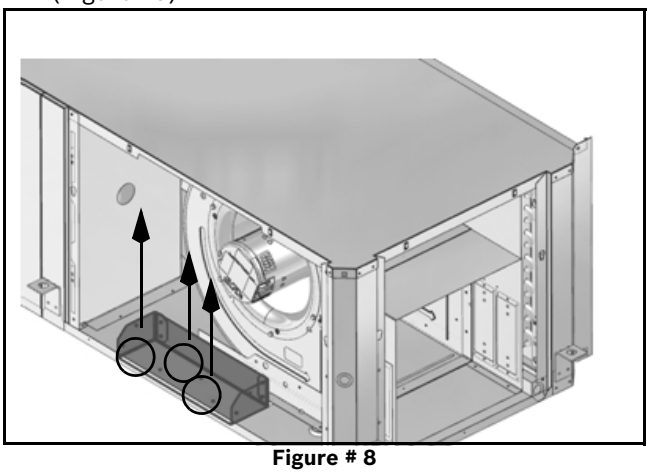


Figure # 8

4. Loosen blower assembly by removing (4) screws. (Figure #9)

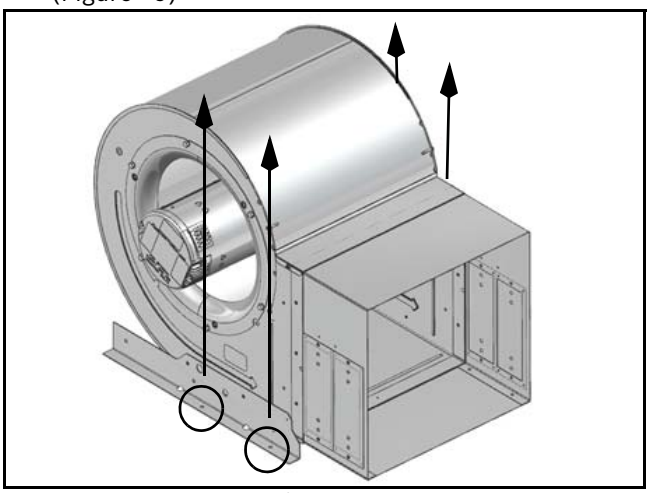


Figure # 9

5. Remove and retain bracket by removing (2) screws. (Figure #10)

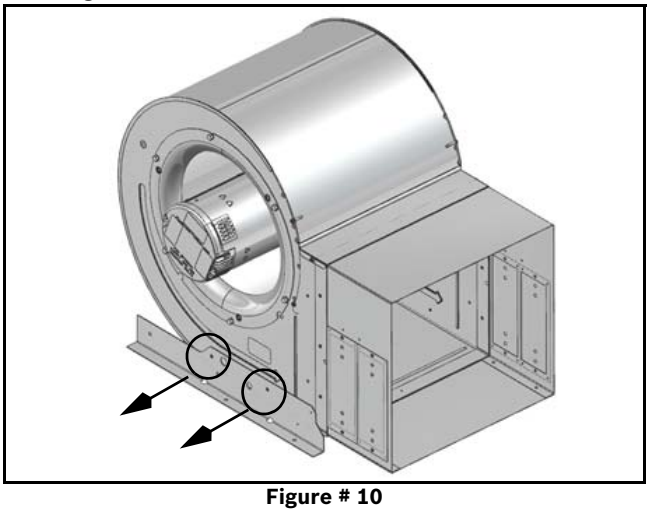


Figure # 10

6. Rotate the blower into its new position.(Figure#11)

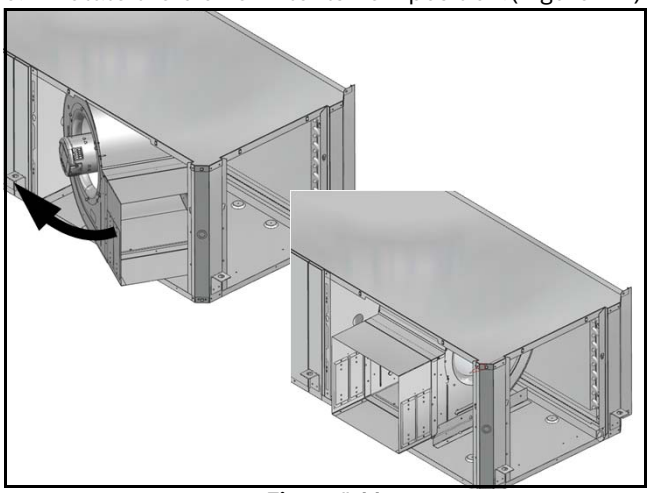


Figure # 11

7. Remove and retain remaining bracket by removing (2) screws. (Figure #12)

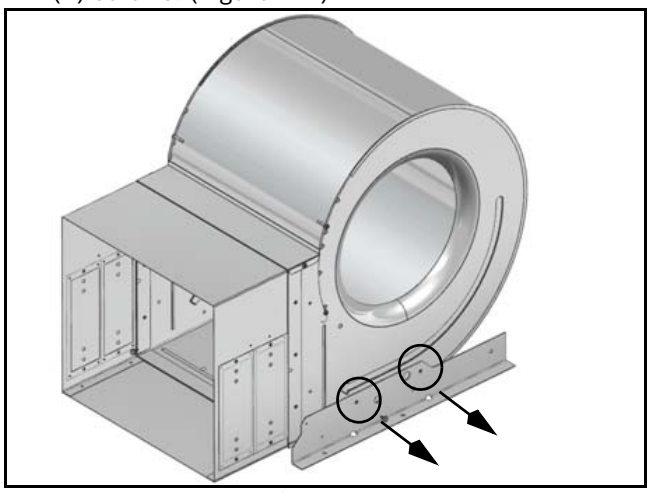


Figure # 12

8. Remove the blower assembly by sliding it forward. (Figure #13)

Unit top is notched to allow blower to slide through.

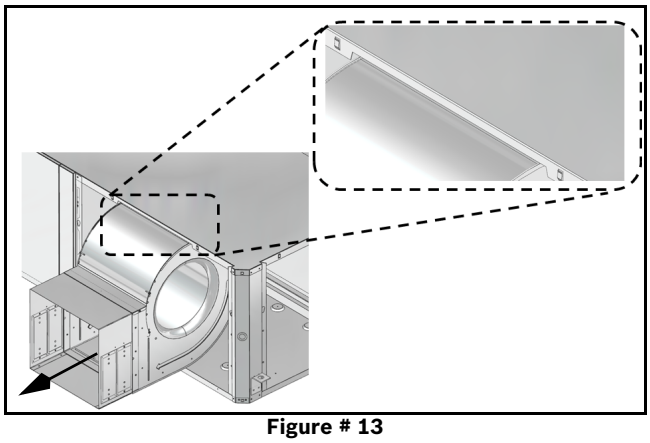


Figure # 13

9. Remove and discard blower collar by removing (8) screws. (Figure #14)

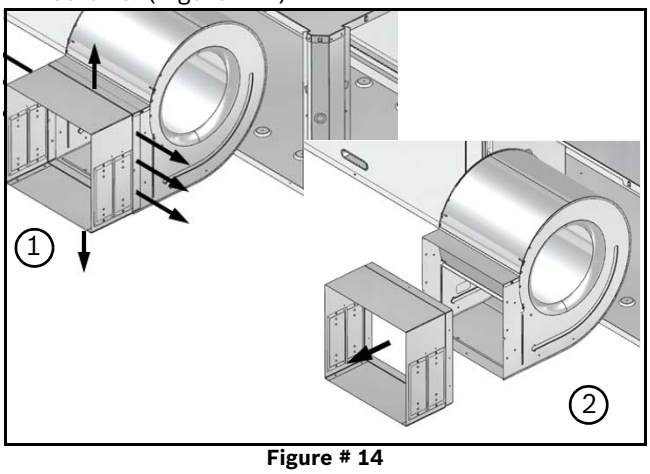


Figure # 14

10. Reorient the blower assembly 180 degree with blower “belly” down and slide back into the cabinet. (Figure #15)

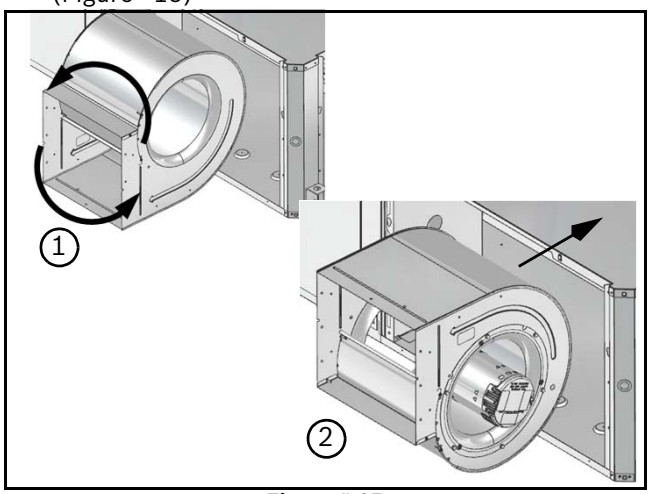


Figure # 15

11. Reinstall bracket in the new vertical position using (2) screws. (Figure #16)

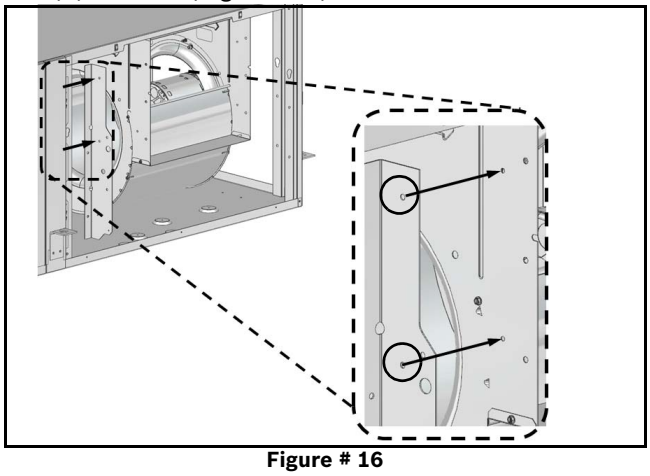


Figure # 16

12. Reinstall bracket removed in step (#3) using (3) screws in the same location. (Figure#17)

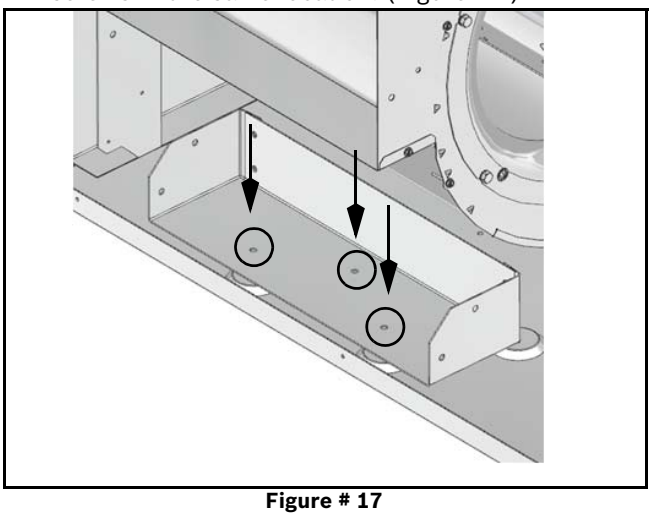


Figure # 17

13. Reinstall remaining bracket using (2) screws. (Figure#18)

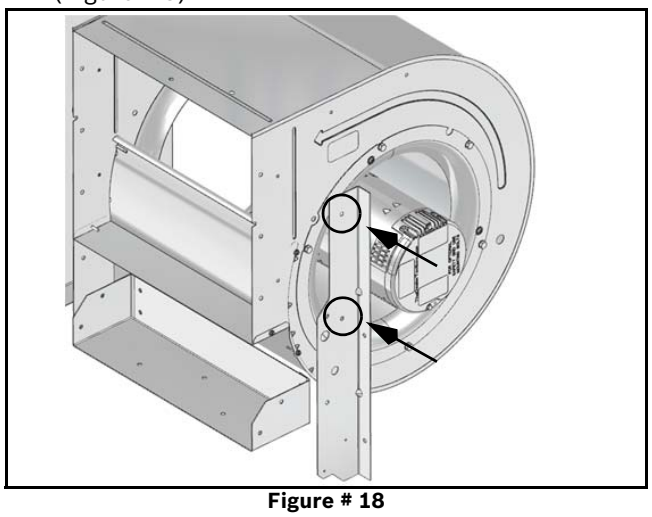


Figure # 18

14. Connect vertical and horizontal brackets by installing (4) screws. (Figure#19)

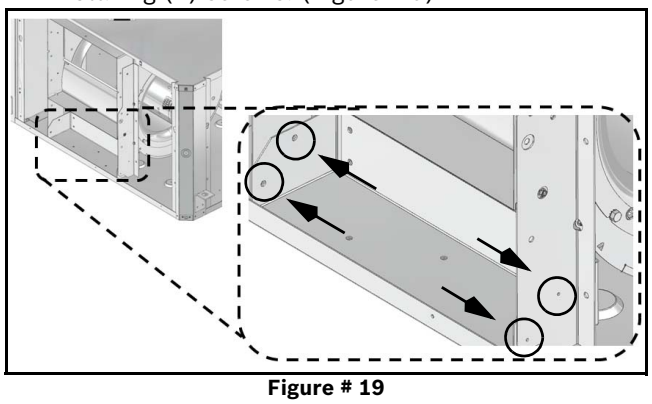


Figure # 19

15. Reconnect blower motor wiring and ground wire.
16. Install the new blower panel from the accessory kit.

Instructions - Right-Hand Unit (SM0**-1HZ-*R*-**)

1. Remove and retain end and side panels.(Figure#20)

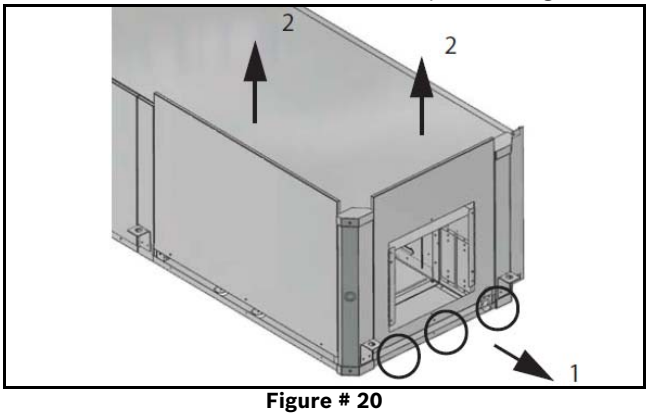


Figure # 20

2. Disconnect blower motor wiring and ground wire fastened to blower housing.(Figure#21)

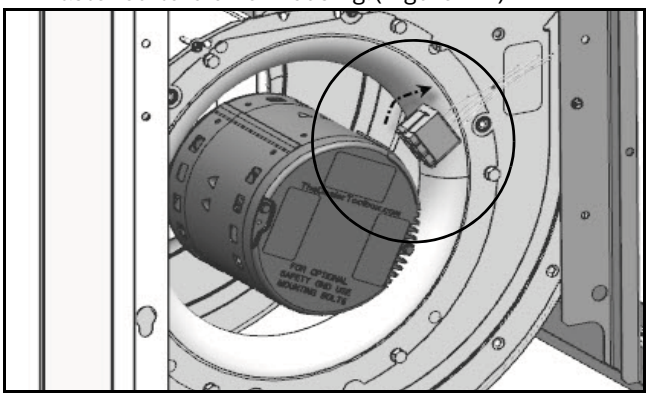


Figure # 21

3. Remove and retain (4) screws under the blower collar. (Figure #22)

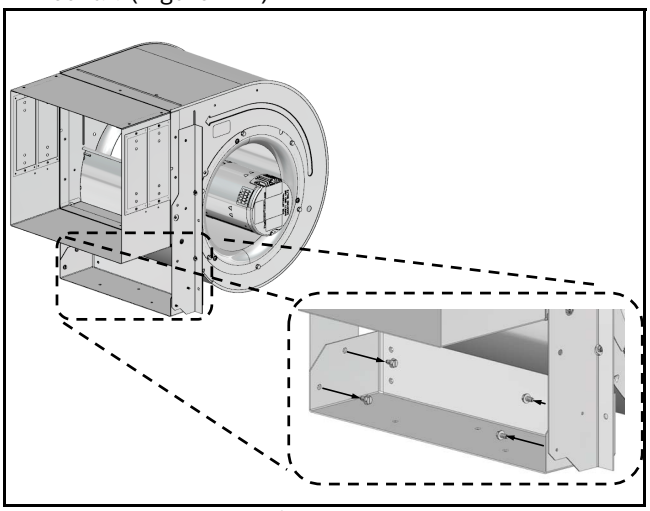


Figure # 22

NOTICE: Air coil is in close proximity to the blower. Air coil fins are easily damaged. Great care must be taken during this step to avoid coil damage. Shipping cardboard can be used as protection during blower removal and installation.

4. Slide blower assembly away from mounting bracket. (Figure #23)

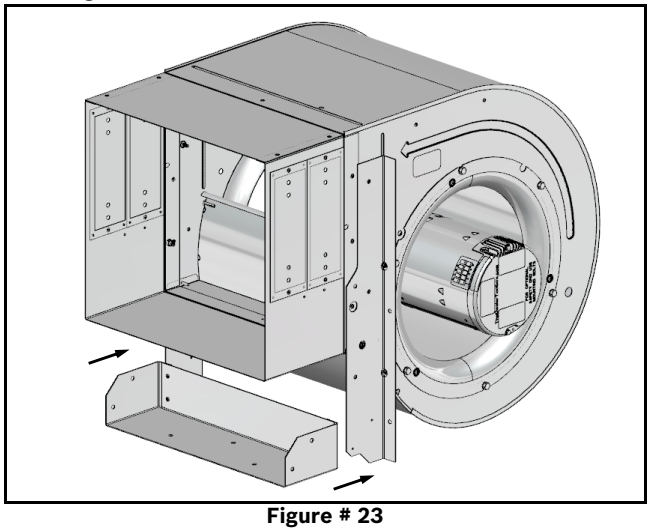


Figure # 23

5. Remove and retain (1) vertical bracket by removing (2) screws. (Figure #24)

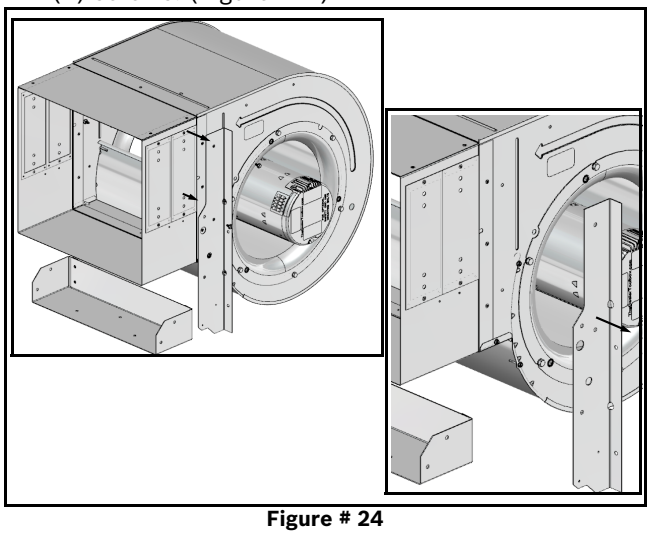


Figure # 24

6. Remove and discard horizontal blower bracket by removing (3) screws. (Figure #25)

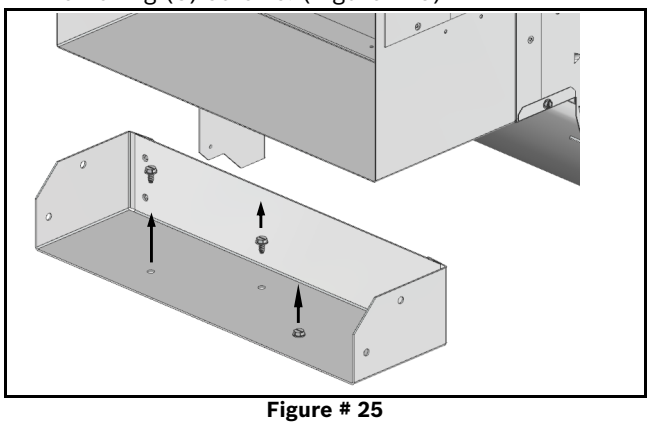


Figure # 25

7. Rotate the blower into its new position.(Figure#26)

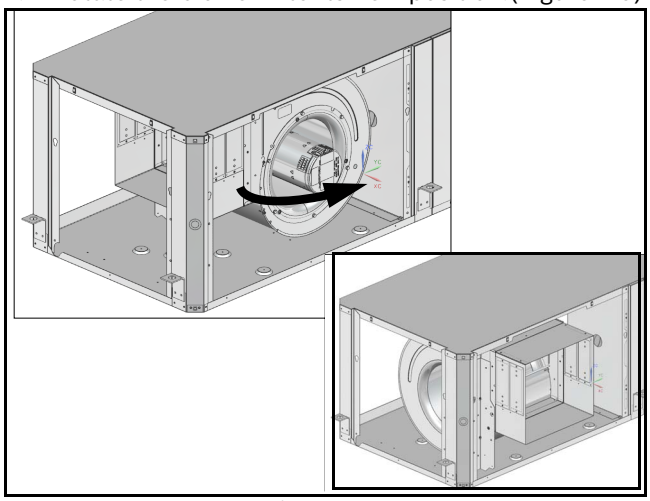


Figure # 26

8. Remove and retain remaining vertical blower bracket by removing (2) screws. (Figure #27)

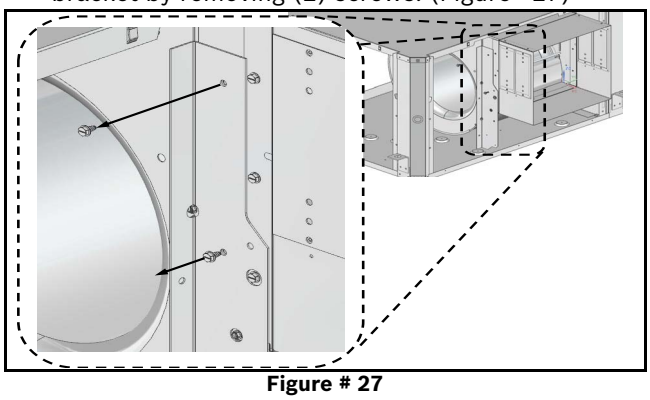


Figure # 27

9. Remove the blower assembly by sliding it forward. (Figure #28)

Unit top is notched to allow blower to slide through.

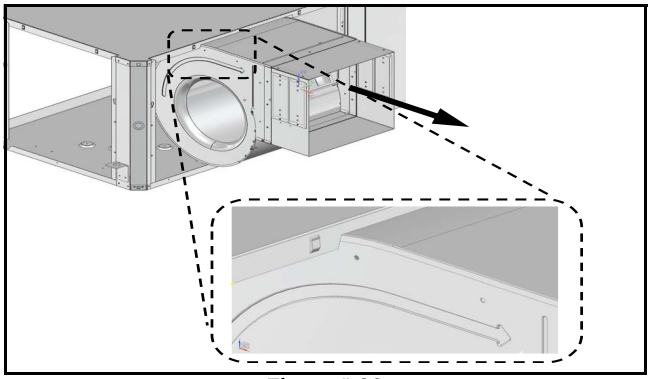


Figure # 28

10. Remove and discard blower collar by removing (8) screws. (Figure #29)

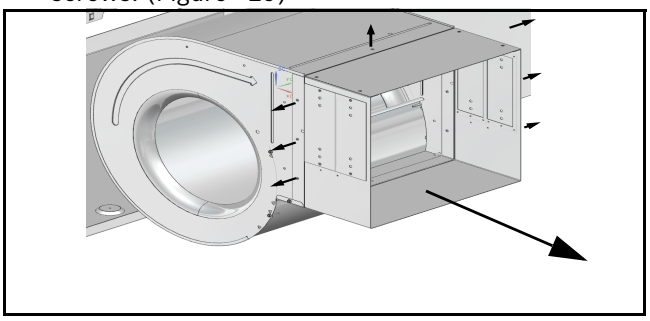


Figure # 29

11. Reorient the blower assembly 180 degree with blower “belly” up. (Figure #30)

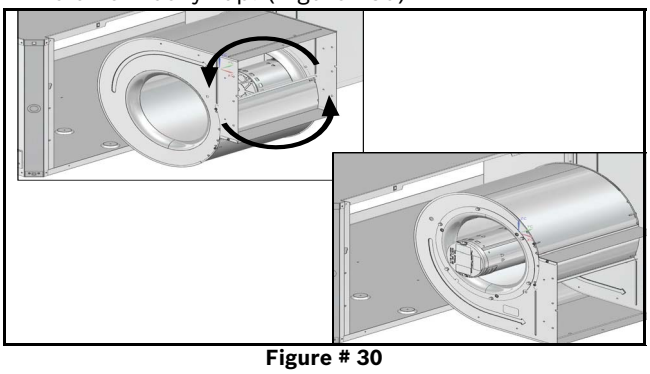


Figure # 30

12. Move the blower back into the cabinet. (Figure #31)

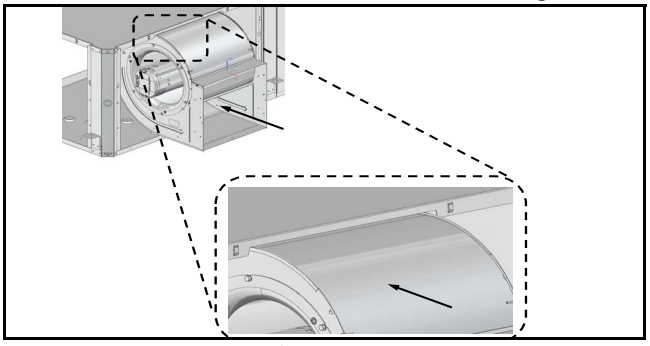


Figure # 31

13. Reinstall (2) vertical blower brackets in the new horizontal position using (4) screws. (Figure #32)

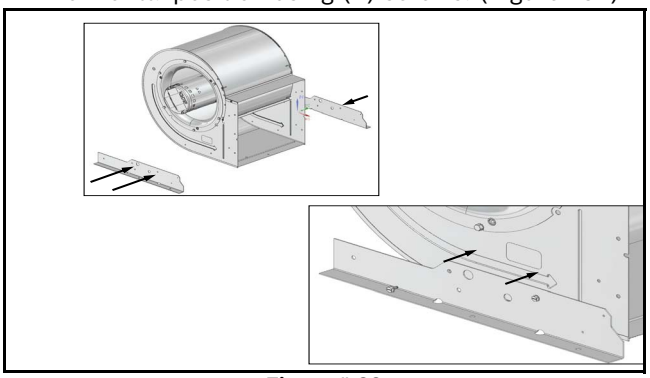


Figure # 32

14. Secure (2) the new horizontal blower brackets to the unit base using (4) screws. (Figure#33)

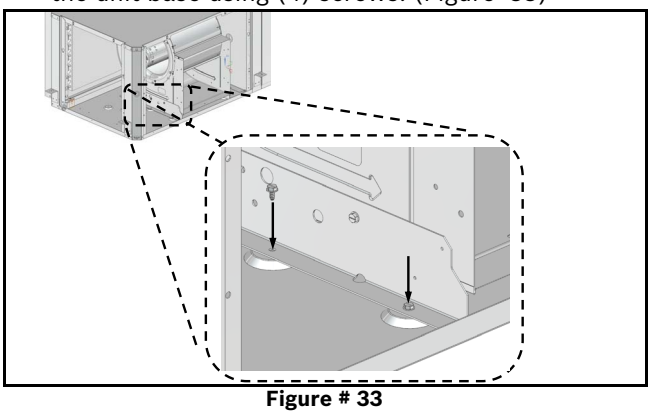


Figure # 33

15. Reconnect blower motor wiring and ground wire.
16. Install the new blower panel from the accessory kit.

COUNTERFLOW CONFIGURABILITY

The counterflow configuration water source heat pump is a dedicated down flow configuration. Available from the factory in left-hand and right-hand return air configurations.

VERTICAL CONFIGURABILITY

The vertical configuration water source heat pump is a dedicated up flow configuration. Available from the factory in left-hand and right-hand return air configurations.

RETURN AND DISCHARGE DUCT FLANGES

Return and discharge opening duct flanges are shipped unfolded. Flange bend lines are perforated allowing easy bending using standard sheet metal pliers or channel locks. (Figure #34)

Bend flanges one at a time.

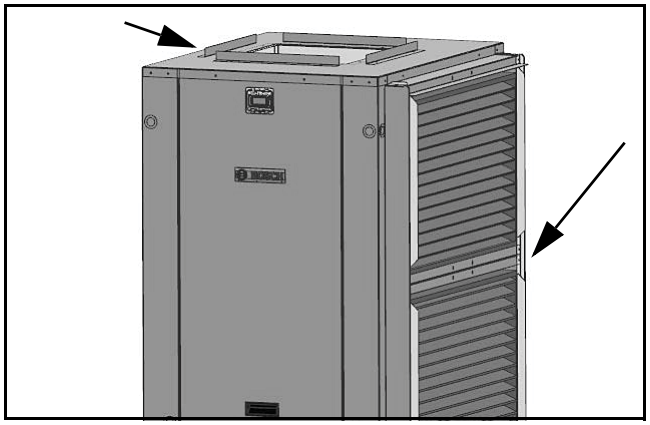


Figure # 34

PRE INSTALLATION UNIT PREPARATION

Corner Cap Installation Instructions

Only on HZ Units

Each corner cap is stamped with one of the following identifiers: T, T1,T2 B, B1, B2, A.

Corner cap installation is only applied to HZ units. VT and CF units do not require corner cap installation

1. Identify Letter code on each corner cap. (Figure#35)

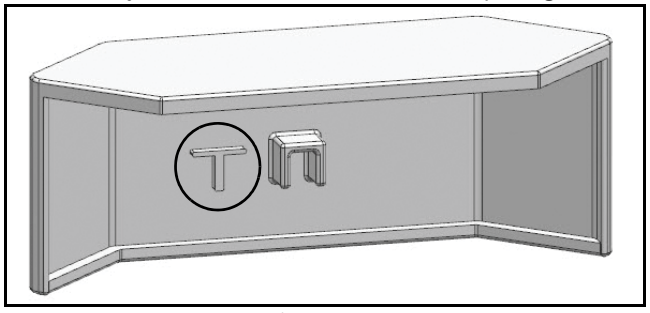


Figure # 35

2. In preparation for installation identify each corner cap location. (Figure#36)

Ensure cabinet surface is clean and free of debris to ensure proper corner cap Adhesion.

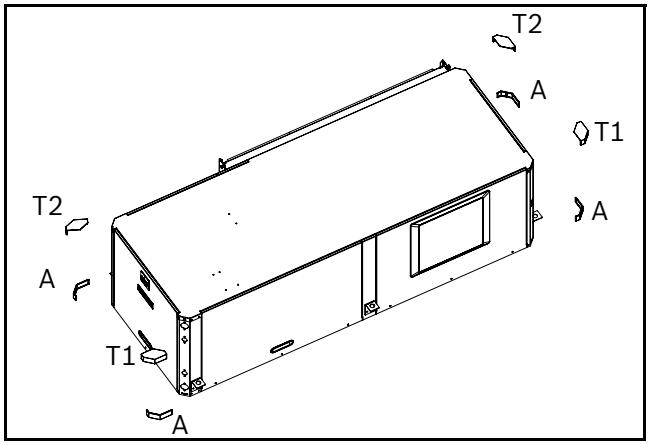


Figure # 36

3. Remove adhesive backing and install each corner cap. (Figure#37 and#38)

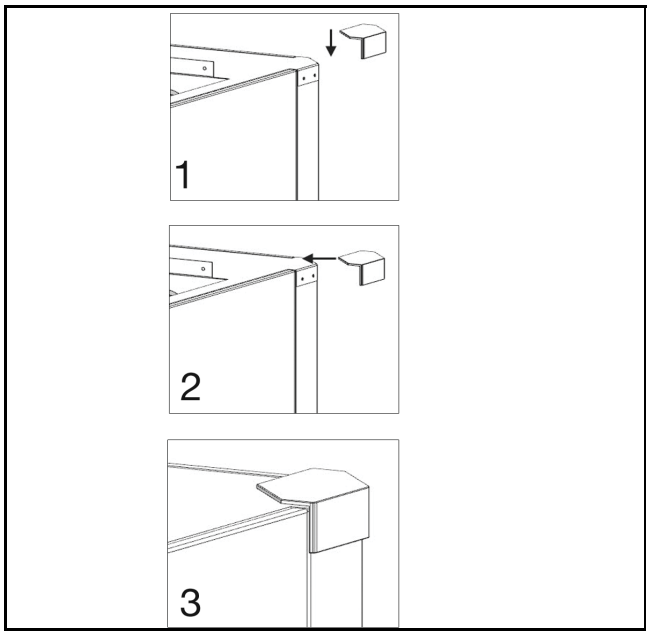


Figure # 37

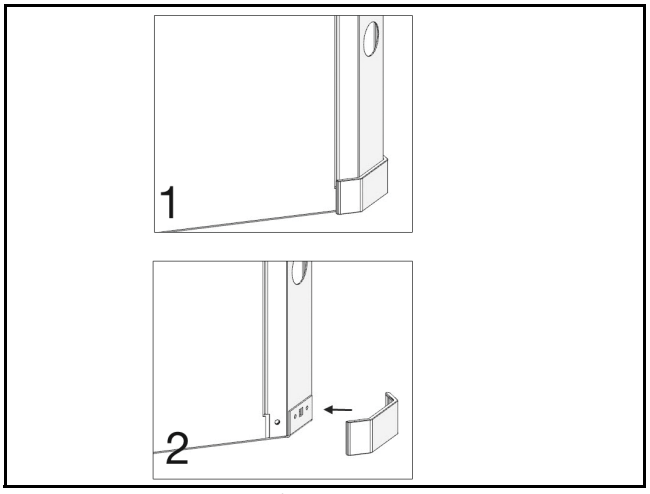


Figure # 38

MOUNTING VERTICAL UNITS

Vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to minimize vibration transmission to the building structure. It is not necessary to anchor the unit to the floor. (Figure #39).

