



# SM Series Heat pump GreenSource

SM024 | SM036 | SM048 | SM060 | SM070



**BOSCH**

**Installation, Operation and Maintenance Manual**

6 720 220 406 (2015/02)

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## 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:

- **NOTE** indicates a situation that could result in damage to property or equipment.
- **CAUTION** indicates a situation that could result in minor to medium injury.
- **WARNING** indicates a situation that could result in severe injury or death.
- **DANGER** indicates a situation that will result in severe injury or death.

### 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.



**NOTE:** 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.



**NOTE:** 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.



**NOTE:** 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

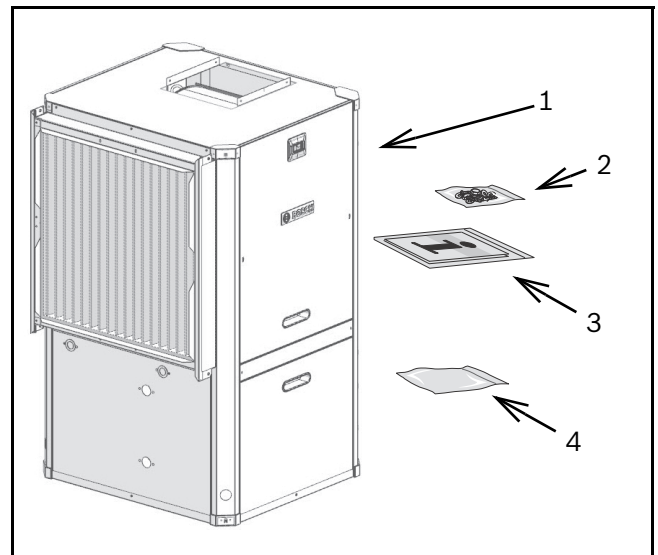


Figure # 1

- [1] SM Series Water-to-Air Heat Pump
- [2] Corner Caps Package
- [3] Installation and Operation Manual
- [4] Hanging Bracket kit (HZ unit only)

# MODEL NOMENCLATURE

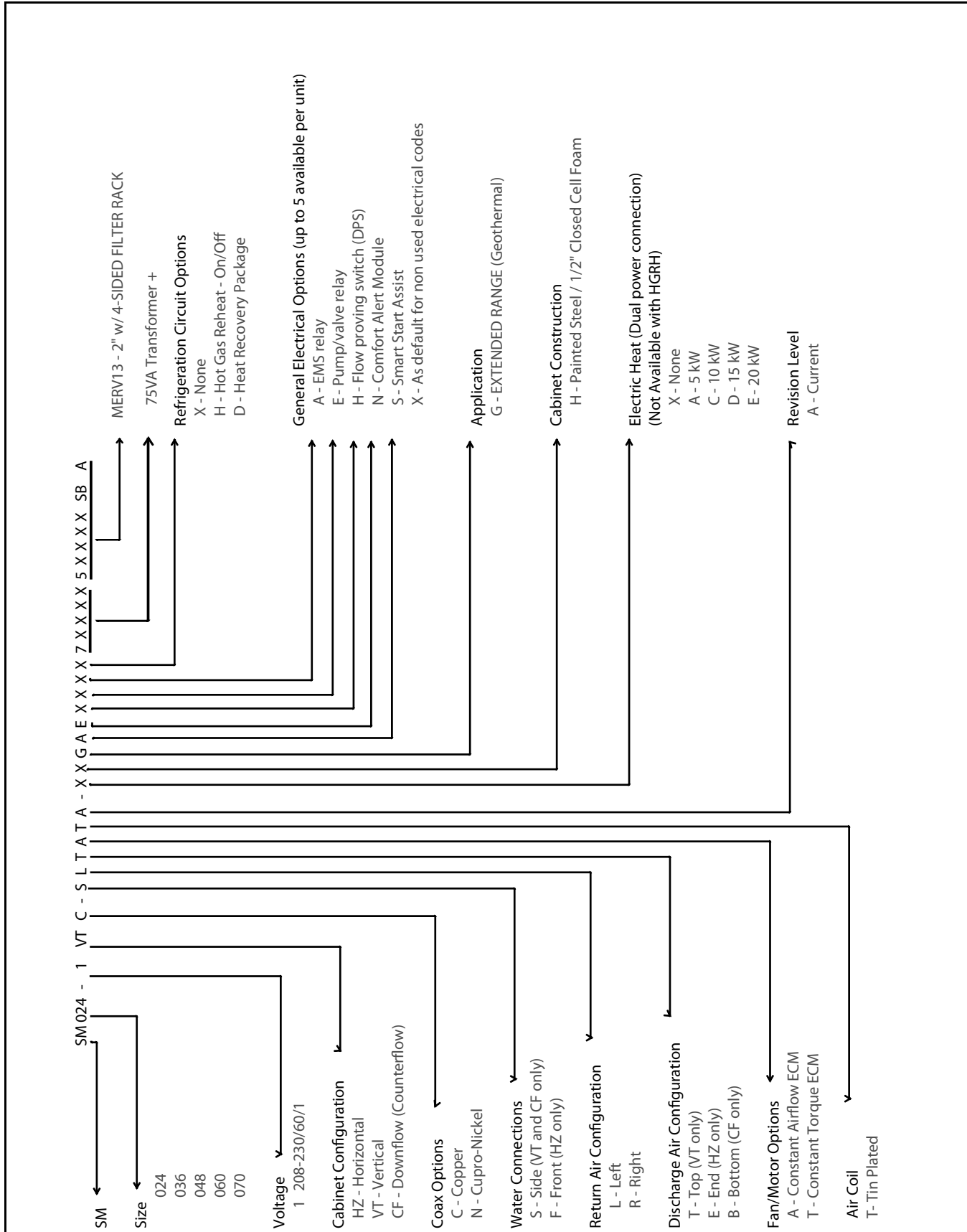


Figure # 2



## 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 90°F in the heating mode and between 30°F to 120°F in the cooling mode



**NOTE:** Heat Pump operating under extreme conditions will have limitation on air/fluid flow rates and/or temperatures.

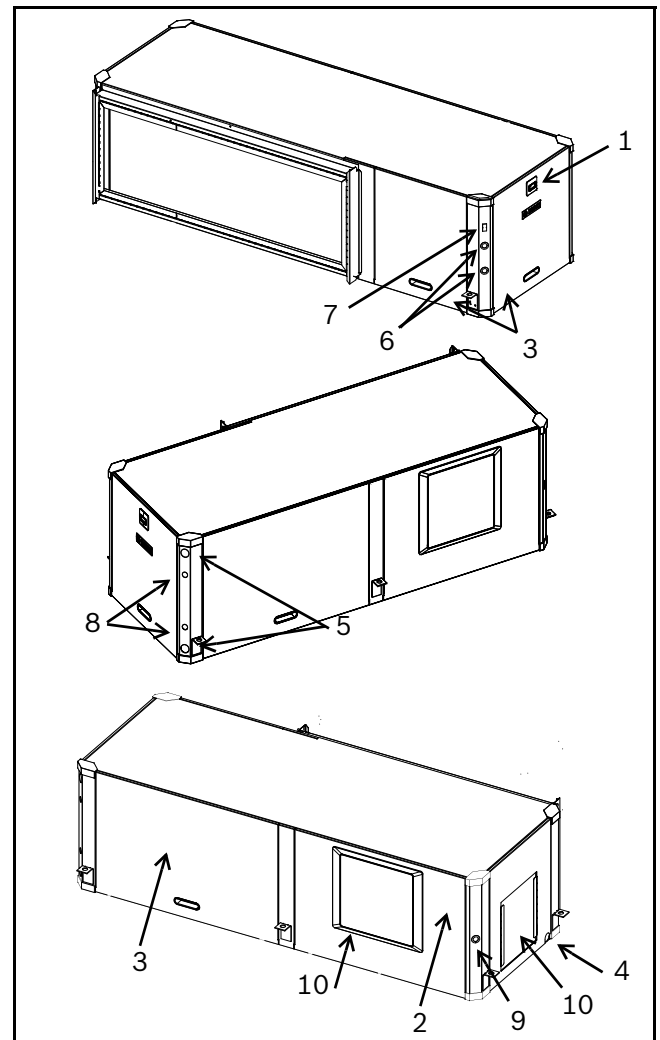


**NOTE:** 50° F Minimum Entering Water Temperature (EWT) is recommended for well water applications with sufficient water flow to prevent freezing. Antifreeze solution is required for all closed loop applications and EWT below 45°. Cooling Tower/Boiler and Geothermal applications should have sufficient 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. VT units are field convertible for three discharge/supply air orientations and left-hand (LH) or right-hand (RH) return configurations. HZ units have two field configurable discharge/supply air orientations. Several factory installed options are available: Hot Gas Reheat, Electric Heat, Heat Recovery Package, Smart Start Assist, Constant Airflow Blower Motor, DPS Water Flow Proving Switch, Auxiliary Pump Relay, and Comfort Alert Module. Electric Heat and Smart Start Assist are also available as field installed accessory. See Pg#37 for more detail.

Safety devices are built into each unit to provide the maximum system protection possible when properly installed and maintained. Each unit has externally mounted LCD error code 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#95 through Pg#95



**Figure # 3**

- [1] LCD Error Code Display
- [2] Air handler access panel
- [3] Condensing section access panel
- [4] Condensate drain connection
- [5] Water connection
- [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 (Supply Air)

## 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.



**WARNING:** For storage If unit stacking is required, stack units as follows:

Vertical units: less than 6 tons, no more than two high.

Horizontal units: less than 6 tons, no more than three high.

## INITIAL INSPECTION

Be certain to inspect all cartons or crates on each unit as received at the job site before signing the freight bill. Verify that all items have been received and that there are no visible damages; note any shortages or damages on all copies of the freight bill. In the event of damage or shortage, remember that the purchaser is responsible for filing the necessary claims with the carrier. Concealed damages not discovered until after removing the units from the packaging must be reported to the carrier within 24 hours of receipt.

## 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.



**NOTE:** These units are not approved for outdoor installation; therefore, they must be installed inside the structure being conditioned. 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 (default) and straight through. (Figure #4 and #5)

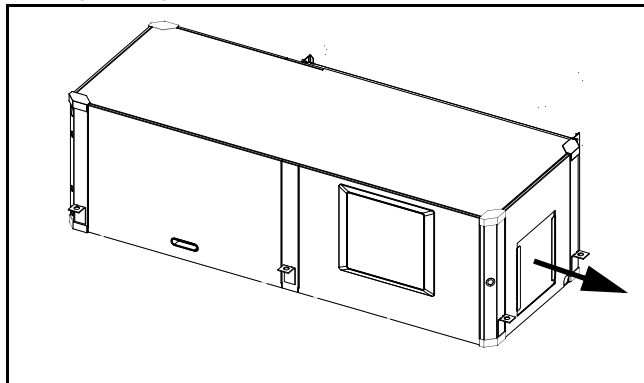


Figure # 4

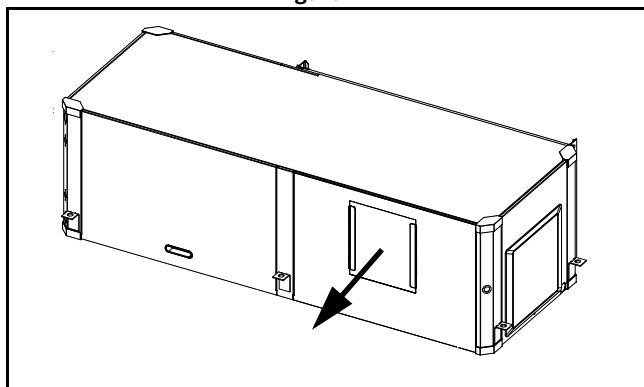


Figure # 5



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#10.



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
- Flat screw driver
- Phillips screw driver