Vibration absorbing pad not supplied with the unit.

On VT and CF units, the condensate drain pan is internally sloped. There is no internal P-Trap.

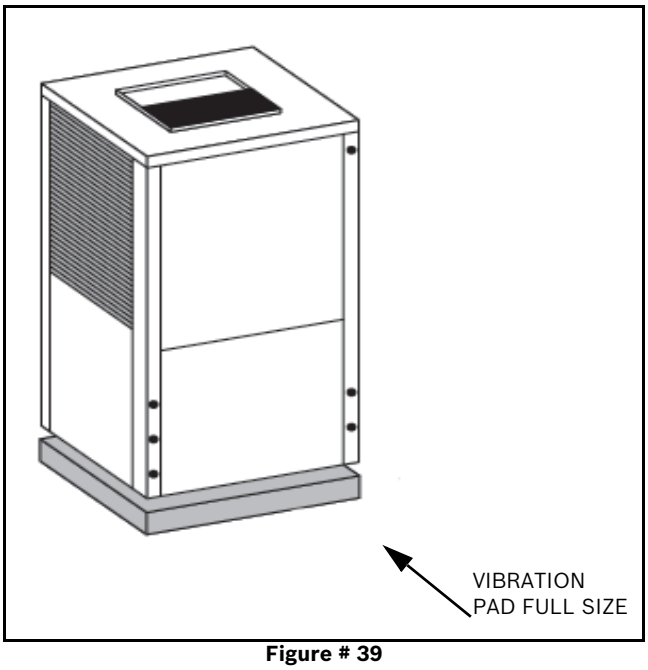


Figure # 39

NOTICE: Vertical Units should be mounted on a vibration absorbing pad. The unit must be supported along the entirety of its base.

MOUNTING HORIZONTAL UNITS

While horizontal units may be installed on any level surface strong enough to hold their weight, they are typically suspended above a ceiling by threaded rods. The manufacturer recommends these be attached to the unit corners by hanging bracket kits (supplied with horizontal units). The rods must be securely anchored to the ceiling. Refer to the hanging bracket assembly and installation instructions for details.

WARNING: Horizontal units installed above the ceiling must conform to all local codes. An auxiliary drain pan if required by code, should be at least four inches larger than the bottom of the heat pump.

Plumbing connected to the heat pump must not come in direct contact with joists, trusses, walls, etc. Some applications require an attic floor installation of the horizontal unit. In this case the unit should be set in a full size secondary drain pan on top of a vibration absorbing mesh.

The secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling.

The secondary drain pan is usually placed on a plywood base isolated from the ceiling joists by additional layers of vibration absorbing mesh. In both cases, a 3/4”drain connected to this secondary pan should be run to an eave at a location that will be noticeable.

If the unit is located in a crawl space, the bottom of the unit must be at least 4” above grade to prevent flooding of the electrical parts due to heavy rains.

HZ units condensate drain pan is NOT internally sloped.

NOTICE: Horizontal (HZ) units must be installed pitched approximately 1/4” towards the condensate drain connection in both directions to facilitate condensate removal. See Figure # 40

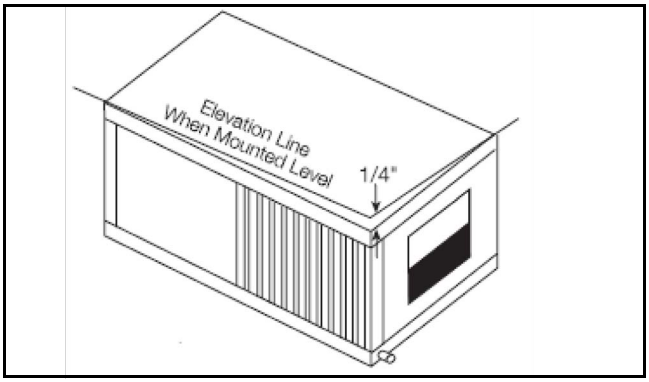


Figure # 40

HANGING BRACKET KIT

Installation Instructions

All horizontal units come with hanging bracket installation kit to facilitate suspended unit mounting using threaded rod.Hanging brackets are to be installed as shown in Figure #41.

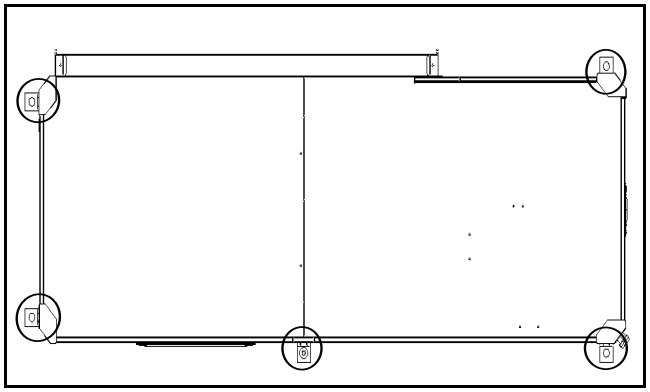


Figure # 41

This kit includes the following:
(5) Brackets
(5) Rubber Vibration isolators
(8) Screws #10x1/2 (not used for these models)
(10) Bolts 1/4-28x12” Hex bolt

The following are needed and are to be field provided:
Threaded rod (3/8“ max dia)
Hex nuts
Washers (1-3/4“ min O.D.)

1. Remove and discard factory provided screws from locations where hanging brackets will be installed shown in Figure #42

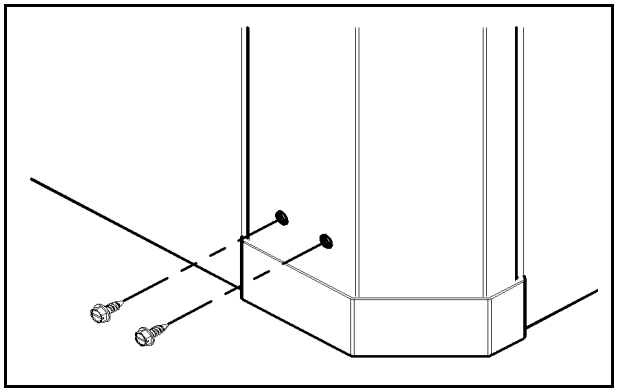


Figure # 42

2. Mount 5 brackets to unit corner post using the Bolts provided in the kit as shown on Figure # 43

WARNING: Do not re-use screws removed from the unit on step 1 to mount the hanging brackets to the unit.

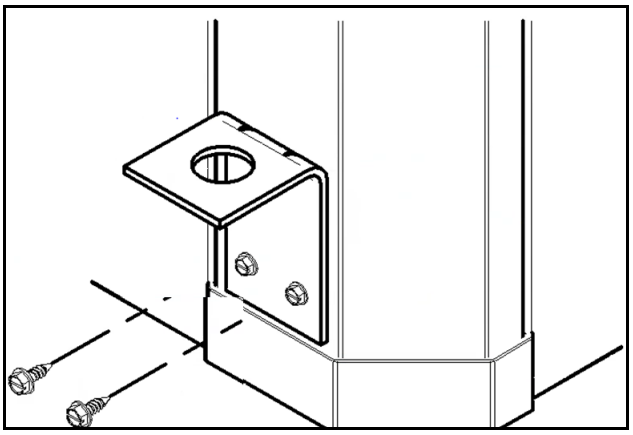


Figure # 43

WARNING: Follow all applicable codes and requirements when hanging this unit, selecting threaded rod material, etc.

3. Install rubber grommet onto the brackets as shown in Figure # 44

4. Hang the unit and assemble the field provided threaded rod, nuts and washers on to the brackets as shown in Figure # 44

WARNING: Rods must be securely anchored to the ceiling

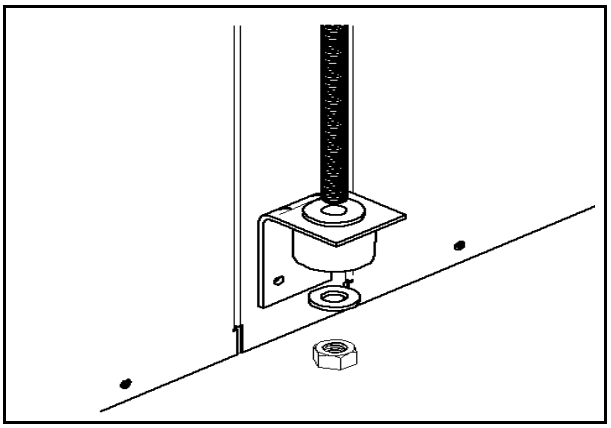


Figure # 44

CONDENSATE DRAIN

A drain line must be connected to the heat pump and pitched away from the unit a minimum of 1/8” per foot to allow the condensate to flow away from the unit.
This connection must be in conformance with local plumbing codes. A trap must be installed in the condensate line to ensure free condensate flow.
A vertical air vent is sometimes required to avoid air pockets. The length of the trap depends on the amount of positive or negative pressure on the drain pan. A second trap must not be included.(Figure # 45)

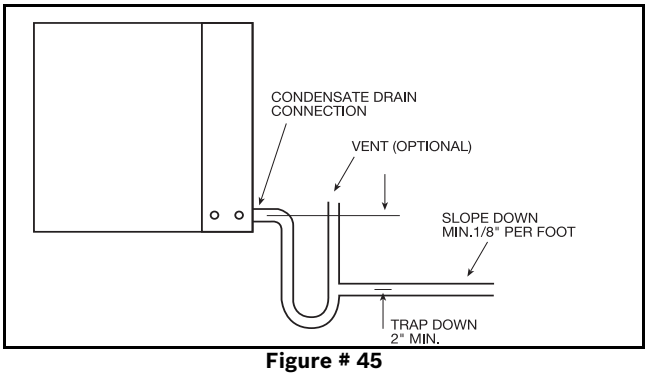


Figure # 45

DUCT SYSTEM

A supply air outlet collar and return air duct flange are provided on all units to facilitate duct connections.

Supply air duct and return air duct flanges are shipped unfolded with the unit.

Fold the duct flange outwards along the perforated line. Refer to unit dimensional drawings for physical dimensions of the collar and flange. (Pg#58 to Pg#61)
A flexible connector is recommended for supply and return air duct connections on metal duct systems. All metal ducting should be insulated with a minimum of one inch duct insulation to avoid heat loss or gain and prevent condensate forming during the cooling operation. Application of the unit to uninsulated duct work is not recommended as the unit’s performance will be adversely affected.

NOTICE: Do not connect discharge ducts directly to the blower outlet.

The factory provided air filter must be removed when using a filter back return air grill. The factory filter should be left in place on a free return system.
If the unit will be installed in a new installation which includes new duct work, the installation should be designed using current ASHRAE procedures for duct sizing. If the unit is to be connected to existing duct work, a check should be made to assure that the duct system has the capacity to handle the air required for the unit application. If the duct system is too small, larger duct work should be installed.
Check for existing leaks and repair.
The duct system and all diffusers should be sized to handle the designed air flow quietly. To maximize sound attenuation of the unit blower, the supply and return air plenums should be insulated. There should be no direct straight air path thru the return air inlet into the heat pump. The return air inlet to the heat pump must have at least one 90 degree turn away from the space return air grille. If air noise or excessive air flow are a problem, the blower speed can be changed to a lower speed to reduce air flow.

PIPING

Supply and return piping must be as large as the unit connections on the heat pump (larger on long runs).

NOTICE: Never use flexible hoses of a smaller inside diameter than that of the fluid connections on the unit.

SM units are supplied with either a copper or optional cupro-nickel condenser. Copper is adequate for ground water that is not high in mineral content.

Proper testing is recommended to assure the well water quality is suitable for use with water source equipment. When in doubt, use cupro-nickel.

In conditions anticipating moderate scale formation or in brackish water, a cupro-nickel heat exchanger is recommended.
Refer to the water quality table on pg #16.
Both the entering and leaving water lines will sweat if subjected to low water temperature. These lines should be insulated to prevent damage from condensation. All manual flow valves used in the system must be ball valves. Globe and gate valves must not be used due to high pressure drop and poor throttling characteristics.

NOTICE: Never exceed the recommended water flow rates as serious damage or erosion of the water-to-refrigerant heat exchanger could occur.

Always check carefully for water leaks and repair appropriately. Units are equipped with swivel female pipe thread fittings. Swivel fittings are used in typical residential installation where water pressure ratings are below 125 psi. For higher pressure ratings which are typical to commercial installation, swivel fittings MUST not be used. (VT, CF Swivel shipped loose, HZ factory brazed). Consult unit dimensional drawings. (Pg#58 through Pg#61)

Pipe thread sealer should be used when connecting water piping connections to the units to ensure against leaks and possible heat exchanger fouling.

NOTICE: Water side pressure rating is 450 psi for FPT fittings and 125 psi for field or factory installed swivel fittings.

NOTICE: Do not overtighten the connections.

Flexible hoses should be used between the unit and the rigid system to avoid possible vibration. Ball valves should be installed in the supply and return lines for unit isolation and unit water flow balancing.

WATER QUALITY

Table 1: Water Quality

POTENTIAL PROBLEM	Water Characteristic	Acceptable Value	
		Copper	Cupro-Nickel
	pH (Acidity/Alkalinity)	7-9	7-9
SCALING	Hardness (CaCO3, MgCO3)	< 350 ppm	< 350 ppm
	Ryznar Stability Index	6.0 - 7.5	6.0 - 7.5
	Langelier Saturation Index	-0.5 - +0.5	-0.5 - +0.5
CORROSION	Hydrogen Sulfide (H2S)	< 0.5 ppm *	10-50 ppm
	Sulfates	< 125 ppm	< 125 ppm
	Chlorine	< 0.5 ppm	< 0.5 ppm
	Chlorides	< 20 ppm	< 150 ppm
	Carbon Dioxide	< 50 ppm	< 50 ppm
	Ammonia	< 2 ppm	< 2 ppm
	Ammonia Chloride	< 0.5 ppm	< 0.5 ppm
	Ammonia Nitrate	< 0.5 ppm	< 0.5 ppm
	Ammonia Hydroxide	< 0.5 ppm	< 0.5 ppm
	Ammonia Sulfate	< 0.5 ppm	< 0.5 ppm
	Dissolved Solids	< 1,000 ppm	< 1,500 ppm
IRON FOULING	Iron (Fe2+ Iron Bacteria Potential)	< 0.2 ppm	< 0.2 ppm
	Iron Oxide	< 1 ppm	< 1 ppm
EROSION	Suspended Solids	< 10 ppm, < 600 µm size **	< 10 ppm, < 600 µm size **
	Maximum Water Velocity	6 ft/sec	6 ft/sec

* No “rotten egg” smell present at < 0.5 ppm H2S.

** Equivalent to 30 mesh strainer

ELECTRICAL

Refer to electrical component box layout. (Figure #46)

WARNING: Field wiring must comply with local and national electric codes.

WARNING: Power to the unit must be within the operating voltage range indicated on the unit nameplate or on the performance data sheet.

NOTICE: Operation of unit on improper line voltage or with excessive phase imbalance will be hazardous to the unit, constitutes abuse and may void the warranty.

Properly sized fuses or HACR circuit breakers must be installed for branch circuit protection. See unit nameplate for maximum fuse or breaker size.
The unit is provided with a concentric knock-out for attaching common trade sizes of conduit, route power supply wiring through this opening. Always connect the ground lead to the grounding lug provided in the control box and power leads to the line side of compressor contactor as indicated on the wiring diagram Pg#55 through Pg#57).

Units supplied with internal electric heat require two (2) separate power supplies:

1) Unit compressor

2) Electric Heat, blower motor and control circuit.

Refer to the ELECTRIC HEATER PACKAGE OPTION section and Pg#55 through Pg#57 for wiring diagrams. See data plate for minimum circuit ampacities and maximum fuse/breaker sizing.

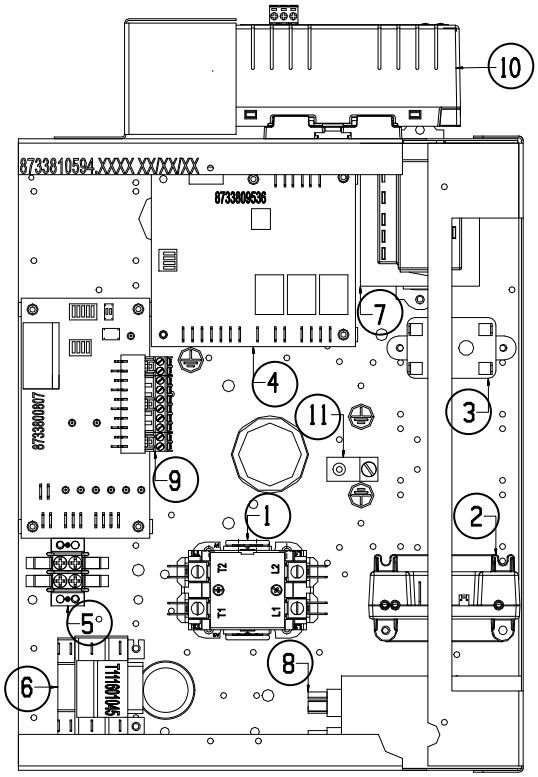


Figure # 46 Ebox Layout

[1] Compressor contactor
[2] Comfort Alert Module (Option)
[3] Energy Management Relay (Option)
[4] UPM
[5] Terminal Block
[6] Pump Valve Relay
[7] Transformer
[8] Capacitor
[9] ECM Board
[10] Smart Start Assist (Option)
[11] Ground Lug

Safety Devices and the UPM Controller

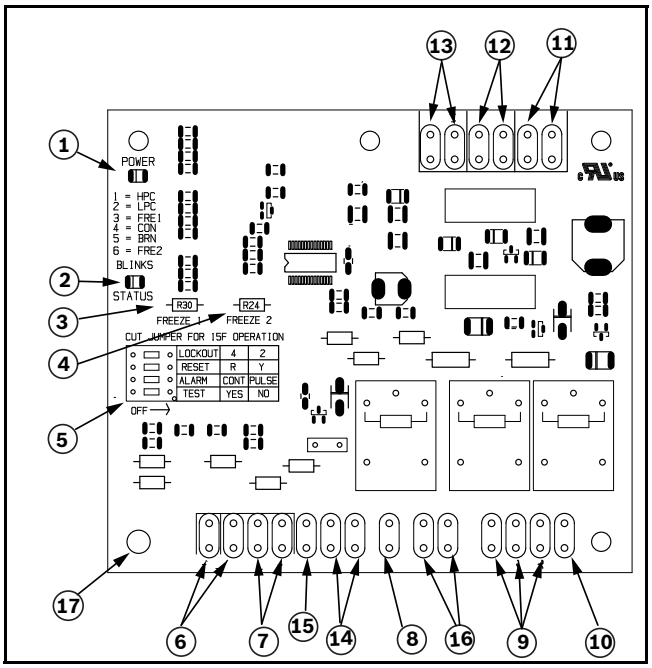


Figure # 47

[1] Board Power Indicator
[2] UPM Status LED Indicator
[3] Water Coil Freeze Protection Temperature Selection [R30]
[4] Air Coil Freeze Protection Temperature Selection
[5] UPM Board Settings
[6] Water Coil Freeze Connection (Freeze 1)
[7] Air Coil Freeze Connection (Freeze 2)
[8] LCD Unit Display Connection
[9] 24VAC Power Input
[10] Compressor Contact Output
[11] High Pressure Switch Connection
[12] Call for Compressor Y1
[13] Low Pressure Switch Connection
[14] 24VAC Power Common
[15] Condensate Overflow Sensor
[16] Dry Contact
[17] UPM Ground Standoff

If the unit is being connected to a thermostat with a malfunction light, this connection is made at the unit malfunction output or relay. Refer to Figure #46

If the thermostat is provided with a malfunction light powered off of the common (C) side of the transformer, a jumper between “R” and “COM” terminal of “ALR” contacts must be made.

If the thermostat is provided with a malfunction light powered off of the hot (R) side of the transformer, then the thermostat malfunction light connection should be connected directly to the (ALR) contact on the unit’s UPM board.

Each unit is provided with a factory installed Unit Protection Module that controls the compressor operation and monitors the safety controls that protect the unit.
Safety controls include the following:

- High pressure switch located in the refrigerant discharge line and wired across the HPC terminals on the UPM.
- Low pressure switch located in the unit refrigerant suction line and wired across terminals LPC1 and LPC2 on the UPM.

UPM Board Dry Contacts are Normally Open (NO)

- Water side freeze protection sensor, mounted close to condensing water coil, monitors refrigerant temperature between condensing water coil and thermal expansion valve. If temperature drops below or remains at freeze limit trip for 30 seconds, the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit trip is 26°F, however this can be changed to 15°F by cutting the R30 or Freeze1 resistor located on top of DIP switch SW1 (Refer to Figure #47, item [3] for resistor location), Refer to Figure #48 for sensor location.

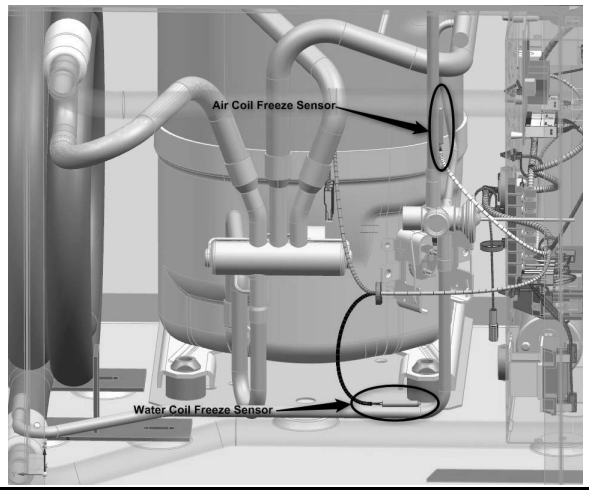


Figure # 48

NOTICE: If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze1 R30 resistor set to 26°F in order to shut down the unit at the appropriate leaving water temperature and protect your heat pump from freezing.

- Evaporator freeze protection sensor, mounted after the thermal expansion device and the evaporator, monitors refrigerant temperature between the evaporator coil and thermal expansion valve. If temperature drops below or remains at freeze limit trip for 30 seconds, the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit trip is 26°F. (Figure#49)

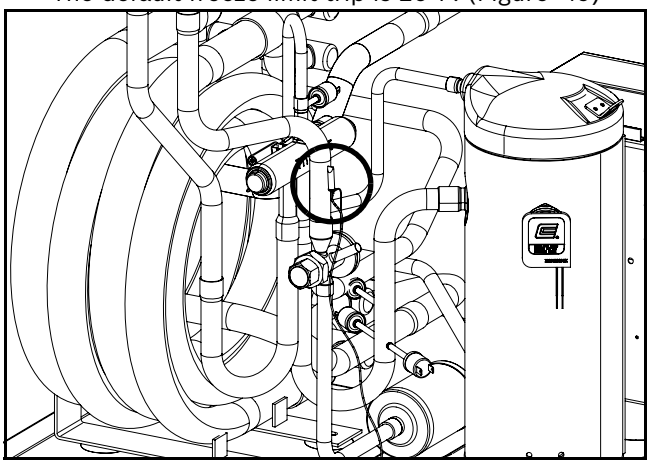


Figure # 49

- The condensate overflow protection sensor is located in the drain pan of the unit and connected to the 'COND' terminal on the UPM board. (Figure #49)

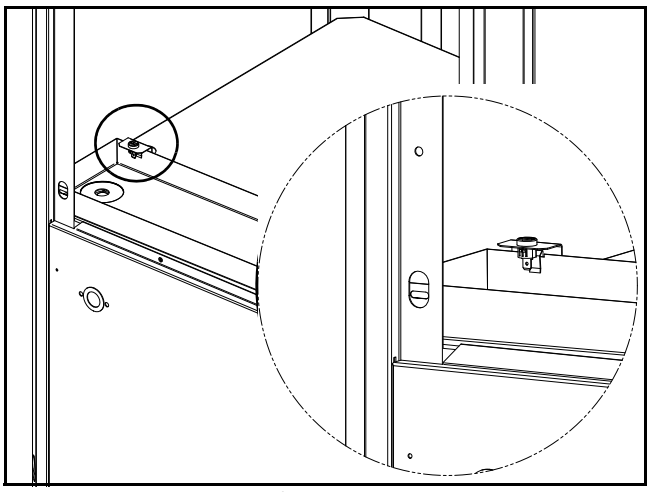


Figure # 50

UPM Board Factory Default Settings	
TEMP	26°F
LOCKOUT	2
RESET	Y
ALARM	PULSE
TEST	NO

UPM DIP SWITCH DEFAULT POSITION			
	lockout	4	2
	reset	R	Y
	alarm	Cont	pulse
	test	yes	no

The UPM Board includes the following features:

- **ANTI-SHORT CYCLE TIMER:** 5 minute delay on break timer to prevent compressor short cycling.
- **RANDOM START:** Each controller has an unique random start delay ranging from 270 to 300 seconds on initial power up to reduce the chance of multiple unit simultaneously starting at the same time after power up or after a power interruption, thus avoiding creating large electrical spike.
- **LOW PRESSURE BYPASS TIMER:** If the compressor is running and the low pressure switch opens, the controller will keep the compressor ON for 120 seconds. After 2 minutes if the low pressure switch remains open, the controllers will shut down the compressor and enter a soft lockout. The compressor will not be energized until the low pressure switch closes and the anti-short cycle time delay expires. If the low pressure switch opens 2-4 times in 1 hour, the unit will enter a hard lockout. In order to exit hard lockout, power to the unit would need to be reset.
- **BROWNOUT/SURGE/POWER INTERRUPTION PROTECTION:** The brownout protection in the UPM board will shut down the compressor if the incoming power falls below 18 VAC. The compressor will remain OFF until the voltage is above 18 VAC and ANTI-SHORT CYCLE TIMER (300 seconds) times out. The unit will not go into a hard lockout.

- **MALFUNCTION OUTPUT:** Alarm output is Normally Open (NO) dry contact. If pulse is selected the alarm output will be pulsed. The fault output will depend on the dip switch setting for "ALARM". If it is set to "CONST", a constant signal will be produced to indicate a fault has occurred and the unit requires inspection to determine the type of fault. If it is set to "PULSE", a pulse signal is produced and a fault code is detected by a remote device indicating the fault. See L.E.D Fault Indication below for blink code explanation. The remote device must have a malfunction detection capability when the UPM board is set to "PULSE".

If 24 VAC output is needed, R must be wired to ALR-COM terminal; 24 VAC will be available o the ALR-OUT terminal when the unit is in the alarm condition.

- **DISPLAY OUTPUT:** The Display output is a pulse output connected to the Unit Diagnostic Display (UDD) and it pulses 24VAC when the unit is in an lockout alarm condition.
- **TEST DIP SWITCH:** A test dip switch is provided to reduce all time delays settings to 10 seconds during troubleshooting or verification of unit operation.

NOTICE: Operation of unit in test mode can lead to accelerated wear and premature failure of components. The "TEST" switch must be set back to "NO" after troubleshooting/servicing.

- **FREEZE SENSOR:** The default setting for the freeze limit trip is 26°F (sensor number 1); however this can be changed to 15°F by cutting the R30 resistor located on top of the DIP switch SW1. The default setting for the freeze limit trip is 26°F (sensor number 1); however this can be changed to 15°F by cutting the R24 resistor located on top of the DIP switch SW1. Since freeze sensor 2 is dedicated to monitor the evaporator coil it is recommended to leave the factory default setting on the board

.

NOTICE: Do not cut freeze sensor 2

The UPM controller will constantly monitor the refrigerant temperature with the sensor mounted closer to the condensing water coil between the thermal expansion valve and water coil. If temperature drops below or remains at the freeze limit trip for 30 seconds, the controller will shut the compressor down and enter into a soft lockout condition. Both the status LED and the Alarm contact will be active. The LED will flash (three (3) times) the code associated with this alarm condition. If this alarm occurs 2 times (or 4 if Dip switch is set to 4) within an hour the UPM controller will enter into a hard lockout condition. Sensor number 2 will constantly monitor the refrigerant temperature with the sensor mounted close to the evaporator between the thermal expansion valve and evaporator coil as shown in Figure #5. If temperature drops below or remains at the freeze limit trip for 30 seconds, the controller will shut the compressor down and enter into a soft lockout condition. Both the status LED and the Alarm contact will be active. The LED will flash (six (6) times) the code associated with this alarm condition. If this alarm occurs 2 times (or 4 if Dip switch is set to 4) within an hour the controller will enter into a hard lockout condition.

NOTICE: Do not cut freeze sensor 2

NOTICE: Freeze sensor will not guard against the loss of water. Flow switch is recommended to prevent unit from running if water flow is lost or reduced.

- **INTELLIGENT RESET:** If a fault condition is initiated, the 5 minute delay on break time period is initiated and the unit will restart after these delays expire. During this period the fault LED will indicate the cause of the fault. If the fault condition still exists or occurs 2 or 4 times (depending on 2 or 4 setting for Lockout dip switch) before 60 minutes, the unit will go into a hard lockout and requires a manual lockout reset. A single condensate overflow fault will cause the unit to go into a hard lockout immediately, and will require a manual lockout reset.
- **LOCKOUT RESET:** A hard lockout can be reset by turning the unit thermostat off and then back on when the “RESET” dip switch is set to “Y” or by shutting off unit power at the circuit breaker when the “RESET” dip switch is set to “R”.

The blower motor will remain active during a lockout condition.

ECM INTERFACE BOARD

Refer to Figure #46, item [9] for ECM interface board location. In addition to providing a connecting point for thermostat wiring, the interface board also translates thermostat inputs into control commands for the Electronic Commutated Motor (ECM) fan motor and provides thermostat signals to the unit's UPM board. The thermostat connections and their functions are as follows:

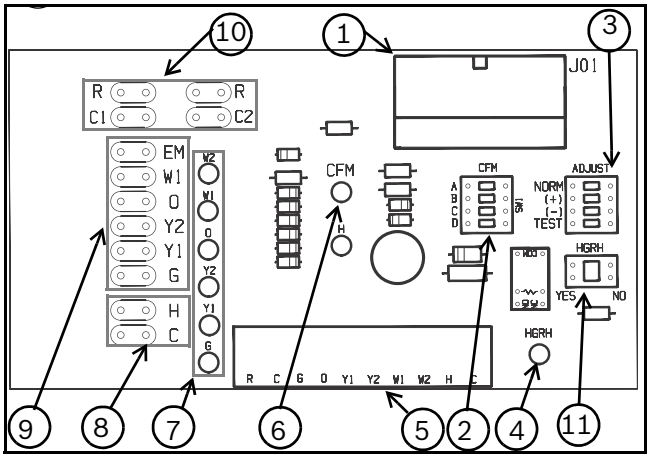


Figure # 51

[1] Motor harness plug
[2] Blower CFM adjustment
[3] Motor settings
[4] Dehumidification indication
[5] Thermostat contact inputs
[6] CFM count indicator
[7] Thermostat input status indication
[8] Reheat digital outputs
[9] Thermostat outputs
[10] 24 VAC
[11] Dehumidification method selector

CFM LED indication is an approximation. Utilize conventional Test and Balance equipment for accurate airflow measurement.

- CFM count indicator (Figure #51 item [6]) blinks to indicate approximate airflow in CFM and may flicker when the unit is off.
- Each blink of the LED represent approximately 100 CFM of air delivery so if the LED blinks 12 times, pauses, blinks 12 times, etc. the blower is delivering approximately 1200 CFM.

Thermostat Outputs	
Y1	First Stage Compressor Operation
Y2	Second Stage Compressor Operation
G	Fan
O	Reversing Valve (energized in cooling)
W1	Auxiliary Electric Heat (runs in conjunction with compressor)
EM/W2	Emergency Heat (electric heat only)
C	Transformer 24 VAC Common
R	Transformer 24 VAC Hot
H	Dehumidification Mode

Constant Airflow Motor

The Constant Airflow Motor is an Electronic Commutated Motor (ECM) that provides a constant air flow over a wide range of external static pressures, while optimizing the power consumption of the motor.
This option allows the unit to have different air flow settings depending on the mode that the unit is operating; i.e heating, cooling, fan only, electric heat, etc.

Airflow Selector

The airflow selector (Figure #50, items [2] & [3]) allows airflow adjustment to meet application requirements and to ease troubleshooting.

Only one dip switch can be enabled at a time. Refer to Figure #52 for each airflow setting.

- CFM Selector (Figure #52) must remain with only "A" being enabled.
- ADJUST Selector can be adjusted to NOM, (+), (-), or TEST. NOM, (+) and (-) can be adjusted as needed by application. TEST is used for troubleshooting to override unit airflow to 100%

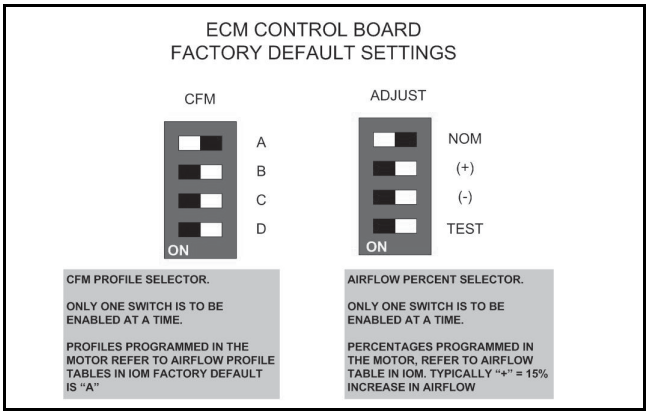


Figure # 52

CAUTION: Do not set the ADJ DIP switch to the (-) setting when electric heaters are installed. Doing so may cause the heaters to cycle on their thermal overload switches, potentially shortening the life of the switches.

DANGER: Always disconnect power before changing DIP switch positions on the interface board and reset the unit afterward.

Dehumidification Method Selector

Dehumidification method selector (Figure #51, item [11]) must be set to NO for cool to dehumidify method as below.:

- On dehumidification call, the heat pump fan will operate at a lower speed to increase dehumidification while cooling. Dehumidification selector ((Figure #51), item [11]) should be selected to 'NO'.

In this mode, the heat pump will only dehumidify the space when it is running in cooling mode.

Dehumidification indicator LED (Figure #51, item [4]) will energize when dehumidification call is present.

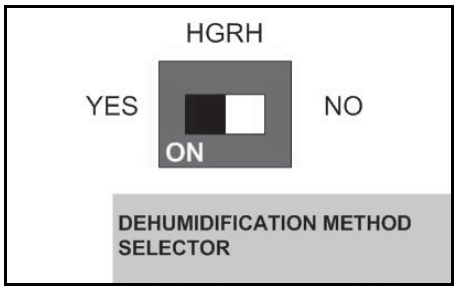


Figure # 53

ELECTRONIC THERMOSTAT

Installation

Thermostat wire must be 8-conductor, 18-AWG wire. Strip the wires back 1/4-inch (longer strip lengths may cause shorts) and insert the thermostat wires into the heat pump connector as shown below. The thermostat should have the same type connectors as shown below, requiring the same wiring. If thermostat connectors are different than below, please refer to thermostat's installation and operations manual for detailed installation and operation All thermostat should be configured according the specifications outlined in the installation and operation manual for proper commission and operations.

If you would like to use 2 stages of electrical heat with a single terminal on your thermostat, please place a jumper cable between W1 and W2 cable as shown below. (See Figure # 54)

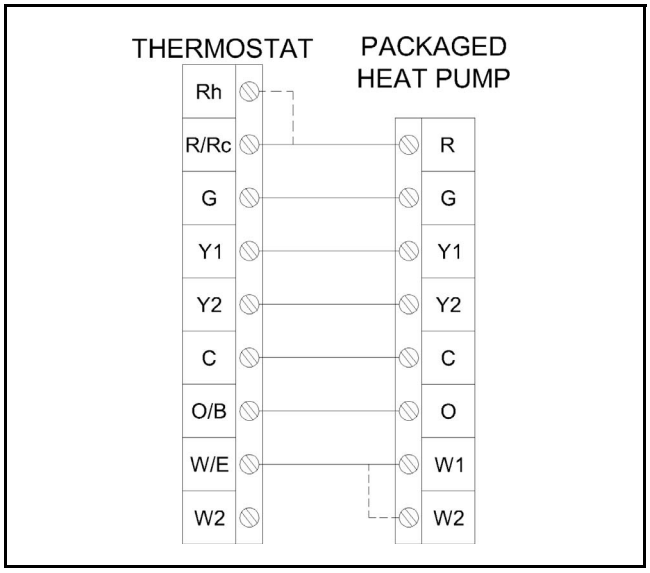


Figure # 54

Packaged heat pumps are equipped with detachable Thermostat connectors located on the ECM Interface board.

Depending on the options selected, some wires in the Wiring Harness may be utilized please see the Wiring Harness Drawing notes for further details.

OPTIONS

Number of factory installed options are available on SM Series of Heat Pumps. The following details the purpose, function and components of each option.

Electric Heat

Internally mounted supplemental electric heat is available on select models of the SM series. Electric heating elements can operate along with reverse cycle heating as auxiliary heat or in lieu of mechanical heating (refrigeration heating) as emergency backup heat. Availability matrix, including available nominal kW capacities is shown below:

Internal mounted Electric Heat is only available on top blow vertical cabinets, end blow horizontal cabinet or on down blow counterflow cabinets.

In cases where Electric Heat is not available in a desired configuration but is needed, contact your distributor for available Duct Mounted Electric Heat Package.

NOTICE: Units with internal electric heat must have 2 field power supplies.

Heater Model	KW		Stgs	Btu/h		Product Series Compatibility				
	208V	230V		208V	230V	SM024	SM036	SM048	SM060	SM070
HK050-1201	3.6	4.8	1	12300	16300	x	x	x	x	x
HK100-1201	7.2	9.6	2	24600	32700	x	x	x	x	x
HK150-1201	10.8	14.4	2	36900	49100		x	x	x	x
HK200-1201	14.4	19.2	2	49200	63400			x	x	x
x Available										

Heat Recovery Package (HRP)

The heat recovery package is a factory installed option on SM series of heat pumps. The HRP can be used to heat potable water during unit operation heat which would otherwise be wasted from the compressor discharge gas. In some cases the HRP could maintain water heater set point temperature requirements for a typical home.

The HRP consists of three major components:

- Double wall, vented refrigerant to water heat exchanger
- Circulating pump
- Control circuit

The heat exchanger is rated for use with potable water and is acceptable for use as a domestic water heating device in most building codes.

The pump circulates water between the domestic hot water tank and HRP heat exchanger in the Heat Pump. The control circuit ensures that the HRP only operates when there is available heat from the compressor and when the water is within a safe temperature range of below 140 deg F.

For schematics on HRP please see pg# 27.

When the heat pump compressor operates, the HRP will monitor the temperature of the discharge gas from the compressor. Once discharge gas is hot enough to provide useful heat to the domestic water tank, the circulating pump will be enabled, drawing water from the tank, through the HRP heat exchanger and then depositing the heated water back into the tank. If the water temperature reaches 140 deg F, the circulating pump is disabled to prevent over heating of the domestic water. The HRP is provided with an on/off switch in case the end user desires that the HRP be inactivated (typically during the winter months when space heating is most important).

Valve Relay

The factory installed pump relay can be used to energize a supply pump or solenoid valve when there is a call for compressor operation. This relay can be used to switch either high or low voltage power.

Comfort Alert Module

The Comfort Alert diagnostics module (CADM) is a breakthrough innovation for troubleshooting heat pump system failures. (Figure #55)

Comfort Alert Module

Figure # 55

By monitoring and analyzing data from the compressor and the thermostat demand, the module can accurately detect the cause of electrical and system related failures without any sensors. A flashing LED indicator communicates the ALERT code and guides the service technician more quickly and accurately to the root cause of a problem.

This module does not provide safety protection! The Comfort Alert module is a monitoring device and cannot shut down the compressor directly.

When an abnormal system condition occurs, the Comfort Alert module displays the appropriate ALERT and/or TRIP LED. The yellow ALERT LED will flash a number of times consecutively, pause and then repeat the process.

To identify a Flash Code number, count the number of consecutive flashes. Every time the module powers up, the last ALERT Flash Code that occurred prior to shut down is displayed for one minute.

Energy Management System Relay

The factory installed Energy Management System Relay can be used by individual commercial and/or residential entities to monitor, measure and control their electrical building load needs. This is accomplished by energizing and de-energizing the relay coil which opens and closes the relay contacts that are in series with the low voltage output of the unit transformer and the input of the UPM board.Energy

Smart Start Assist

SM series are available with the Smart Start Assist device as either a factory installed option or a field installed accessory. This device reduces starting (in-rush) current for compressors by 45% to 65%. This reduction in starting current can eliminate or greatly reduce “light flickering” during compressor starts and can reduce the required size of back-up transformers. The adaptive technology of the device can also extend compressor life by providing smoother, lower currents starts and by protecting the compressor from transient over voltage and under voltage after ramp up.

The Smart Start is designed for single phase scroll compressors and can also optimize algorithms for high pressure starts. SSA as showed in figure #56.

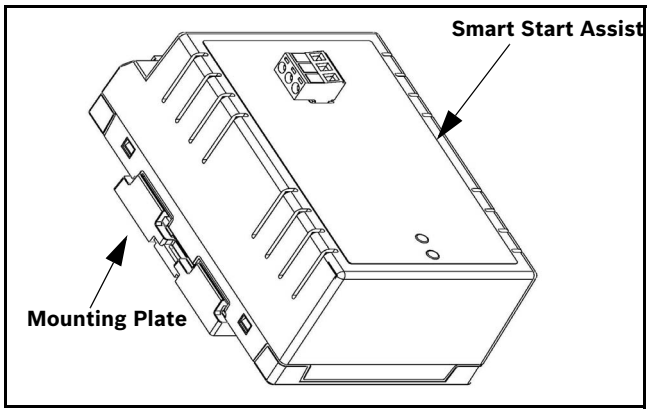


Figure # 56

SSA Specifications

Rated Operational Voltage:	208/230VACrms +/- 15% 50-60 Hz
Environmental Operating Range:	-4° to 149°F (-20° to 65°C); < 95% @ 40 C relative humidity, non-condensing
Degree of Protection:	IP20
Overvoltage:	Category II
Operational Rated Current:	32 Amps
Max Starting Current: **Min Full Load Current:**	80A ACrms 80A ACrms
Min time between starts:	6 minutes
Min time between stop to start:	3 minutes

Mode of Operation

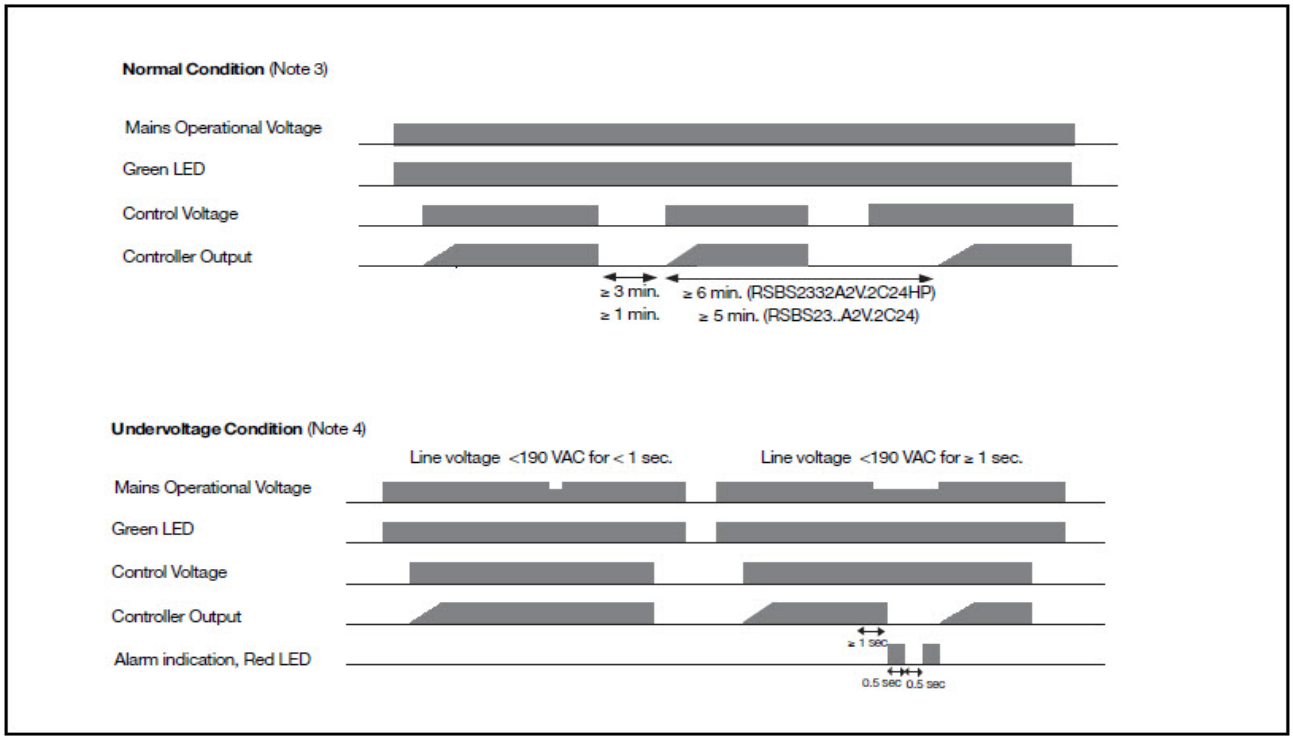


Figure # 57

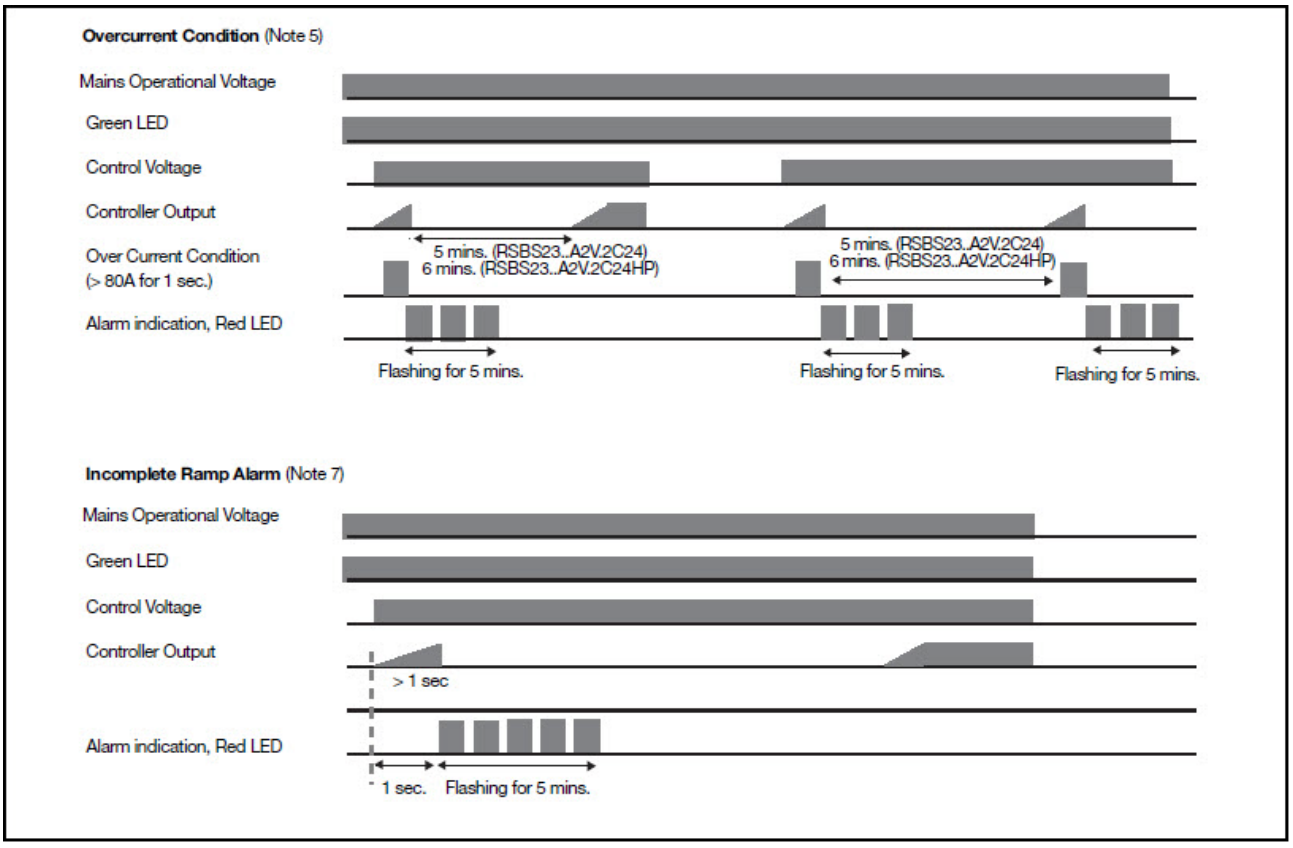


Figure # 58

Mode of operation Notes

1. The Smart Start Assist has 2 indication LEDs on board. The green LED indicates the status of the on-board power supply while the red LED indicates an alarm condition or the recovery time between starts.
2. Once the main voltage is present, the green LED will be fully ON. In case the main voltage is less than the stated pickup voltage alarm value, the green LED will be flashing. In case main voltage is higher than the stated pick-up voltage and green LED is flashing, then this may indicate that the on-board power supply is faulty. (Power Supply Alarm)
3. Upon closing L/L1, the Smart Start Assist will start ramping, duration of which is < 1 second, provided that the minimum time from stop to start is respected. When opening L/L1, the Smart Start Assist will stop without any ramp down.
4. In the case of an under voltage, the Smart Start Assist will shut down and the red LED flashes 2 times as long as the under voltage is present. Once the main voltage is restored the red LED will continue flashing for 5 minutes.Following these 5 minutes (6 minutes for HP versions), the Smart Start Assist will start ramping function in the case L/L1 is closed. The device can be reset at any time by removing power on L2/N connection. When the power is reapplied, the soft starter will star ramping up as soon as L/L1 is closed, provided that the minimum time from stop to start are respected.
5. If an over current (>80A for 1 sec.) is sensed, the Smart start Assist will shut down and the red LED will flash 3 times indicating an over current situation.This continues for 5 minutes. In the case that the over current is still present at the second attempt, user intervention is required to reset the controller by cycling power for the device to operate again as this implies that there are problems in the system.
6. A detection circuitry provides protection in case of a faulty starting capacitor EMR. In such situation, the red LED will flash 4 times for 5 minutes. Smart Start Assist will check the status of the starting capacitor EMR before attempting a ramping function (in the case L/L1 is closed). If at the second attempt, the starting capacitor EMR is found to be faulty, user intervention is required to reset the controller by cycling power for the device.
7. In the case of incomplete ramping of the Smart Start Assist, the red LED will flash 5 times. The flashing will be indicated by the red LED for 5 minutes. If after the second attempt, there is another incomplete ramp alarm, user intervention is required to reset the controller.
8. During the recovery from under-voltage, over-current and incomplete ramp alarms, the red LED will flash twice the normal flashing frequency using the same number of flashes. The figure #58 shows the flashing in case of a recovery from an under-voltage alarm.
9. During the recovery time between starts, the Smart Start Assist will be continuously ON until the necessary recovery time elapses.
10. If Power supply on Smart Start Assist is removed before the recovery period has elapsed, when supply is restored, the delay will continue until the remaining recovery time from the last start/stop (before supply removal) is over. Following this, another start may be attempted. If supply is removed during alarm recovery (red LED flashing), when supply is restored, the alarm will be reset and the Smart Start Assist will only wait for the respective delays between starts and/or stop to start to elapse before attempting another start (assuming L/L1 is closed).

HEAT RECOVERY PACKAGE

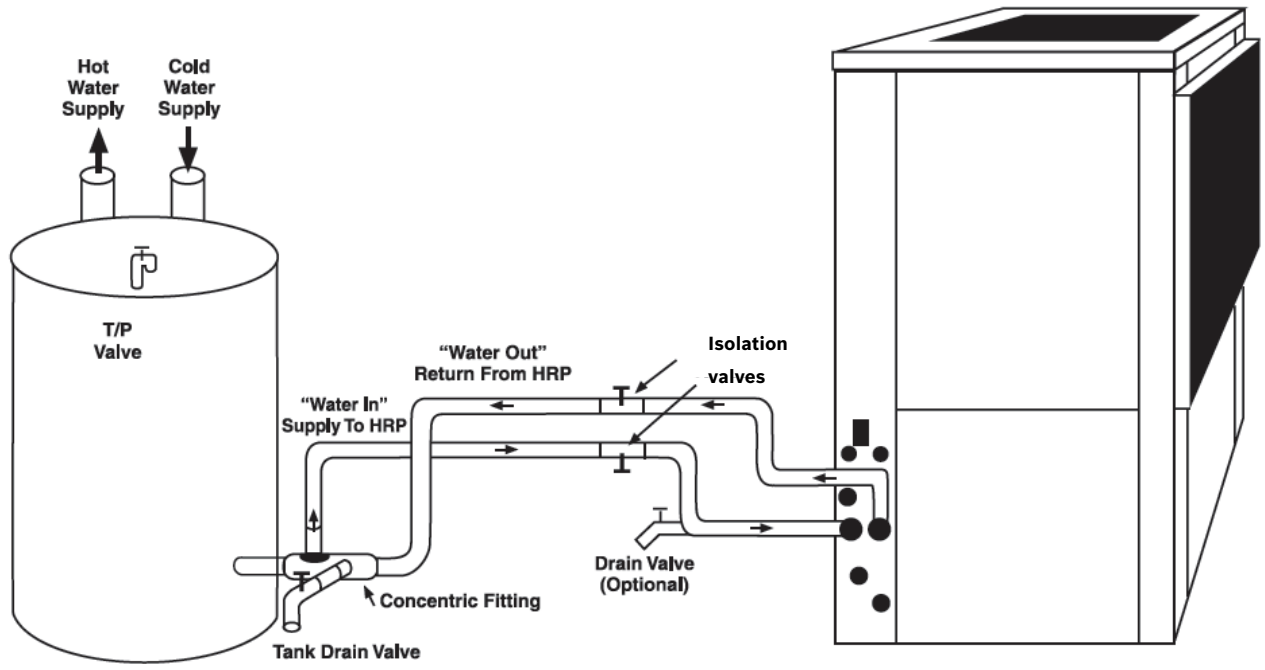
Water Tank Preparation

1. Turn off electrical or fuel supply to the water heater.
2. Attach garden hose to water tank drain connection and run other end of hose out doors or to an open drain.
3. Close cold water inlet valve to water heater tank.
4. Drain tank by opening drain valve on the bottom of the tank, then open pressure relief valve or hot water faucet.
5. Once drained the tank should be flushed with cold water until the water leaving the drain hose is clear and free of sediment.
6. Close all valves and remove the drain hose.
7. Install HR water piping.

Concentric water fitting (p/n 8-733-907-779) is recommended.

HR Water Piping

All hot water piping MUST be a minimum of 3/8” O.D. copper tube to a maximum distance of 15 feet. For distances beyond fifteen feet but not exceeding 60 feet use 1/2” copper tube. Separately insulate all exposed surface of both connecting water lines with 3/8” wall closed cell insulation. Install isolation valves on supply and return to the heat recovery. (Figure #59)



NOTE: Diagram for illustration purposes only.

Figure # 59

Water Tank Refill

1. Open the cold water supply to the tank.
2. Open a hot water faucet to vent air from the system until water flows from the faucet, then close.
3. Depress the hot water tank pressure relief valve handle to ensure there is no air remaining in the tank.
4. Carefully inspect all plumbing for water leaks. Correct as required.
5. Purge all air from HR through an external purge valve. Allow all air to bleed out until water appears at the valve. Locate the external purge value at the highest point in installation.

NOTICE: All piping from HRP to domestic water tank must be copper.

6. Before restoring the power or fuel supply to the water heater, adjust the temperature setting on the tank thermostat(s) to ensure maximum utilization of the heat available from the refrigeration system and conserve the most energy. On tanks with both upper and lower elements and thermostats, the lower element should be turned down to 100° F, while the upper element should be adjusted to 120° F. Depending upon the specific needs of the customer, you may need to adjust the upper element differently. On tanks with a single thermostat lower the thermostat setting to 120° F or the “LOW” position. After thermostat adjustments are completed, replace access cover and restore electrical or fuel supply to water heater.

INITIAL START-UP

NOTICE: Make sure all valves in heat recovery water piping system are open. NEVER OPERATE HR PUMP DRY.

1. Turn on the heat pump. The HR pump should not run if the compressor is not running.
2. Turn HR switch to the “ON” position. The pump will operate if entering water temperature to HR is below 120° F.
3. The temperature difference between the water entering and leaving the heat recovery should be 5° to 15° F.
4. Allow the unit to operate for 20 to 30 minutes to ensure it is functioning properly. The pump should shut off when the water temperature entering the heat recovery reaches 120°F.

SEQUENCE OF OPERATION

Cooling Mode

Energizing the “O” terminal energizes the unit reversing valve thus placing the unit into cooling mode. The fan motor starts when the “G” terminal is energized.

The fan motor will take 30 seconds to ramp up to operating speed and will run at fan only rated air flow as long as there is no call for compressor or heater operation.

When the thermostat calls for first stage cooling (Y1) the loop pump or solenoid valve if present is energized and the first stage of compressor capacity starts. The fan ramps up to first stage cooling air flow in 30 seconds.

Some options will have a built in delay, and hence, compressor operation is not immediate. See ‘Options’ sections for more detail.

When the thermostat calls for second stage cooling (Y2) the second stage (or full compressor capacity) is initiated. The fan ramps up to full cooling air flow.

Once the thermostat is satisfied, the compressor shuts down and the fan ramps down to either fan only mode or off over a span of 30 seconds.

Note that a fault condition initiating a lockout will de-energize the compressor irrespective of which stage is engaged.

Heating Mode

The first two stages of heating (Y1 & Y2) operate in the same manner as cooling, but with the reversing valve de-energized. On a call for auxiliary heat (W1), the fan ramps up to auxiliary heat air flow immediately and the electric heater package is energized along with the compressor.

As the thermostat is satisfied, the heaters will shut off as soon as W1 is de-energized, and the compressors will remain on until the thermostat stages are satisfied.

If the unit compressor locks out for any reason at this time, the electric heaters will continue to function normally.

Once the thermostat is satisfied, the compressor shuts down and the fan ramps down either fan only mode or off over a span of 30 seconds. If thermostat has two different output points one for Auxiliary heat and a different one for Emergency heat the two outputs must be terminated on W1 units equipped with one stage of Electric heat.

When using a 2-cool, 3-heat thermostat both the W1 & W2 on the Heat Pump and W2 & EM on the thermostat must be connected together via a jumper. (See Figure#54)

Sequence Of Operation Flow Chart

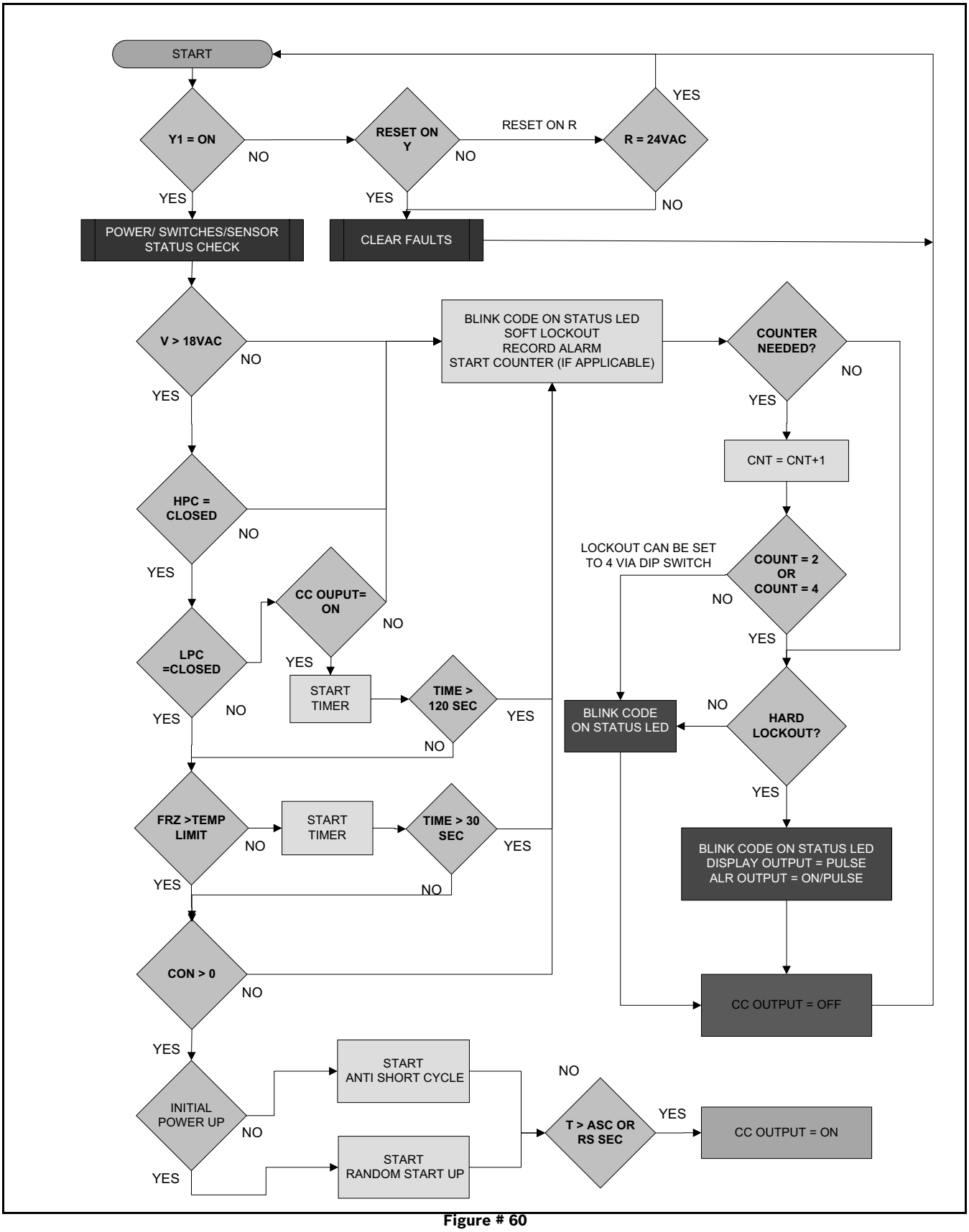


Figure # 60

APPLICATION CONSIDERATIONS

Well Water Systems

Copper is adequate for ground water that is not high in mineral content. Should your well driller express concern regarding the quality of the well water available or should any known hazards exist in your area, we recommend proper testing to assure the well water quality is suitable for use with water source equipment. (See Water Quality table on page #16) In conditions anticipating moderate scale formation or in brackish water a cupro-nickel heat exchanger is recommended. In well water applications water pressure must always be maintained in the heat exchanger. This can be accomplished with either control valve or a bladder type expansion tank. When using a single water well to supply both domestic water and the heat pump care must be taken to ensure that the well can provide sufficient flow for both. In well water applications a slow closing solenoid valve must be used and installed on the leaving water side of coaxial to prevent water hammer. Solenoid valves should be connected across Y1 and C1 on the interface board for all. Make sure that the VA draw of the valve does not exceed the contact rating of the thermostat.(Figure #61)

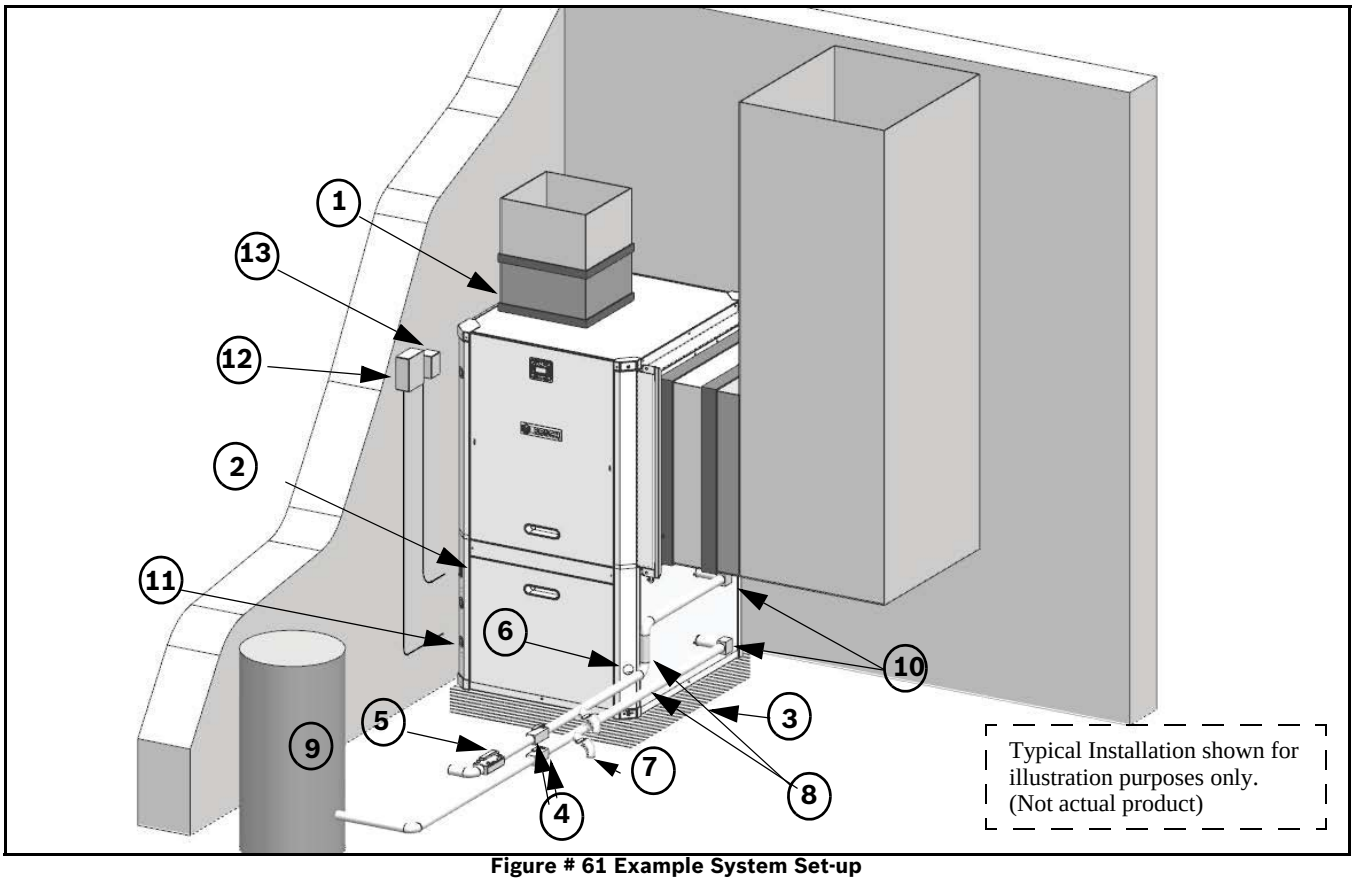


Figure # 61 Example System Set-up

[1] Flex Duct Connection
[2] Low Voltage Control Connection
[3] Vibration Pad
[4] Ball Valves
[5] Solenoid Valve Slow Closing
[6] Condensate Drain Connection
[7] Drain Valves
[8] Hose Kits (optional)
[9] Pressure Tank (optional)
[10] P/T Ports (optional)
[11] Line Voltage Connection
[12] Electric Heater Line Voltage Disconnect
[13] Unit Line Voltage Disconnect

Cooling Tower/Boiler Systems

The cooling tower and boiler water loop temperature is usually maintained between 50° F to 100 ° F to assure adequate cooling and heating performance.