- 1/4" hex head driver
- Needle nose pliers
- 5/16"-1/4" ratchet wrench



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

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

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

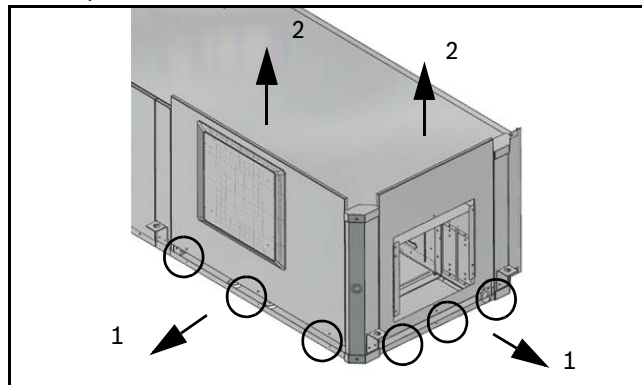


Figure # 6

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

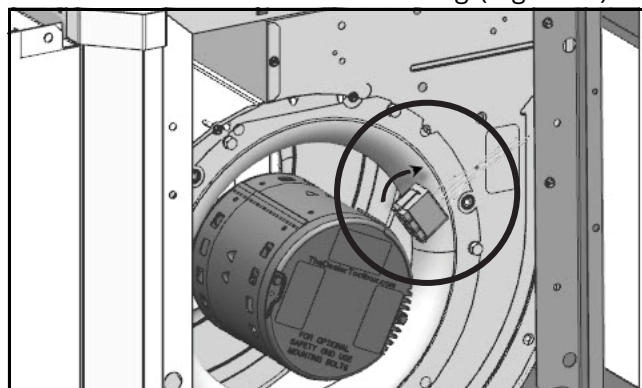


Figure # 7

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

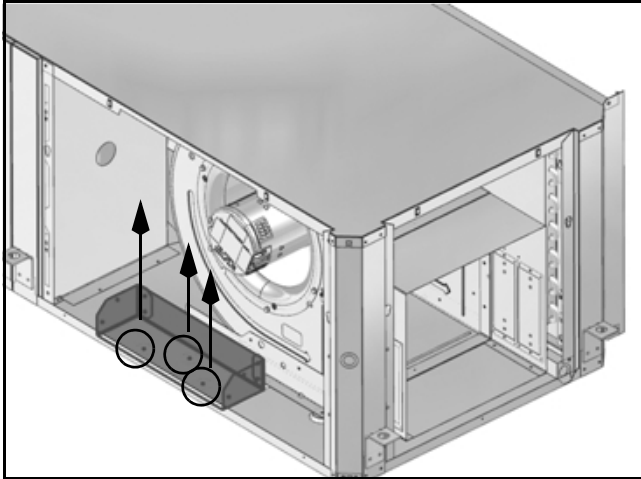


Figure # 8

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

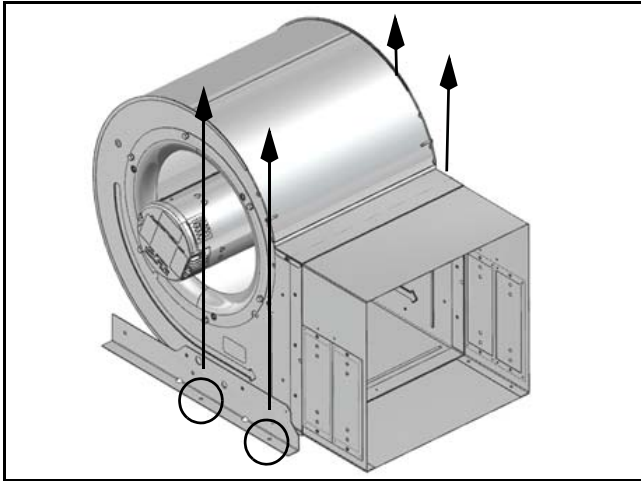


Figure # 9

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

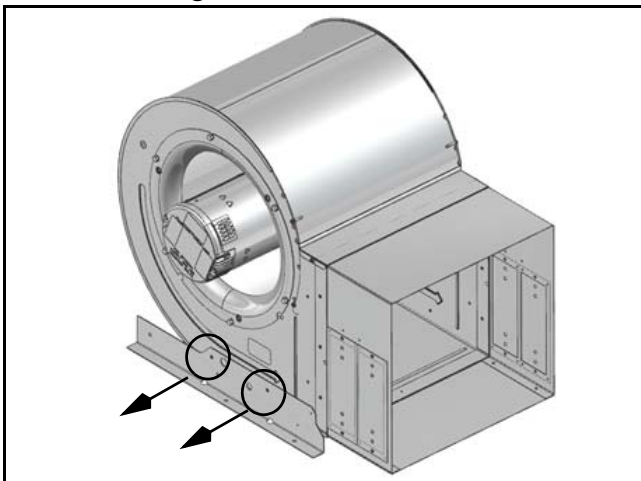


Figure # 10

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

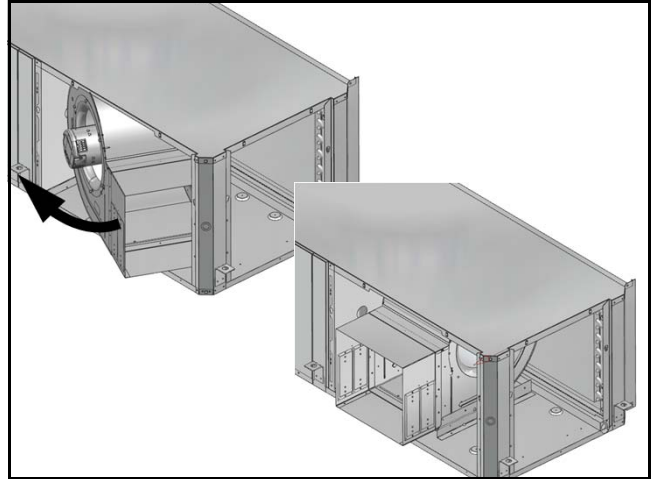


Figure # 11

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

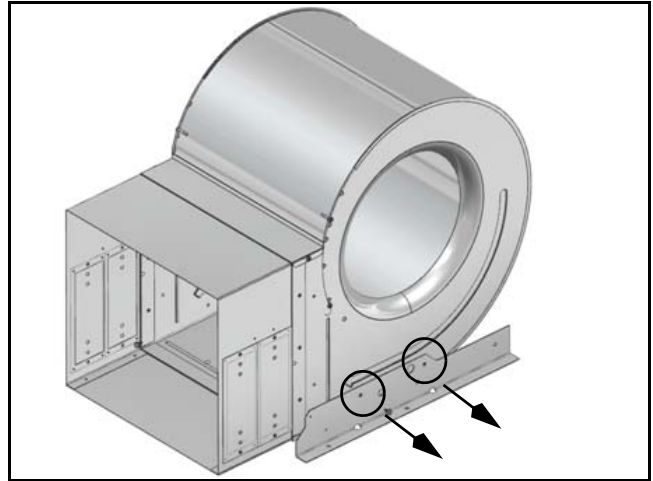


Figure # 12

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

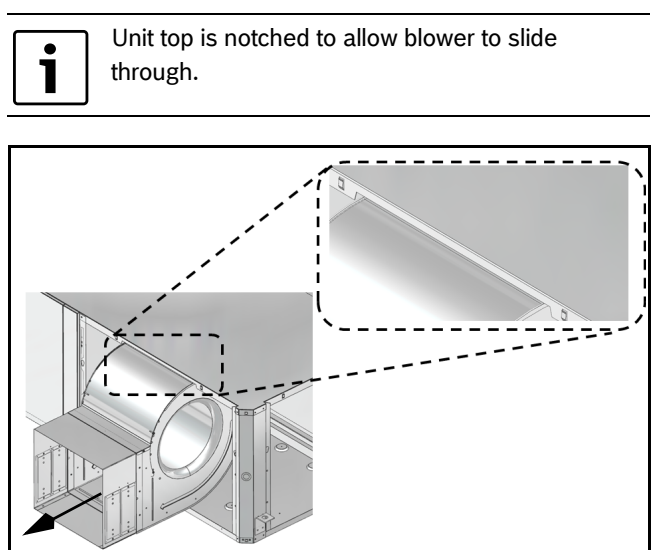


Figure # 13

**i** Unit top is notched to allow blower to slide through.

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

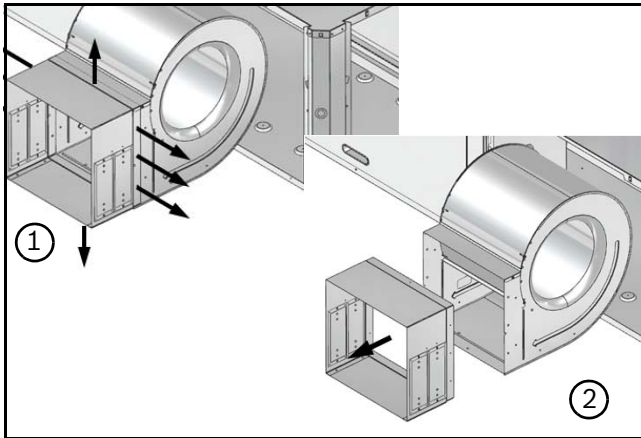


Figure # 14

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

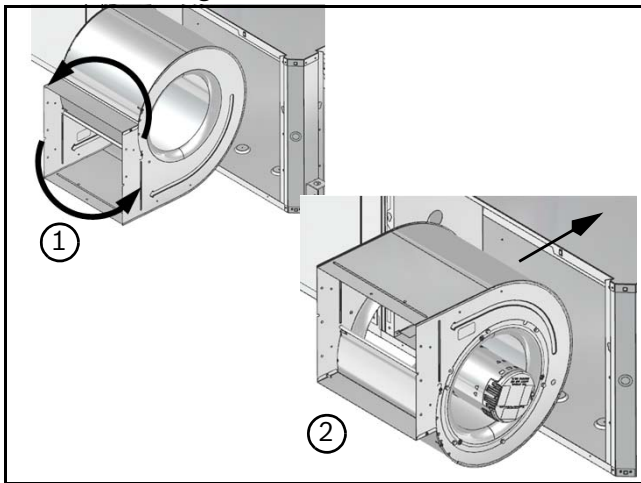


Figure # 15

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

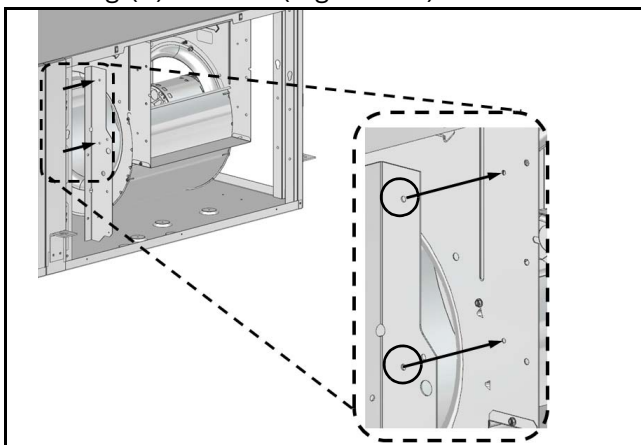


Figure # 16

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

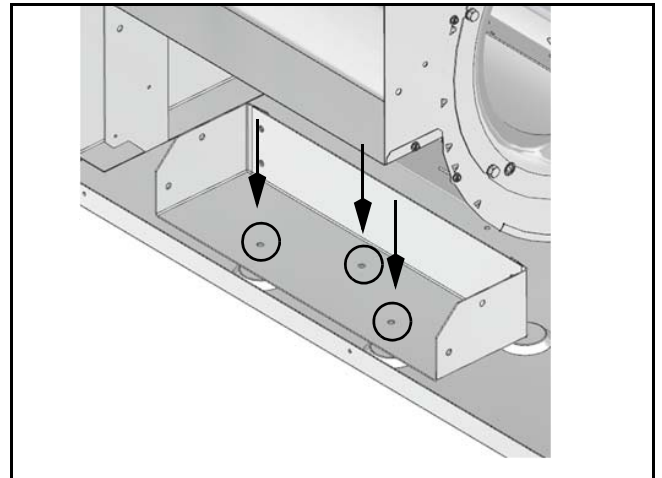


Figure # 17

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

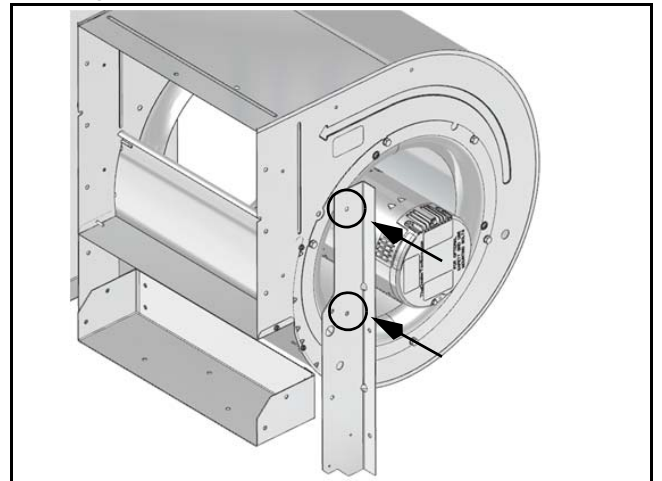


Figure # 18

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

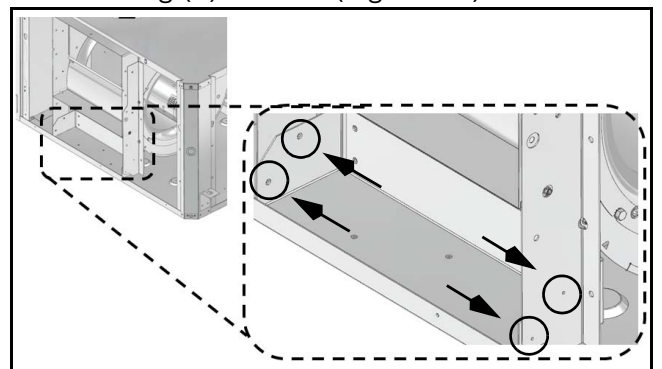


Figure # 19

15. Reconnect blower motor wiring and ground wire.



- Remove and retain plastic Blower opening cover by removing (6) screws and reinstall it in the new location (Figure#20 and #21)

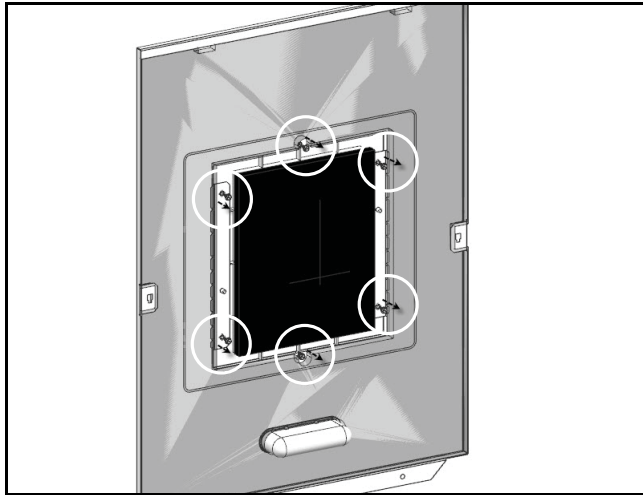


Figure # 20

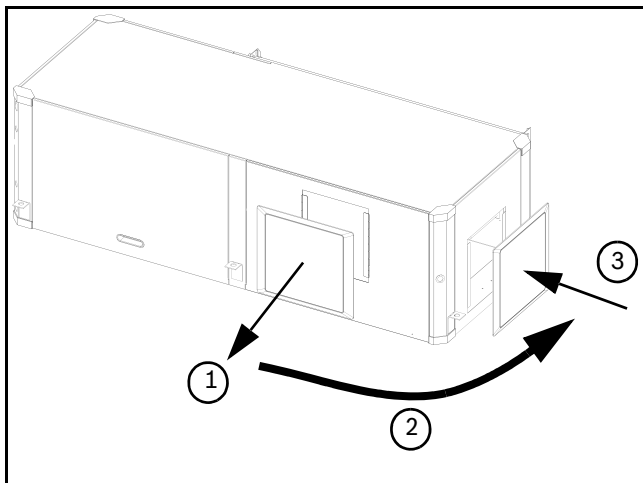


Figure # 21

- Reinstall all unit panels.

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

- Remove and retain end and side panels.(Figure#22)

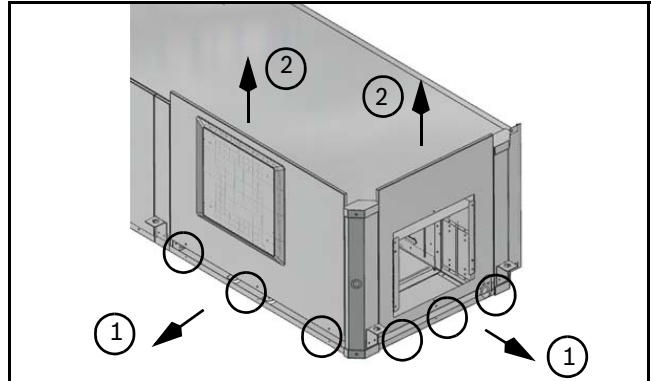


Figure # 22

- Disconnect blower motor wiring and ground wire fastened to blower housing.(Figure#23)

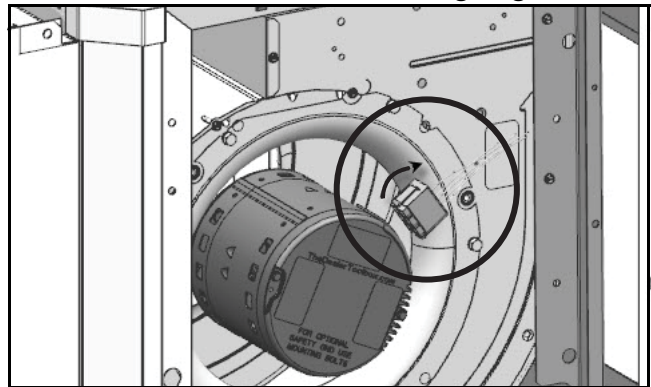


Figure # 23

- Remove and retain (4) screws under the blower collar. (Figure #24)

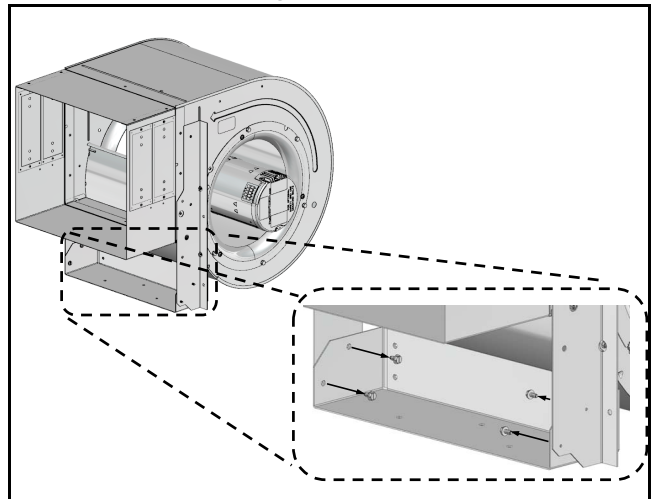


Figure # 24



**NOTE:** 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.

- Slide blower assembly away from mounting bracket. (Figure #25)

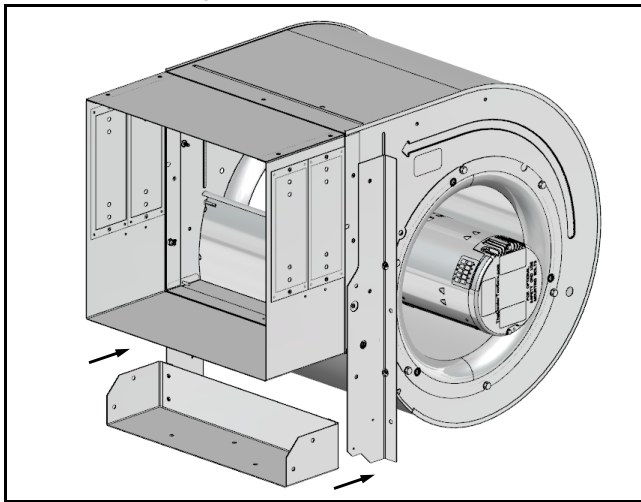


Figure # 25

- Remove and retain (1) vertical bracket by removing (2) screws. (Figure #26)

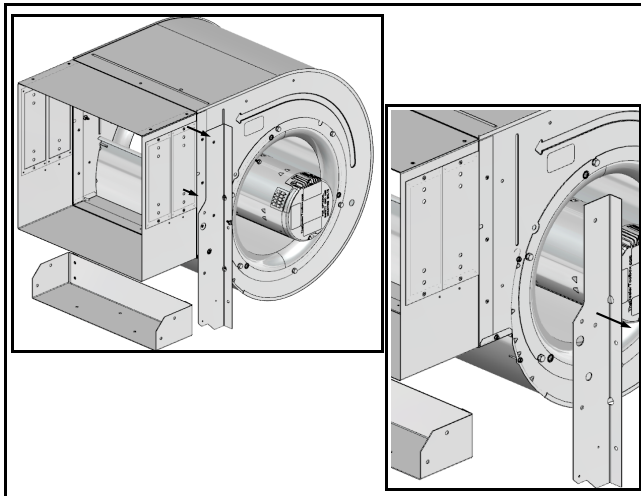


Figure # 26

- Remove and discard horizontal blower bracket by removing (3) screws. (Figure #27)

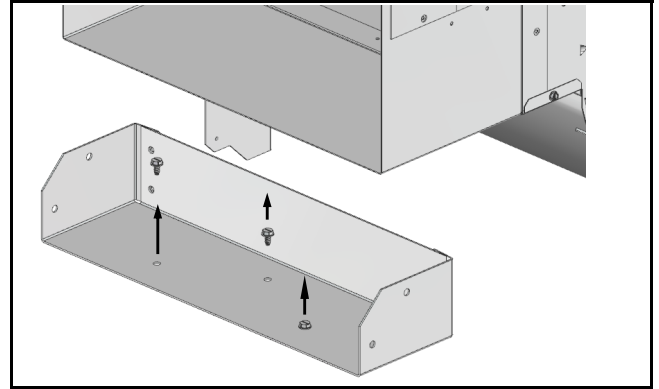


Figure # 27

- Rotate the blower into its new position. (Figure #28)

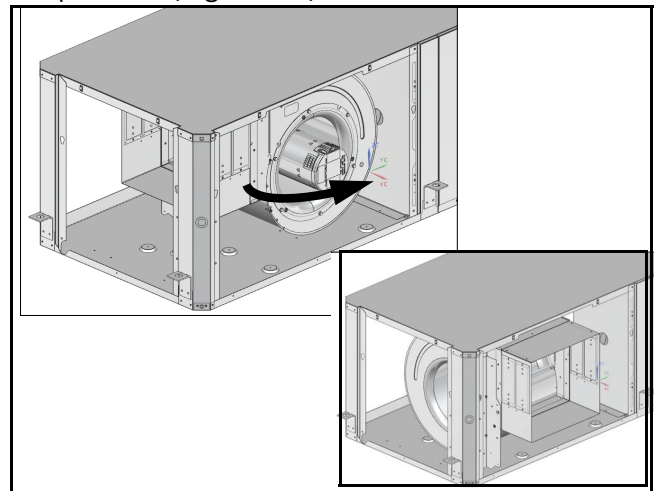


Figure # 28

- Remove and retain remaining vertical blower bracket by removing (2) screws. (Figure #29)

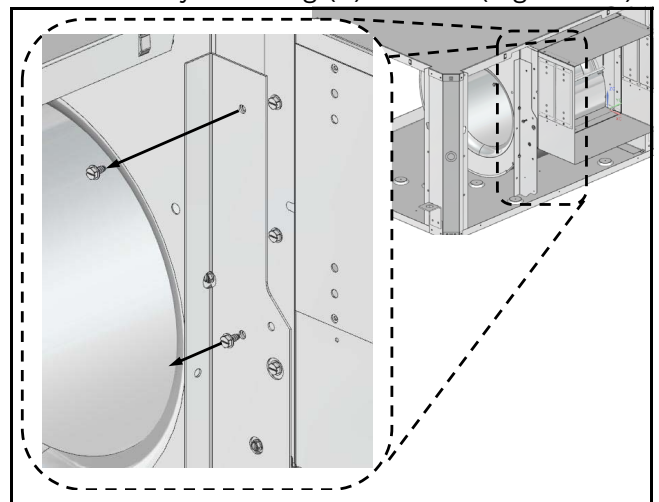


Figure # 29

9. Remove the blower assembly by sliding it forward. (Figure #30)



Unit top is notched to allow blower to slide through.