In the cooling mode, heat is rejected from the unit into the water loop. A cooling tower provides evaporative cooling to the loop water thus maintaining a constant supply temperature to the unit. When utilizing open cooling towers, chemical water treatment is mandatory to ensure the water is free from corrosive elements. A secondary heat exchanger (plate frame) between the unit and the open cooling tower may also be used. It is imperative that all air be eliminated from the closed loop side of the heat exchanger to ensure against fouling. In the heating mode, heat is absorbed from the water loop. A boiler can be utilized to maintain the loop at the desired temperature.

NOTICE: Water piping exposed to extreme low ambient temperatures is subject to freezing.

Thread seal tape/ PTFE tape sealer should be used when connecting to the unit to ensure against leaks and possible heat exchanger fouling.

Consult the specification sheets for pipe connection sizes.

Do not overtighten the connections. Flexible hoses should be used between the unit and the rigid system to avoid possible vibration.

Ball valves should be installed in the supply and return lines for unit isolation and unit water flow balancing. Pressure/temperature ports are recommended in both supply and return lines for system flow balancing. Water flow can be accurately set by measuring the water-to-refrigerant heat exchangers water side pressure drop. See specification sheets for water flow vs. pressure drop information.

No unit should be connected to the supply or return piping until the water system has been completely cleaned and flushed to remove any dirt, piping chips or other foreign material. Supply and return hoses should be connected together during this process to ensure the entire system is properly flushed. After the cleaning and flushing has taken place the unit may be connected to the water loop and should have all valves wide open. (Figure #62)

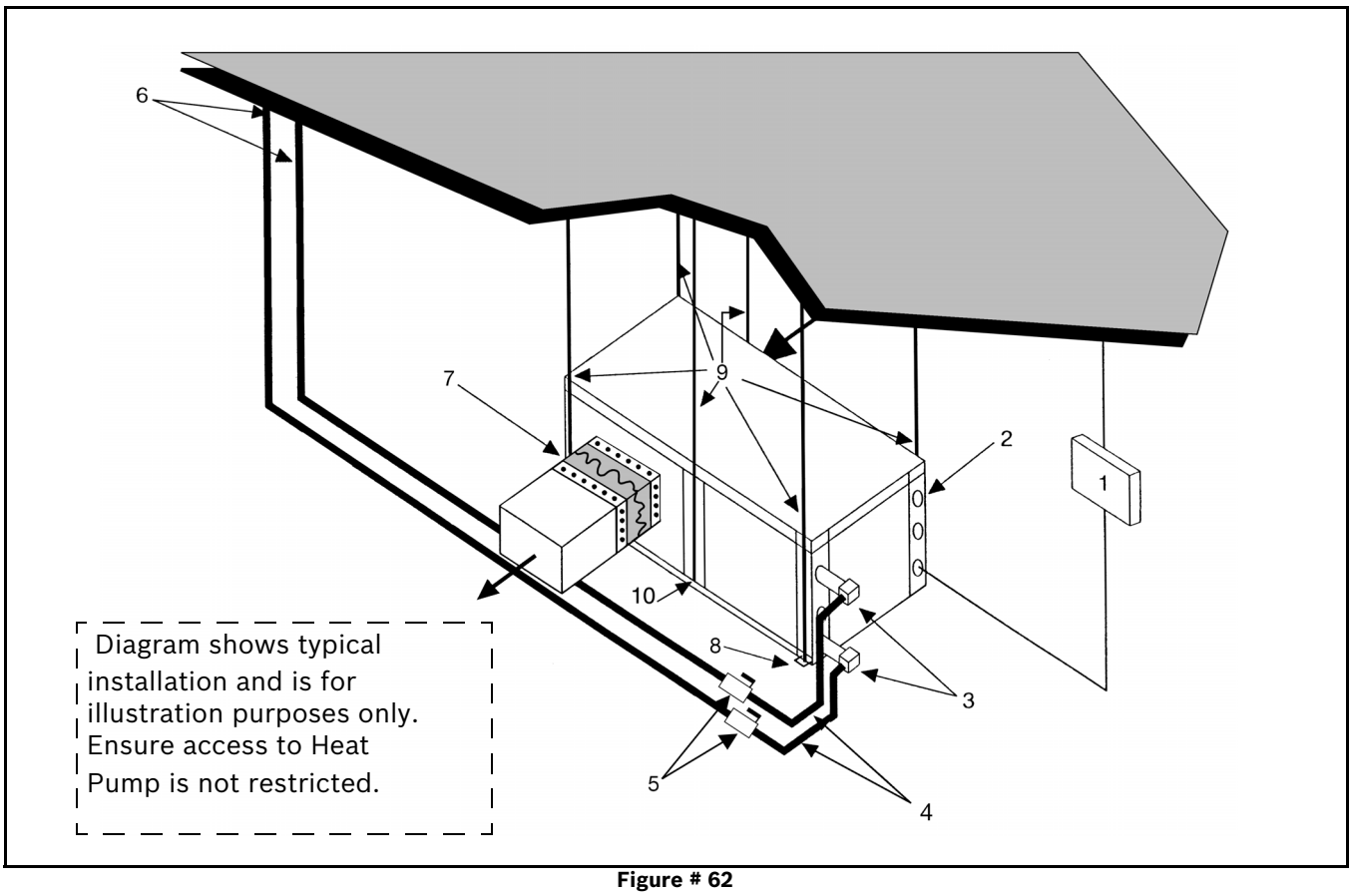


Figure # 62

[1] Line voltage disconnect (unit)
[2] Low voltage control connection
[3] P/T ports (optional)
[4] Hose kits (optional)
[5] Ball valves
[6] Supply and return line of central system
[7] Flex duct connection
[8] Hanging bracket assembly
[9] Threaded rod
[10] Hanging bracket assembly

Geothermal Systems

Closed loop and pond applications require specialized design knowledge. No attempt at these installations should be made unless the dealer has received specialized training. Utilizing a Bosch flow center, hose kit, and connection accessories will simplify the installation process. Anti-freeze solutions are utilized when low evaporating conditions are expected to occur. Refer to the Bosch flow center installation manuals for more specific instructions. (Figure #63)

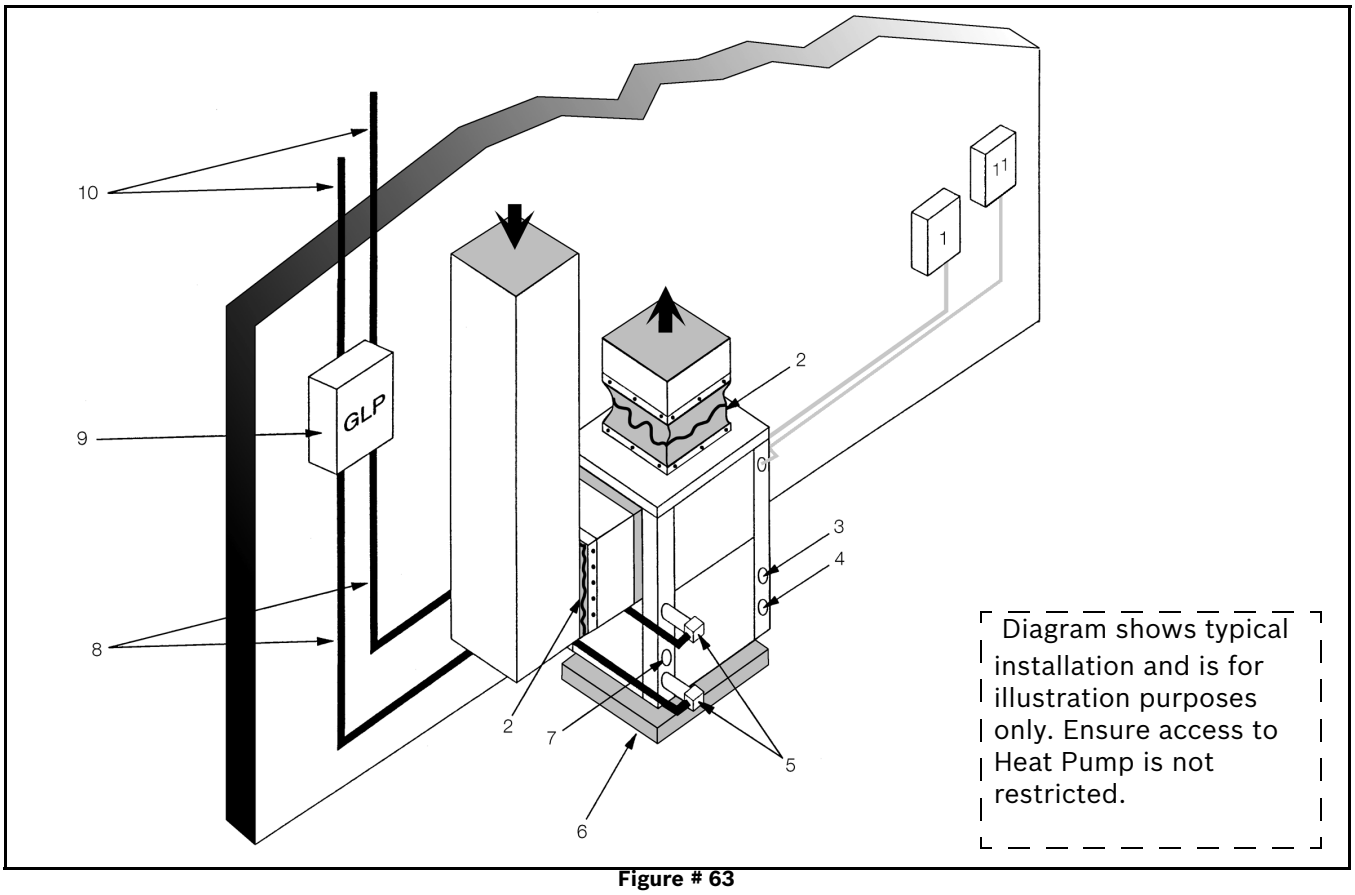


Figure # 63

[1] Line voltage disconnect (unit)
[2] Flex duct Connection
[3] Low voltage control connection
[4] Line voltage connection (unit)
[5] P/T ports
[6] Vibration pad
[7] Condensate drain connection
[8] Ground loop connection kit
[9] Ground loop pumping package
[10] Polyethylene with insulation
[11] Line voltage disconnect (electric heater)

TROUBLESHOOTING

SM Series Water Source Heat Pump is equipped with a externally mounted LCD screen that displays unit errors. (Figure #64)

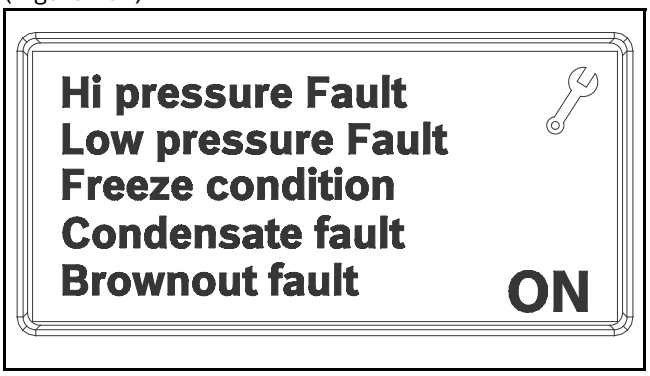


Figure # 64

Troubleshooting Information Solution column may reflect a possible fault that may be one of, or a combination of causes and solutions. Check each cause and adopt “process of elimination” and or verification of each before making any conclusion.

UPM Board LED Indications		
Indication Color	**Blinks**	**Description**
GREEN	Solid	18-30 VAC Power is present
RED	1	High pressure lockout
RED	2	Low pressure lockout
RED	3	Coax Freeze sensor lockout
RED	4	Condensate overflow
RED	5	Brownout
RED	6	Evaporator Freeze lockout

Compressor Ohms		
Model	**Start Winding**	**Run Winding**
SM024	1.64	1.3
SM036	1.50	0.85
SM048	1.90	0.53
SM060	1.68	0.42
SM070	1.91	0.36
Tolerance +/- 7%. All resistance values must be measured with compressor at room temperature.		

UNIT TROUBLESHOOTING					
Problem	**Mode**		**Check**	**Possible Cause**	**Action**
	Cooling	**Heating**			
In test mode unit operates but UPM board shows fault	X	X	Is Fault LED blinking 3 times?	UPM board is in test mode	Change the dip switch setting to Normal. This is part of test mode to ensure that freeze 1 and freeze 2 sensors are correctly located
			Is Fault LED blinking 6 times?	UPM board is in test mode	Change the dip switch setting to Normal. This is part of test mode to ensure that freeze 1 and freeze 2 sensors are correctly located
Unit operates but UPM board shows fault	X	X	Is Fault LED blinking 3 times?	UPM board is in test mode	Change the dip switch setting to Normal
Unit operates but no or short (~10sec) delays on start or restart	X	X	Is Fault LED blinking 3 times?	UPM board is in test mode	Change the dip switch setting to Normal
No compressor operation but fan runs	X		Is fault LED Blinking 1 time?	High Pressure fault - no or low water flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.
				High Pressure fault - high water temperature	Check water temperature - is it in range?
				High Pressure fault - fouled or scaled water coil	Check for proper flow rate and water temperature, but low water side temp rise in cooling
		X	Is fault LED Blinking 1 time?	High Pressure fault - no or low air flow	Check fan motor for proper operation.
					Check air filter
					Inspect air coil for dirt/debris
					Check duct work - are dampers closed or blocked?
	X		Is fault LED Blinking 2 times?	Low Pressure fault - no or low air flow	Check fan motor for proper operation.
					Check air filter
					Inspect air coil for dirt/debris
					Check duct work - are dampers closed or blocked?
				Low Pressure fault - low refrigerant	Check refrigerant pressure with gauge set
		X	Is fault LED Blinking 2 times?	Low Pressure fault - no or low water flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.
					Check for proper flow rate and water temperature, but low water side temp drop in heating.
				Low Pressure fault - low refrigerant	Check refrigerant pressure with gauge set
		X	Is fault LED Blinking 3 times?	Freeze fault, water coil - no or low water flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.
				Freeze fault - low water temperature	Check water temperature - is it below 40° entering? If heat pump is connected to a closed loop with antifreeze check that the “FREEZE 1" resistor on the UPM board has been cut to set the unit to antifreeze mode (see UPM features on pages 12-14).
				Freeze fault - low refrigerant	Check refrigerant pressure with gauge set

UNIT TROUBLESHOOTING					
Problem	**Mode**		**Check**	**Possible Cause**	**Action**
	Cooling	**Heating**			
No compressor operation but fan runs	X		Is fault LED Blinking 4 times?	Condensate fault - poor drainage	Check condensate pan for high water level. Check drain line for blockages, double trapping or inadequate trapping.
				Condensate fault - blocked return air	Check condensate pan for high water level. Check air filter and return air duct work for blockage. Check that there is adequate space between the return air opening and walls or other obstructions on free return applications.
	X		Is fault LED Blinking 5 times?	Brown out fault - low supply voltage	Check primary voltage - ensure it is within the limits listed on the unit data plate.
				Brown out fault - overloaded control circuit	Check control voltage - if it is below 18 V check accessories connected to the unit and ensure that they do not exceed the VA draw shown on page # 11.
				Brown out fault - bad thermostat connection	Check that thermostat wiring is proper gauge and length, that it is not damaged and that all connections at the thermostat and heat pump are secure.
	X		Is fault LED Blinking 6 times?	Freeze fault, air coil - no or low air flow	Check fan motor for proper operation. Check air filter Inspect air coil for dirt/debris Check duct work - are dampers closed or blocked?
				Freeze fault, air coil - blocked return air	Check that there is adequate space between the return air opening and walls or other obstructions on free return applications.
				Freeze fault, air coil - low refrigerant	Check refrigerant pressure with gauge set.
	X	X	No fault LED - contactor not energized	Thermostat not calling for compressor operation	Ensure that the thermostat is on and calling for "Y"
				Bad thermostat connection	Check "Y" connection from thermostat. Ensure that there is 24 VAC between "Y" and "C".
				Loose wire to contactor coil	Check wiring - ensure that there is 24 VAC across the contactor coil.
				Burned out contactor coil	Test contactor with 24VAC (between "R" and "C"). Ohm contactor coil - an open circuit indicates a burned coil.

UNIT TROUBLESHOOTING					
Problem	**Mode**		**Check**	**Possible Cause**	**Action**
	Cooling	**Heating**			
No compressor operation but fan runs	X	X	No fault LED - contactor energized	Open compressor overload	Check for supply voltage at the load side of the contactor. For 3 phase models check phase rotation and voltage at all 3 phases.
				Poor wiring connections	Look for signs of heat on the wiring insulation. Check that all wiring connections are secure and properly torqued.
				Burned out compressor	Does compressor hum when power is applied? If not check the resistance of the compressor windings using the values shown in the compressor characteristics chart. Note that the compressor must be cool (70° F) when checking the windings.
No compressor or fan operation	X	X	Power LED ON	Bad thermostat connection / faulty thermostat	Check thermostat and wiring. Check unit terminal block for 24 VAC between "Y" and "C" and "G" and "C".
			Power LED OFF	Low or no supply power	Ensure that the supply voltage to the unit is with in the range shown on the unit data plate.
				Faulty control transformer	Check for 24 VAC between "R" and "C" on the unit terminal block. For 75 and 100 VA transformers, check that the transformer circuit breaker has not tripped. Check low voltage circuit for overload conditions or short circuits before replacing the transformer.
No fan operation - ECM constant airflow motor	X	X	See Action	No fan operation signal	Check for 24 VAC between "G" and "C". Check all wiring connections. Make sure that the thermostat connection plug is securely connected.
				Loose wiring	Check all wiring connections at motor and control box. Check that power and control harnesses are securely connected.
				Interface board problems	Make sure that the interface board is not damaged and that all DIP switches are in the proper configuration (refer to the blower performance tables).
				Faulty motor	Check supply voltage to the motor. Check that all motor wires are secure. Move the "TEST" DIP switch to "ON" and the other switches to "OFF" on the "ADJUST" switch block on the interface board - the motor should run at 70% torque when "G" is called. With power off spin the motor shaft - noise, resistance or uneven motion can be signs of motor failure.
Fan operates but motor does not change speed - ECM constant airflow motor	X	X	Is motor behaviour only observed during start-up?	Ramp-up programming delays are still in effect	Wait for at least 5 min after the start-up and then change the fan operation based on thermostat call
			ECM board settings	ECM board is in test mode	Change the air flow setting dip switch on ECM board per air flow table provided in installation manual
				Airflow speed tab on ECM board is incorrect	Change the air flow setting dip switch on ECM board per air flow table provided in installation manual
			Is motor not stopping when no call for cooling or heating from thermostat	Thermostat is in continuous fan mode	Change the thermostat setting to on/off fan operation instead of continuos fan operation
			High external static	Dirty air filter, closed dampers, grills, dirty air coil	Remove the air filter and check that all of the dampers, registers, and grills are open and free flowing. If removing the filter corrects the problem, clean or replace with a less restrictive filter. Also check and clean as needed the blower wheel, secondary heat exchanger (if applicable) and evaporator coil (if applicable).

UNIT TROUBLESHOOTING					
Problem	**Mode**		**Check**	**Possible Cause**	**Action**
	Cooling	**Heating**			
Unit not shifting into Cooling and Heating	X	X	Reversing valve solenoid energized	Faulty solenoid	Check that the reversing valve solenoid is receiving 24 VAC. If so, Check the resistance of the solenoid - an open circuit may indicate a burned out solenoid.
			Reversing valve solenoid not energized	Miswired/faulty thermostat	Check that the reversing valve thermostat wire is connected to the "O" terminal of the thermostat. Check for a contact closure between "O" and "R".
				Loose wire on "O" terminal	Check that the wires from the thermostat to the unit are securely connected and that the wires from the electrical box to the reversing valve are connected.
Excessively cold supply air temperature in cooling or excessively hot supply air temperature in heating	X	X	Reduced air flow	Dirty Filter	Replace filter.
				Fan speed too low	Consult blower performance table and increase fan speed if possible.
				Excessive duct pressure drop	Consult blower performance table and increase fan speed if possible.
Excessively warm supply air temperature in cooling and/or excessively cool air in heating	X	X	Air flow too high	Fan speed setting too high	Consult blower performance table and reduce fan speed if possible.
			High or low water temperature	Inlet water temperature out of range	Check unit capacity vs. water temperature.
			Air leakage	Leaky duct work	Inspect duct work.
			Loss of refrigeration capacity	Low refrigerant	Check refrigerant pressures with gauge set.
High humidity	X		Air flow too high	Fan speed setting too high	Consult blower performance table and reduce fan speed if possible.
			Loss of refrigeration capacity	Low refrigerant	Check refrigerant pressures with gauge set.
			Short cycling	Unit oversized	Check unit performance against building load calculations.
				Poor thermostat location	Make sure that thermostat is not located by a supply air duct.

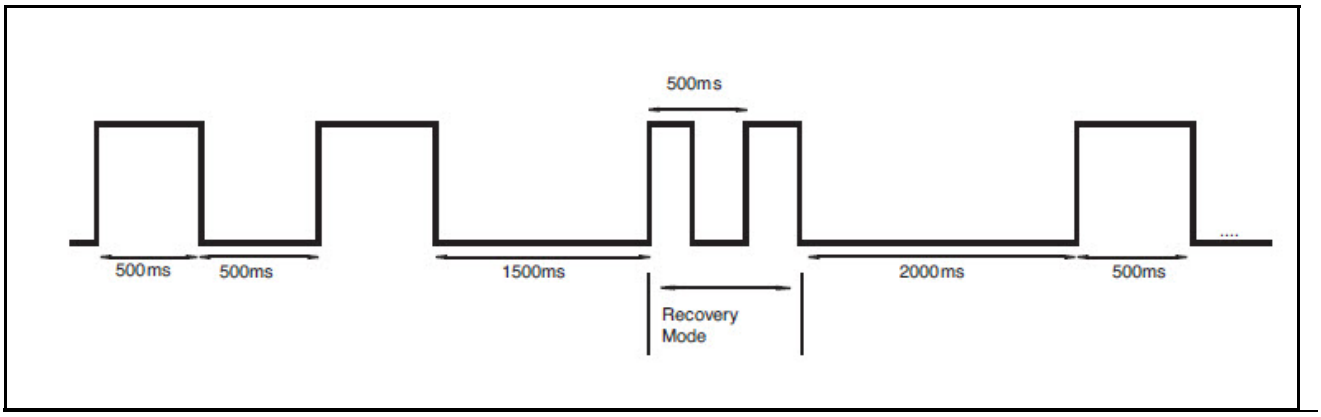
UNIT TROUBLESHOOTING					
Problem	**Mode**		**Check**	**Possible Cause**	**Action**
	Cooling	**Heating**			
Objectionable noise levels	X	X	Air noise	Poor duct work/grille design	Ensure duct work and grilles are properly sized for unit air flow.
				Fan speed setting too high	Consult blower performance table and reduce fan speed if possible.
			Structure bourne noise	Unit not mounted on full vibration pad	Mount unit on a vibration pad (see page 7).
				Unit not connected with flexible conduit, water lines and/or duct work	Install unit in accordance with instructions on pages 5-15.
				Unit cabinet touching wall or other building component	Adjust unit location to avoid unit touching structure.
	X	X	Compressor noise	High water temperature or low water flow rate elevating head pressure	Increase water flow rate and/or reduce water temperature if possible.
				Scaled or fouled water coil elevating heat pressure	Clean/de scale water coil.
				Low air flow elevating head pressure	Check filter.
					Increase fan speed.
	X	X	Water hammer	Fast closing valves installed	Change valves to slow-close type.

HRP Troubleshooting		
Problem	**Possible Cause**	**Checks and Corrections**
NO FLOW LOW FLOW	No Power	Check power supply
	On/Off Switch Position	Set switch to “ON” position
	Compressor Contactor	Engage heat pump contactor
	Broken or loose wires	Repair or tighten wires
	Air Lock	Purge air from piping system
	Stuck pump shaft/impeller	Remove pump cartridge and clean
	Defective pump	Replace pump
	Kinked or under sized water piping	Repair kink and check for proper line size
HIGH WATER TEMPERATURE	Water temp limit closed	Stuck limit switch Sensor not attached securely to line
LOW HEAT OUTPUT	Scaled or fouled heat exchanger	Clean heat exchanger

Comfort Alert Module -Flash Codes		
Status LED	**Status LED Description**	**Status LED Troubleshooting Information Solution**
YELLOW "ALERT" FLASH CODE 3	Short Cycling Compressor is running only briefly	1. Thermostat demand signal is intermittent 2. Time delay relay or control board defective 3. If high pressure switch present go to Flash Code 2 information 4. If low pressure switch present go to Flash Code 1 information
YELLOW "ALERT" FLASH CODE 4	Locked Rotor	1. Run capacitor has failed (may not be bad, verify) 2. Low line voltage (contact utility if voltage at disconnect is low) • Check wiring connections 3. Excessive liquid refrigerant in compressor 4. Compressor bearings are seized • Measure compressor oil level
YELLOW "ALERT" FLASH CODE 5	Open Circuit	1. Outdoor unit power disconnect is open 2. Compressor circuit breaker or fuse(s) is open 3. Compressor contactor has failed open • Check compressor contactor wiring and connectors • Check for compressor contactor failure (burned, pitted or open) • Check wiring and connectors between supply and compressor • Check for low pilot voltage at compressor contactor coil 4. High pressure switch is open and requires manual reset 5. Open circuit in compressor supply wiring or connections 6. Unusually long compressor protector reset time due to extreme ambient temperature 7. Compressor windings are damaged • Check compressor motor winding resistance
YELLOW "ALERT" FLASH CODE 6	Open Start Circuit Current only in run circuit	1. Run capacitor has failed (may not be bad, verify) 2. Open circuit in compressor start wiring or connections • Check wiring and connectors between supply and the compressor "S'" terminal 3. Compressor start winding is damaged • Check compressor motor winding resistance
YELLOW "ALERT" FLASH CODE 7	Open Run Circuit Current only in start circuit	1. Open circuit in compressor run wiring or connections • Check wiring and connectors between supply and the compressor "R" terminal 2. Compressor run winding is damaged • Check compressor motor winding resistance
YELLOW "ALERT" FLASH CODE 8	Welded Contactor Compressor always runs	1. Compressor contactor has failed closed 2. Thermostat demand signal not connected to module
YELLOW "ALERT" FLASH CODE 9	Low Voltage Control circuit < 17VAC	1. Control circuit transformer is overloaded 2. Low line voltage (contact utility if voltage at disconnect is low) • Check wiring connections Flash Code number corresponds to a number of LED flashes, followed by a pause and then repeated. TRIP and ALERT LEDs flashing at same time means control circuit voltage is too low for operation

SMART START ASSIST LED STATUS INDICATION			
Red Led	**Relay Contact***	**Condition**	**Action**
FULLY ON +	11/12	Min. recovery time between starts and /or recovery time between stop to start	Auto reset when minimum recovery time elapses
2 FLASHES	11/14	Under voltage (Ue<190VAC)	Auto reset with 5 mins recovery **
3 FLASHES	11/14	Over current (>80A for >1 sec.)	Auto reset with 5 mins recovery
4 FLASHES	11/14	relay protection	Auto reset with 5 mins recovery***
5 FLASHES	11/14	incomplete ramp	Auto reset with 5 mins recovery
N/A	11/12	Supply phase loss	Physical check
N/A	11/12	Idle state	
N/A	11/12	Ramping state	
N/A	11/12	Bypass mode	
Green Led	**Relay Contact***	**Condition**	**Action**
FLASHING	11/12	Power supply alarm	Replace Smart Start device
FULLY ON	11/12	Idle State	RSBS waiting for control signal to start
+ APPLICABLE TO RSBS2332A2V.2C24HP. FOR MODELS,NO INDICATION ON THE RED LED IS PROVIDED *APPLIES ONLY TO RSB23XXA2V22C24..MODELS **MONITORED DURING IDLE AND BYPASS ***REFER TO NOTE 6 IN MODE OF OPERATION SECTION ****REFER TO VOLTAGE DIPS AND INTERRUPTIONS SECTION FOR MODE OF OPERATION			

Smart Start Assist Flashing sequence



During recovery from an alarm condition, the red LED will flash at twice the normal flashing frequency between successive flashing cycles as shown above to indicate that the Smart start Assist is in recovery mode which recovery lasts for 5 minutes.