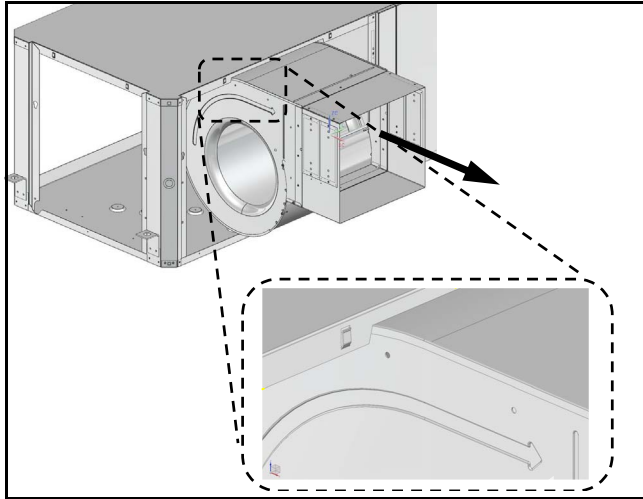


Figure # 30

10. Remove and discard blower collar by removing (8) screws. (Figure #31)

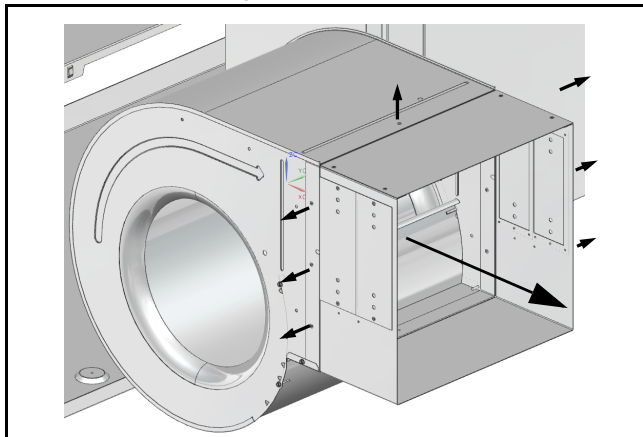


Figure # 31

11. Reorient the blower assembly 180 degree with blower “belly” up. (Figure #32)

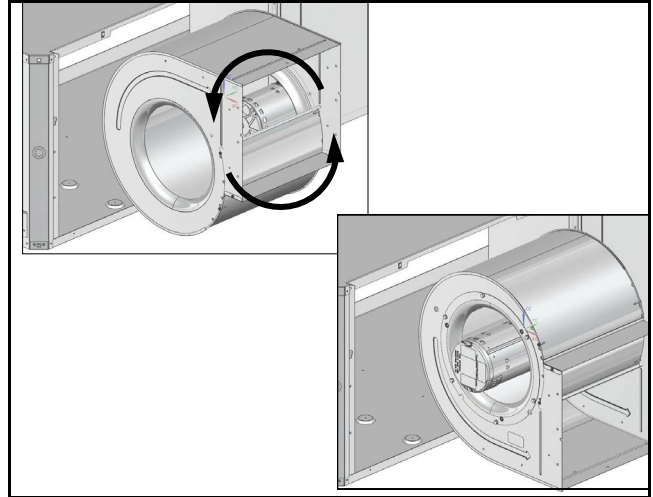


Figure # 32

12. Move the blower back into the cabinet. (Figure #33)

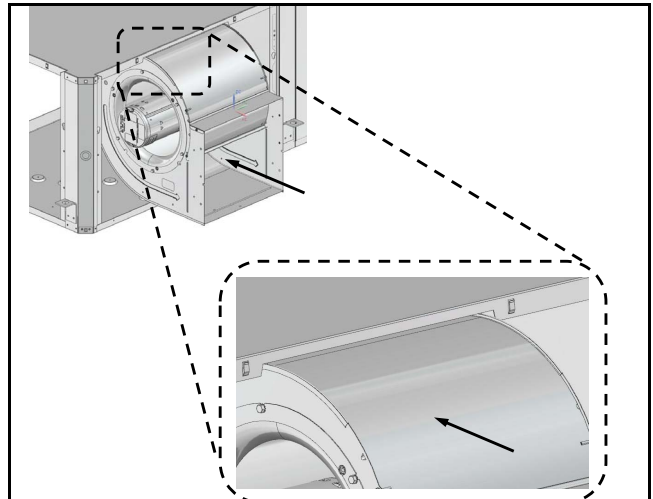


Figure # 33

13. Reinstall (2) vertical blower brackets in the new horizontal position using (4) screws. (Figure #34)

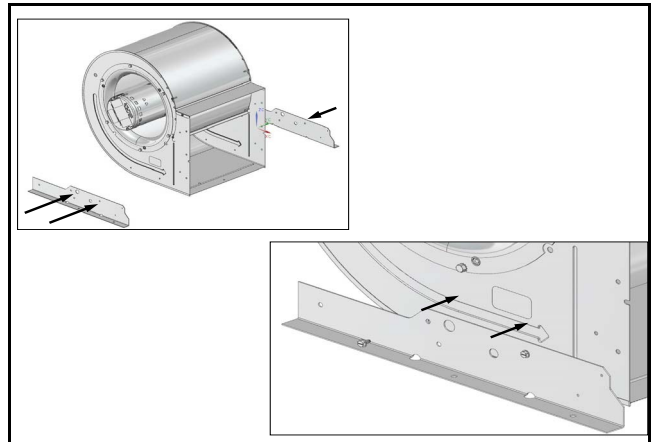


Figure # 34



- Secure (2) the now horizontal blower brackets to the unit base using (4) screws. (Figure#35)

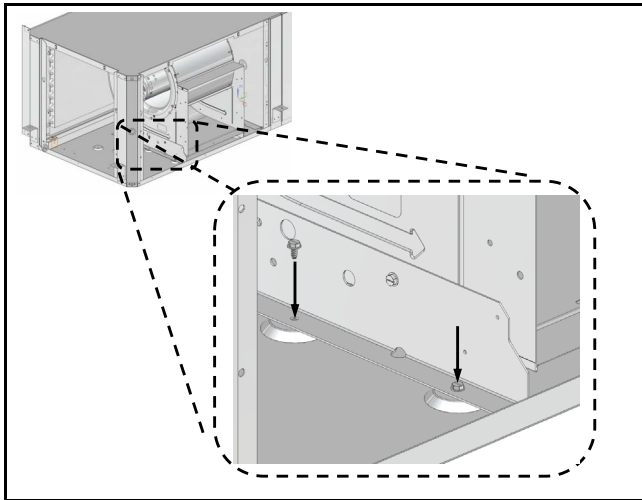


Figure # 35

- Reconnect blower motor wiring and ground wire.
- Remove and retain plastic Blower opening cover by removing (6) screws and cutting/tearing insulation at perforations around the perimeter of cover. Reinstall it in the new location (Figure#36 and #37)

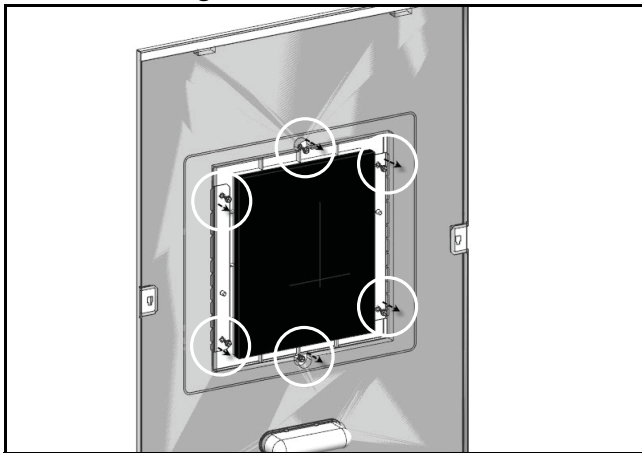


Figure # 36

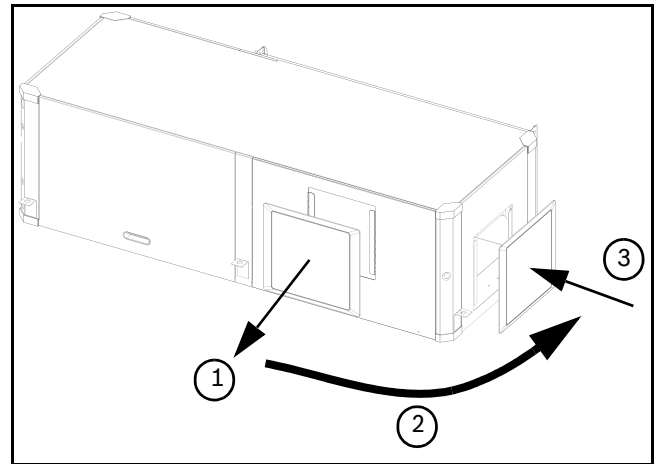


Figure # 37

- Reinstall all unit panels.

### COUNTER-FLOW CONFIGURABILITY

The Counter-Flow 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 (VT) Configuration water source heat pump is designed to be field configured for various configurations. This is achieved by relocating Electrical box (E-box), unit panels and reorienting blower to discharge UP, BACK OR SIDE. See Figure #37 through #41 for more detail.



The unit, as shipped from the factory, does not have configuration on the discharge air from to side or back, field configuration kit is required, (sold as an accessory Kit).



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



Blower, E-box and panel configuration changes should be done prior to unit being installed in the final location.

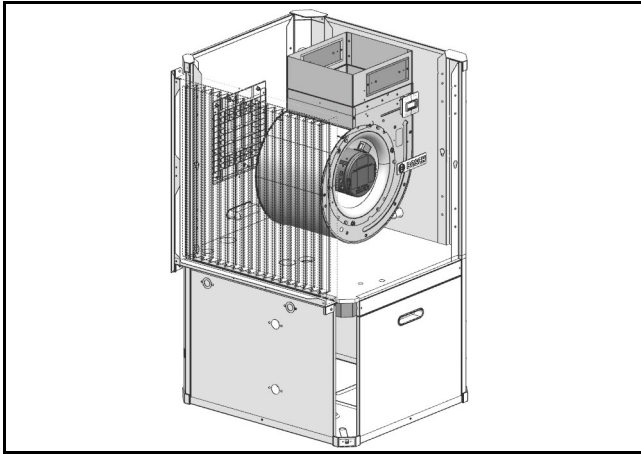


Figure # 38 Top Discharge (Default)

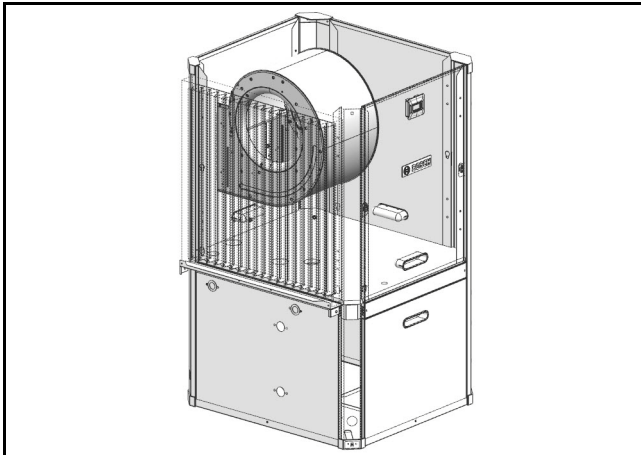


Figure # 39 Back Discharge

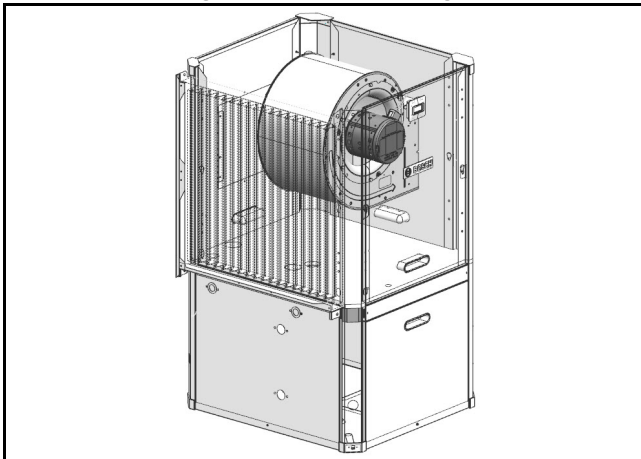


Figure # 40 Side Discharge

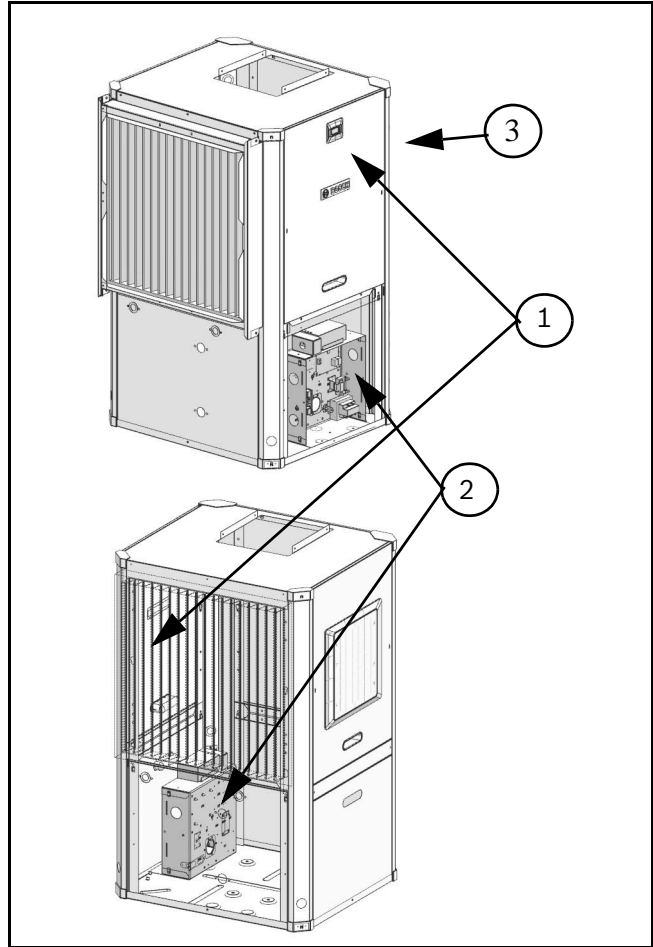


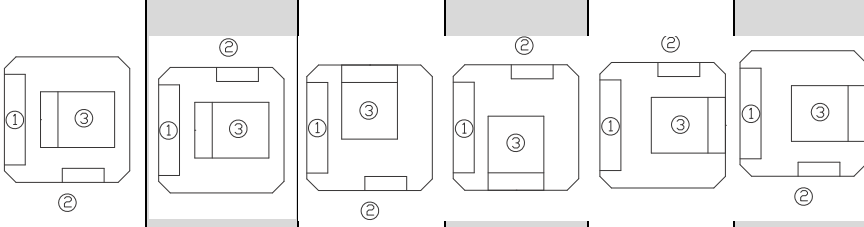
Figure # 41

- [1] Logo/Front Panel
- [2] Electrical Box
- [3] Default Configuration (can be ordered as either right or left hand return)



Internally mounted electric heat is only available in Top Discharge configuration. See table below for details

Blower Orientation and Electric Heat Compatibility		
Blower	Up	Yes Internally or Duct Mounted
	Back	Duct Mounted
	Side	Duct Mounted

Required steps	Possible unit configurations					
<p><i>How to use this table:</i></p> <ul style="list-style-type: none"> <li>Select desired configuration from “possible unit configurations”.</li> <li>Instructions with “X” have to be performed to reconfigure the unit.</li> </ul>						
	Left return, top discharge	Right return, top discharge	Left return, rear discharge	Right return, rear discharge	Right return, left discharge	Left return, right discharge
ACCESS TO INTERNAL COMPONENTS (PG#15)		X	X	X	X	X
BLOWER RE-CONFIGURATION (PG#17)			X	X	X	X
E-BOX CONFIGURATION (PG#24)		X		X	X	
ELECTRIC HEAT RELOCATION* (PG#22)		X*				
CONDENSATE DRAIN RELOCATION (PG#20)		X		X	X	
HRP SWITCH* (PG#21)	X*	X*		X*	X*	
REINSTALL PANELS (PG#25)		X	X	X	X	X
<p>*APPLIES IF OPTION IS INSTALLED                      [1] AIR COIL                      [2] E-BOX (UNIT FRONT)                      [3] BLOWER                      X APPLICABLE STEP</p>						



All heat pumps are supplied with panel belt which needs to be removed to access screws for panel removal. The panels have additional internal fasteners to prevent any air leakage.



For safety precautions two persons are required to perform this operation.

**Required Tools**

- 5/16" hex head driver
- 3/8" hex head driver
- 7/16" hex head driver
- Flat screw driver
- Phillips screw driver
- 1/4" hex head driver
- Needle nose pliers

**Access to Internal Components**

- Using a Flat Screw driver remove and retain Panel Belt by inserting the screwdriver into the slot and releasing the catch. (Figures#42and#43)



The belt is held in place by a clip on one side and an interference fit on the other end.

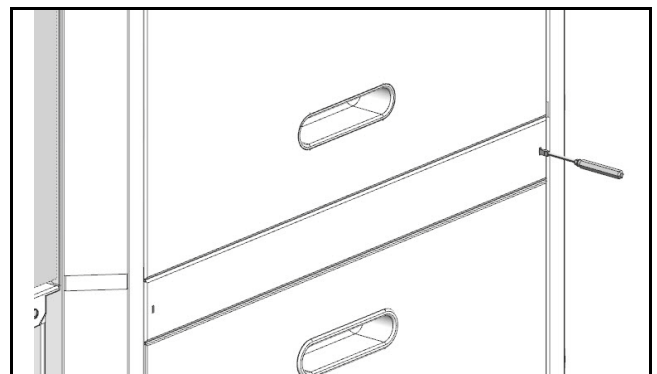


Figure # 42

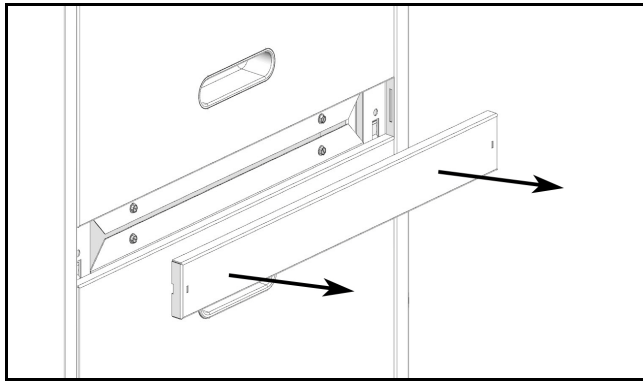


Figure # 43

- Remove and retain Condensing Section access panels (bottom panel) by removing (3) screws. (Figure #44)

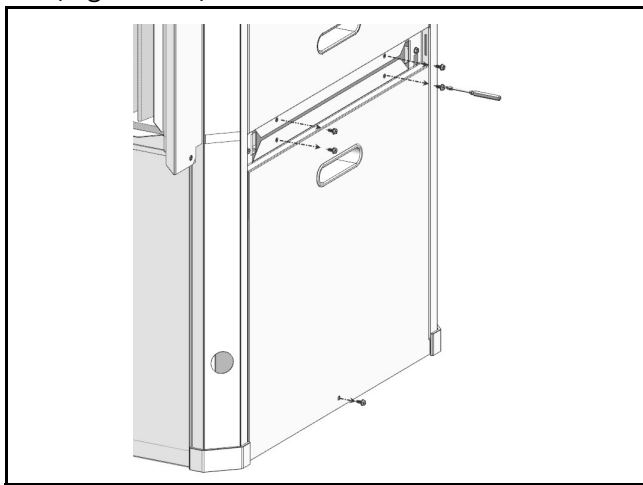



Figure # 44

- Remove and retain Air Handler Panel by lifting up and out as shown in Figure #46. Remove panel about 12" away from the cabinet and unplug LCD screen wiring. (Figures #45 and #46)



The unit panel mounted diagnostic display is connected to the heat pump controls with a wire harness. Use care when removing the display panel and carefully disconnect and reconnect the harness when repositioning the panel.

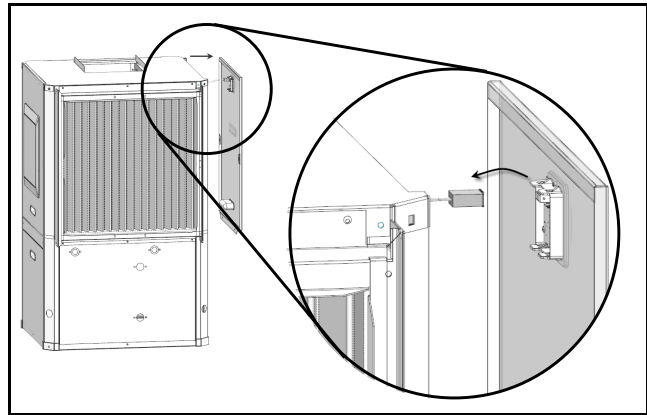


Figure # 45

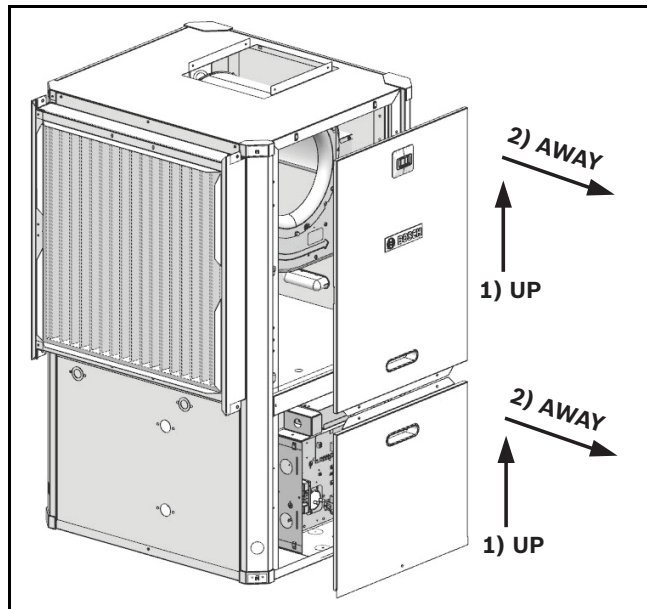


Figure # 46

- Repeat steps 1–3 for all three sides.

## Blower Re-Configuration



This instruction details re-configuration of blower from UP to SIDE discharge. Re-configuration to other side uses similar steps.

1. Remove and retain diagonal support brackets on Front and Back sides of the unit. (Figure #47)

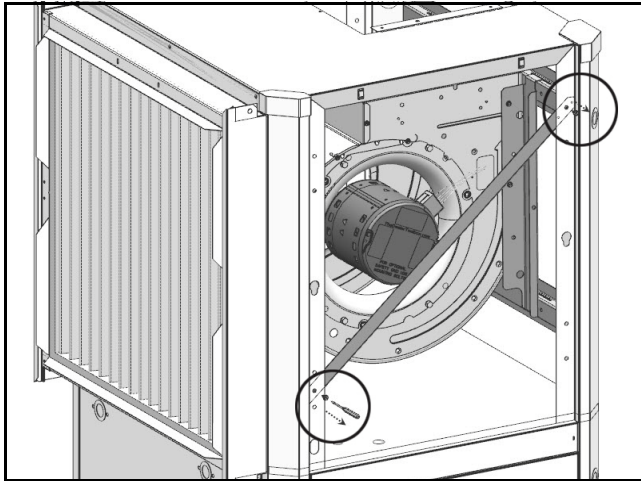


Figure # 47

2. Unplug electrical connections of Blower motor and ground wire connected to blower housing. (Figure #48)

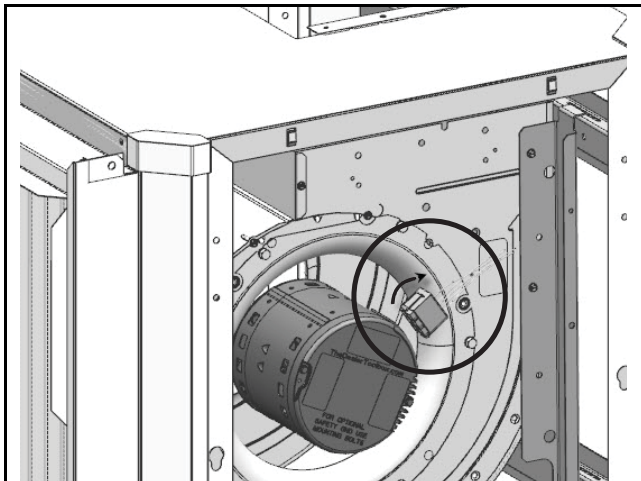


Figure # 48

3. Remove and retain blower motor and inlet ring assembly by removing (3) bolts securing blower motor bracket and screws securing the blower inlet ring. (Figure #49)



Removing the blower motor and blower wheel greatly simplifies handling of the blower assembly and reduces the chance of damaging heat pump components.

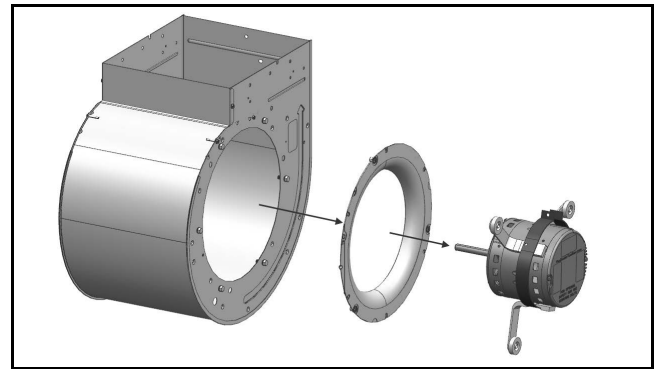


Figure # 49

4. Remove screws on both sides of the blower securing vertical blower bracket to horizontal support. (Figure#50)

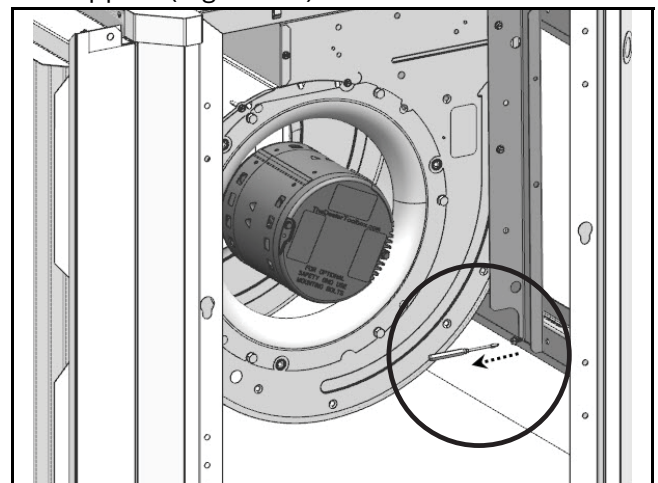


Figure # 50

5. Remove and retain blower assembly by lifting up. (Figure #51)



Air coil is in close proximity to the blower and 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.



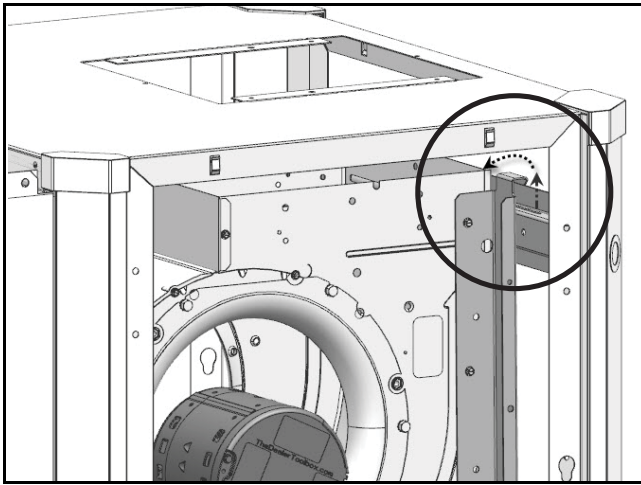


Figure # 51

6. Remove and discard blower collar. (Figure #52)



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

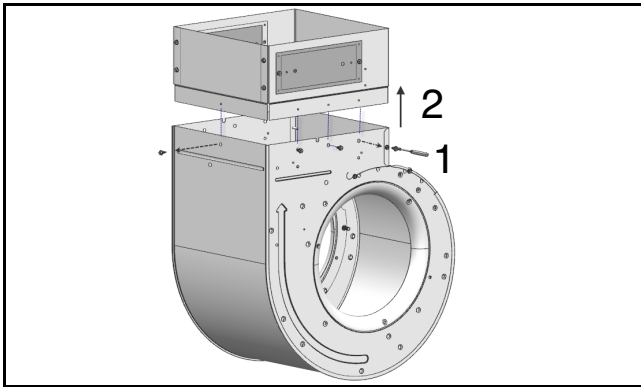


Figure # 52

7. Remove and retain side panel blower opening cover by removing (6) phillips head screws and cutting/tearing insulation at perforations around the perimeter of cover. (Figures #53 and #54)

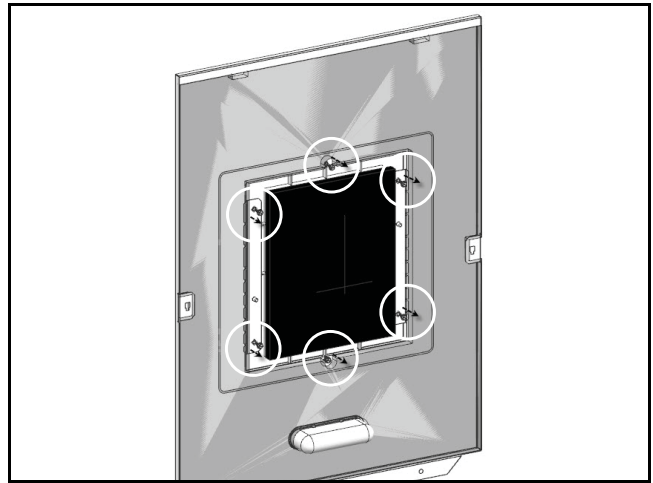


Figure # 53

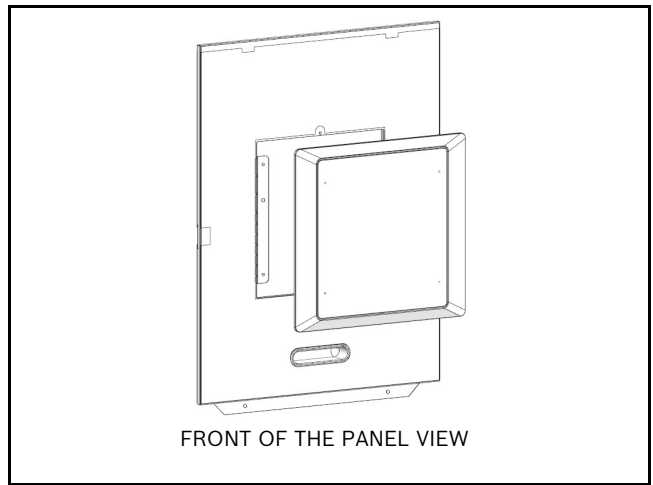


Figure # 54

8. Reinstall blower opening cover in the TOP panel. (Figure #55)

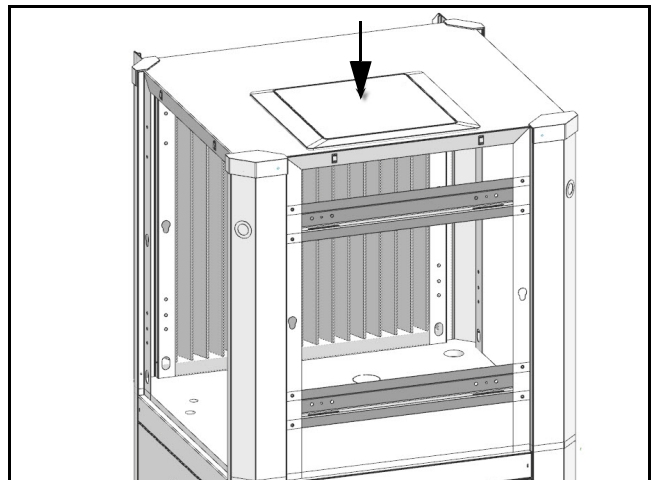


Figure # 55

- Remove and retain (2) horizontal blower support brackets by removing (4) screws in each. (Figure #56)



Upper bracket contains two push-in rubber bump stops.

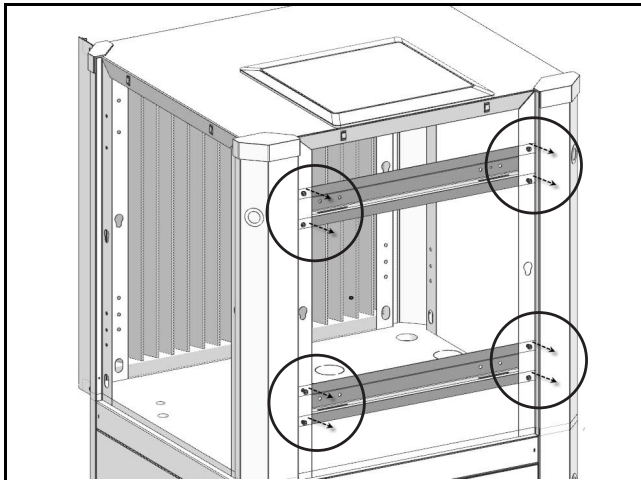


Figure # 56

- Reinstall brackets removed in Step (9) on the same side of the unit as the blower outlet. (Figure #57)



Ensure bracket with push-in rubber bump stops is installed in the top position.

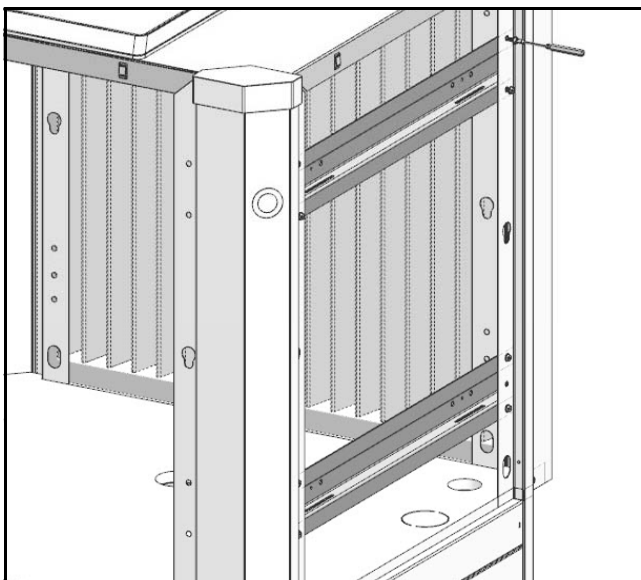


Figure # 57

- Remove and retain vertical brackets from blower by removing (4) screws, (2) on each side of the blower. (Figure #58)

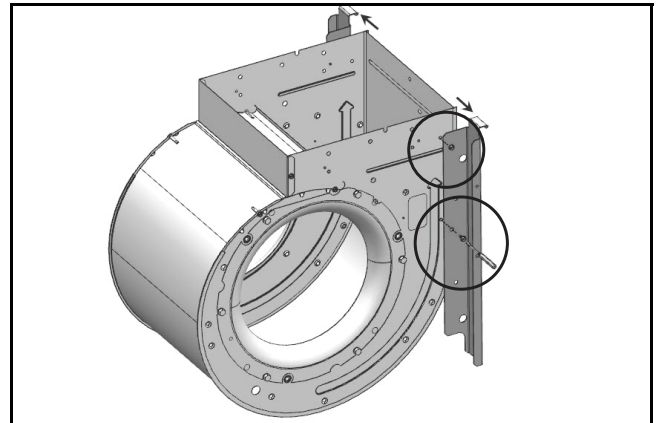


Figure # 58

- Reinstall vertical brackets in new orientation. (Figure #59)

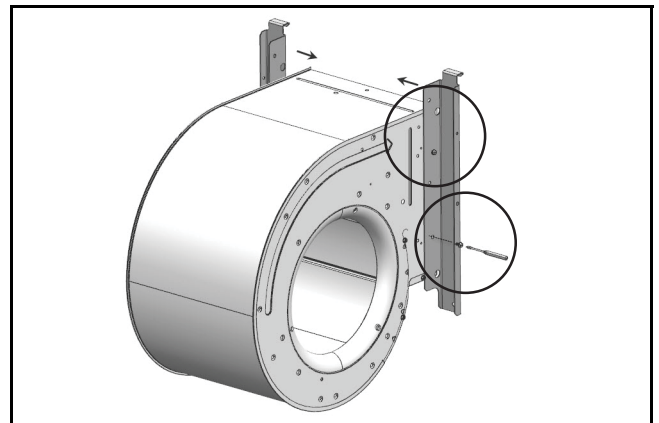


Figure # 59

- Reinstall the blower assembly in the new desired location, using the existing holes. (Figure #60)



**NOTE:** Be aware of blower housing proximity to air side coil and potential for coil damage.

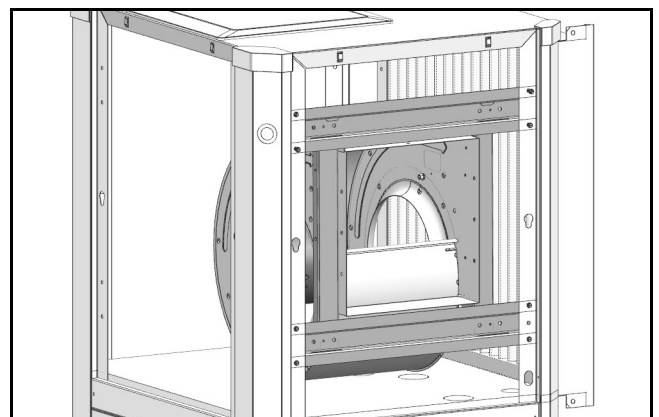


Figure # 60

- 14. Reinstall blower motor and inlet ring assembly by reversing Step #6. (Figure #61)