OPERATING TEMPERATURES AND PRESSURES

SM024 Full Load

COOLING								HEATING							
Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F	Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F
30								20	3	234 - 286	48 - 59	3 - 9	9 - 24	6 - 9	13 - 19
									5	238 - 291	52 - 64	1 - 6	8 - 23	4 - 6	14 - 20
									7	240 - 293	54 - 66	1 - 6	8 - 22	3 - 4	14 - 21
40								30	3	244 - 298	59 - 72	4 - 10	8 - 21	7 - 11	15 - 22
									5	249 - 305	64 - 79	2 - 7	8 - 20	5 - 7	15 - 23
									7	251 - 307	67 - 82	1 - 6	7 - 20	3 - 5	16 - 24
50	3	238 - 290	130 - 159	22 - 32	4 - 11	19 - 28	18 - 27	40	3	255 - 312	71 - 87	5 - 12	7 - 19	8 - 12	17 - 25
	5	207 - 253	129 - 157	15 - 24	4 - 11	11 - 17	19 - 28		5	262 - 320	78 - 95	3 - 8	7 - 18	5 - 8	18 - 26
	7	194 - 237	128 - 157	12 - 19	4 - 12	8 - 12	19 - 28		7	265 - 324	81 - 99	1 - 6	7 - 18	4 - 6	18 - 27
60	3	269 - 329	132 - 161	21 - 31	4 - 11	18 - 27	18 - 27	50	3	267 - 327	84 - 103	7 - 13	7 - 17	9 - 14	19 - 28
	5	237 - 290	130 - 159	14 - 22	4 - 11	11 - 17	18 - 27		5	276 - 337	93 - 114	3 - 9	6 - 16	6 - 9	20 - 30
	7	224 - 273	130 - 159	11 - 18	4 - 11	8 - 12	18 - 28		7	280 - 342	97 - 119	2 - 7	6 - 16	5 - 7	21 - 31
70	3	303 - 371	134 - 163	19 - 29	4 - 10	18 - 27	18 - 26	60	3	281 - 343	99 - 121	8 - 15	6 - 16	11 - 16	21 - 31
	5	270 - 330	132 - 161	13 - 21	4 - 11	11 - 16	18 - 27		5	291 - 355	109 - 134	4 - 10	6 - 15	7 - 11	22 - 33
	7	256 - 313	131 - 160	10 - 17	4 - 11	8 - 12	18 - 27		7	296 - 362	115 - 141	2 - 8	6 - 15	5 - 8	23 - 35
80	3	341 - 417	135 - 166	18 - 28	4 - 10	17 - 26	17 - 25	70	3	296 - 361	115 - 140	9 - 17	6 - 15	12 - 18	23 - 34
	5	307 - 375	134 - 164	12 - 20	4 - 10	11 - 16	17 - 26		5	304 - 371	128 - 156	5 - 12	5 - 15	8 - 12	25 - 37
	7	292 - 357	133 - 163	9 - 17	4 - 11	8 - 11	18 - 26		7	309 - 378	135 - 165	3 - 9	5 - 14	6 - 9	26 - 39
90	3	382 - 467	137 - 168	17 - 26	4 - 10	17 - 25	17 - 25	80	3	307 - 375	132 - 161	11 - 19	5 - 14	14 - 21	25 - 38
	5	347 - 424	135 - 166	11 - 19	4 - 10	10 - 15	17 - 26		5	319 - 390	148 - 181	6 - 13	5 - 14	9 - 14	27 - 41
	7	332 - 405	135 - 165	8 - 16	4 - 10	7 - 11	17 - 26		7	325 - 397	157 - 192	4 - 10	5 - 13	7 - 10	28 - 43
100	3	424 - 518	139 - 169	15 - 24	4 - 10	17 - 25	16 - 24	90							
	5	390 - 476	137 - 168	10 - 18	4 - 10	10 - 15	17 - 25								
	7	375 - 459	137 - 167	8 - 15	4 - 10	7 - 11	17 - 25								
110	3	469 - 573	141 - 172	14 - 22	3 - 9	16 - 24	16 - 24	100							
	5	435 - 532	139 - 170	9 - 16	4 - 9	10 - 15	16 - 24								
	7	421 - 514	139 - 170	7 - 14	4 - 9	7 - 10	16 - 24								

This chart shows approximate temperatures and pressures for a unit in good normal operation. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80º D.B/67º W.B. Entering air temperature in cooling, 70º D.B entering air temperature in heating. Heating data at entering fluid temperatures below 50º assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

SM024 Part Load

COOLING								HEATING							
Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F	Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F
30								20	3	220 - 269	54 - 66	2 - 7	9 - 24	4 - 6	11 - 16
									5	223 - 272	57 - 69	1 - 6	9 - 23	3 - 4	11 - 17
									7	224 - 274	58 - 71	1 - 6	8 - 23	2 - 3	11 - 17
40								30	3	230 - 281	65 - 80	3 - 9	8 - 20	5 - 8	12 - 19
									5	234 - 286	69 - 85	1 - 6	7 - 19	3 - 5	13 - 19
									7	235 - 288	72 - 88	1 - 6	7 - 18	2 - 4	13 - 20
50	3	208 - 254	126 - 154	15 - 24	4 - 11	14 - 21	19 - 28	40	3	241 - 294	78 - 96	4 - 10	6 - 17	6 - 10	14 - 21
	5	186 - 228	125 - 153	9 - 17	4 - 11	9 - 13	19 - 28		5	245 - 300	84 - 102	2 - 7	6 - 16	4 - 6	15 - 23
	7	176 - 215	124 - 152	7 - 13	4 - 11	6 - 9	19 - 29		7	248 - 303	87 - 106	1 - 6	6 - 16	3 - 5	16 - 23
60	3	238 - 291	127 - 156	14 - 23	4 - 11	14 - 21	18 - 27	50	3	252 - 308	92 - 113	5 - 11	6 - 15	8 - 11	16 - 24
	5	216 - 264	126 - 155	9 - 16	4 - 11	8 - 13	18 - 27		5	258 - 315	100 - 122	2 - 8	5 - 14	5 - 7	17 - 26
	7	204 - 249	126 - 154	6 - 13	4 - 11	6 - 9	19 - 28		7	261 - 318	104 - 127	1 - 7	5 - 14	4 - 5	18 - 27
70	3	270 - 330	126 - 154	13 - 21	4 - 12	13 - 20	18 - 27	60	3	277 - 338	126 - 154	6 - 13	5 - 12	10 - 15	20 - 31
	5	248 - 303	127 - 156	8 - 15	4 - 11	8 - 12	18 - 27		5	285 - 348	138 - 169	3 - 9	4 - 12	6 - 10	22 - 33
	7	236 - 288	127 - 156	6 - 12	4 - 11	6 - 9	18 - 27		7	289 - 353	144 - 176	2 - 7	4 - 12	5 - 7	22 - 34
80	3	307 - 375	129 - 157	12 - 20	4 - 11	13 - 19	18 - 26	70	3	290 - 354	145 - 177	8 - 14	4 - 11	11 - 17	22 - 34
	5	284 - 348	131 - 160	7 - 14	4 - 11	8 - 12	17 - 25		5	300 - 366	160 - 196	4 - 10	4 - 11	7 - 11	24 - 36
	7	270 - 331	127 - 155	5 - 11	4 - 11	6 - 9	18 - 27		7	304 - 371	168 - 205	2 - 8	4 - 11	5 - 8	25 - 37
90	3	346 - 423	130 - 159	11 - 19	4 - 11	13 - 19	17 - 25	80	3	303 - 371	167 - 204	9 - 16	4 - 10	12 - 19	25 - 37
	5	323 - 395	133 - 162	6 - 13	4 - 11	8 - 11	16 - 25		5	312 - 381	185 - 226	5 - 11	4 - 10	8 - 12	26 - 40
	7	309 - 378	129 - 157	4 - 10	4 - 11	5 - 8	17 - 26		7	316 - 386	194 - 237	3 - 9	4 - 10	6 - 9	27 - 41
100	3	388 - 474	133 - 163	10 - 17	4 - 11	12 - 18	16 - 24	90							
	5	363 - 444	132 - 161	6 - 12	4 - 11	7 - 11	16 - 25								
	7	352 - 430	132 - 161	4 - 10	4 - 11	5 - 8	17 - 25								
110	3	433 - 529	135 - 165	9 - 16	4 - 11	12 - 18	16 - 23	100							
	5	408 - 499	134 - 164	5 - 11	4 - 11	7 - 11	16 - 24								
	7	396 - 484	134 - 163	3 - 9	4 - 11	5 - 8	16 - 24								

This chart shows approximate temperatures and pressures for a unit in good normal operation. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80º D.B/67º W.B. Entering air temperature in cooling, 70º D.B entering air temperature in heating. Heating data at entering fluid temperatures below 50º assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

SM036 Full Load

COOLING								HEATING							
Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F	Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F
30								20	5	238 - 291	62 - 75	3 - 9	8 - 21	7 - 10	15 - 22
									7	241 - 295	65 - 79	2 - 7	8 - 21	5 - 8	15 - 23
									10	244 - 298	68 - 83	1 - 6	8 - 20	4 - 6	16 - 24
40								30	5	249 - 305	74 - 90	4 - 10	7 - 19	8 - 12	17 - 25
									7	253 - 309	78 - 96	2 - 8	7 - 19	6 - 9	18 - 26
									10	256 - 313	82 - 100	1 - 6	7 - 18	4 - 7	18 - 27
50	5	185 - 227	132 - 161	20 - 30	3 - 9	17 - 26	17 - 26	40	5	261 - 319	88 - 107	5 - 11	7 - 17	9 - 14	19 - 29
	7.5	170 - 208	131 - 160	15 - 24	3 - 9	11 - 17	17 - 26		7	266 - 325	93 - 114	3 - 9	6 - 17	7 - 10	20 - 30
	10	163 - 199	130 - 159	12 - 20	3 - 9	9 - 13	18 - 26		10	271 - 331	98 - 120	2 - 7	6 - 16	5 - 8	21 - 31
60	5	214 - 262	133 - 163	19 - 29	3 - 8	17 - 25	17 - 25	50	5	274 - 335	103 - 125	6 - 13	6 - 16	10 - 16	21 - 32
	7.5	198 - 242	132 - 161	14 - 23	3 - 9	11 - 17	17 - 26		7	280 - 342	110 - 134	4 - 10	6 - 16	8 - 12	22 - 33
	10	190 - 232	132 - 161	11 - 19	3 - 9	8 - 13	17 - 26		10	285 - 348	116 - 142	2 - 8	6 - 16	6 - 9	23 - 35
70	5	245 - 300	134 - 164	18 - 27	3 - 8	16 - 25	16 - 25	60	5	287 - 351	119 - 146	8 - 15	6 - 15	12 - 18	24 - 36
	7.5	229 - 280	134 - 163	13 - 21	3 - 8	11 - 16	17 - 25		7	294 - 359	128 - 156	5 - 12	6 - 15	9 - 14	25 - 37
	10	221 - 270	133 - 163	10 - 18	3 - 8	8 - 12	17 - 25		10	299 - 366	136 - 166	3 - 9	5 - 14	7 - 10	26 - 39
80	5	280 - 343	136 - 166	17 - 26	3 - 8	16 - 24	16 - 24	70	5	300 - 367	137 - 168	9 - 16	5 - 14	13 - 20	26 - 39
	7.5	263 - 322	135 - 165	12 - 21	3 - 8	10 - 15	16 - 24		7	308 - 377	148 - 181	6 - 13	5 - 14	10 - 15	28 - 42
	10	255 - 311	135 - 165	10 - 17	3 - 8	8 - 12	16 - 24		10	315 - 385	158 - 193	4 - 10	5 - 13	8 - 11	29 - 43
90	5	319 - 390	139 - 170	15 - 24	3 - 8	15 - 23	15 - 23	80	5	315 - 384	157 - 192	10 - 18	5 - 14	15 - 22	29 - 43
	7.5	301 - 367	137 - 168	11 - 19	3 - 8	10 - 15	16 - 24		7	324 - 396	170 - 208	7 - 14	5 - 13	11 - 17	30 - 46
	10	292 - 356	137 - 167	9 - 16	3 - 8	8 - 12	16 - 24		10	332 - 406	182 - 223	5 - 11	5 - 13	8 - 12	32 - 48
100	5	360 - 440	142 - 173	14 - 23	3 - 7	15 - 22	15 - 22	90							
	7.5	342 - 418	140 - 171	10 - 18	3 - 8	10 - 15	15 - 22								
	10	333 - 407	139 - 170	8 - 15	3 - 8	7 - 11	15 - 23								
110	5	405 - 496	145 - 177	13 - 21	3 - 8	14 - 22	14 - 21	100							
	7.5	387 - 474	143 - 175	9 - 16	3 - 8	10 - 15	14 - 21								
	10	378 - 462	143 - 175	7 - 14	3 - 8	7 - 11	14 - 21								

This chart shows approximate temperatures and pressures for a unit in good normal operation. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80º D.B/67º W.B. Entering air temperature in cooling, 70º D.B entering air temperature in heating. Heating data at entering fluid temperatures below 50º assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

SM036 Part Load

COOLING								HEATING							
Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F	Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F
30								20	5	221 - 270	67 - 82	1 - 6	9 - 23	5 - 7	12 - 18
									7	223 - 273	70 - 86	1 - 6	8 - 22	3 - 5	12 - 18
									10	225 - 275	73 - 89	1 - 6	8 - 21	2 - 4	12 - 18
40								30	5	231 - 283	81 - 99	2 - 7	7 - 19	6 - 8	13 - 20
									7	234 - 286	84 - 103	1 - 6	7 - 18	4 - 6	14 - 21
									10	236 - 288	87 - 107	1 - 6	7 - 18	3 - 5	14 - 21
50	5	226 - 276	123 - 151	11 - 19	4 - 11	12 - 18	19 - 29	40	5	242 - 295	96 - 118	3 - 9	6 - 17	7 - 10	16 - 23
	7.5	200 - 245	122 - 149	7 - 14	4 - 10	8 - 12	20 - 29		7	245 - 299	101 - 123	1 - 7	6 - 16	5 - 7	16 - 24
	10	187 - 229	121 - 148	5 - 11	4 - 10	6 - 9	20 - 30		10	247 - 302	105 - 128	1 - 6	6 - 16	4 - 6	17 - 25
60	5	257 - 314	125 - 153	10 - 18	4 - 12	12 - 18	19 - 28	50	5	253 - 309	113 - 138	4 - 10	6 - 15	8 - 12	18 - 27
	7.5	230 - 282	124 - 151	6 - 13	4 - 11	8 - 12	19 - 29		7	257 - 314	119 - 145	2 - 8	5 - 14	6 - 9	18 - 28
	10	217 - 265	123 - 150	4 - 11	4 - 11	6 - 9	19 - 29		10	260 - 318	124 - 151	1 - 6	5 - 14	4 - 6	19 - 28
70	5	292 - 357	127 - 155	9 - 17	4 - 12	11 - 17	18 - 27	60	5	265 - 324	131 - 160	5 - 11	5 - 14	9 - 13	20 - 30
	7.5	264 - 322	125 - 153	6 - 12	4 - 12	8 - 11	19 - 28		7	270 - 330	139 - 169	3 - 9	5 - 13	7 - 10	21 - 31
	10	250 - 305	125 - 153	4 - 10	4 - 11	6 - 8	19 - 28		10	274 - 335	145 - 177	2 - 7	5 - 13	5 - 7	21 - 32
80	5	330 - 403	129 - 157	8 - 16	5 - 12	11 - 16	18 - 27	70	5	278 - 339	151 - 185	6 - 13	5 - 13	10 - 15	22 - 33
	7.5	301 - 367	127 - 156	5 - 11	4 - 12	7 - 11	18 - 27		7	283 - 345	161 - 196	4 - 10	5 - 12	8 - 12	23 - 35
	10	286 - 349	126 - 155	3 - 9	4 - 12	5 - 8	18 - 28		10	287 - 351	169 - 206	2 - 8	4 - 12	6 - 8	24 - 36
90	5	371 - 454	132 - 161	8 - 15	4 - 10	11 - 16	17 - 25	80	5	290 - 354	173 - 212	7 - 14	4 - 12	11 - 17	24 - 36
	7.5	340 - 416	129 - 158	4 - 10	5 - 12	7 - 10	18 - 27		7	295 - 361	185 - 226	5 - 11	4 - 11	9 - 13	25 - 38
	10	325 - 398	128 - 157	3 - 8	5 - 12	5 - 8	18 - 27		10	301 - 368	195 - 239	3 - 9	4 - 11	6 - 9	26 - 40
100	5	415 - 507	134 - 163	7 - 13	4 - 10	10 - 16	16 - 24	90							
	7.5	383 - 468	129 - 157	4 - 10	6 - 16	7 - 10	18 - 27								
	10	369 - 451	130 - 159	2 - 8	5 - 13	5 - 8	17 - 26								
110	5	461 - 563	133 - 163	6 - 12	5 - 14	10 - 15	16 - 25	100							
	7.5	431 - 527	131 - 160	3 - 9	6 - 15	7 - 10	17 - 26								
	10	418 - 510	134 - 163	2 - 7	4 - 11	5 - 7	16 - 24								

This chart shows approximate temperatures and pressures for a unit in good normal operation. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80º D.B/67º W.B. Entering air temperature in cooling, 70º D.B entering air temperature in heating. Heating data at entering fluid temperatures below 50º assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

SM048 Full Load

COOLING								HEATING							
Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F	Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F
30								20	6	246 - 301	65 - 79	3 - 9	8 - 20	7 - 10	16 - 24
									9	251 - 306	69 - 84	1 - 7	7 - 20	5 - 7	16 - 25
									12	253 - 310	71 - 87	1 - 6	7 - 19	4 - 6	17 - 25
40								30	6	259 - 316	76 - 93	4 - 10	7 - 18	8 - 12	18 - 27
									9	264 - 323	81 - 100	2 - 8	7 - 18	6 - 9	19 - 28
									12	268 - 327	84 - 103	1 - 6	7 - 17	4 - 7	19 - 29
50	6	200 - 245	128 - 156	22 - 33	3 - 9	18 - 28	19 - 29	40	6	272 - 332	88 - 108	5 - 11	6 - 17	9 - 14	20 - 30
	9	182 - 222	127 - 155	16 - 25	3 - 9	12 - 19	19 - 29		9	279 - 340	95 - 117	3 - 9	6 - 16	7 - 10	21 - 32
	12	173 - 211	126 - 154	13 - 21	3 - 9	9 - 14	20 - 29		12	282 - 345	99 - 121	2 - 7	6 - 16	5 - 8	22 - 33
60	6	230 - 281	130 - 159	21 - 31	3 - 8	18 - 27	19 - 28	50	6	285 - 348	102 - 125	6 - 13	6 - 16	10 - 16	22 - 34
	9	211 - 258	129 - 157	15 - 24	3 - 9	12 - 18	19 - 28		9	293 - 358	111 - 135	4 - 10	6 - 15	8 - 11	24 - 36
	12	201 - 246	128 - 156	12 - 20	3 - 9	9 - 14	19 - 29		12	297 - 364	116 - 142	2 - 8	6 - 15	6 - 9	25 - 37
70	6	263 - 321	131 - 161	20 - 30	3 - 8	18 - 26	18 - 27	60	6	299 - 365	118 - 144	8 - 15	6 - 15	12 - 18	25 - 38
	9	243 - 297	130 - 159	14 - 23	3 - 8	12 - 18	18 - 27		9	308 - 377	128 - 157	5 - 11	5 - 14	8 - 13	27 - 40
	12	233 - 284	130 - 159	11 - 19	3 - 9	9 - 13	18 - 28		12	314 - 383	134 - 164	3 - 9	5 - 14	7 - 10	28 - 42
80	6	299 - 365	133 - 163	18 - 28	3 - 8	17 - 26	18 - 26	70	6	313 - 383	134 - 164	9 - 16	5 - 14	13 - 20	28 - 42
	9	279 - 341	132 - 161	13 - 22	3 - 8	12 - 17	18 - 27		9	324 - 396	147 - 180	6 - 12	5 - 14	10 - 14	30 - 44
	12	268 - 328	132 - 161	10 - 18	3 - 8	9 - 13	18 - 27		12	331 - 405	155 - 189	4 - 10	5 - 13	8 - 11	31 - 46
90	6	337 - 412	135 - 165	17 - 27	3 - 8	16 - 25	17 - 25	80	6	329 - 402	153 - 187	11 - 18	5 - 13	15 - 22	30 - 45
	9	317 - 387	134 - 164	12 - 20	3 - 8	11 - 17	17 - 26		9	342 - 418	168 - 206	7 - 14	5 - 13	11 - 16	32 - 49
	12	306 - 374	134 - 163	10 - 17	3 - 8	9 - 13	17 - 26		12	349 - 427	178 - 217	5 - 11	5 - 13	8 - 12	34 - 51
100	6	377 - 461	137 - 168	16 - 25	3 - 8	16 - 24	16 - 25	90							
	9	357 - 437	137 - 167	11 - 19	3 - 8	11 - 17	17 - 25								
	12	347 - 424	136 - 166	9 - 16	3 - 8	8 - 12	17 - 25								
110	6	420 - 514	140 - 171	14 - 23	3 - 8	16 - 24	16 - 24	100							
	9	401 - 490	139 - 170	10 - 18	3 - 8	11 - 16	16 - 24								
	12	390 - 477	138 - 169	8 - 15	3 - 8	8 - 12	16 - 24								

This chart shows approximate temperatures and pressures for a unit in good normal operation. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80º D.B/67º W.B. Entering air temperature in cooling, 70º D.B entering air temperature in heating. Heating data at entering fluid temperatures below 50º assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

SM048 Part Load

COOLING								HEATING							
Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F	Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F
30								20	6	237 - 290	65 - 79	4 - 10	8 - 20	5 - 8	15 - 22
									9	240 - 293	68 - 83	3 - 9	7 - 19	4 - 5	15 - 23
									12	242 - 295	70 - 86	2 - 8	7 - 19	3 - 4	16 - 24
40								30	6	248 - 303	78 - 95	5 - 11	7 - 17	6 - 9	17 - 26
									9	252 - 308	82 - 100	4 - 10	6 - 17	4 - 6	18 - 27
									12	254 - 311	85 - 104	3 - 9	6 - 16	3 - 5	18 - 27
50	6	234 - 286	121 - 148	10 - 18	7 - 18	14 - 21	20 - 30	40	6	261 - 319	92 - 113	6 - 13	6 - 15	7 - 11	19 - 29
	9	203 - 248	119 - 146	10 - 17	6 - 15	9 - 14	20 - 30		9	266 - 325	98 - 120	4 - 10	6 - 15	5 - 8	20 - 30
	12	195 - 238	119 - 145	10 - 17	7 - 17	7 - 11	20 - 30		12	269 - 328	101 - 124	3 - 9	5 - 15	4 - 6	21 - 31
60	6	265 - 324	123 - 150	10 - 17	7 - 18	13 - 20	19 - 29	50	6	275 - 336	108 - 132	7 - 14	5 - 14	8 - 12	22 - 32
	9	233 - 284	121 - 148	10 - 17	7 - 18	9 - 14	20 - 30		9	280 - 342	115 - 141	5 - 11	5 - 13	6 - 9	23 - 34
	12	224 - 274	120 - 147	9 - 17	7 - 18	7 - 10	20 - 30		12	283 - 346	120 - 146	4 - 10	5 - 13	4 - 7	23 - 35
70	6	300 - 366	125 - 152	9 - 16	7 - 18	13 - 19	19 - 28	60	6	287 - 351	125 - 153	8 - 15	5 - 13	9 - 14	24 - 36
	9	266 - 325	123 - 150	9 - 16	7 - 18	9 - 13	19 - 29		9	294 - 360	135 - 164	6 - 12	5 - 12	7 - 10	25 - 38
	12	257 - 314	122 - 149	9 - 16	7 - 18	7 - 10	19 - 29		12	299 - 365	140 - 171	4 - 11	5 - 12	5 - 8	26 - 39
80	6	337 - 411	126 - 154	8 - 15	7 - 19	12 - 19	18 - 27	70	6	302 - 369	144 - 176	9 - 17	5 - 12	11 - 16	27 - 40
	9	302 - 369	125 - 152	8 - 16	7 - 18	8 - 13	19 - 28		9	310 - 379	156 - 191	7 - 13	4 - 12	8 - 11	28 - 42
	12	293 - 358	124 - 152	8 - 16	7 - 18	6 - 9	19 - 28		12	315 - 384	163 - 199	5 - 11	4 - 11	6 - 9	29 - 44
90	6	377 - 461	128 - 156	7 - 14	7 - 19	12 - 18	18 - 27	80	6	316 - 387	166 - 202	11 - 18	4 - 11	12 - 18	29 - 44
	9	342 - 418	126 - 154	8 - 15	7 - 18	8 - 12	18 - 27		9	327 - 399	179 - 219	8 - 14	4 - 11	8 - 13	31 - 47
	12	333 - 407	126 - 154	8 - 15	7 - 18	6 - 9	18 - 27		12	332 - 406	188 - 230	6 - 12	4 - 11	7 - 10	32 - 48
100	6	421 - 515	129 - 158	6 - 13	7 - 19	12 - 18	17 - 26	90							
	9	386 - 472	128 - 156	7 - 14	7 - 19	8 - 12	18 - 27								
	12	377 - 461	128 - 156	7 - 14	7 - 19	6 - 9	18 - 27								
110	6	469 - 573	131 - 160	5 - 11	7 - 20	11 - 17	17 - 25	100							
	9	435 - 531	130 - 158	6 - 12	7 - 20	8 - 12	17 - 26								
	12	426 - 520	129 - 158	6 - 13	7 - 19	6 - 9	17 - 26								

This chart shows approximate temperatures and pressures for a unit in good normal operation. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80º D.B/67º W.B. Entering air temperature in cooling, 70º D.B entering air temperature in heating. Heating data at entering fluid temperatures below 50º assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

SM060 Full Load

COOLING								HEATING							
Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F	Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F
30								20	7	262 - 321	56 - 69	12 - 20	9 - 24	7 - 11	17 - 26
									12	269 - 329	62 - 76	9 - 17	9 - 23	5 - 7	18 - 27
									15	271 - 332	64 - 78	9 - 16	9 - 23	4 - 6	19 - 28
40								30	7	276 - 337	68 - 83	13 - 21	8 - 23	9 - 13	19 - 29
									12	284 - 347	75 - 91	10 - 18	8 - 22	5 - 8	21 - 31
									15	286 - 350	77 - 94	9 - 17	8 - 22	4 - 7	21 - 32
50	7	234 - 286	121 - 148	25 - 36	7 - 18	20 - 30	20 - 30	40	7	290 - 354	80 - 98	14 - 22	8 - 21	10 - 15	22 - 33
	12	203 - 248	119 - 146	18 - 27	6 - 15	12 - 17	20 - 30		12	299 - 366	89 - 109	11 - 19	8 - 21	6 - 9	24 - 35
	15	195 - 238	119 - 145	16 - 25	7 - 17	9 - 14	20 - 30		15	302 - 369	92 - 112	10 - 17	8 - 20	5 - 8	24 - 36
60	7	265 - 324	123 - 150	24 - 35	7 - 18	19 - 29	19 - 29	50	7	304 - 372	94 - 115	15 - 24	8 - 20	11 - 17	24 - 37
	12	233 - 284	121 - 148	17 - 26	7 - 18	11 - 17	20 - 30		12	315 - 386	104 - 128	12 - 20	8 - 20	7 - 11	26 - 39
	15	224 - 274	120 - 147	15 - 24	7 - 18	9 - 13	20 - 30		15	319 - 390	108 - 132	11 - 18	7 - 20	6 - 9	27 - 40
70	7	300 - 366	125 - 152	23 - 33	7 - 18	19 - 28	19 - 28	60	7	320 - 391	109 - 133	17 - 26	7 - 20	13 - 19	27 - 41
	12	266 - 325	123 - 150	16 - 25	7 - 18	11 - 16	19 - 29		12	334 - 408	123 - 150	13 - 21	7 - 19	8 - 12	29 - 44
	15	257 - 314	122 - 149	14 - 23	7 - 18	9 - 13	19 - 29		15	338 - 414	127 - 155	11 - 19	7 - 19	7 - 10	30 - 45
80	7	337 - 411	126 - 154	21 - 32	7 - 19	18 - 27	18 - 27	70	7	337 - 412	126 - 154	18 - 28	7 - 19	14 - 21	30 - 45
	12	302 - 369	125 - 152	15 - 24	7 - 18	11 - 16	19 - 28		12	353 - 432	142 - 174	14 - 22	7 - 19	9 - 14	33 - 49
	15	293 - 358	124 - 152	13 - 22	7 - 18	8 - 13	19 - 28		15	359 - 438	148 - 181	12 - 20	7 - 18	8 - 11	33 - 50
90	7	377 - 461	128 - 156	20 - 30	7 - 19	18 - 27	18 - 27	80	7	355 - 434	144 - 176	20 - 30	7 - 18	16 - 24	33 - 49
	12	342 - 418	126 - 154	14 - 23	7 - 18	10 - 15	18 - 27		12	374 - 457	164 - 201	15 - 23	7 - 18	10 - 15	36 - 54
	15	333 - 407	126 - 154	13 - 21	7 - 18	8 - 12	18 - 27		15	380 - 465	171 - 209	13 - 21	7 - 18	8 - 13	37 - 55
100	7	421 - 515	129 - 158	19 - 29	7 - 19	18 - 26	17 - 26	90							
	12	386 - 472	128 - 156	14 - 22	7 - 19	10 - 15	18 - 27								
	15	377 - 461	128 - 156	12 - 20	7 - 19	8 - 12	18 - 27								
110	7	469 - 573	131 - 160	18 - 27	7 - 20	17 - 26	17 - 25	100							
	12	435 - 531	130 - 158	13 - 21	7 - 20	10 - 15	17 - 26								
	15	426 - 520	129 - 158	12 - 19	7 - 19	8 - 12	17 - 26								

This chart shows approximate temperatures and pressures for a unit in good normal operation. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80º D.B/67º W.B. Entering air temperature in cooling, 70º D.B entering air temperature in heating. Heating data at entering fluid temperatures below 50º assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

SM060 Part Load

COOLING								HEATING							
Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F	Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F
30								20	7	246 - 300	64 - 79	7 - 14	7 - 20	5 - 8	16 - 23
									12	250 - 306	69 - 84	5 - 12	7 - 19	3 - 5	16 - 24
									15	251 - 307	71 - 86	5 - 11	7 - 18	3 - 4	17 - 25
40								30	7	258 - 316	77 - 95	8 - 15	7 - 17	6 - 10	18 - 27
									12	264 - 323	83 - 102	6 - 12	6 - 17	4 - 6	19 - 28
									15	266 - 325	85 - 104	5 - 12	6 - 17	3 - 5	19 - 29
50	7	198 - 242	127 - 155	15 - 24	6 - 15	15 - 23	20 - 29	40	7	273 - 333	92 - 113	9 - 16	6 - 16	8 - 12	20 - 30
	12	176 - 215	125 - 153	9 - 17	5 - 14	9 - 13	20 - 30		12	280 - 342	99 - 121	6 - 13	6 - 15	5 - 7	21 - 32
	15	169 - 207	125 - 153	8 - 15	5 - 14	7 - 11	20 - 30		15	282 - 345	102 - 125	6 - 12	6 - 15	4 - 6	22 - 33
60	7	228 - 278	129 - 158	14 - 23	6 - 15	14 - 22	19 - 28	50	7	287 - 350	108 - 132	10 - 18	6 - 15	9 - 13	23 - 34
	12	204 - 249	127 - 156	9 - 16	6 - 15	9 - 13	19 - 29		12	295 - 360	117 - 143	7 - 14	5 - 14	6 - 8	24 - 36
	15	197 - 241	127 - 155	7 - 14	6 - 15	7 - 11	20 - 29		15	297 - 364	120 - 147	6 - 13	5 - 14	4 - 7	25 - 37
70	7	259 - 317	131 - 160	13 - 21	6 - 15	14 - 21	18 - 27	60	7	301 - 368	125 - 153	11 - 19	5 - 14	10 - 15	25 - 38
	12	235 - 287	129 - 158	8 - 15	6 - 15	8 - 13	19 - 28		12	311 - 380	137 - 168	8 - 15	5 - 13	6 - 9	27 - 41
	15	229 - 279	129 - 158	6 - 13	6 - 15	7 - 10	19 - 28		15	314 - 384	141 - 173	7 - 14	5 - 13	5 - 8	28 - 41
80	7	295 - 360	133 - 162	12 - 20	6 - 16	14 - 20	18 - 27	70	7	317 - 387	144 - 176	12 - 21	5 - 13	11 - 17	28 - 42
	12	270 - 330	132 - 161	7 - 14	6 - 16	8 - 12	18 - 27		12	328 - 401	159 - 195	9 - 16	5 - 12	7 - 11	30 - 45
	15	263 - 321	131 - 160	6 - 12	6 - 16	7 - 10	18 - 28		15	332 - 406	164 - 201	8 - 15	5 - 12	6 - 9	31 - 46
90	7	333 - 407	135 - 165	11 - 18	6 - 16	13 - 20	17 - 26	80	7	333 - 407	166 - 202	14 - 22	5 - 12	13 - 19	31 - 46
	12	308 - 377	134 - 163	6 - 13	6 - 16	8 - 12	18 - 27		12	346 - 423	184 - 225	10 - 17	5 - 12	8 - 12	33 - 50
	15	301 - 368	133 - 163	5 - 11	6 - 16	6 - 9	18 - 27		15	351 - 429	190 - 233	8 - 15	4 - 12	7 - 10	34 - 51
100	7	373 - 456	137 - 167	9 - 16	6 - 17	13 - 19	17 - 25	90							
	12	349 - 427	136 - 166	5 - 12	6 - 17	8 - 11	17 - 26								
	15	343 - 419	135 - 166	4 - 10	6 - 17	6 - 9	17 - 26								
110	7	417 - 509	139 - 170	8 - 15	7 - 18	12 - 19	16 - 24	100							
	12	394 - 482	138 - 169	4 - 11	7 - 17	7 - 11	17 - 25								
	15	388 - 474	138 - 168	3 - 9	6 - 17	6 - 9	17 - 25								

This chart shows approximate temperatures and pressures for a unit in good normal operation. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80º D.B/67º W.B. Entering air temperature in cooling, 70º D.B entering air temperature in heating. Heating data at entering fluid temperatures below 50º assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

SM070 Full Load

COOLING								HEATING							
Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F	Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F
30								20	9	265 - 324	57 - 70	8 - 16	8 - 22	7 - 10	18 - 26
									12	269 - 328	60 - 73	7 - 14	8 - 21	6 - 8	18 - 27
									18	272 - 332	63 - 77	6 - 12	8 - 21	4 - 6	19 - 28
40								30	9	279 - 340	69 - 84	9 - 17	8 - 20	8 - 12	20 - 30
									12	282 - 345	72 - 88	8 - 15	8 - 20	6 - 9	20 - 30
									18	287 - 351	76 - 93	6 - 13	7 - 20	5 - 7	21 - 32
50	9	205 - 251	127 - 156	14 - 23	5 - 14	14 - 20	17 - 25	40	9	293 - 358	81 - 99	10 - 18	7 - 19	9 - 14	22 - 33
	15	185 - 226	126 - 154	9 - 16	5 - 14	8 - 12	17 - 26		12	297 - 364	86 - 105	9 - 16	7 - 19	7 - 11	23 - 35
	18	180 - 220	125 - 153	8 - 15	5 - 14	7 - 11	17 - 26		18	303 - 370	91 - 111	7 - 14	7 - 19	5 - 8	24 - 36
60	9	234 - 286	127 - 156	13 - 22	5 - 14	13 - 20	16 - 25	50	9	308 - 377	95 - 117	12 - 20	7 - 19	10 - 16	25 - 37
	15	213 - 261	126 - 154	8 - 15	5 - 15	8 - 12	17 - 25		12	314 - 384	101 - 124	10 - 17	7 - 18	8 - 12	26 - 39
	18	208 - 255	125 - 153	7 - 14	5 - 14	7 - 10	17 - 25		18	321 - 393	108 - 132	8 - 15	7 - 18	6 - 9	27 - 40
70	9	267 - 327	129 - 157	12 - 20	5 - 13	13 - 19	16 - 24	60	9	325 - 397	111 - 136	13 - 21	7 - 18	12 - 18	28 - 41
	15	245 - 299	127 - 156	8 - 14	6 - 15	8 - 12	16 - 25		12	332 - 406	118 - 145	11 - 18	6 - 17	9 - 14	29 - 43
	18	239 - 293	127 - 156	6 - 13	5 - 15	7 - 10	16 - 25		18	341 - 416	127 - 155	8 - 16	6 - 17	7 - 10	30 - 45
80	9	302 - 369	132 - 161	11 - 19	6 - 15	13 - 19	16 - 24	70	9	343 - 419	128 - 157	14 - 23	6 - 17	13 - 20	30 - 45
	15	279 - 341	129 - 158	7 - 13	6 - 17	8 - 12	16 - 24		12	351 - 429	137 - 167	12 - 20	6 - 17	10 - 16	32 - 47
	18	275 - 336	129 - 158	6 - 12	5 - 13	6 - 9	16 - 23		18	362 - 442	148 - 180	9 - 16	6 - 17	7 - 11	33 - 50
90	9	341 - 416	132 - 161	10 - 18	6 - 16	12 - 19	15 - 23	80	9	362 - 442	147 - 180	16 - 25	6 - 17	15 - 22	33 - 50
	15	318 - 388	130 - 158	6 - 13	6 - 16	7 - 11	16 - 23		12	371 - 454	158 - 193	13 - 21	6 - 17	12 - 17	35 - 52
	18	312 - 381	132 - 161	5 - 11	6 - 16	6 - 9	16 - 23		18	384 - 469	171 - 209	10 - 17	6 - 16	8 - 12	36 - 55
100	9	383 - 468	134 - 163	9 - 16	6 - 16	12 - 18	15 - 22	90							
	15	360 - 440	132 - 162	5 - 12	6 - 16	7 - 11	15 - 23								
	18	354 - 433	132 - 161	4 - 10	6 - 16	6 - 9	15 - 23								
110	9	429 - 524	135 - 165	8 - 15	7 - 18	12 - 18	14 - 22	100							
	15	406 - 496	134 - 164	5 - 11	6 - 16	7 - 11	14 - 22								
	18	400 - 489	134 - 164	4 - 10	6 - 17	6 - 9	15 - 22								