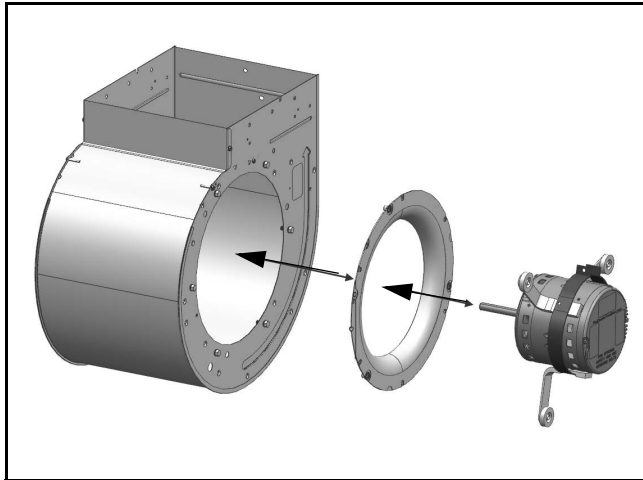


Figure # 61

- 15. Reconnect blower motor electrical plug and ground wire.
- 16. Reinstall diagonal bracket(s). (Figure #62)

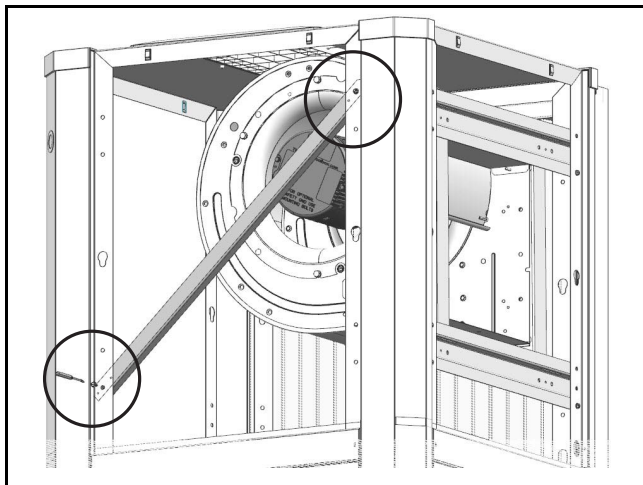


Figure # 62

### Condensate Drain Connection Re-configuration

When re-configuring the unit from Left-Hand Return to Right-Hand Return it is necessary to relocate condensate drain connection from FRONT left corner post to BACK left corner post. (Figure#63)

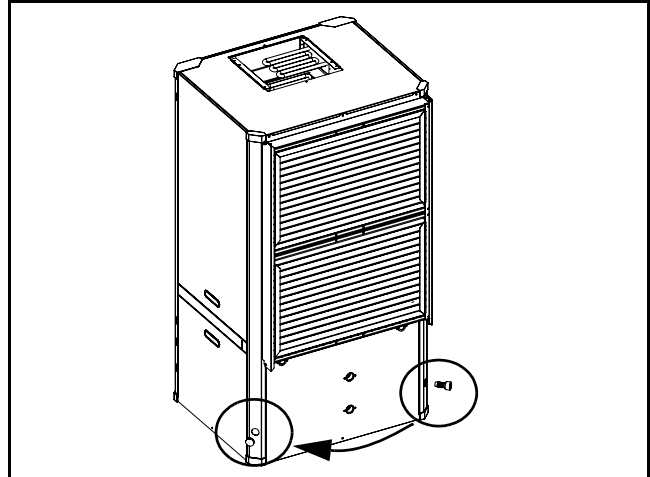


Figure # 63

- 1. Cut the condensate drain hose on the inside of cabinet.



Be sure to retain the spring

- 2. Remove and retain condensate drain plastic fitting and grommet from the hose by pulling it away from the hose (barb style connection). (Figure#64)

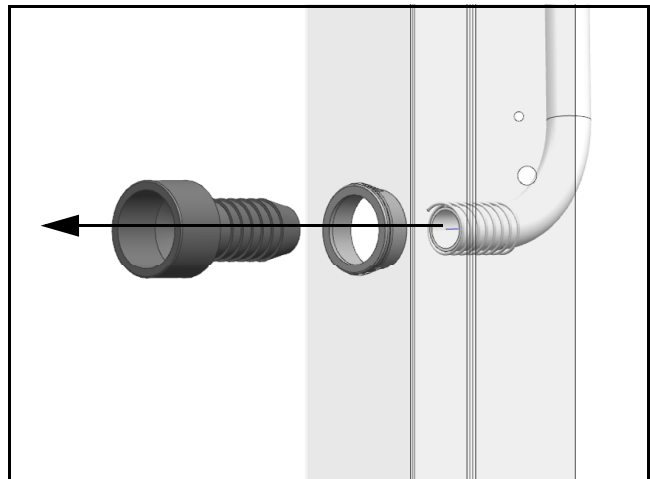


Figure # 64



3. Locate the BACK left condensate drain and remove and retain plastic plug covering the cutout. (Figure#65)

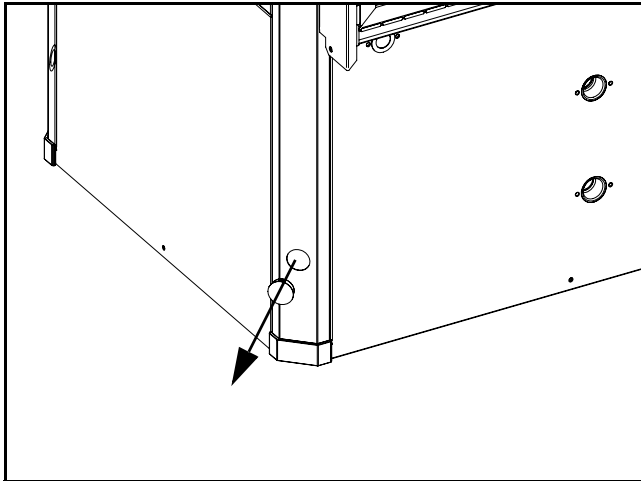


Figure # 65

4. Reinstall the removed plastic plugs in the original Condensate Drain Location.
5. Route the flexible plastic tube from FRONT left corner post to BACK left. (Figure#66)



**NOTE:** Avoid kinking the hose and/or creating a dip which could act as a second internal p-trap. Double trapped drain lines will not drain properly.

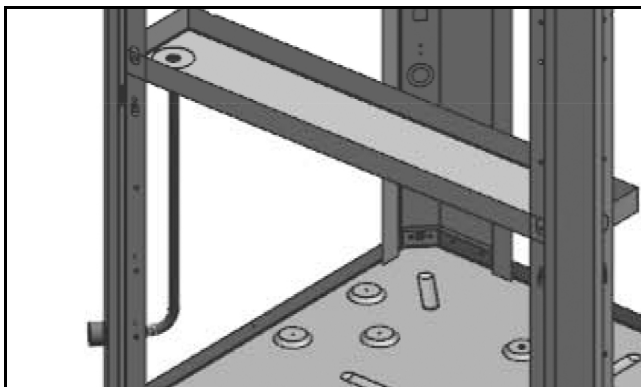


Figure # 66

6. Measure and cut the condensate drain hose to the appropriate length.
7. Insert spring onto condensate drain hose.

8. Reinstall condensate drain plastic fitting and bushing in its new location. (Figure#67)

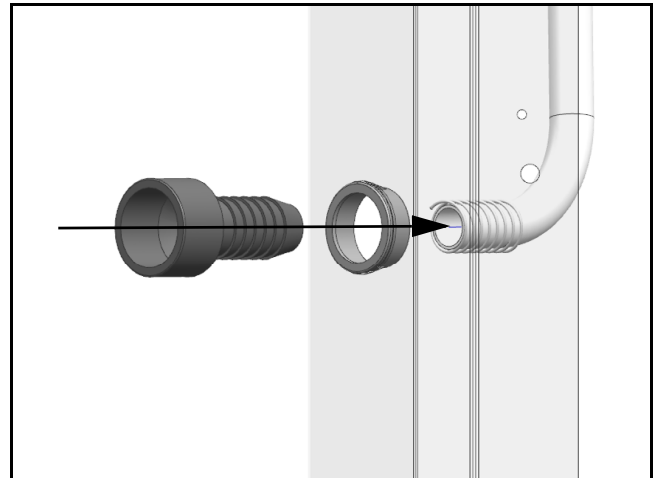


Figure # 67

### HRP Switch Relocation

The HRP Pump Disconnect Switch is shipped loose inside unit E-Box, to be connected to either FRONT right corner post or BACK right corner post. (Figure#68)

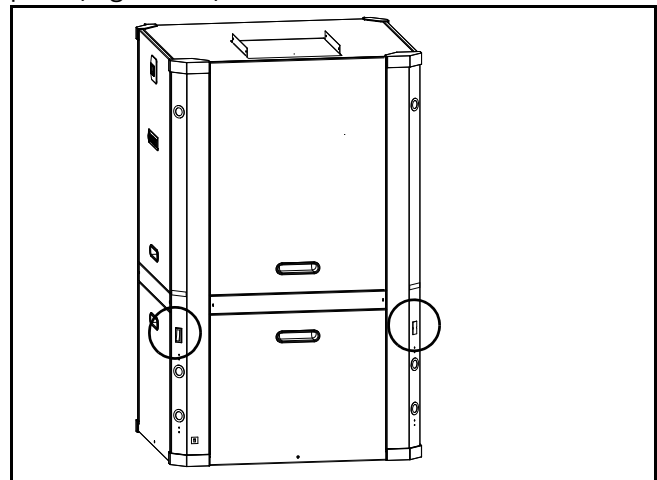


Figure # 68

1. From the inside of the unit remove (2) wires connected to HRP Pump Disconnect Switch.

2. Identify a rectangular knockout and remove it. Along with insulation.(Figure#69)

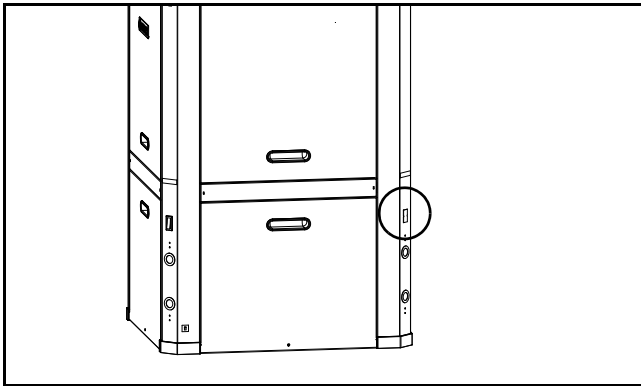



Figure # 69


3. Route HRP Pump Disconnect switch wires to the new switch location.

 **NOTE:** Do not route wiring over potentially hot surfaces or exposed sharp edges. Damage to wiring could result.

4. Install HRP Switch.
5. Reconnect the Switch wires.

### Electric Heat Relocation

When changing the unit from Left-Hand Return to Right-Hand Return, it's required to relocate Electric Heat Components to the opposite side of the blower in order to allow field servicing.

 Electric Heat comes with (1) or (2) heating element inserts, depending on capacity. This instruction shows (1) heating element insert. Perform the same steps for the second insert, if present.

1. Identify Electric Heat components. (Figure#70)

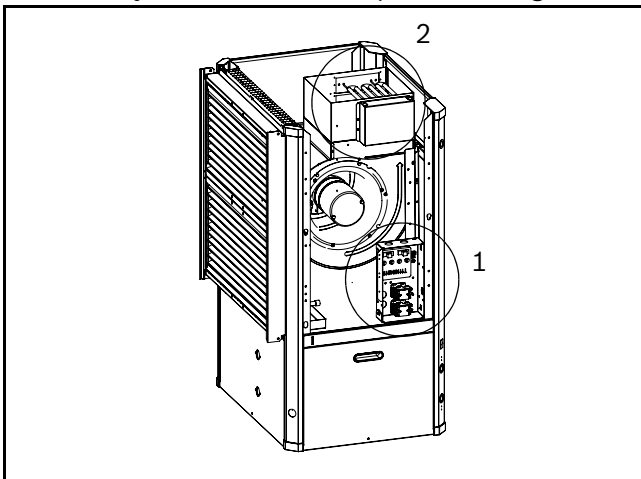


Figure # 70

- [1] Electric Heat Electrical Box
- [2] Electric Heat Elements.

2. Remove and retain the Electric Heat Element cover(s) by removing (4) screws in each.(Figure#71)

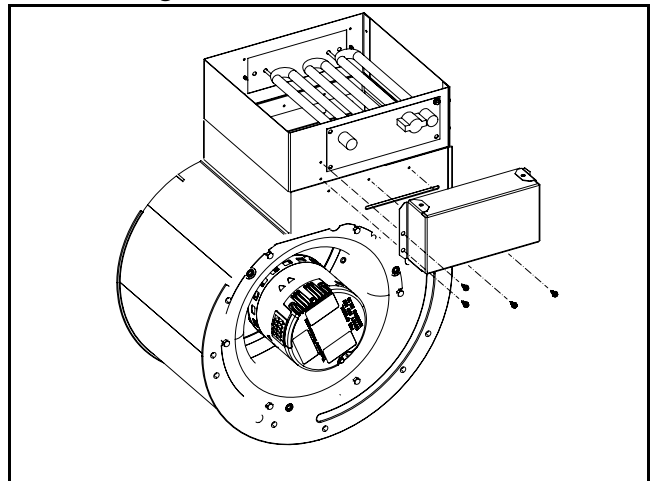


Figure # 71

3. Disconnect high voltage wiring a the Electric Heat Elements. (Figure#72)

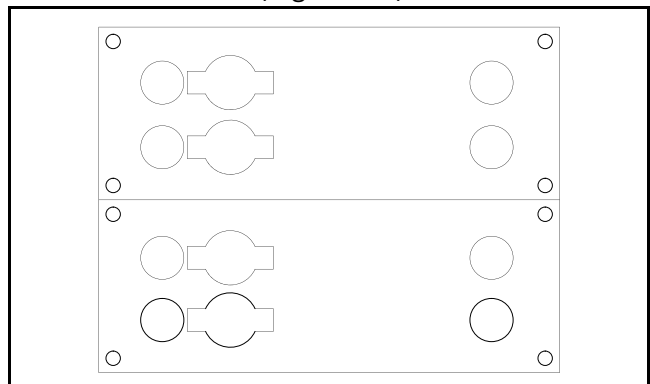


Figure # 72

4. Remove and retain Electric Heat Element(s).(Figure#73)

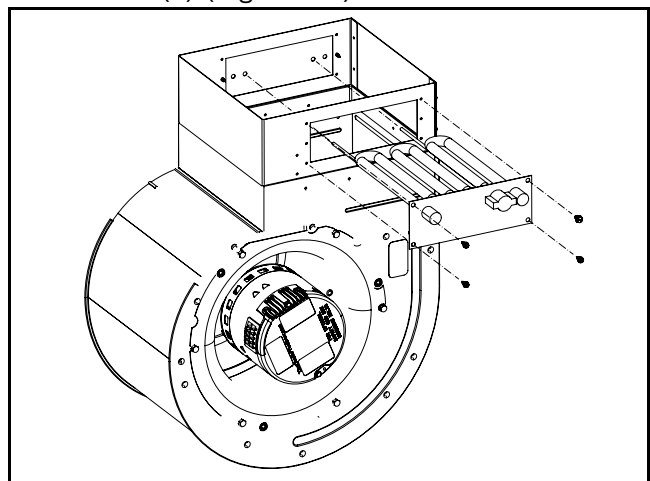


Figure # 73

5. Disconnect main Electric Heat E-box plug.(Figure#74)

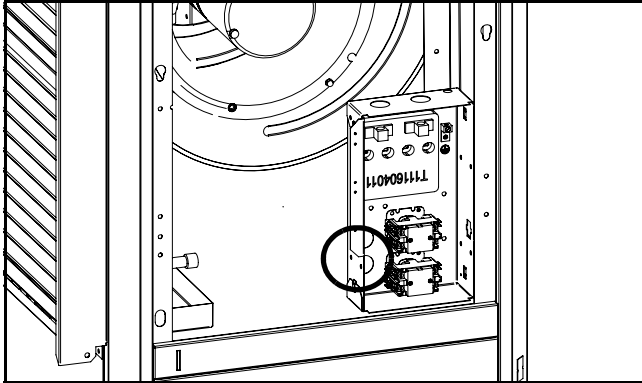


Figure # 74

6. Remove and retain Electric Heat E-box by removing (2) screws.(Figure#75)

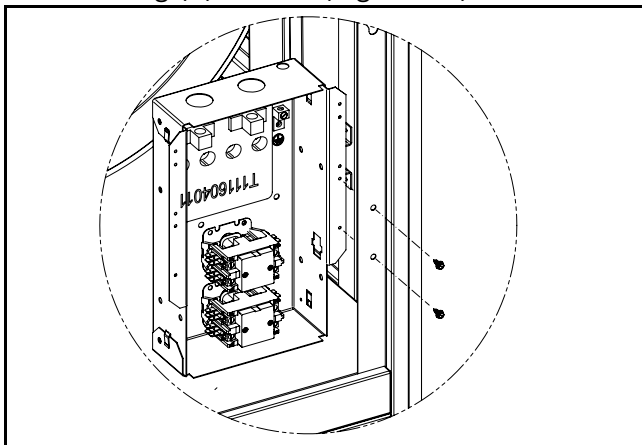


Figure # 75

7. Re-install Electric Heat E-box in the new location. (Figure#76)

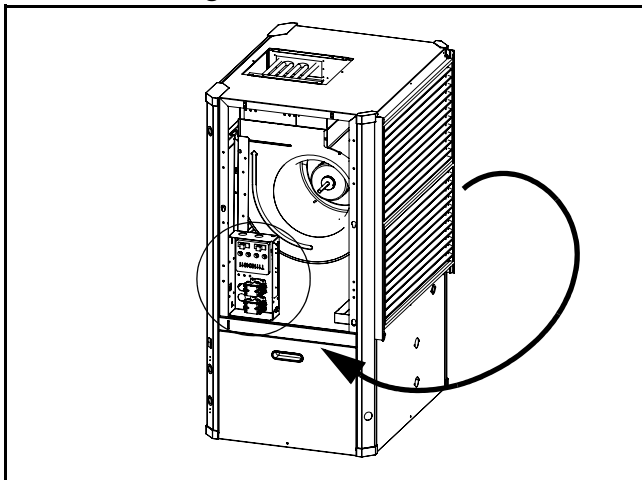


Figure # 76

8. Remove and retain Blower collar cover(s). (Figure#77)

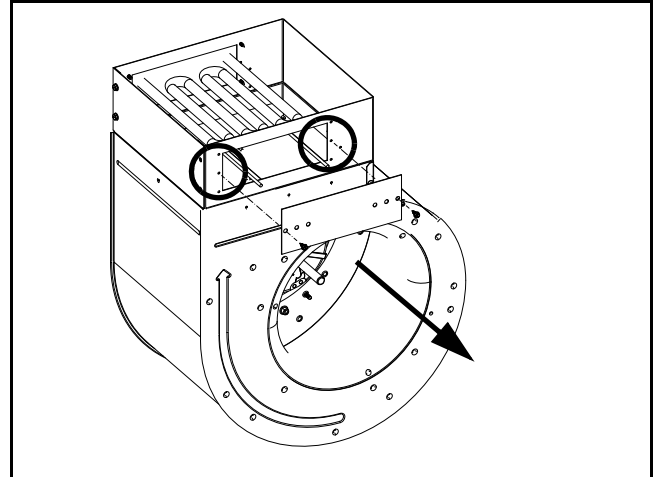


Figure # 77

9. Re-install Electric Heat Elements in the new location. Ensure High Temperature Cutouts are located on the left side. (Figure#78)

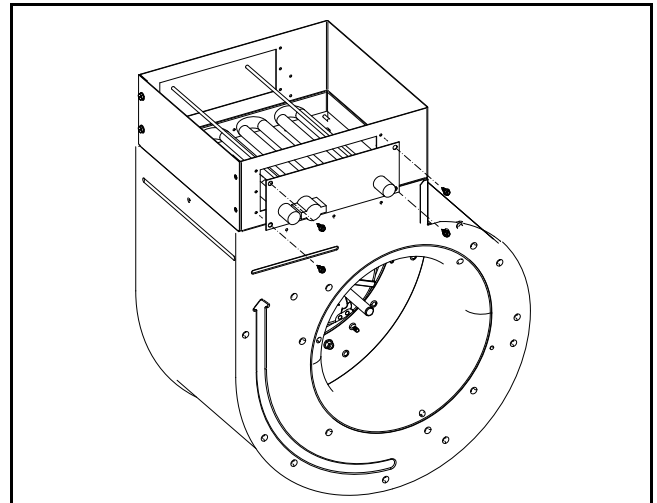


Figure # 78

10. Route the Unit E-box to Electric Heat wiring harness to the new Electric Heat Element location.

11. Connect wiring harness to the connector on the side of Electric Heat E-Box. (Figure#79)

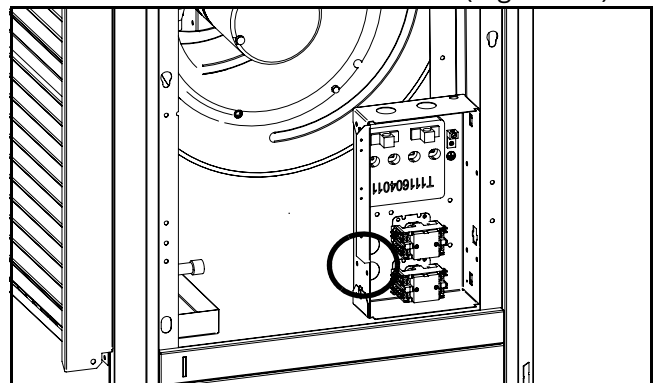


Figure # 79

12. Reconnect high voltage wiring from Electric Heat E-Box and Heating Element(s) matching wire number to terminals as shown.(Figure#80)

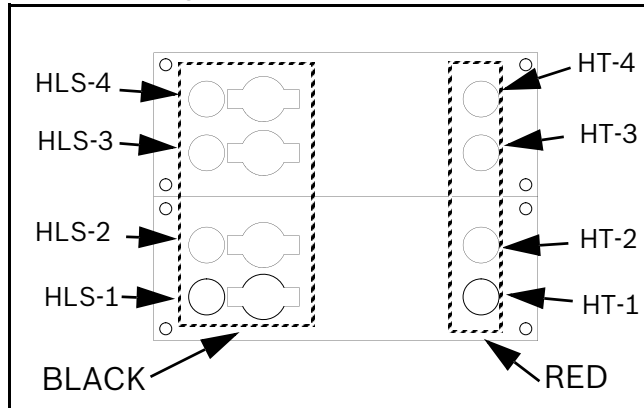


Figure # 80

13. Re-install Electric Heat Elements Cover(s). (Figure#81)

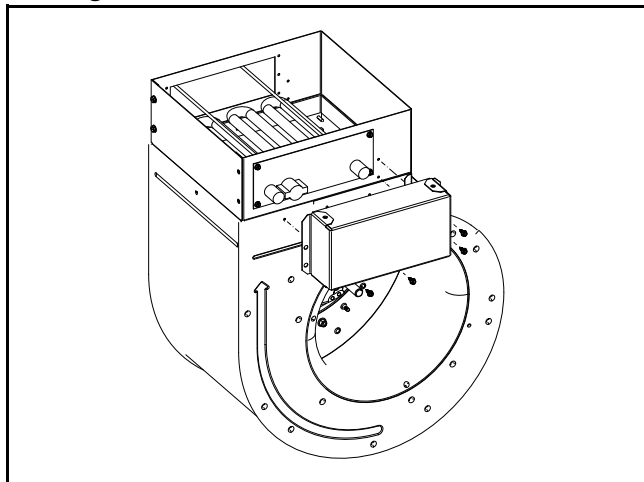


Figure # 81

### Electrical Box re-configuration

E-box is designed to be removable to support field configuration of unit: Left-Hand Return and Right-Hand Return, and also to allow full access to compressor during servicing.

The Electrical box (E-Box) has a set of plugs that allows complete removal from the system while keeping the majority of its internal connections. (Figure#123 & #124, Pg#72 and Pg#73)

1. Disconnect wiring harness by unplugging the following plugs: P18, P19, P20 and P23 (P12 if unit is equipped with Electric Heat). (Figure#123 & #124, Pg#72 and Pg#73)
2. Disconnect compressor plugs at compressor.
3. Remove and retain Electric Box by removing (2) screws. (Figure #82)



**CAUTION:** take great care to ensure all wires are disconnected and none of the wires are 'snagged' on any components

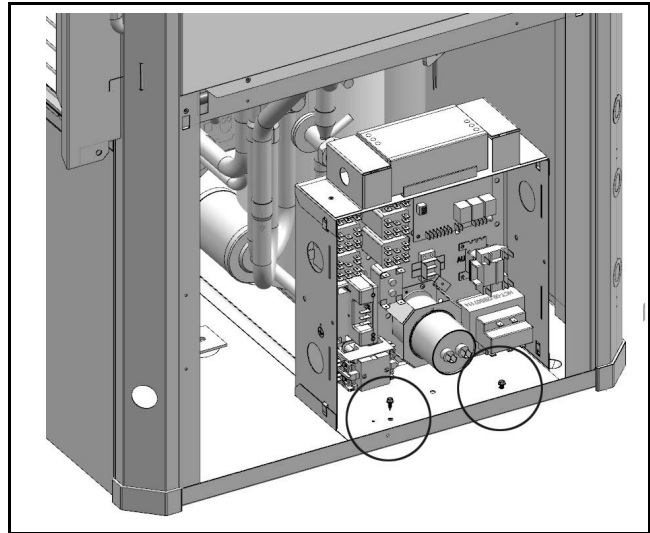


Figure # 82

4. Reroute all of the disconnected wire bundles to the opposite side of the heat pump.



**NOTE:** Do not route wiring over potentially hot surfaces or exposed sharp edges. Damage to wiring could result.

5. Install E-box in its new location by installing (2) screws. (Figure #83)

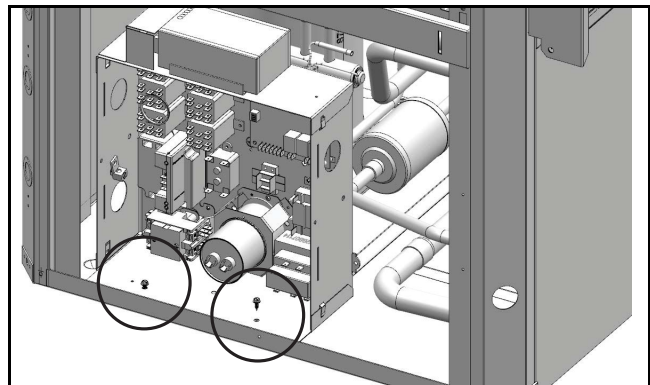


Figure # 83

6. Reconnect all the wiring disconnected in Step #1.



**NOTE:** Ensure all connectors are properly oriented and are fully engaged.

7. Identify and re-route LCD wiring harness to the new location.



Panel containing LCD always mounts on the same side as E-Box.

8. Swap FRONT panel (containing LCD) to the BACK

**Reinstall All Panels**

1. Re-route the LCD wiring to the new location and reconnect LCD screen wiring. Reinstall panels. (Figure #84)



Panel containing LCD and Bosch Logo must be installed on the same side as Electrical Box.

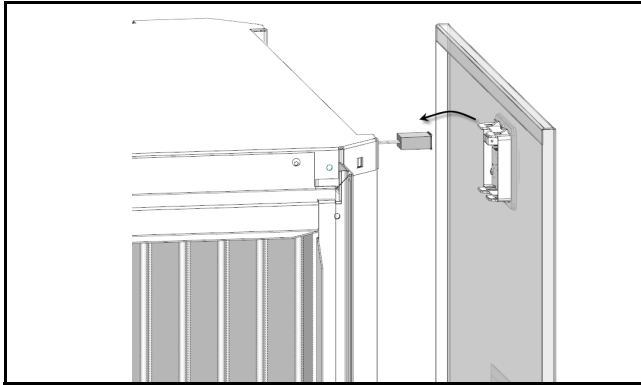


Figure # 84



**NOTE:** When re-installing panel, the “RED” cable from the LCD connector must be connected to the “R” terminal of the LCD PCB. The LCD will not work any other way.

2. Reinstall belts. (Figure#85)

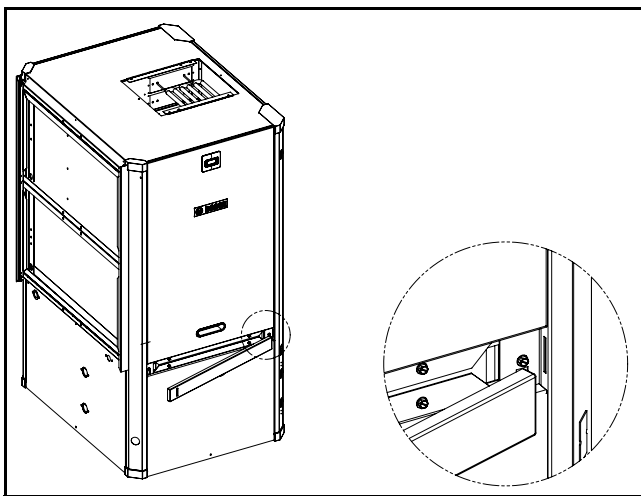


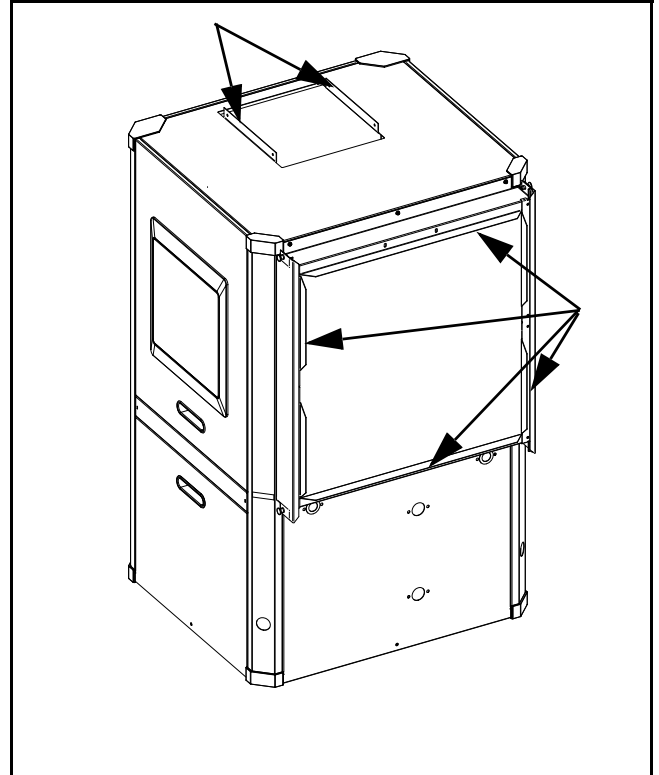
Figure # 85

**RETURN AND DISCHARGE DUCT FLANGES**

Return and discharge opening duct flanges are shipped unfolded. Flanges bend lines are perforated allowing easy bending using standard sheet metal pliers or channel locks. (Figure #90)



Bend flanges one at a time.



## PRE INSTALLATION UNIT PREPARATION

### Corner Cap Installation Instructions

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

1. Identify Letter code on each Corner Cap. (Figure#86)

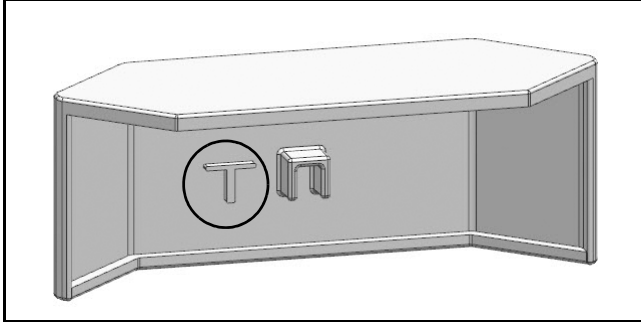


Figure # 86

2. In preparation for installation identify each Corner Cap location. (VT & CF Figure#87 and HZ Figure#88)

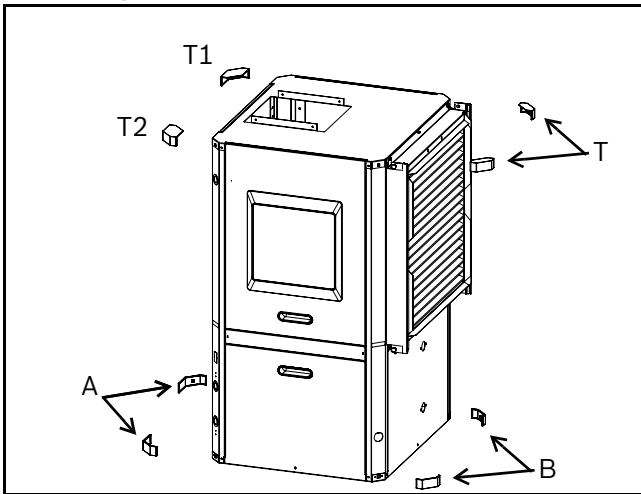


Figure # 87

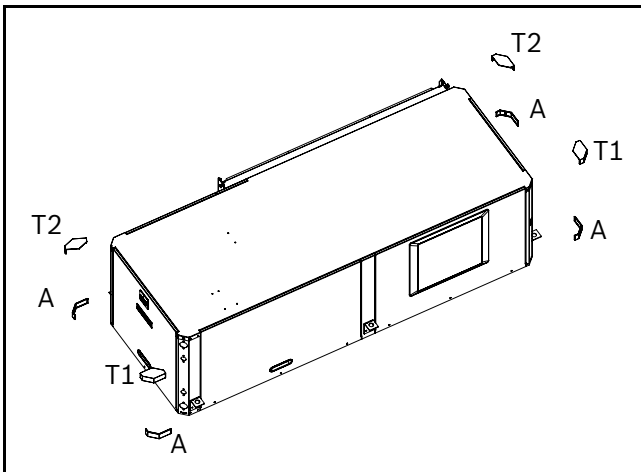


Figure # 88

3. Remove adhesive backing and install each Corner Cap. (Figure#89 and#90)



Ensure cabinet surface is clean and free of debris to ensure proper Corner Cap Adhesion.

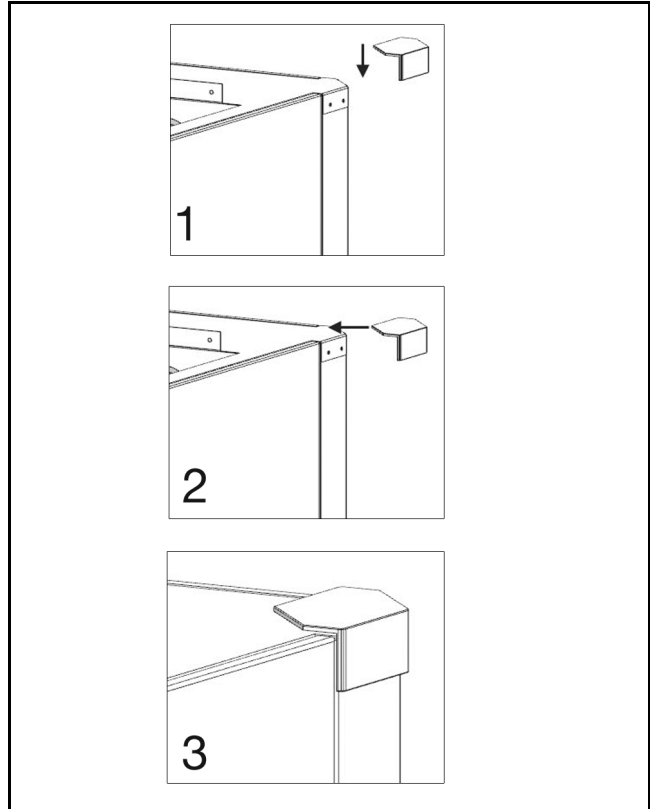


Figure # 89

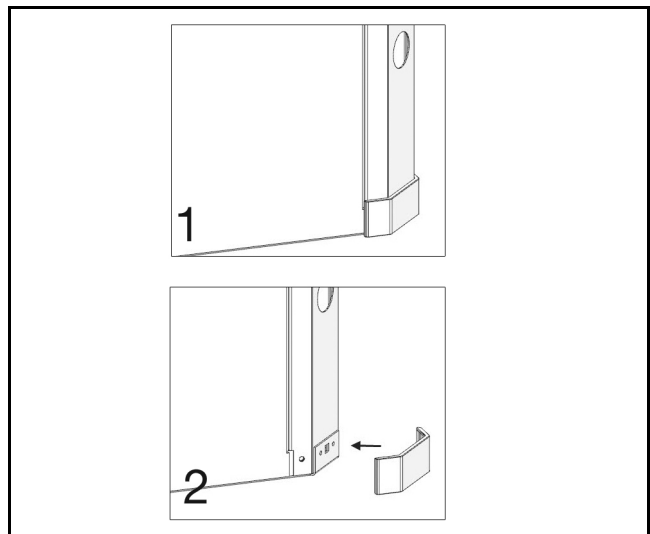


Figure # 90

## 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 #91).



On VT and CF Units Condensate Drain pan is internally sloped. There is no internal P-Trap.