This chart shows approximate temperatures and pressures for a unit in good normal operation. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80º D.B/67º W.B. Entering air temperature in cooling, 70º D.B entering air temperature in heating. Heating data at entering fluid temperatures below 50º assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

SM070 Part Load

COOLING								HEATING							
Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Rise °F	Air Temp Drop °F	Entering Water °F	Water flow GPM	Discharge Pressure (PSIG)	Suction Pressure (PSIG)	Subcooling °F	Superheat °F	Water Temp Drop °F	Air Temp Rise °F
30								20	9	253 - 310	65 - 79	7 - 14	7 - 17	5 - 8	17 - 25
									12	256 - 312	67 - 82	6 - 12	6 - 17	4 - 6	17 - 26
									18	259 - 316	70 - 85	5 - 11	6 - 17	3 - 4	18 - 27
40								30	9	267 - 327	78 - 95	8 - 15	6 - 16	6 - 9	19 - 29
									12	271 - 331	81 - 99	7 - 13	6 - 15	5 - 7	20 - 30
									18	275 - 336	84 - 103	5 - 12	6 - 15	3 - 5	20 - 30
50	9	226 - 230	139 - 144	14 - 23	8 - 10	14 - 20	19 - 23	40	9	282 - 344	92 - 113	9 - 16	5 - 14	7 - 11	22 - 32
	15	204 - 208	137 - 143	9 - 16	8 - 10	8 - 12	19 - 24		12	285 - 349	96 - 117	7 - 14	5 - 14	6 - 9	22 - 33
	18	198 - 202	137 - 142	8 - 15	8 - 10	7 - 11	20 - 24		18	290 - 354	101 - 123	6 - 12	5 - 14	4 - 6	23 - 35
60	9	258 - 263	139 - 144	13 - 22	8 - 10	13 - 20	19 - 23	50	9	297 - 362	108 - 132	10 - 17	5 - 13	8 - 12	24 - 36
	15	234 - 239	137 - 143	8 - 15	8 - 10	8 - 12	19 - 23		12	301 - 368	113 - 138	8 - 15	5 - 13	7 - 10	25 - 38
	18	229 - 234	137 - 142	7 - 14	8 - 10	7 - 10	19 - 23		18	306 - 374	119 - 145	6 - 13	5 - 13	5 - 7	26 - 39
70	9	294 - 300	140 - 146	12 - 20	7 - 9	13 - 19	18 - 22	60	9	312 - 382	125 - 153	11 - 18	5 - 12	9 - 14	27 - 40
	15	269 - 275	139 - 144	8 - 14	8 - 10	8 - 12	18 - 23		12	318 - 389	132 - 161	9 - 16	5 - 12	7 - 11	28 - 42
	18	263 - 269	139 - 144	6 - 13	8 - 10	7 - 10	19 - 23		18	325 - 397	139 - 170	7 - 14	5 - 12	5 - 8	29 - 44
80	9	332 - 339	143 - 149	11 - 19	9 - 10	13 - 19	18 - 22	70	9	330 - 403	145 - 177	12 - 20	4 - 12	11 - 16	30 - 45
	15	307 - 313	141 - 147	7 - 13	9 - 12	8 - 12	18 - 22		12	337 - 411	153 - 187	10 - 17	4 - 12	8 - 13	31 - 46
	18	302 - 308	141 - 146	6 - 12	7 - 9	6 - 9	18 - 21		18	344 - 421	162 - 198	8 - 15	4 - 11	6 - 9	32 - 48
90	9	375 - 382	143 - 149	10 - 18	9 - 11	12 - 19	17 - 21	80	9	348 - 425	167 - 204	13 - 21	4 - 11	12 - 18	33 - 49
	15	349 - 356	141 - 147	6 - 13	9 - 11	7 - 11	18 - 21		12	356 - 435	176 - 215	11 - 19	4 - 11	9 - 14	34 - 51
	18	343 - 350	144 - 149	5 - 11	9 - 11	6 - 9	18 - 21		18	366 - 447	188 - 229	8 - 15	4 - 11	7 - 10	36 - 53
100	9	421 - 430	145 - 151	9 - 16	9 - 11	12 - 18	17 - 20	90							
	15	396 - 404	144 - 150	5 - 12	9 - 11	7 - 11	17 - 21								
	18	389 - 397	144 - 150	4 - 10	9 - 11	6 - 9	17 - 21								
110	9	471 - 481	147 - 153	8 - 15	10 - 12	12 - 18	16 - 20	100							
	15	446 - 455	146 - 152	5 - 11	9 - 11	7 - 11	16 - 20								
	18	440 - 449	146 - 152	4 - 10	9 - 11	6 - 9	16 - 20								

This chart shows approximate temperatures and pressures for a unit in good normal operation. The values shown are meant as a guide only and should not be used to estimate system charge. This chart assumes rated air flow and 80º D.B/67º W.B. Entering air temperature in cooling, 70º D.B entering air temperature in heating. Heating data at entering fluid temperatures below 50º assumes the use of antifreeze. As a result of continuing research and development, specifications are subject to change without notice.

BLOWER PERFORMANCE DATA
(HZ) UNITS REV A

Models	Fan Speed	Rated Airflow	Adjust	Fan Only	External Static Pressure (in of Water)									
					0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
024- Part Load	High	725	+	550	730	730	730	730	730	730	730	730	-	-
	Med	650	Normal A	480	650	650	650	650	650	650	650	650	-	-
	Low	500	-	375	500	500	500	500	500	500	500	500	-	-
024- Full Load	High	950	+	710	950	950	950	950	950	950	950	950	-	-
	Med	825	Normal A	615	825	825	825	825	825	825	825	825	-	-
	Low	725	-	550	730	730	730	730	730	730	730	730	-	-
036- Part Load	High	950	+	650	950	950	950	950	950	950	950	950	950	950
	Med	800	Normal A	550	800	800	800	800	800	800	800	800	800	800
	Low	750	-	515	750	750	750	750	750	750	750	750	750	750
036- Full Load	High	1300	+	900	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	Med	1100	Normal A	750	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	Low	950	-	650	950	950	950	950	950	950	950	950	950	950
048- Part Load	High	1400	+	970	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
	Med	1300	Normal A	900	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	Low	1100	-	760	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
048- Full Load	High	1800	+	1240	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
	Med	1600	Normal A	1100	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
	Low	1400	-	160	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
060- Part Load	High	1800	+	1350	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
	Med	1600	Normal A	1200	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
	Low	1400	-	1050	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
060- Full Load	High	2200	+	1650	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
	Med	2000	Normal A	1500	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
	Low	1800	-	1350	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
070- Part Load	High	2100	+	1575	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100
	Med	1850	Normal A	1390	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
	Low	1600	-	1200	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
070- Full Load	High	2500	+	1875	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
	Med	2350	Normal A	1760	2350	2350	2350	2350	2350	2350	2350	2350	2350	2350
	Low	2100	-	1575	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100

Blower Performance Data

(VT/CF) units Rev B

Model	ECM Board setting	Rated Airflow	DeHum Airflow	External Static Pressure (in of Water)									
				0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
024- Fan Only	+	630	500	630	630	630	630	630	630	630	630	-	-
	Norm A	560	450	560	560	560	560	560	560	560	560	-	-
	-	490	390	490	490	490	490	490	490	490	-	-	-
024- Part Load	+	800	640	800	800	800	800	800	800	800	800	-	-
	Norm A	700	560	700	700	700	700	700	700	700	700	-	-
	-	600	480	600	600	600	600	600	600	600	-	-	-
024- Full Load	+	900	720	900	900	900	900	900	900	900	900	-	-
	Norm A	800	640	800	800	800	800	800	800	800	800	-	-
	-	700	560	700	700	700	700	700	700	700	-	-	-
036- Fan Only	+	945	760	945	945	945	945	945	945	945	945	945	945
	Norm A	840	670	840	840	840	840	840	840	840	840	840	840
	-	735	590	735	735	735	735	735	735	735	735	735	735
036- Part Load	+	1200	960	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
	Norm A	1050	840	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
	-	900	720	900	900	900	900	900	900	900	900	900	900
036- Full Load	+	1350	1080	1350	1350	1350	1350	1350	1350	1350	1350	1350	1350
	Norm A	1200	960	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
	-	1050	840	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
048- Fan Only	+	1260	1010	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260
	Norm A	1120	900	1120	1120	1120	1120	1120	1120	1120	1120	1120	1120
	-	1015	810	1015	1015	1015	1015	1015	1015	1015	1015	1015	1015
048- Part Load	+	1450	1160	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450
	Norm A	1300	1040	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	-	1150	920	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150
048- Full Load	+	1800	1440	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
	Norm A	1600	1280	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
	-	1450	1160	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450
060- Fan Only	+	1540	1230	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540
	Norm A	1365	1090	1365	1365	1365	1365	1365	1365	1365	1365	1365	1365
	-	1225	980	1225	1225	1225	1225	1225	1225	1225	1225	1225	1225
060- Part Load	+	1800	1440	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
	Norm A	1550	1240	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
	-	1400	1120	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
060- Full Load	+	2200	1760	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
	Norm A	1950	1560	1950	1950	1950	1950	1950	1950	1950	1950	1950	1950
	-	1750	1400	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
070- Fan Only	+	1680	1340	1680	1680	1680	1680	1680	1680	1680	1680	1680	1680
	Norm A	1575	1260	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575
	-	1330	1060	1330	1330	1330	1330	1330	1330	1330	1330	1330	1330
070- Part Load	+	2000	1600	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
	Norm A	1800	1440	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
	-	1550	1240	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
070- Full Load	+	2400	1920	2400	2400	2400	2400	2400	2400	2400	2400	2250	2250
	Norm A	2250	1800	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250
	-	1900	1520	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900

WATER SIDE PRESSURE DROP TABLE

HZ Units only (Rev A)

Water Side Pressure Drop Table			
Model	GPM	Heat Pump water pressure drop Water PD @ 77°EWT with Water in Psi	Additional pressure drop in hose kit* Water PD in Psi
SM024	3	0.7	0.04
	4	1.2	0.04
	5	1.7	0.09
	6	2.4	0.09
	7	3.2	0.13
	8	4.0	0.17
SM036	4.5	1.3	0.09
	6	2.2	0.09
	7.5	3.2	0.17
	9	4.5	0.22
	10.5	5.9	0.30
	12	7.5	0.35
SM048	6	1.1	0.09
	8	1.8	0.17
	10	2.7	0.26
	12	3.7	0.35
	14	4.9	0.48
	16	6.2	0.61
SM060	7.5	1.1	0.17
	10	1.9	0.26
	12.5	2.8	0.39
	15	3.9	0.52
	17.5	5.2	0.69
	20	6.6	0.91
SM070	9	2.4	0.22
	12	4.0	0.36
	15	6.0	0.53
	18	8.3	0.72
	21	3.9	0.95
	24	5.0	1.21
* Hose kit pressure drop based on straight hose. Pressure drop may vary depending on installation of hose kits.			

VT/CF Units (Rev B)

Water Side Pressure Drop Table			
Model	GPM	Heat Pump water pressure drop	Additional pressure drop in hose kit*
		Water PD @ 77°EWT with Water in Psi	Water PD in Psi
SM024	3	0.9	0.03
	4	1.5	0.05
	5	2.2	0.08
	6	3.0	0.11
	7	4.0	0.14
	8	5.0	0.18
SM036	4.5	0.9	0.07
	6	1.5	0.11
	7.5	2.2	0.16
	9	3.1	0.22
	10.5	4.0	0.28
	12	5.1	0.36
SM048	6	1.3	0.11
	8	2.2	0.18
	10	3.3	0.26
	12	4.5	0.36
	14	5.9	0.47
	16	7.6	0.59
SM060	7.5	1.7	0.16
	10	2.9	0.26
	12.5	4.3	0.38
	15	6.0	0.53
	17.5	7.9	0.69
SM070	9	2.4	0.22
	12	4.0	0.36
	15	6.0	0.53
	18	8.3	0.72
* Hose kit pressure drop based on straight hose. Pressure drop may vary depending on installation of hose kits.			

WIRING DIAGRAMS

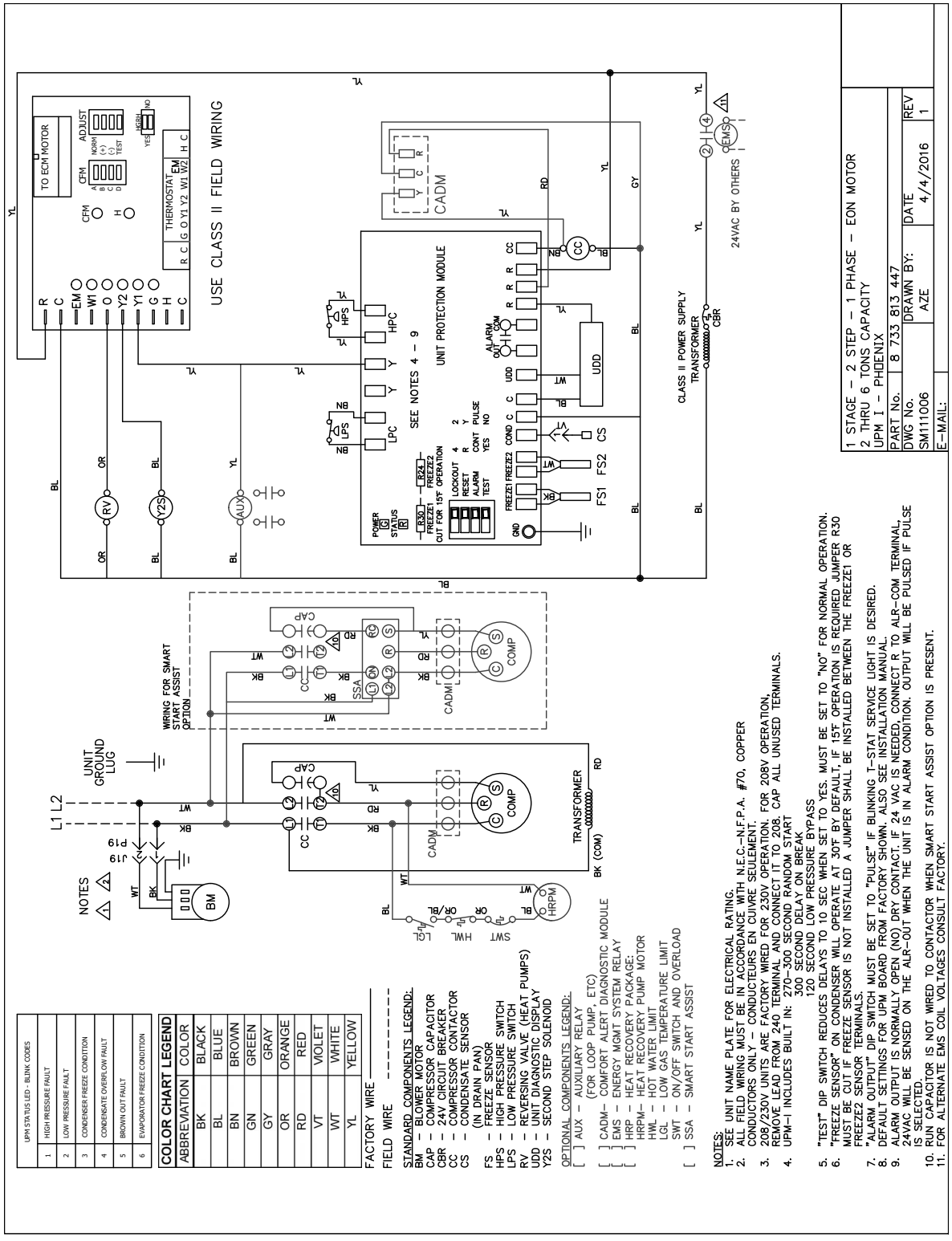
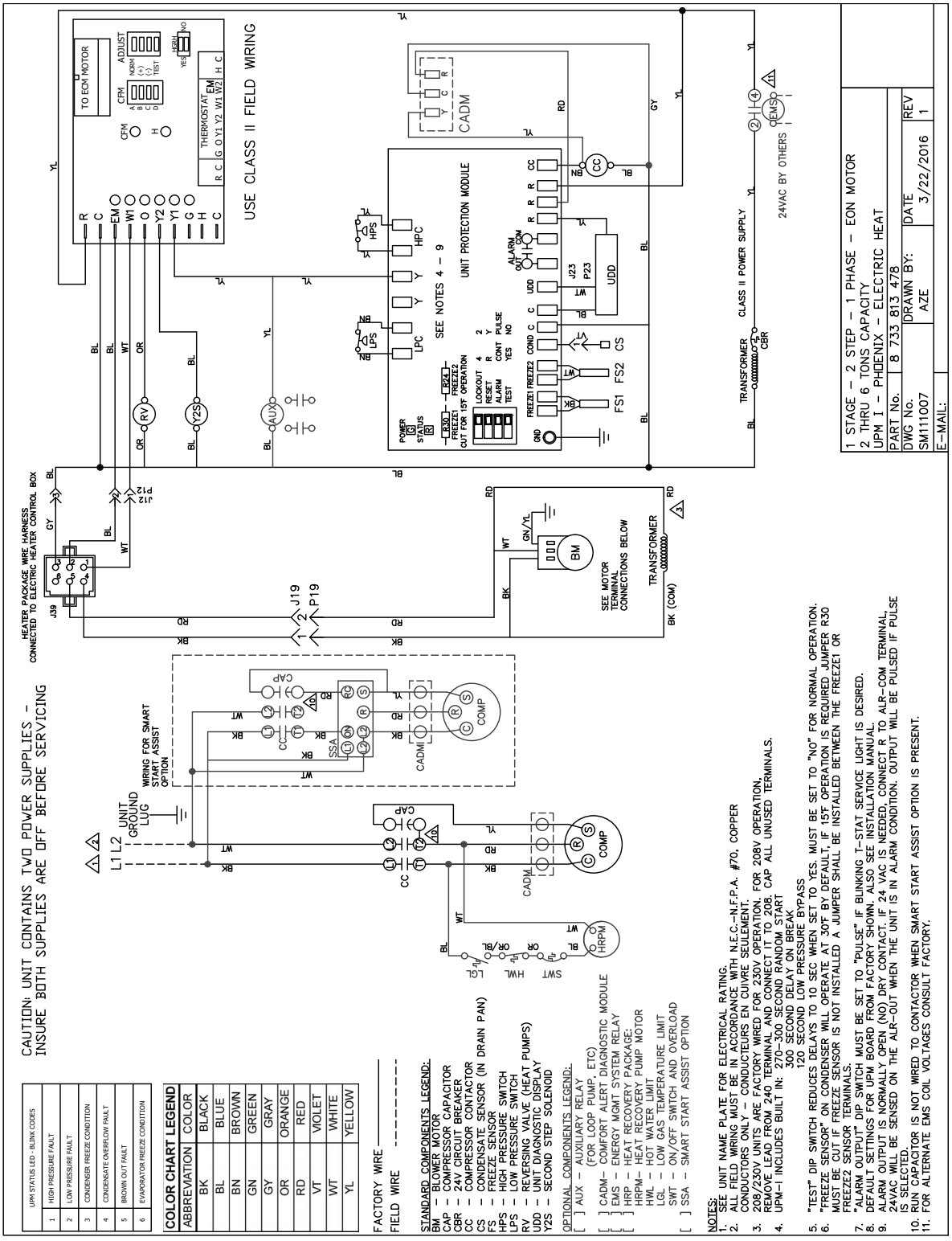


Figure # 65

FOR REFERENCE ONLY Actual unit wiring may vary from this example. Always refer to the wiring diagram attached to the unit.



UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GN	GREEN
GY	GRAY
OR	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW

FACTORY WIRE _____
FIELD WIRE - - - - - - - - - -

STANDARD COMPONENTS LEGEND:
BM - BLOWER MOTOR
CAP - COMPRESSOR CAPACITOR
CBR - 24V CIRCUIT BREAKER
CC - COMPRESSOR CONTACTOR
CS - CONDENSATE SENSOR (IN DRAIN PAN)
FS - FREEZE SENSOR
HPS - HIGH PRESSURE SWITCH
LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE (HEAT PUMPS)
UDD - UNIT DIAGNOSTIC DISPLAY
Y2S - SECOND STEP SOLENOID

OPTIONAL COMPONENTS LEGEND:
[ ] AUX - AUXILIARY RELAY (FOR LOOP PUMP, ETC)
[ ] CADM- COMFORT ALERT DIAGNOSTIC MODULE
[ ] EMS - ENERGY MGMT SYSTEM RELAY
[ ] HRP - HEAT RECOVERY PACKAGE:
[ ] HRPM- HEAT RECOVERY PUMP MOTOR
HWL - HOT WATER LIMIT
LGL - LOW GAS TEMPERATURE LIMIT
SWT - ON/OFF SWITCH AND OVERLOAD
[ ] SSA - SMART START ASSIST OPTION

NOTES:
1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.-N.F.P.A. #70, COPPER CONDUCTORS ONLY - CONDUCTEURS EN CUIVRE SEULEMENT.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE LEAD FROM 240 TERMINAL AND CONNECT IT TO 208. CAP ALL UNUSED TERMINALS.
4. UPM-I INCLUDES BUILT IN: 270-300 SECOND RANDOM START
300 SECOND DELAY ON BREAK
120 SECOND LOW PRESSURE BYPASS
5. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
6. "FREEZE SENSOR" ON CONDENSER WILL OPERATE AT 30°F BY DEFAULT, IF 15°F OPERATION IS REQUIRED JUMPER R30 MUST BE CUT IF FREEZE SENSOR IS NOT INSTALLED A JUMPER SHALL BE INSTALLED BETWEEN THE FREEZE1 OR FREEZE2 SENSOR TERMINALS.
7. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED.
8. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
9. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R TO ALR-COM TERMINAL. 24VAC WILL BE SENSED ON THE ALR-OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
10. RUN CAPACITOR IS NOT WIRED TO CONTACTOR WHEN SMART START ASSIST OPTION IS PRESENT.
11. FOR ALTERNATE EMS COIL VOLTAGES CONSULT FACTORY.

Figure # 66

FOR REFERENCE ONLY Actual unit wiring may vary from this example. Always refer to the wiring diagram attached to the unit.

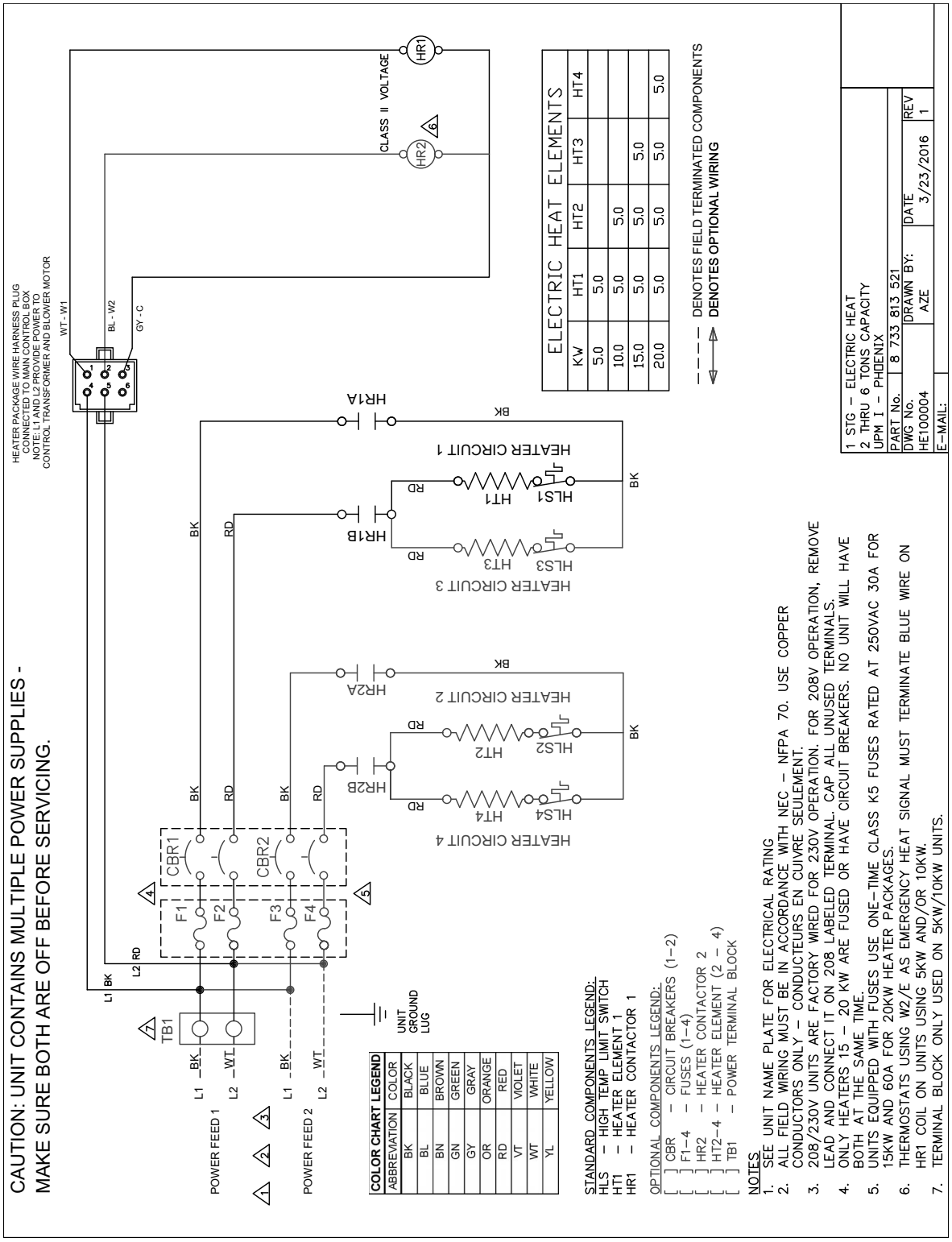


Figure # 67

FOR REFERENCE ONLY Actual unit wiring may vary from this example. Always refer to the wiring diagram attached to the unit.

DIMENSIONAL DRAWINGS

Horizontal - Straight Through

Model	A (A') WIDTH	B (B') DEPTH	C (C') HEIGHT	D FILTER RACK HEIGHT	E FILTER RACK WIDTH	F FILTER RACK DEPTH	G RETURN AIR DUCT WIDTH	H RETURN AIR DUCT HEIGHT	J WATER OUT	K K' DRAIN PORT	L WATER IN	M ELECTRICAL KNOCKOUT	N	O HRP KNOCKOUT	P HEATER KNOCKOUT	Q HRP CONNECTIONS**	R	S (RH) SUPPLY AIR DUCT OPENING	S' (LH)	T	U (RH)	U' (LH)	V WATER CONNECTIONS (SWIVEL TYPE)	FILTER SIZE
SM024-HZ	25.1 (25.5)	64.1 (64.5)	19.7 (19.82)	18.7	36.4	3.4	34.0	16.2	17.2	1.3	5.1	2.5	7.4	12.3	15.9	9.9	6.5	13.2	2.0	6.5	10.0	11.8	10.8	1" F.P.T.	18X18X2 (2)
SM036-HZ	28.0 (28.4)	76.0 (76.4)	22.7 (22.82)	20.7	48.4	3.4	46.0	18.2	20.2	1.3	5.1	2.5	8.9	13.8	17.4	11.4	6.5	16.2	2.0	7.5	11.7	12.9	13.0	1" F.P.T.	20X24X2 (2)
SM048-HZ	28.0 (28.4)	76.0 (76.4)	22.7 (22.82)	20.7	48.4	3.4	46.0	18.2	20.2	1.3	5.1	2.5	8.9	13.8	17.4	11.4	6.5	16.2	2.0	7.5	11.7	12.9	13.0	1" F.P.T.	20X24X2 (2)
SM060-HZ	28.0 (28.4)	83.0 (83.4)	22.7 (22.82)	20.7	54.4	3.4	52.0	18.3	20.2	1.3	5.1	2.5	8.9	13.8	17.4	11.4	6.5	16.2	2.0	7.5	14.2	15.1	13.0	1" F.P.T.	18X20X2 (3)
SM070-HZ	28.0 (28.4)	83.0 (83.4)	22.7 (22.82)	20.7	54.4	3.4	52.0	18.3	20.2	1.3	5.1	2.5	8.9	13.8	17.4	11.4	6.5	16.2	2.0	7.5	14.2	15.1	13.0	1" F.P.T.	18X20X2 (3)

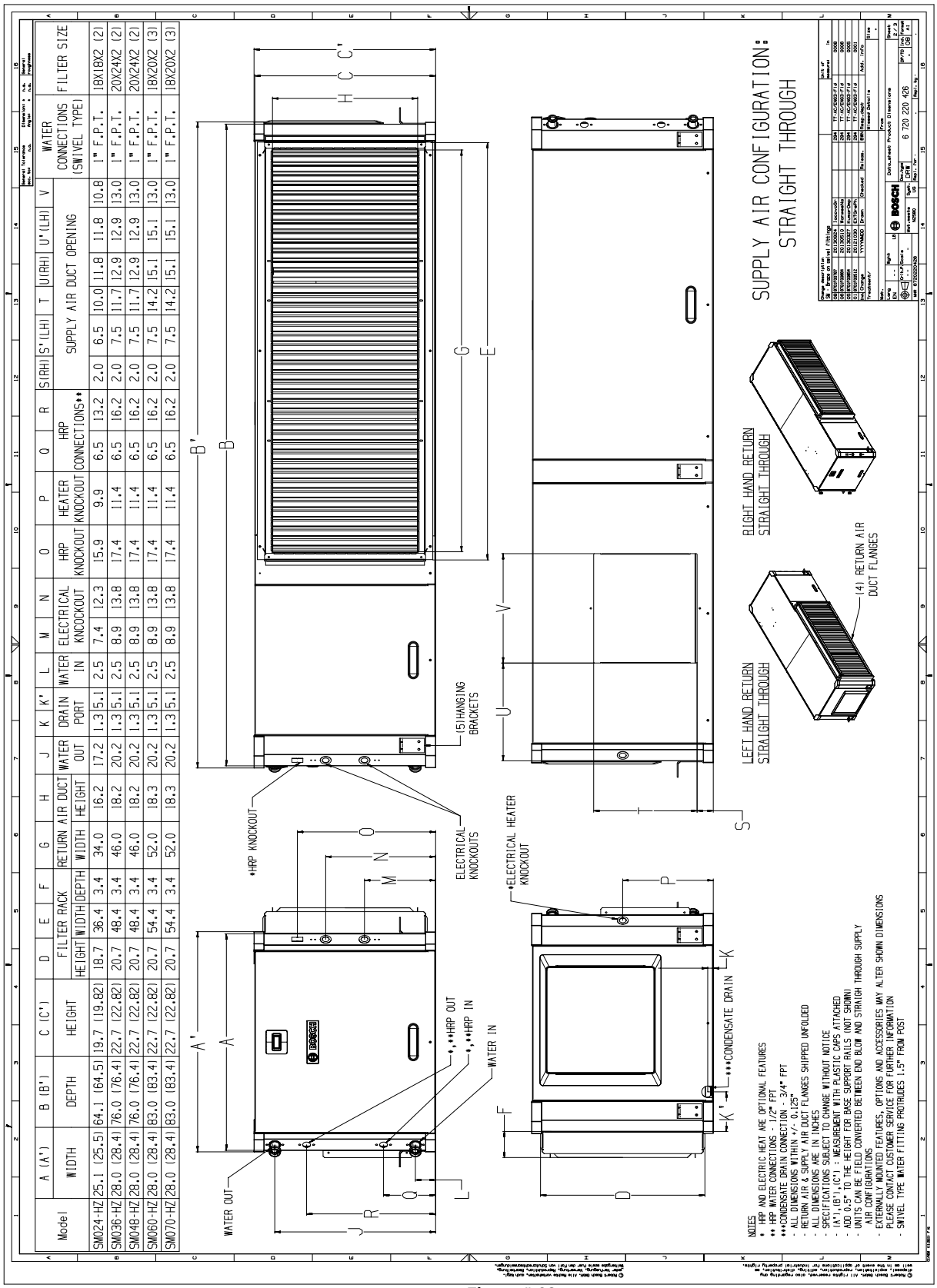
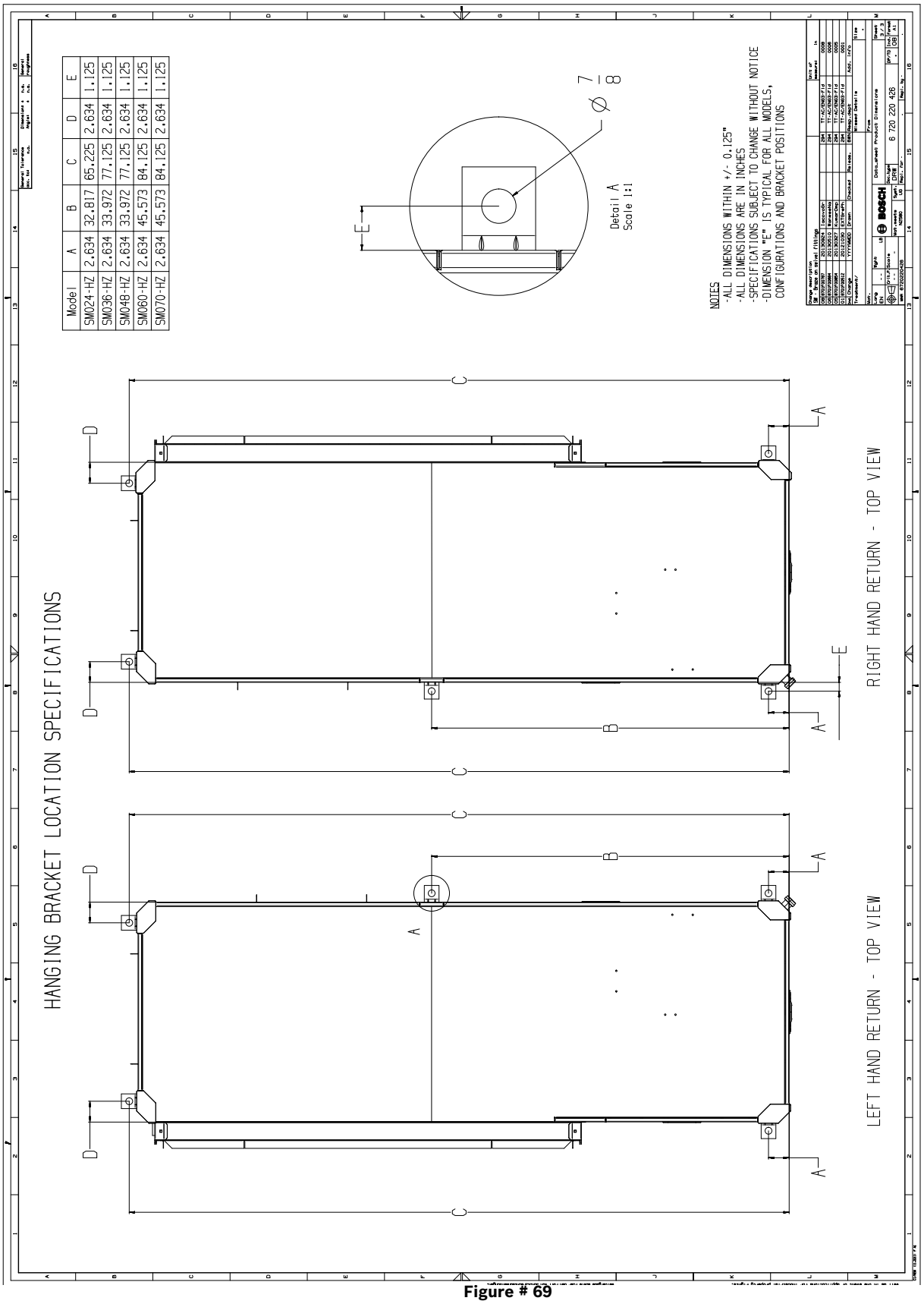


Figure # 68

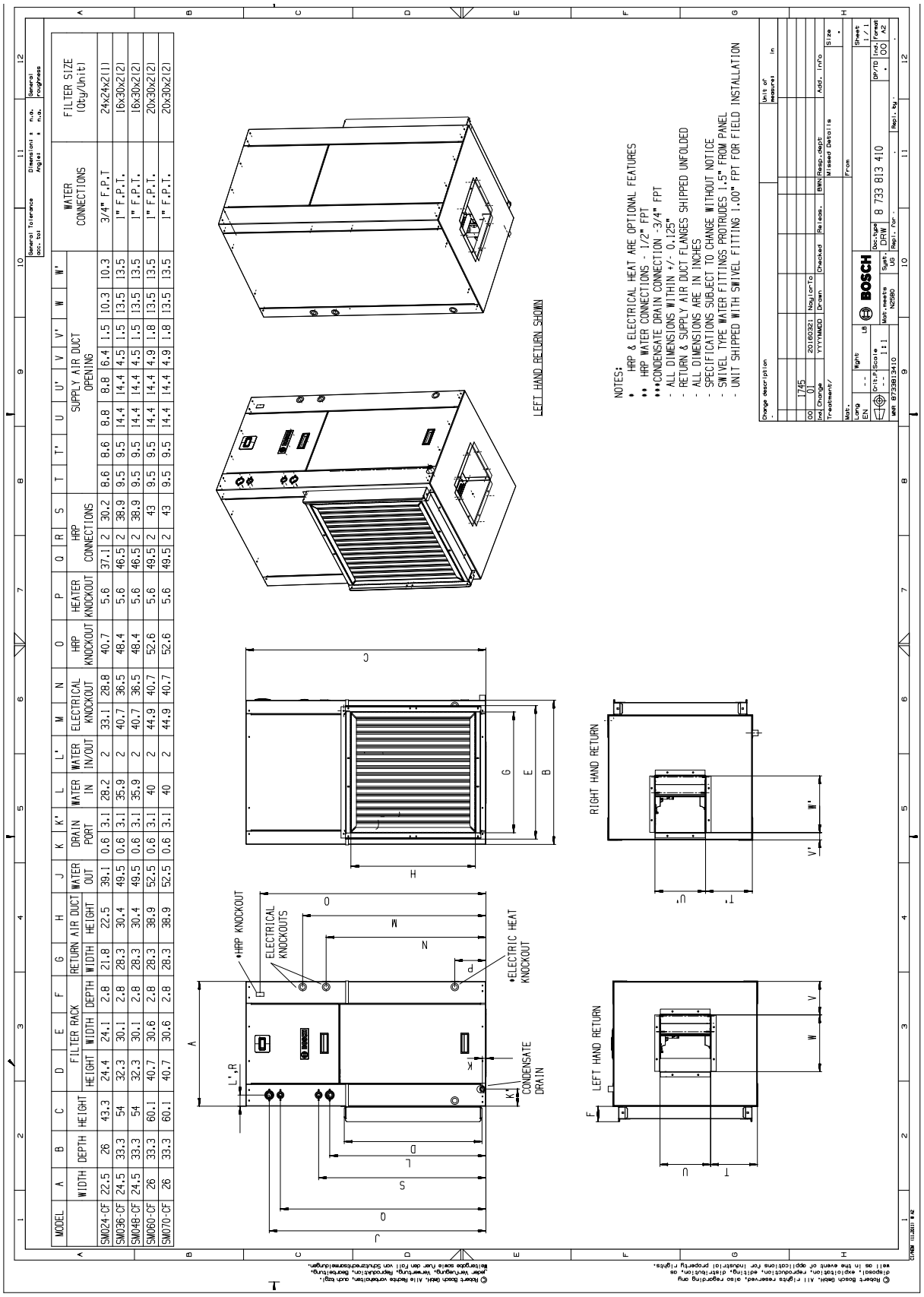
Horizontal - Hanging bracket locations



Model	A	B	C	D	E
SM024-HZ	2.634	32.817	65.225	2.634	1.125
SM036-HZ	2.634	33.972	77.125	2.634	1.125
SM048-HZ	2.634	33.972	77.125	2.634	1.125
SM060-HZ	2.634	45.573	84.125	2.634	1.125
SM070-HZ	2.634	45.573	84.125	2.634	1.125

Figure # 69

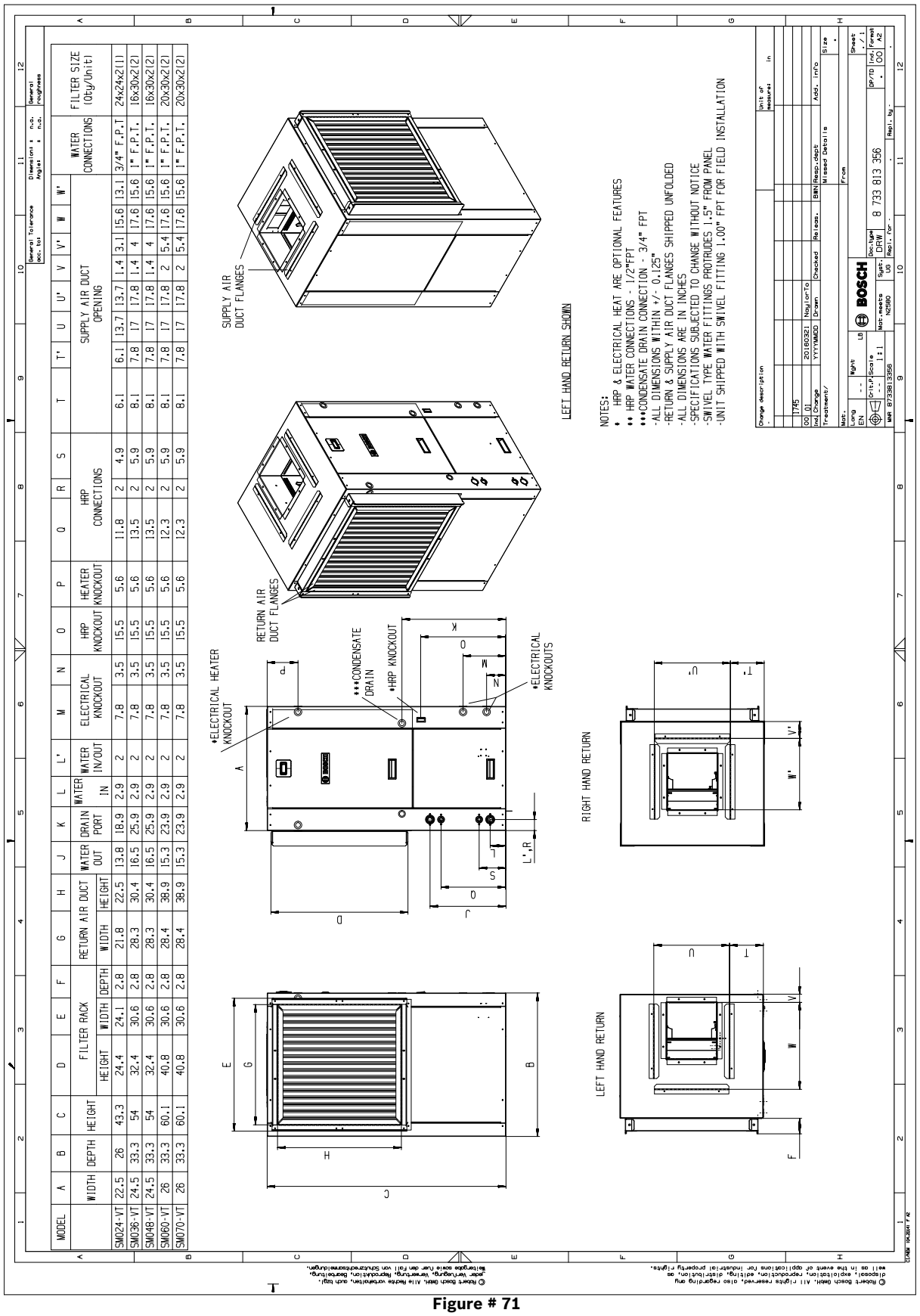
COUNTER FLOW



MODEL	A	B	C	D	E	F	G	H	J	K	K'	L	L'	M	N	O	P	Q	R	S	T	T'	U	U'	V	V'	W	W'	WATER CONNECTIONS	FILTER SIZE (Qty/Unit)
	WIDTH	DEPTH	HEIGHT	FILTER RACK HEIGHT	FILTER RACK WIDTH	FILTER RACK DEPTH	RETURN AIR DUCT WIDTH	RETURN AIR DUCT HEIGHT	WATER OUT	DRAIN PORT	WATER IN	WATER IN/OUT	ELECTRICAL KNOCKOUT		HRP KNOCKOUT	HEATER KNOCKOUT	HRP CONNECTIONS			SUPPLY AIR DUCT OPENING										
SM024-CF	22.5	26	43.3	24.4	24.1	2.8	21.8	22.5	39.1	0.6	3.1	28.2	2	33.1	28.8	40.7	5.6	37.1	2	30.2	8.6	8.6	8.8	8.8	6.4	1.5	10.3	10.3	3/4" F.P.T	24x24x2(1)
SM036-CF	24.5	33.3	54	32.3	30.1	2.8	28.3	30.4	49.5	0.6	3.1	35.9	2	40.7	36.5	48.4	5.6	46.5	2	38.9	9.5	9.5	14.4	14.4	4.5	1.5	13.5	13.5	1" F.P.T.	16x30x2(2)
SM048-CF	24.5	33.3	54	32.3	30.1	2.8	28.3	30.4	49.5	0.6	3.1	35.9	2	40.7	36.5	48.4	5.6	46.5	2	38.9	9.5	9.5	14.4	14.4	4.5	1.5	13.5	13.5	1" F.P.T.	16x30x2(2)
SM060-CF	26	33.3	60.1	40.7	30.6	2.8	28.3	38.9	52.5	0.6	3.1	40	2	44.9	40.7	52.6	5.6	49.5	2	43	9.5	9.5	14.4	14.4	4.9	1.8	13.5	13.5	1" F.P.T.	20x30x2(2)
SM070-CF	26	33.3	60.1	40.7	30.6	2.8	28.3	38.9	52.5	0.6	3.1	40	2	44.9	40.7	52.6	5.6	49.5	2	43	9.5	9.5	14.4	14.4	4.9	1.8	13.5	13.5	1" F.P.T.	20x30x2(2)

Figure # 70

VERTICAL



MODEL	A	B	C	D	E	F	G	H	J	K	L	L'	M	N	O	P	Q	R	S	T	T'	U	U'	V	V'	W	W'	WATER CONNECTIONS	FILTER SIZE (Qty/Unit)
	WIDTH	DEPTH	HEIGHT	FILTER RACK			RETURN AIR DUCT		WATER OUT	DRAIN PORT	WATER IN	WATER IN/OUT	ELECTRICAL KNOCKOUT		HRP KNOCKOUT	HEATER KNOCKOUT	HRP CONNECTIONS			SUPPLY AIR DUCT OPENING								
				HEIGHT	WIDTH	DEPTH	WIDTH	HEIGHT																					
SM024-VT	22.5	26	43.3	24.4	24.1	2.8	21.8	22.5	13.8	18.9	2.9	2	7.8	3.5	15.5	5.6	11.8	2	4.9	6.1	6.1	13.7	13.7	1.4	3.1	15.6	13.1	3/4" F.P.T	24x24x2(1)
SM036-VT	24.5	33.3	54	32.4	30.6	2.8	28.3	30.4	16.5	25.9	2.9	2	7.8	3.5	15.5	5.6	13.5	2	5.9	8.1	7.8	17	17.8	1.4	4	17.6	15.6	1" F.P.T.	16x30x2(2)
SM048-VT	24.5	33.3	54	32.4	30.6	2.8	28.3	30.4	16.5	25.9	2.9	2	7.8	3.5	15.5	5.6	13.5	2	5.9	8.1	7.8	17	17.8	1.4	4	17.6	15.6	1" F.P.T.	16x30x2(2)
SM060-VT	26	33.3	60.1	40.8	30.6	2.8	28.4	38.9	15.3	23.9	2.9	2	7.8	3.5	15.5	5.6	12.3	2	5.9	8.1	7.8	17	17.8	2	5.4	17.6	15.6	1" F.P.T.	20x30x2(2)
SM070-VT	26	33.3	60.1	40.8	30.6	2.8	28.4	38.9	15.3	23.9	2.9	2	7.8	3.5	15.5	5.6	12.3	2	5.9	8.1	7.8	17	17.8	2	5.4	17.6	15.6	1" F.P.T.	20x30x2(2)

Figure # 71

BASIC PIPING DIAGRAM

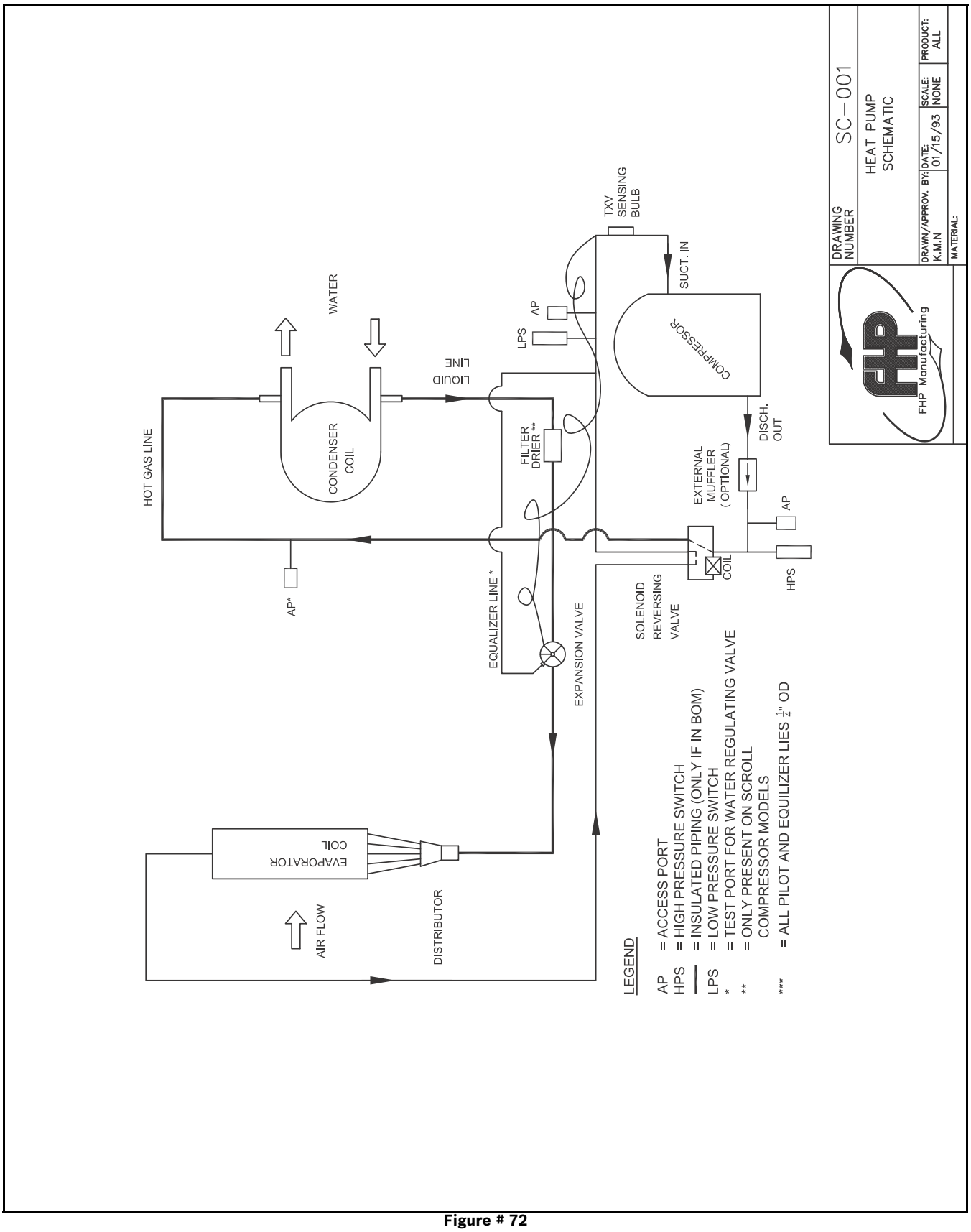


Figure # 72

SYSTEM CHECKOUT

After completing the installation, and before energizing the unit, the following system checks should be made:

1. Verify that the supply voltage to the heat pump is in accordance with the nameplate ratings.
2. Make sure that all electrical connections are tight and secure.
3. Check the electrical fusing and wiring for the correct size.

DANGER: Ensure cabinet and Electrical Box are properly grounded.

4. Verify that the low voltage wiring between the thermostat and the unit is correct.
5. Verify that the water piping is complete and correct.
6. Check that the water flow is correct, and adjust if necessary.
7. Check the blower for free rotation, and that it is secured to the shaft.
8. Check power and communication plug on blower motor.
9. Verify that vibration isolation has been provided.
10. Unit is serviceable. Be certain that all access panels are secured in place.

Considerations:

- Always check incoming line voltage power supply and secondary control voltage for adequacy. Transformer primaries are dual tapped for 208 and 230 volts. Connect the appropriate tap to ensure a minimum of 18 volts secondary control voltage. 24 volts is ideal for best operation.
- Long length thermostat and control wiring leads may create voltage drop. Increase wire gauge or up-size transformers may be required to ensure minimum secondary voltage supply.
- FHP recommends the following guidelines for wiring between a thermostat and the unit: 18 GA up to 60 foot, 16 GA up to 100 ft and 14 GA up to 140 ft.
- Do not apply additional controlled devices to the control circuit power supply without consulting the factory. Doing so may void equipment warranties.
- Check with all code authorities on requirements involving condensate disposal/over flow protection criteria.

UNIT START-UP

1. Set the thermostat to the highest setting.
2. Set the thermostat system switch to “COOL”, and the fan switch to the “AUTO” position. The reversing valve solenoid should energize. The compressor and fan should not run.
3. Reduce the thermostat setting approximately 5 degrees below the room temperature.
4. Verify the heat pump is operating in the cooling mode.
5. Turn the thermostat system switch to the “OFF” position. The unit should stop running and the reversing valve should de energize.
6. Leave the unit off for approximately (5) minutes to allow for system equalization.
7. Turn the thermostat to the lowest setting.
8. Set the thermostat switch to “HEAT”.
9. Increase the thermostat setting approximately 5 degrees above the room temperature.
10. Verify the heat pump is operating in the heating mode.
11. Set the thermostat to maintain the desired space temperature.
12. Check for vibrations, leaks, etc.

MAINTENANCE

1. Filter changes or cleaning are required at regular intervals. The time period between filter changes will depend upon type of environment the equipment is used in. In a single family home, that is not under construction, changing or cleaning the filter every 60 days is sufficient. In other applications such as motels, where daily vacuuming produces a large amount of lint, filter changes may need to be as frequent as biweekly.

NOTICE: Equipment should never be used during construction due to likelihood of wall board dust accumulation in the air coil of the equipment which permanently affects the performance and may shorten the life of the equipment.

2. An annual “checkup” is recommended by a trained and qualified HVAC mechanic. Recording the performance measurements of volts, amps, and water temperature differences (both heating and cooling) is recommended. This data should be compared to the information on the unit’s data plate and the data taken at the original startup of the equipment. (We recommend to complete the unit check out sheet located on pg# 64)
3. The condensate drain should be checked twice a year by cleaning and flushing to ensure proper drainage.
4. Periodic lockouts almost always are caused by air or water flow problems. The lockout (shutdown) of the unit is a normal protective measure in the design of the equipment. If continual lockouts occur call a mechanic immediately and have them check for: water flow problems, water temperature problems, air flow problems or air temperature problems. Use of the pressure and temperature charts for the unit may be required to properly determine the cause. Have Mechanic complete the unit checkout sheet located on pg# 64 and call 866-642-3198 for support.

INFORMATION ON DECOMMISSIONING

Only trained and qualified technicians are allowed to decommission and dispose of equipment following applicable requirements and local codes

.

WARNING: Decommissioning of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service the equipment.

Protecting the Environment

Components

Many parts in the Heat Pump can be fully recycled in the end of the product life. Contact your city authorities for information about the disposal of recyclable products.

Refrigerant

At the end of the service life of this appliance and prior to it's environmental disposal, a person qualified to work with refrigerant circuits must recover the refrigerant from within the sealed system.

By disposing of this product correctly you will help ensure that the waste undergoes the necessary treatment, recovery and recycling-thus preventing potential negative effects on the environment and human health which could otherwise arise due to inappropriate waste handling.

UNIT CHECK-OUT SHEET

Customer Data

Customer Name _____ Date _____
Address _____
_____
Phone _____ Unit Number _____

Unit Nameplate Data

Unit Make _____
Model Number _____ Serial Number _____
Refrigerant Charge (oz) _____
Compressor: RLA _____ LRA _____
Blower Motor: FLA (or NPA) _____ HP _____
Maximum Fuse Size (Amps) _____
Maximum Circuit Ampacity _____

Operating Conditions

	Cooling Mode	Heating Mode
Entering / Leaving Air Temp	_____ / _____	_____ / _____
Entering Air Measured at:	_____	_____
Leaving Air Measured at:	_____	_____
Entering / Leaving Fluid Temp	_____ / _____	_____ / _____
Fluid Flow (gpm)	_____	_____
Compressor Volts / Amps	_____ / _____	_____ / _____
Blower Motor Volts / Amps	_____ / _____	_____ / _____
Source Fluid Type	_____	_____
Fluid Flow (gpm)*	_____	_____
Fluid Side Pressure Drop*	_____	_____
Suction / Discharge Pressure (psig)*	_____ / _____	_____ / _____
Suction / Discharge Temp*	_____ / _____	_____ / _____
Suction Superheat*	_____	_____
Entering TXV / Cap Tube Temp*	_____	_____
Liquid Subcooling*	_____	_____

* Required for Troubleshooting ONLY

Auxiliary Heat

Unit Make _____
Model Number: _____ Serial Number _____
Max Fuse Size (Amps) _____
Volts / Amps _____
Entering Air Temperature _____
Leaving Air Temperature _____

TERMINOLOGY

PSC - Permanent-split capacitor motor

EER - Energy Efficiency Ratio

COP - Coefficient of Performance. The COP provides a measure of performance for heat pumps that is analogous to thermal efficiency for power cycles.

ECM-Electronically Commutated Motor.

UPM-Unit Protection Module

WLHP - Water Loop Heat Pump

GLHP - Ground Loop Heat Pump

RLA - Running Load Amps

LRA - Locked Rotor Amps

FLA - Full Load Amps

NPA - Name Plate Amps

HP – Heat Pump

SSA - Smart Start Assist

Suction Pressure - Pressure entering compressor

Discharge Pressure - Pressure leaving compressor

(R/A) - Return Air

Recovery - Means the collection and storage of fluorinated greenhouse gases from products, including containers, and equipment during maintenance or servicing or prior to the disposal of the products or equipment.

Recycling- Means the reuse of a recovered fluorinated greenhouse gas following a basic cleaning process.

Reclamation-Means the reprocessing of a recovered fluorinated greenhouse gas in order to match the equivalent performance of a virgin substance, taking into account its intended use**.**

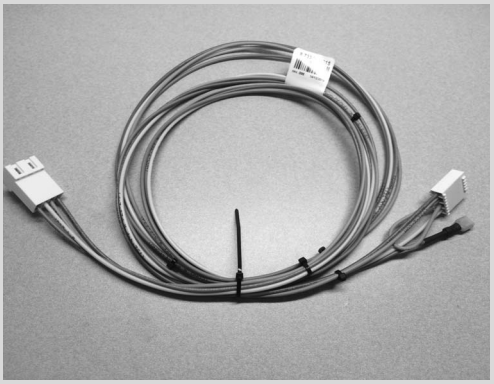
Decommissioning- Means the final shut-down and removal from operation or usage of a product or piece of equipment containing fluorinated greenhouse gases.

Repair- Means the restoration of damaged or leaking products or equipment that contain, or whose functioning relies upon, fluorinated greenhouse gases, involving a part containing or designed to contain such gases.

Conditioned space Space within a building provided with heated or cooled air, or both (or surfaces); and, where required, with humidification or dehumidification means, to maintain conditions for an acceptable thermal environment.

SPARE PARTS LIST

Wiring Harness



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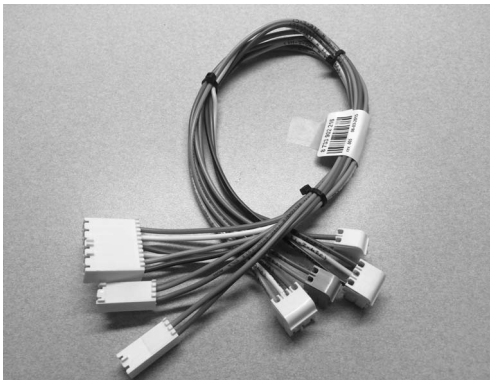

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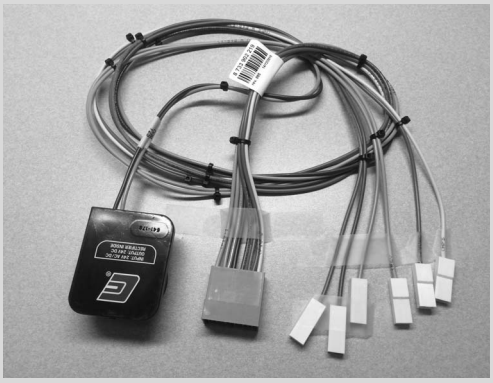

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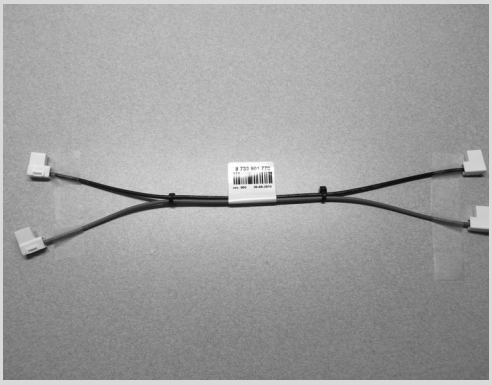

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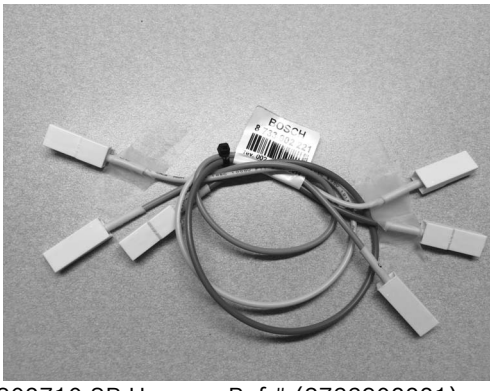

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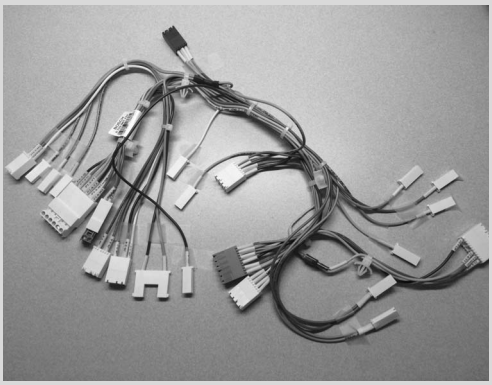

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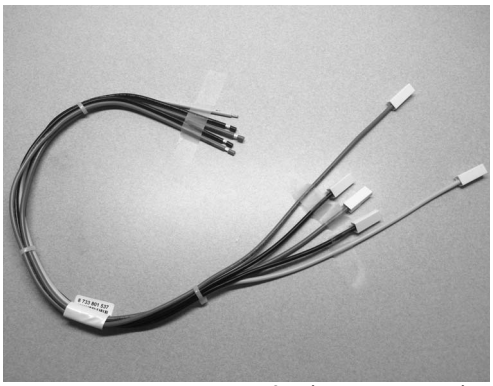

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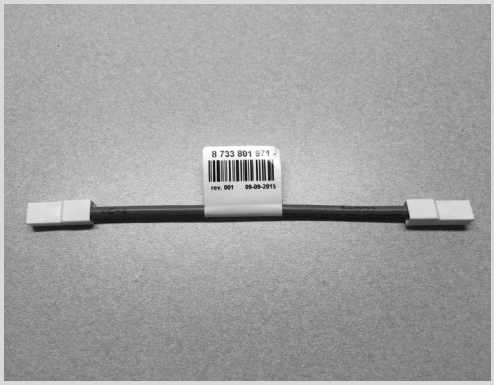

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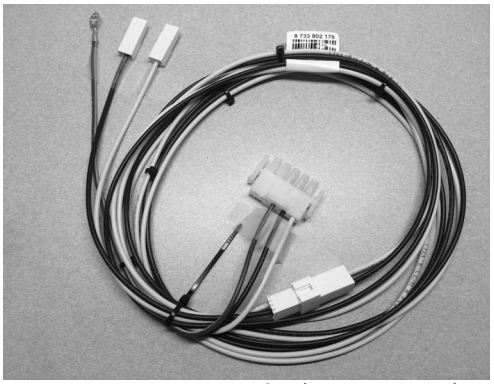