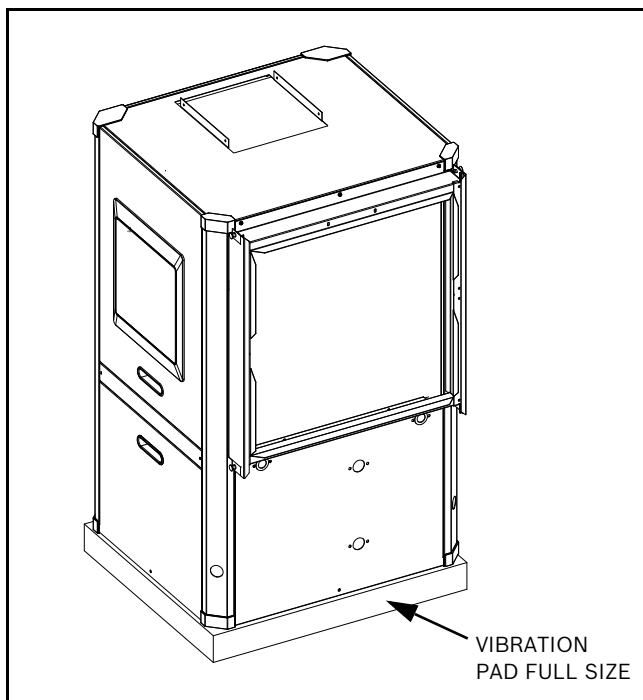


Figure # 91

## 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 hanger bracket kits. 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.



**NOTE:** Horizontal (HZ) units must be installed pitched toward the Condensate Drain Connection 1/8" per foot.

## 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 #92.

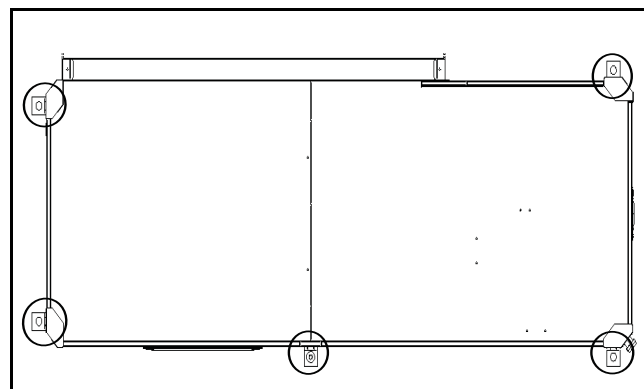


Figure # 92

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 #93

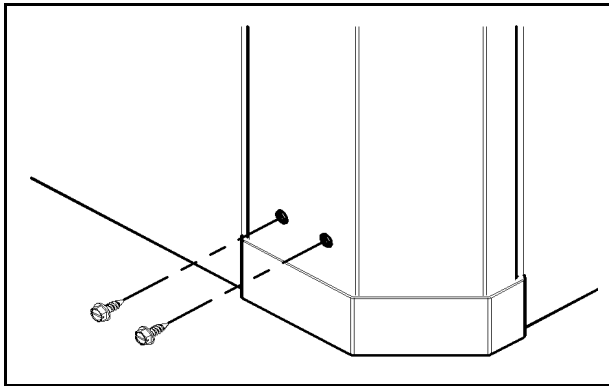


Figure # 93

2. Mount 5 brackets to unit corner post using the Bolts provided in the kit as shown on Figure # 94



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

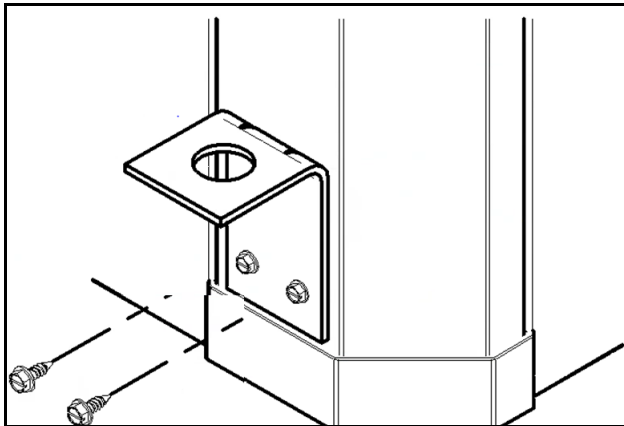


Figure # 94



**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 # 95

4. Hang the unit and assemble the field provided Thread rod, nuts and washers on to the brackets as shown in Figure # 95



**WARNING:** Rods must be securely anchored to the ceiling

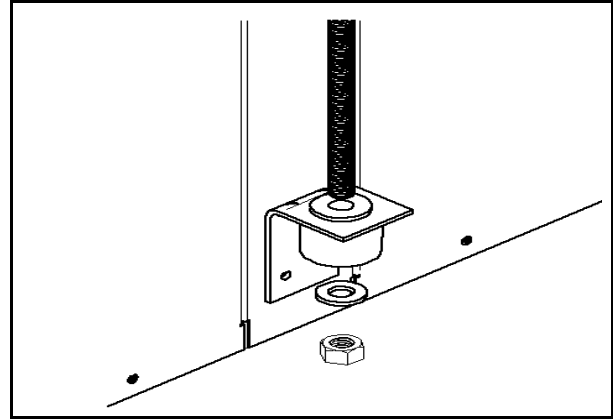


Figure # 95

## CONDENSATE DRAIN

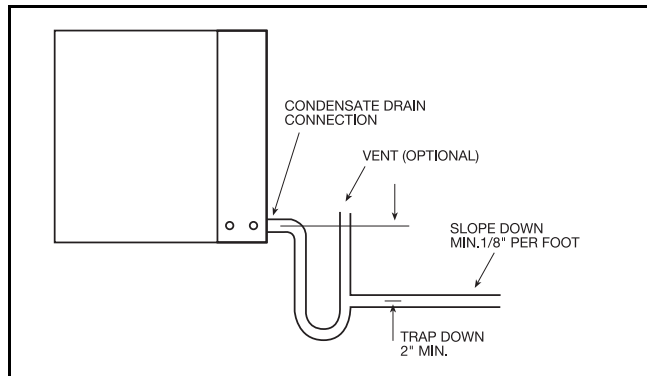


Figure # 96

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.



When converting unit from left-hand return to right-hand return, condensate drain connection must be relocated. Refer to Pg#20.

This connection must be in conformance with local plumbing codes. A trap must be installed in the condensate line to insure free condensate flow.



HZ Heat Pump Drain Pan is not internally sloped.



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.

## 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 unit.

Fold the duct flange outwards along the perforated line. Refer to unit Dimensional Drawings for physical dimensions of the collar and flange. (Pg#95 through Pg#95)

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 the no insulated duct work is not recommended as the unit's performance will be adversely affected.



**NOTE:** 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 grille 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).



**NOTE:** 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 water quality table on page #30

Both the supply and discharge 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.



**NOTE:** 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. Consult Unit Dimensional Drawings. (Pg#95 through Pg#95)



Teflon tape sealer should be used when connecting water piping connections to the units to insure against leaks and possible heat exchanger fouling.



**NOTE:** 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
<b>SCALING</b>	Hardness (CaCO <sub>3</sub> , MgCO <sub>3</sub> )	< 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
<b>CORROSION</b>	Hydrogen Sulfide (H <sub>2</sub> S)	< 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
<b>IRON FOULING</b>	Iron (Fe <sup>2+</sup> Iron Bacteria Potential)	< 0.2 ppm	< 0.2 ppm
	Iron Oxide	< 1 ppm	< 1 ppm
<b>EROSION</b>	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 H <sub>2</sub> S.			
** Equivalent to 30 mesh strainer			

## ELECTRICAL

Refer to electrical component box layout.  
(Figure #97)



**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.



**NOTE:** 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 (Figures#113 through #117 Pg#65 through Pg#66).



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#65 through Pg#66 for wiring diagrams. See data plate for minimum circuit ampacities and maximum fuse/breaker sizing.

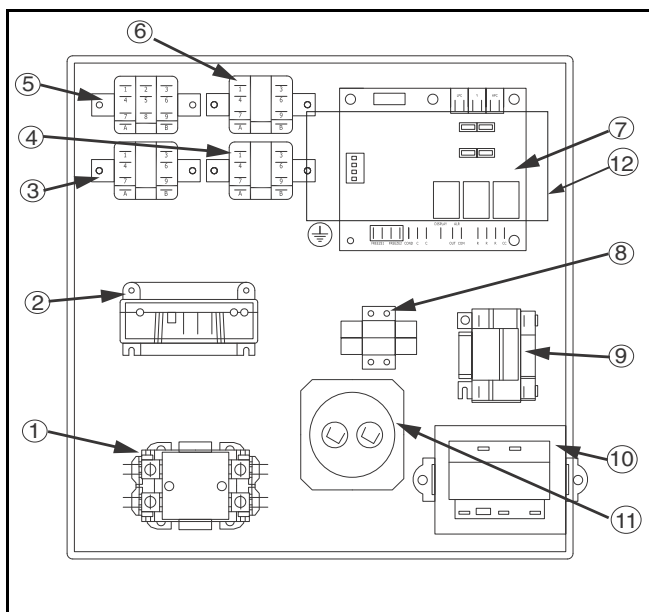


Figure # 97

- [1] Compressor contactor
- [2] Comfort Alert Module (Option)
- [3] Emergency Relay (Option)
- [4] Second Stage Relay
- [5] Hot Gas Reheat Relay (Option)
- [6] Cooling Relay
- [7] Unit Protection Module (UPM)
- [8] Terminal block (Option)
- [9] Auxiliary Relay (Option)
- [10] Transformer
- [11] Capacitor
- [12] ECM Module (Option, mounts on E-Box cover)

### Safety Devices and the UPM Controller

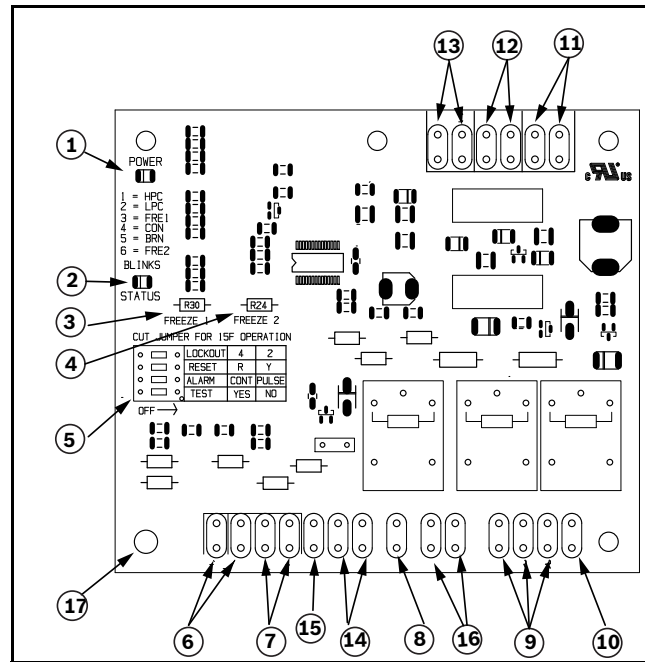


Figure # 98

- [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 #98



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 factory provided with a Unit Protection Module (UPM) 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 #98, item [3] for resistor location), Refer to Figure #99 for sensor location.

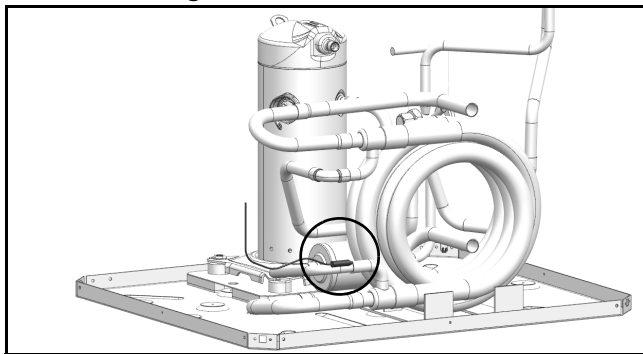


Figure # 99



**NOTE:** 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 if a freeze sensor is included.

- 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#100)

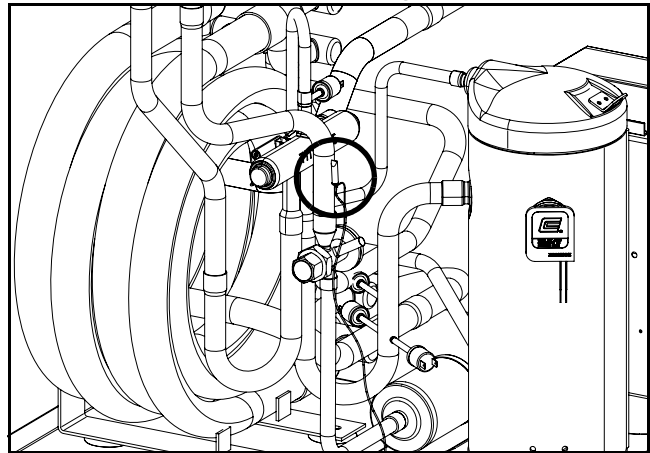


Figure # 100

- 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 #101)

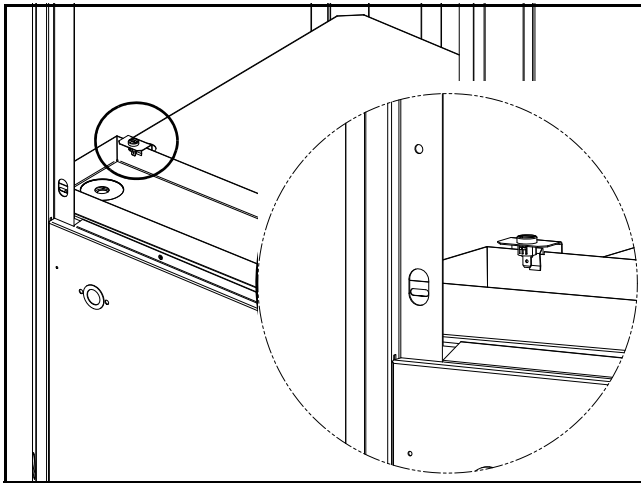


Figure # 101

**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 does 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.



**NOTE:** 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. The UPM controller will constantly monitor the refrigerant temperature with the sensor mounted close 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.



**NOTE:** 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 #97, item [12] 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) DC fan motor and provides thermostat signals to unit’s UPM board. The thermostat connections and their functions are as follows:

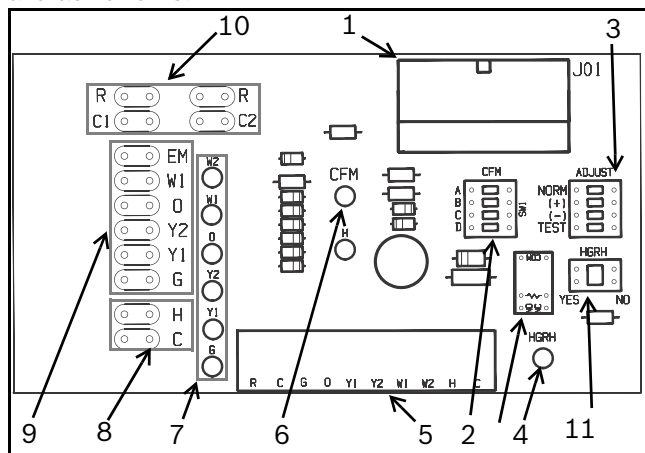


Figure # 102

- Motor harness plug
- Blower CFM adjustment
- Motor settings
- Dehumidification indication
- Thermostat contact inputs
- CFM count indicator
- 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 #102 item [6]) blinks to indicate approximate airflow in CFM and may flicker when the unit is off.
- Each blink of the LED represents 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)
NC	Transformer 24 VAC Common (extra connection)
C1	Transformer 24 VAC Common (primary connection)
R	Transformer 24 VAC Hot
H	Dehumidification Mode

### Airflow Selector

The airflow selector (Figure #102, 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 #103 for each airflow setting.

- CFM Selector (Figure #102, Item [2]) 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%.

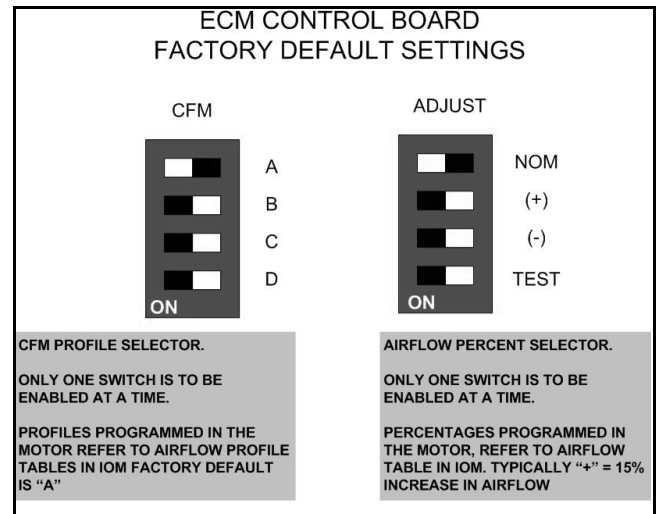


Figure # 103



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.



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

### Dehumidification Method Selector

Dehumidification method selector (Figure #102, item [11]) is used to select between the following two methods:

1. Units equipped with optional Hot Gas Reheat, on dehumidification call (the “H” terminal on the thermostat is energized) the reheat outputs will energize the hot gas reheat valve in the circuit and the heat pump will start in dehumidification mode. Dehumidification selector (Figure #102, item [11]) should be selected to ‘YES’.
2. Units without optional Hot Gas Reheat, on dehumidification call, the heat pump fan will operate at a lower speed to increase dehumidification while cooling. Dehumidification selector ((Figure #104, 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.

- To the left of the red and green status LED's is a row of 1/4" male quick connects. These are used to pass thermostat inputs on to the rest of the control circuit. Remember to always turn off unit power at the circuit breaker before attaching or disconnecting any wiring from these connections to avoid accidental short circuits that can damage unit control components.

Dehumidification indicator LED (Figure #104, item [4]) will energize when dehumidification call is present.