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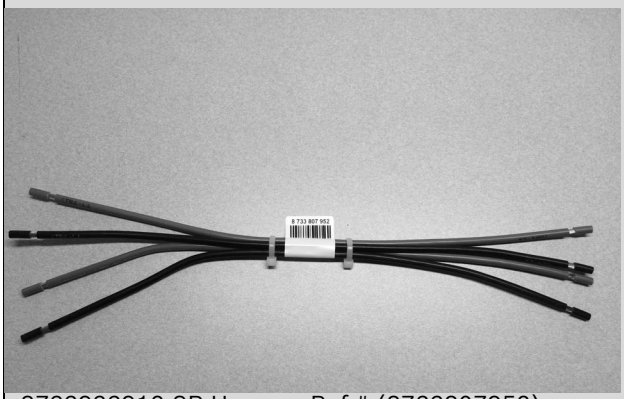

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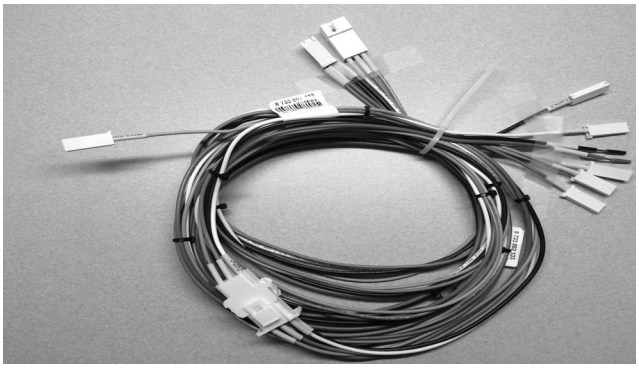

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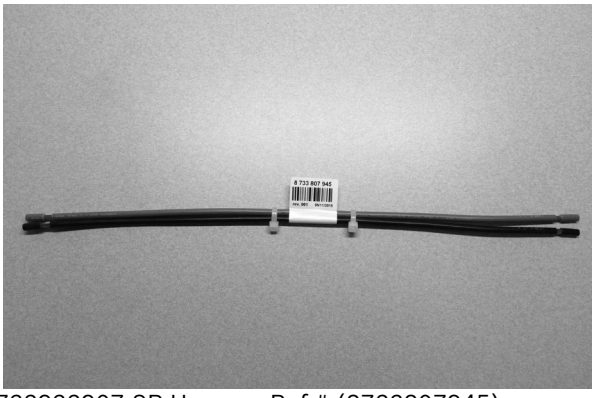
8733933897 SP Harness Ref # (8733807732)



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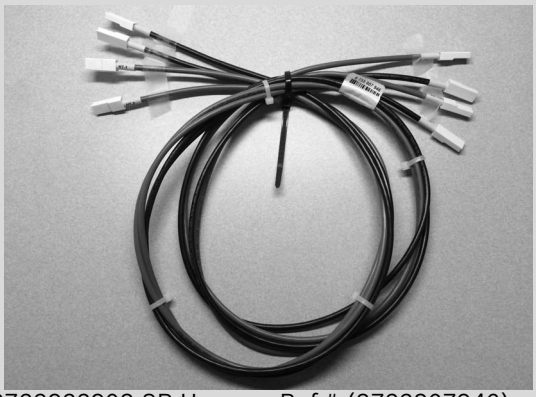

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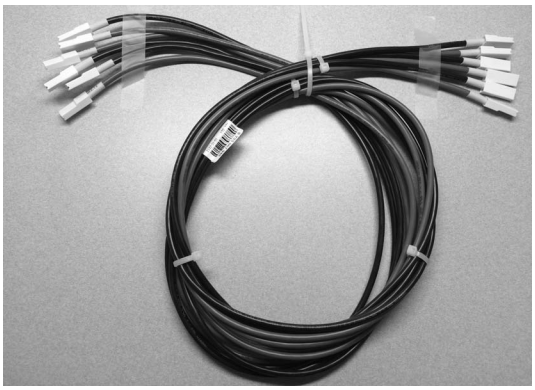

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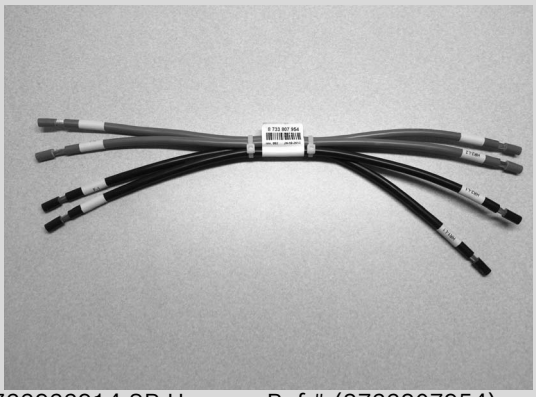

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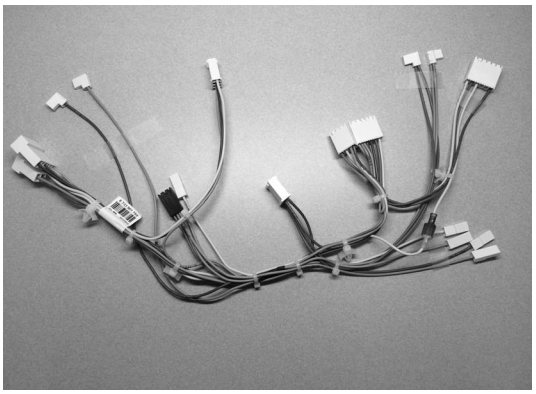


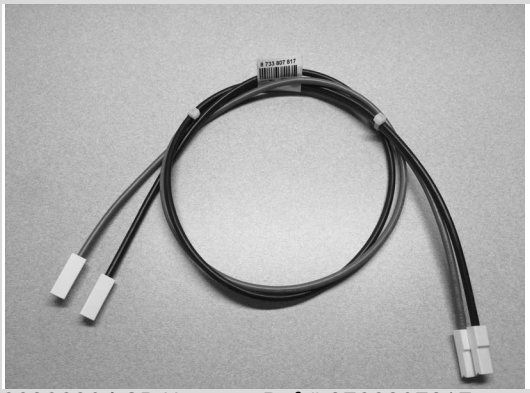
8733802696 SP Harness Ref # (8733901769)

8733908093 SP Harness Ref # (8733902388)

8733933735 SP Harness Ref # 8733801534

8733933756 SP Harness Ref # 8733801972

8733904556 SP Harness Ref # 8733802159
8733942487 SP Harness Ref # 8733813515



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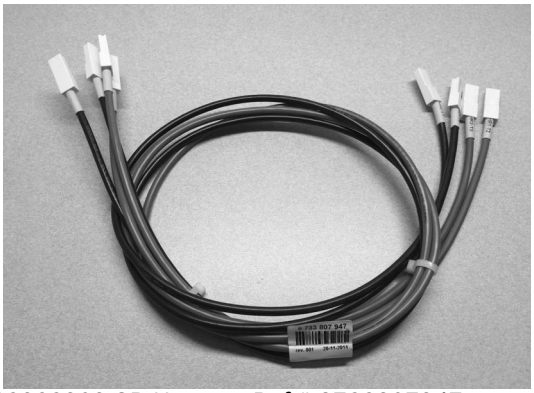

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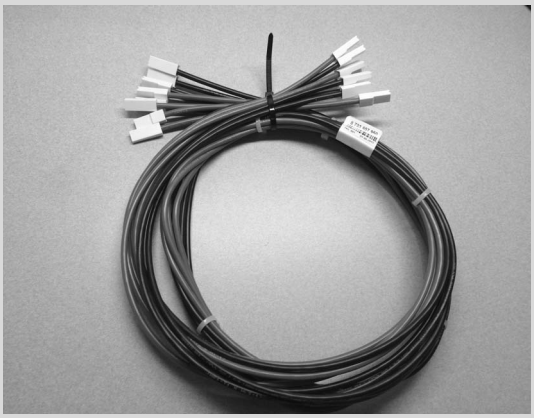

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8733916835 SP Harness Ref # 8733810489

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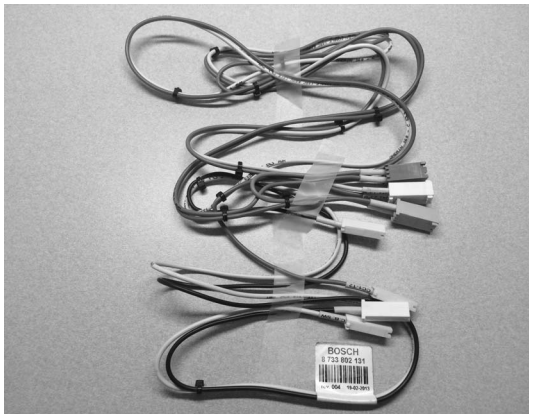

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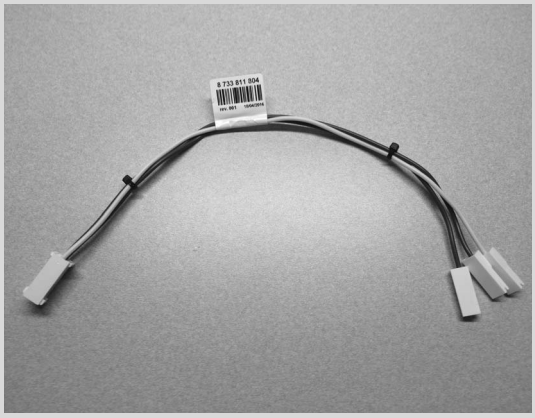

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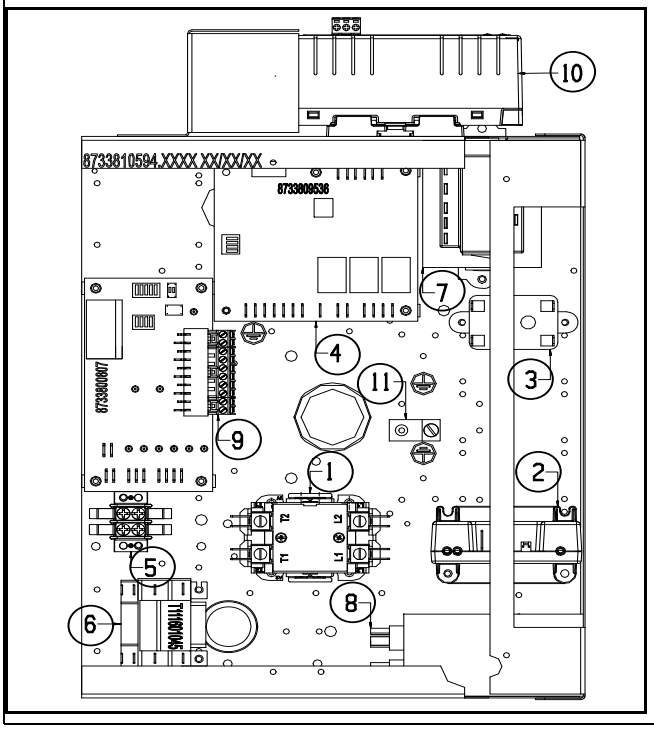
8733908133 SP Harness Ref # 8733937870

Electrical Box



[1] Compressor contactor **E01**
[2] Comfort Alert Module (Option) **E02**
[3] Energy Management Relay (Option) **E03**
[4] UPM **E04**
[5] Terminal Block **E05**
[6] Pump Valve Relay **E03**
[7] Transformer **E07**
[8] Capacitor **E08**
[9] ECM Board **E09**
[10] Smart Start Assist (Option) **E10**
[11] Ground Lug **E11**

Balloon #	EBOX Spare Part List	
E01	Contactor	8733907959 - Contactor 40A 2 Pole
E02	Comfort Alert Module	8733908148 - Comfort Alert Module
E03	Relays	8733907979 - Relay 2 Pole
E03	Relays	8733907983 - Monitor Relay 1 Pole 1 Throw
E03	Relays	8733916818 - Fan/Pump Interlock Relay
E04	Control Board	8733933939 - Control unit UPM I
E05	Terminal Blocks (Low)	8733908039 - Terminal Block 2 Position
E07	Transformers	8733802669 - Transformer 75 VA 208/240
E07	Transformers	8733933694 - Transformer 75VA - 120-208-240-480V
E08	Capacitors & Boots	8733802668 - Capacitor 35/370
E08	Capacitors & Boots	8733802759 - Capacitor 40/370
E08	Capacitors & Boots	8733802760 - Capacitor 30/370
E08	Capacitors & Boots	8733802761 - Capacitor 40/440
E09	ECM Cntl Board	8733802694 - EON ECM Board
E10	Smart Start Cntl	8733920430 - Control unit Smart Start Assist
E11	Ground Lugs	8733908044 - Terminal Ground Lug
E20	Heater Elements	8733907944 - Heater 5KW Insert
E20	Heater Elements	8733907946 - Heater 10KW Insert
E21	Terminal Blocks (High)	8733908032 - Terminal
E22	Fuse Blocks	8733802802 - Fuse Block Dual 60A-30A
E22	Fuse Blocks	8733906362 - Fuse Block Dual 60A
E23	Fuses	8733908200 - Fuse 60 AMP
E23	Fuses	8733935561 - Fuse 30 Amp
E32	Display LCD	8733802686 - Display White

Refrigeration Components

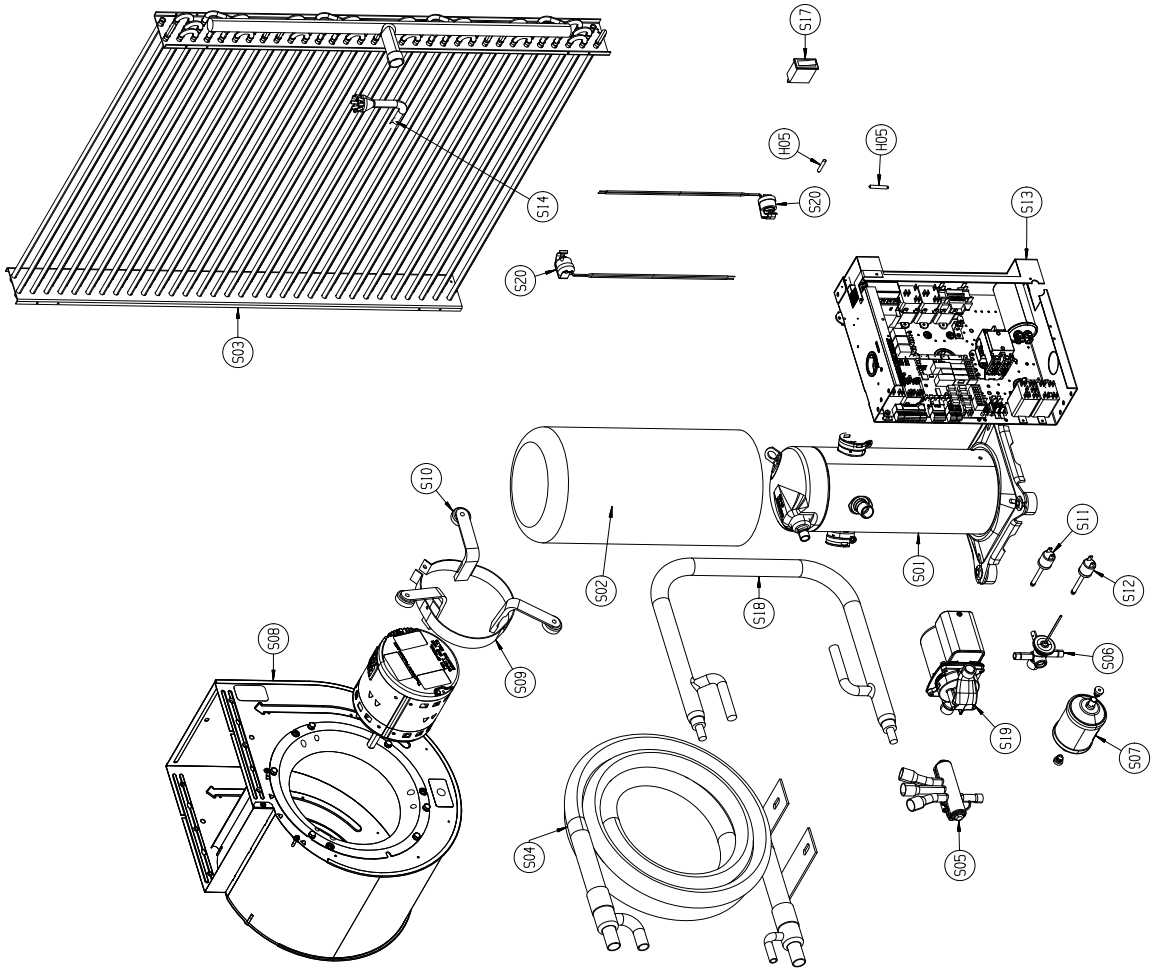
Rev A HZ

#	Part Group	SM024-1HZ*-*A	SM036-1HZ*-*A	SM048-1HZ*-*A	SM060-1HZ*-*A	SM070-1HZ*-*A
S01	Compressor	T111105489	T111105413	T111105414	T111105415	T111105490
S03	Air to Ref HTX	8733929998	8733929642	8733929642	8733929999	8733929999
S04	Water to Ref HTX (Cu)	8733929626	8733929625	8733929623	8733929627	8733929622
S04	Water to Ref HTX (CuNi)	8733929628	8733929629	8733929624	8733929630	8733929631
S05	Reversing Valve	8733930009	8733907671	8733907670	8733907670	8733907670
S06	TXV	8733930004	8733930005	8733930006	8733930008	8733930010
S07	Filter Dryer	8733802650	8733802650	8733802650	8733802650	8733802650
S08	Blower Housing	8733802657	8733802745	8733802745	8733802746	8733802746
S09	Blower Motor	8733802693	8733802784	8733802785	8733802786	8733802787
S10	Blower Motor Mounts	8733908418	8733908418	8733908418	8733908418	8733908418
S10	Blower Motor Mounts	8733916152	8733916153	8733916153	8733916153	8733916153
S11	High Pressure Switch	8733802652	8733802652	8733802652	8733802652	8733802652
S12	Low Pressure Switch	8733802651	8733802651	8733802651	8733802651	8733802651
S14	Distributor Clamp	8733933702	8733933702	8733933702	8733933742	8733933707
S14	Distributor Nozzle	8733933704	8733933705	8733933706	8733933748	8733933742
S16	Shraeder Valves	8733907804	8733907804	8733907804	8733907804	8733907804
S17	HRP Switch	8733908203	8733908203	8733908203	8733908203	8733908203
S18	HRP Water to Ref HTX	8733929618	8733929618	8733929618	8733929619	8733929619
S19	HRP Pump	8733907663	8733907663	8733907663	8733907663	8733907663
S20	Temperature Switches	8733908087	8733908087	8733908087	8733908087	8733908087
S20	Temperature Switches	8733908136	8733908136	8733908136	8733908136	8733908136
S21	Diff Pres Switch	8733908153	8733908153	8733908153	8733908153	8733908153
S23	Air Filters	8733911386	8733920334	8733920334	8733911390	8733911390

Rev B VT/CF

#	Part Group	SM024-1VT/CF*-*B	SM036-1VT/CF*-*B	SM048-1VT/CF*-*B	SM060-1VT/CF*-*B	SM070-1VT/CF*-*B
S01	Compressor	T111105489	T111105413	T111105414	T111105415	T111105490
S02	Compressor Blanket	8733906355	8733906355	8733906355	8733906355	8733906355
S03	Air to Ref HTX	8733942480	8733942481	8733942481	8733942482	8733942482
S04	Water to Ref HTX (Cu)	8733942466	8733942467	8733942468	8733942469	8733942469
S04	Water to Ref HTX (CuNi)	8733942470	8733942471	8733942472	8733942473	8733942473
S05	Reversing Valve	8733930009	8733907670	8733907670	8733907670	8733907670
S06	TXV	8733942474	8733942475	8733942476	8733942477	8733942478
S07	Filter Dryer	7738005186	8733927516	8733927516	8733927516	8733927516
S08	Blower Housing	8733942483	8733942484	8733942484	8733942484	8733942484
S09	Blower Motor	8733942490	8733942491	8733942492	8733942493	8733942494
S10	Blower Motor Mounts	8733802661	8733908418	8733908418	8733908418	8733908418
S10	Blower Motor Mounts	8733908418	8733916153	8733916153	8733916153	8733916153
S11	High Pressure Switch	8733802652	8733802652	8733802652	8733802652	8733802652
S12	Low Pressure Switch	8733802651	8733802651	8733802651	8733802651	8733802651
S15	Condensate Sensor	8733933701	8733933701	8733933701	8733933701	8733933701
S16	Shraeder Valves	8733907804	8733907804	8733907804	8733907804	8733907804
S17	HRP Switch	8733908203	8733908203	8733908203	8733908203	8733908203
S18	HRP Water to Ref HTX	8733907523	8733907524	8733907524	8733907524	8733907524
S19	HRP Pump	8733942479	8733942479	8733942479	8733942479	8733942479
S20	Temperature Switches	8733908087	8733908087	8733908087	8733908087	8733908087
S20	Temperature Switches	8733908136	8733908136	8733908136	8733908136	8733908136
S23	Air Filters	8733927483	8733920364	8733920364	8733927485	8733927485

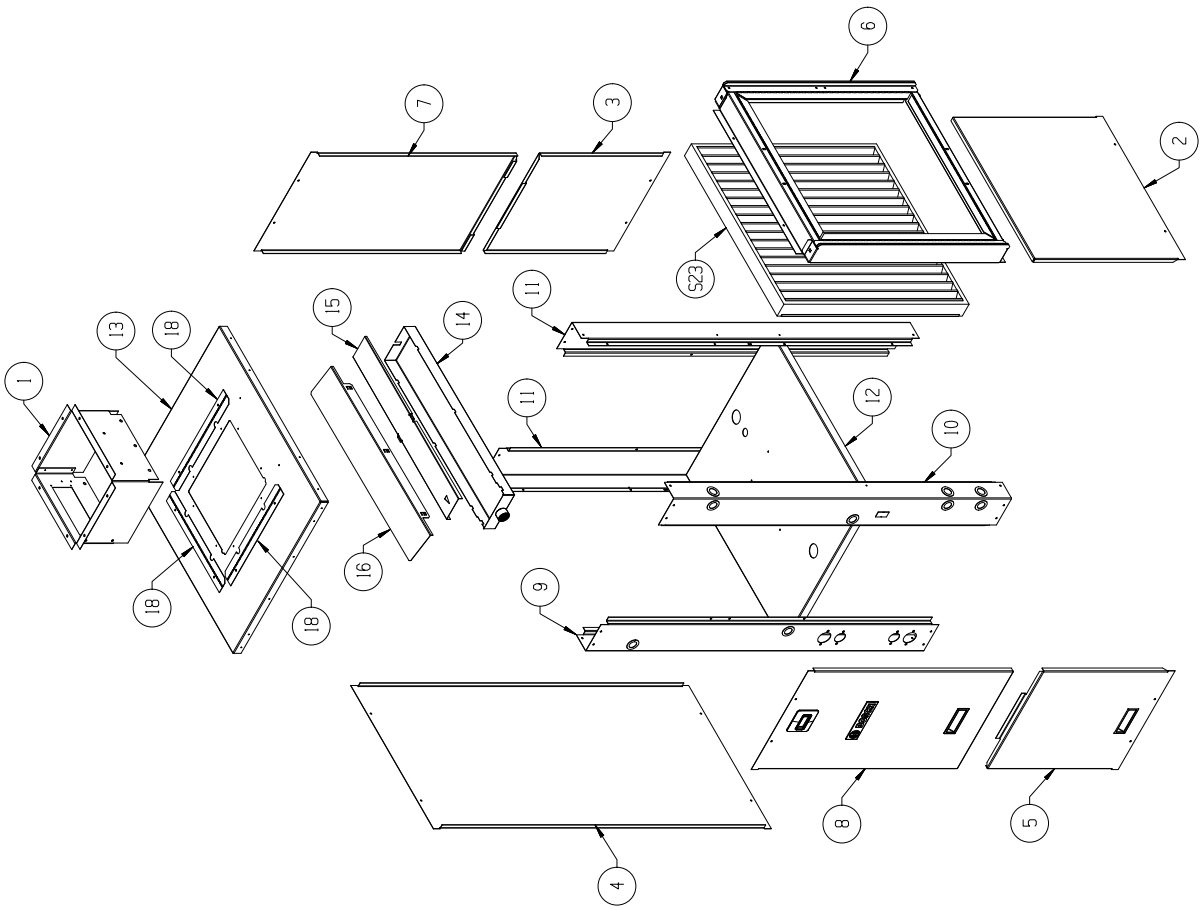
EXPLODED VIEWS



No.	Description
S01	Compressor
S02	Compressor Blanket
S03	Air to Ref HTX
S04	Water to Ref HTX
S05	Reversing Valve
S06	TXV
S07	Filter Dryer
S08	Blower Housing
S09	Blower Motor
S10	Motor Mount
S11	High Presure Switch
S12	Low Presure Switch
S13	Control Box Assy
S14	Distributor (Clamp Nozzle)
S17	HRP On/Off Switch
S18	HRP Water to Ref HTX
S19	HRP Pump
S20	Temperature Switch HRP
H05	Air Coil Freeze Sensor
H05	Water Coil Freeze Sensor

Figure # 73

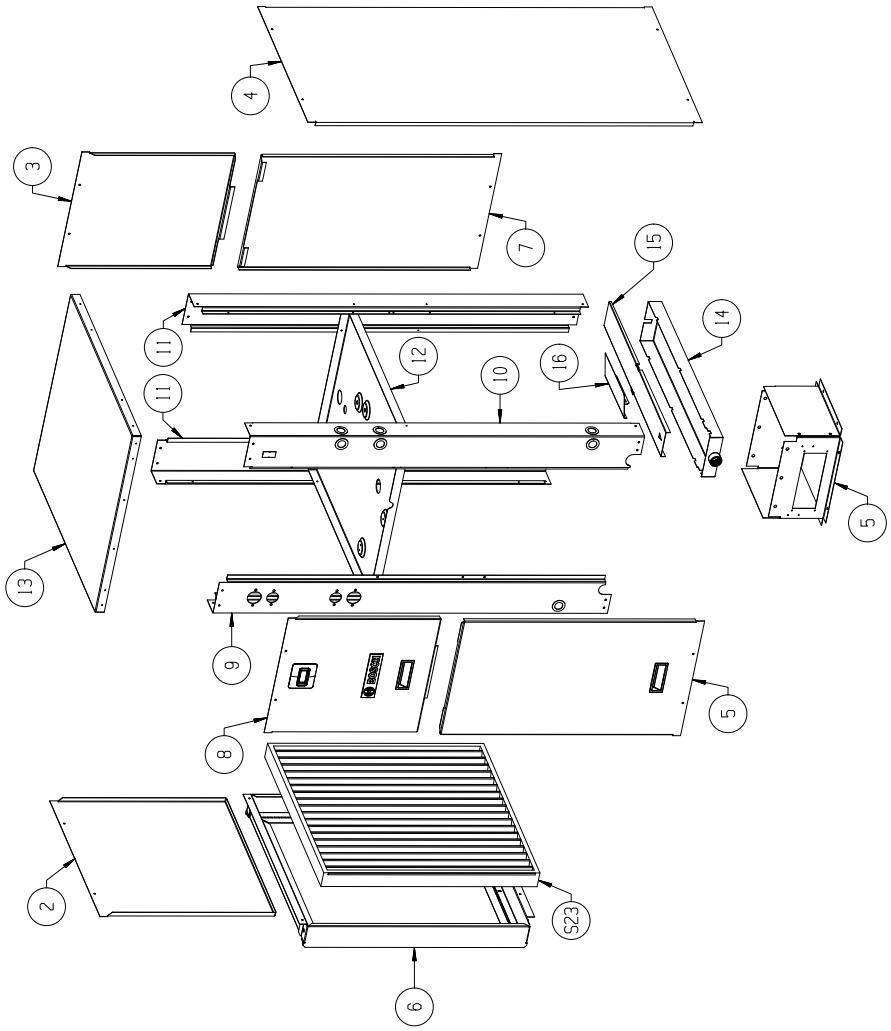
VT



No.	DESCRIPTION
1	HEATER COLLAR
2	EVAPORATOR/LIP PANEL
3	ACCESS PANEL REAR
4	SIDE PANEL FULL
5	ACCESS PANEL
6	FILTER RACK
7	REAR PANEL
8	LOGO PANEL
9	WATER POST
10	ELECTRICAL POST
11	REGULAR POST
12	DIVIDER PANEL
13	TOP PANEL
14	DRAIN PAN
15	WEDGE/AIR COIL SUPPORT
16	CONDENSATE DRIP SHIELD
18	DUCT COLLAR
S23	AIR FILTER

Figure # 74

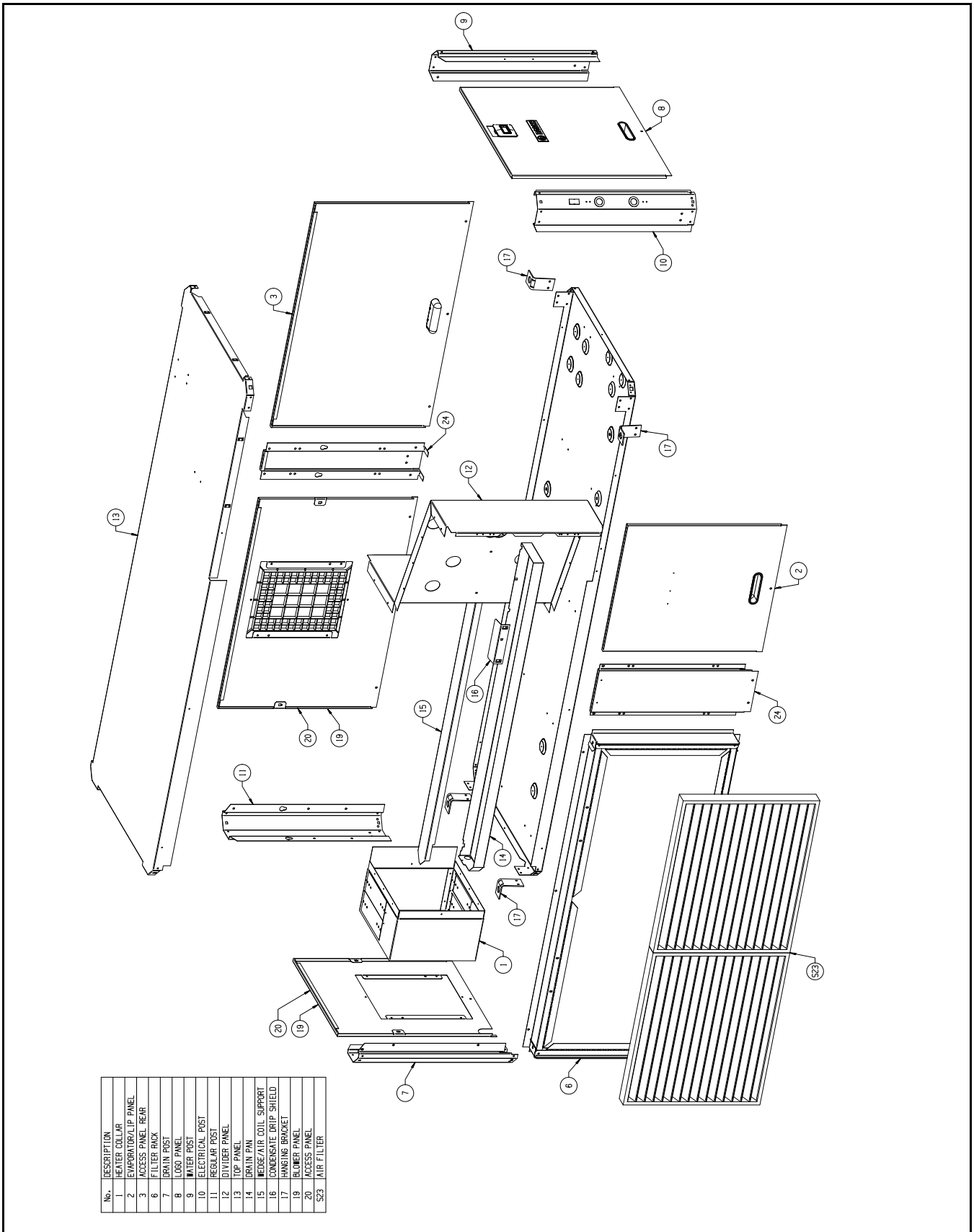
CF



No.	DESCRIPTION
1	HEATER COLLAR
2	EVAPORATOR/LIP PANEL
3	ACCESS PANEL REAR
4	SIDE PANEL FULL
5	ACCESS PANEL
6	FILTER RACK
7	REAR PANEL
8	LOGO PANEL
9	WATER POST
10	ELECTRICAL POST
11	REGULAR POST
12	DIVIDER PANEL
13	TOP PANEL
14	DRAIN PAN
15	WEDGE/AIR COIL SUPPORT
16	CONDENSATE DRIP SHIELD
S23	AIR FILTER

Figure # 75

HZ



No.	DESCRIPTION
1	HEATER COLLAR
2	EVAPORATOR/LIP PANEL
3	ACCESS PANEL REAR
6	FILTER RACK
7	DRAIN POST
8	LOGO PANEL
9	WATER POST
10	ELECTRICAL POST
11	REGULAR POST
12	DIVIDER PANEL
13	TOP PANEL
14	DRAIN PAN
15	WEDGE/AIR COIL SUPPORT
16	CONDENSATE DRIP SHIELD
17	HANGING BRACKET
19	BLOWER PANEL
20	ACCESS PANEL
S23	AIR FILTER

Figure # 76

NOTES

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