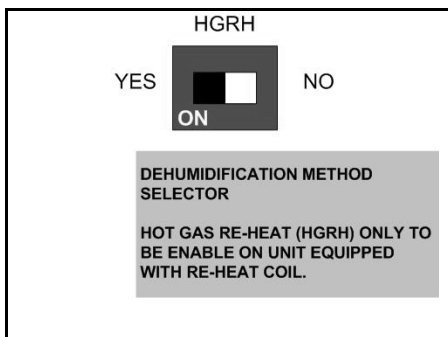


Figure # 104

### Constant Torque Motors (ECM)

For installations where the efficiency of an electronically commutated brushless DC motor (ECM) motor is required, but the features of a constant airflow motor are not required, the LM series comes standard with the constant torque ECM motor option. These motors feature up to 90% thermal efficiency combined with a flatter fan curve than a PSC motor and simple operation. These motors are provided with 5 speed taps to allow for a wide range of air flow and external static options.

To change a speed tap follow the instructions below:

- Disconnect power to the heat pump.
- Remove the blower access panel.
- Remove the speed tap wire from the terminal it is currently connected to and connect it to the terminal desired.

Refer to the constant torque motor performance tables for heat pump blower performance with the constant torque motor option. (Pg#62)



## 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.

### Hot Gas Reheat (HGRH)

Hot gas reheat is an active dehumidification option available on the SM series that cools and dehumidifies return air, and then reheats it back to approximately entering dry bulb temperature using waste compressor heat. In this way, a unit with Hot Gas Reheat can efficiently remove humidity from the return air without altering the sensible temperature of the space.



Hot Gas Reheat (HGRH) Option is not available on SM024 model or on models with Electric Heat installed.

The reheat option consists of a refrigerant to air heat exchanger (reheat coil) mounted down stream of the evaporator coil and a refrigerant diverting valve. When there is a signal for dehumidification AND the sensible space temperature is satisfied, the unit will operate in reheat mode. In reheat mode the heat pump will operate at full load cooling and will divert discharge gas from the compressor to the reheat coil, effectively cooling and dehumidifying the air and then reheating it back to a temperature close to the entering dry bulb temperature. If there is a call for sensible cooling while the unit is operating in the reheat mode, then the unit will revert to cooling until the sensible demand is satisfied.



**NOTE:** Heat pumps with hot Gas Reheat need to be connected to a humidistat along with a traditional thermostat or a combination thermostat/humidistat.

### 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. Electric Heat is not available on units with HGRH.



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.



**NOTE:** Internal electric heat cannot be provided with hot gas reheat. 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

# Only available for units with ECM Constant Airflow Motor.

### 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 using waste heat from the compressor discharge gas. In some cases the HRP can provide most or all of the hot water 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.

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).



**NOTE:** If heat recovery unit is installed in an area where freezing may occur, the unit must be drained during winter months to prevent heat exchanger damage. Heat exchanger ruptures that occur due to freezing will void the heat recovery package warranty along with the heat pump warranty.

### 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, hot gas reheat, etc. Refer to the ECM Interface Board section (pg.35) for more information.

### DPS Water Flow Proving

The DPS water flow proving switch is a factory installed option available for the SM series. The DPS prevents compressor operation if there is inadequate water flow through the water to refrigerant heat exchanger in the heat pump.

The DPS operates by monitoring the water side pressure drop across the water to refrigerant heat exchanger. When the pressure drop between the water in and water out lines reaches a pre-set value, compressor operation is enabled.

### Pump 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 #105)



Figure # 105

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.

## 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.

Smart Start Assist as showed in figure #106.

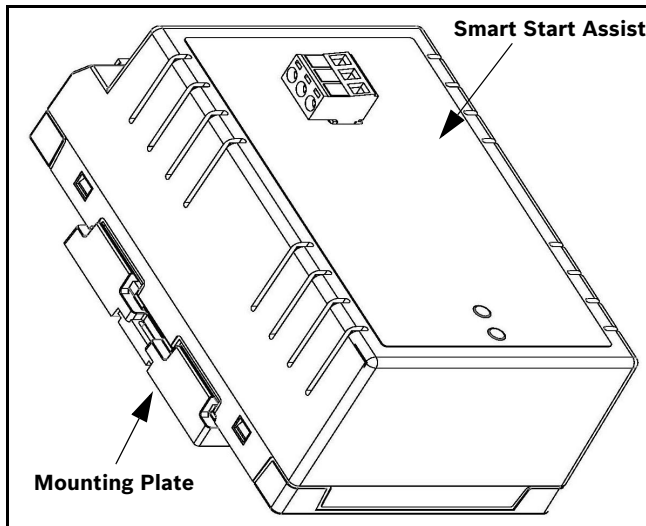


Figure # 106

## SSA Specifications

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

## Mode of Operation

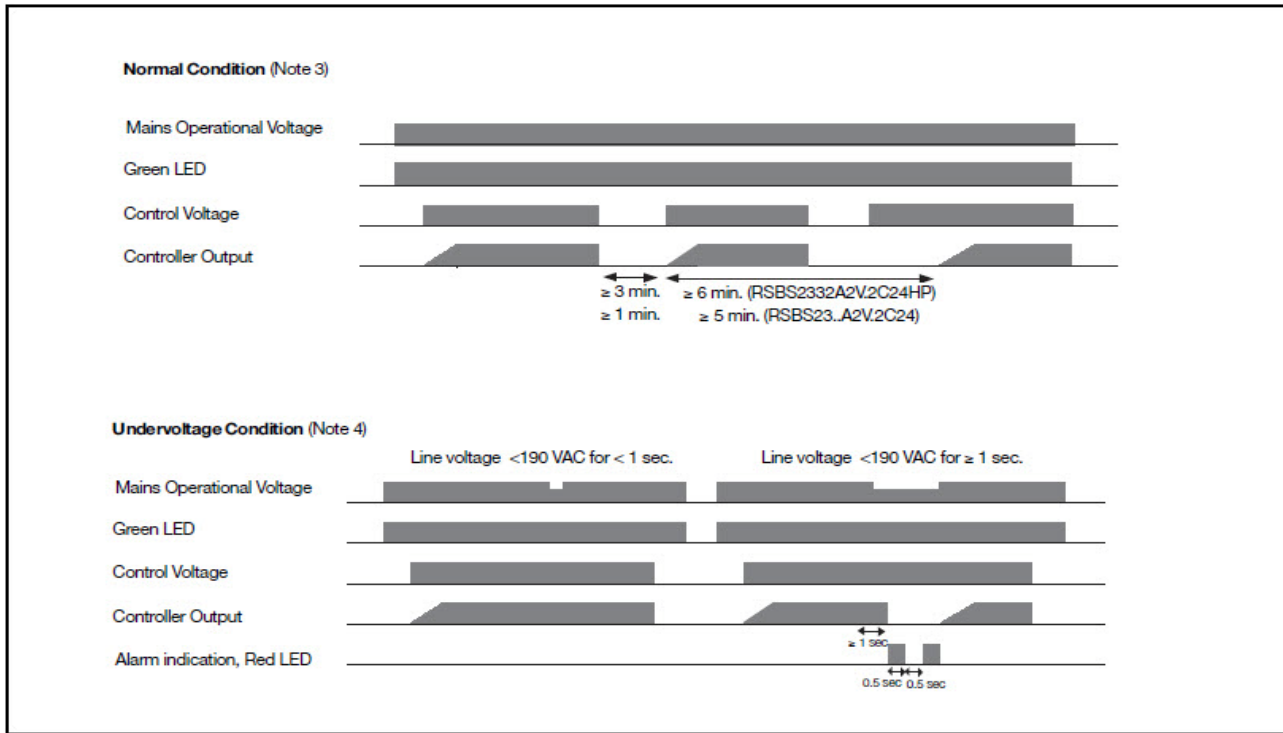


Figure # 107

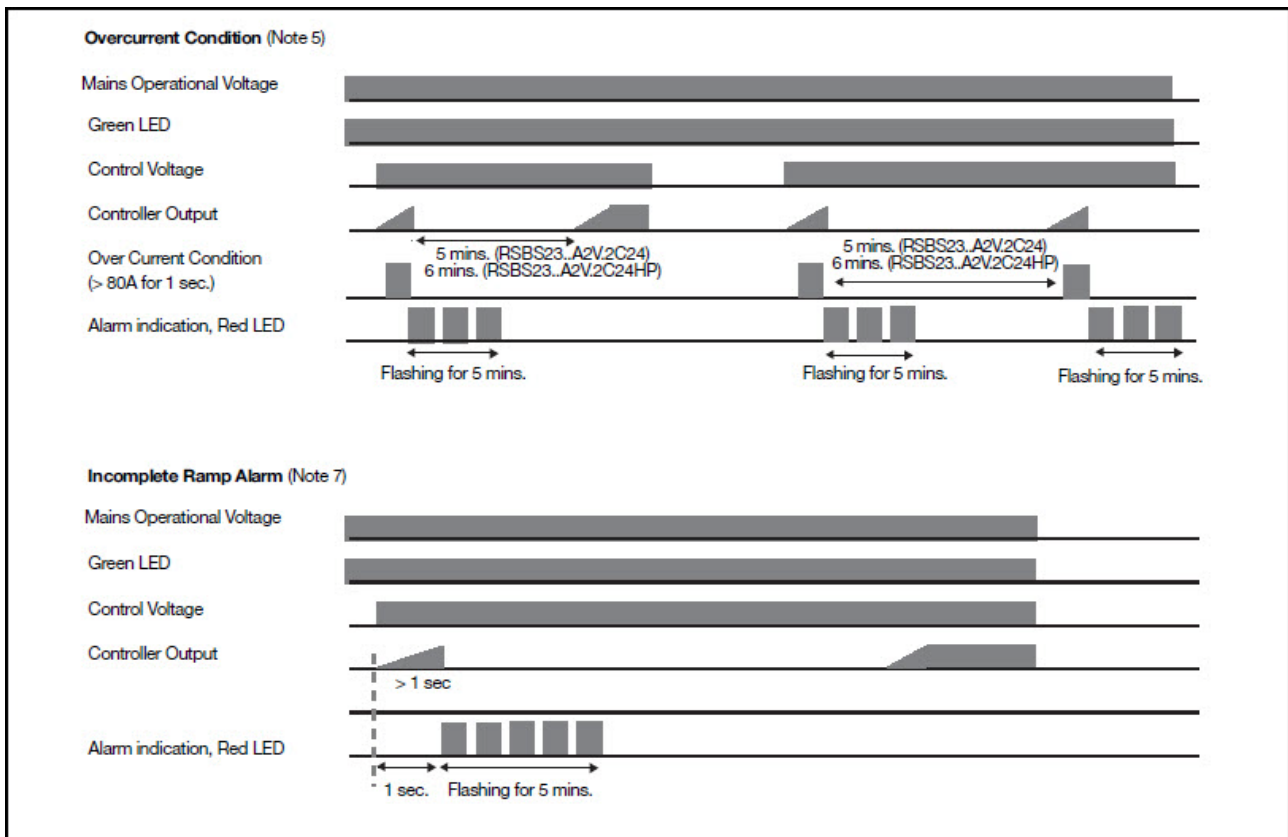


Figure # 108

## 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 K1, 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 K1, 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 K1 is closed. The device can be reset at any time by removing power on L1-N connection. When the power is reapplied, the soft starter will start ramping up as soon as K1 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 K1 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 #108 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 K1 is closed).

\*Applicable to HP versions only

## 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 8733907119) 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 #109)

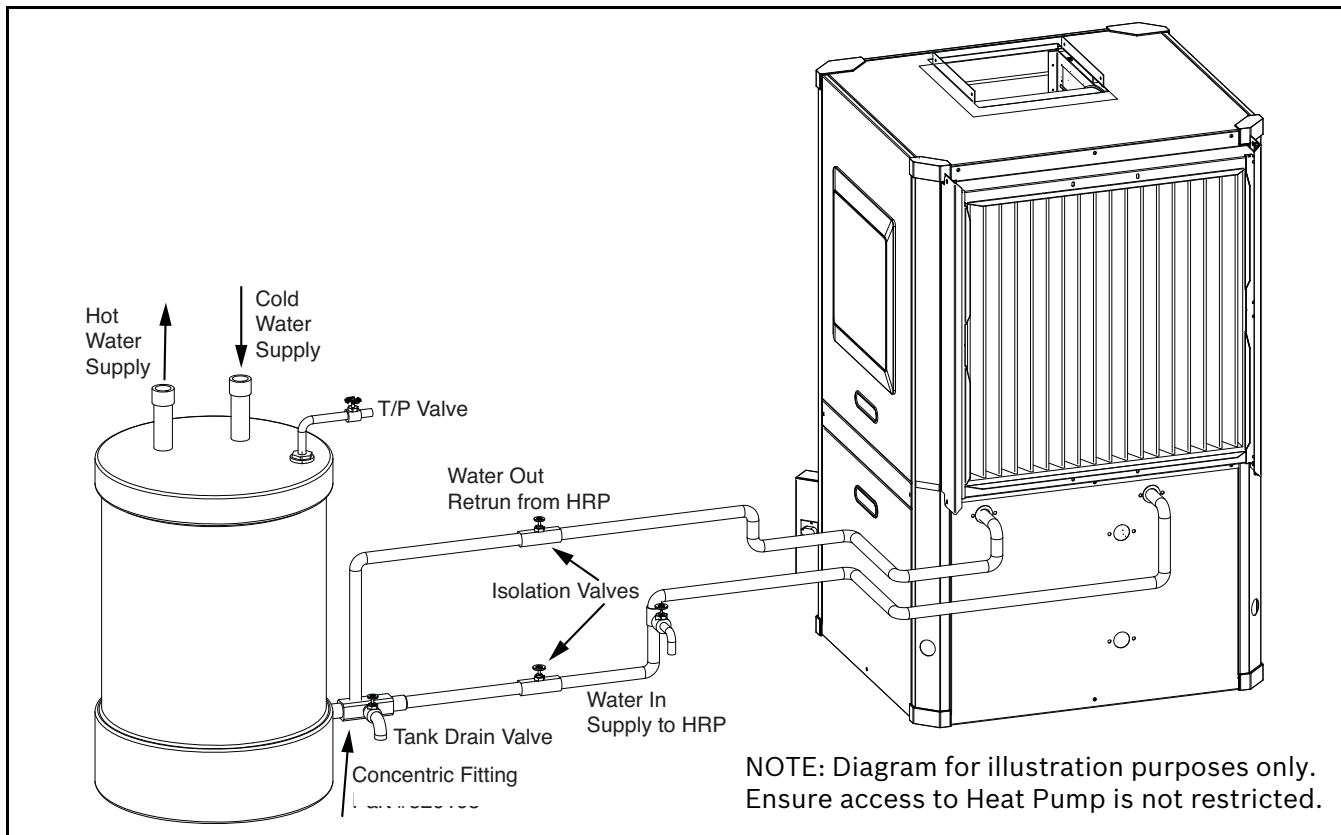


Figure # 109

### 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.
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.



**NOTE:** All piping from HRP to domestic water tank must be copper or any metal of stronger alloy.



## INITIAL START-UP



**NOTE:** 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. (Figure #115)



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#115)

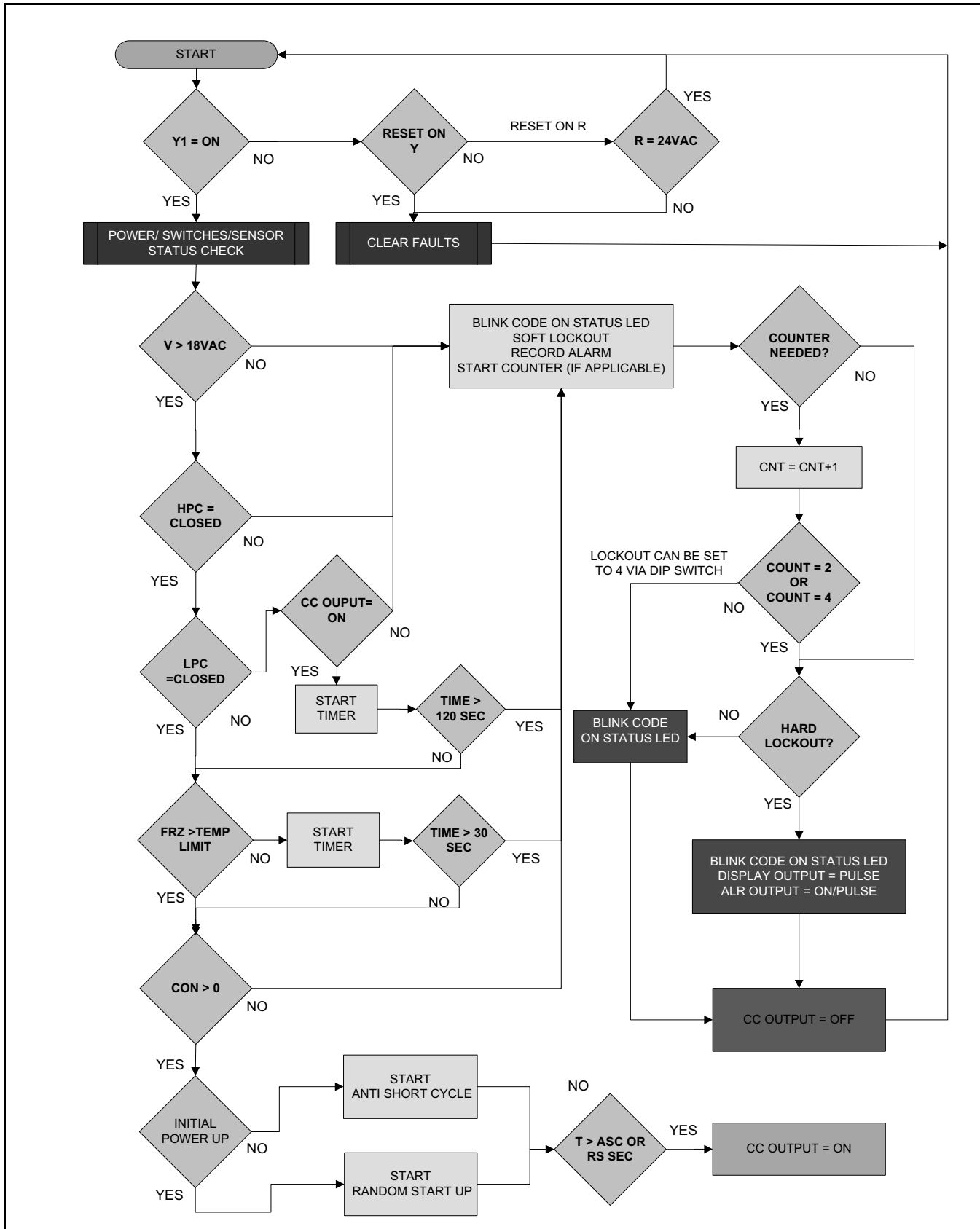


Figure # 110



## 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. 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 insure that the well can provide sufficient flow for both. In well water applications a slow closing solenoid valve must be used 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 #111)

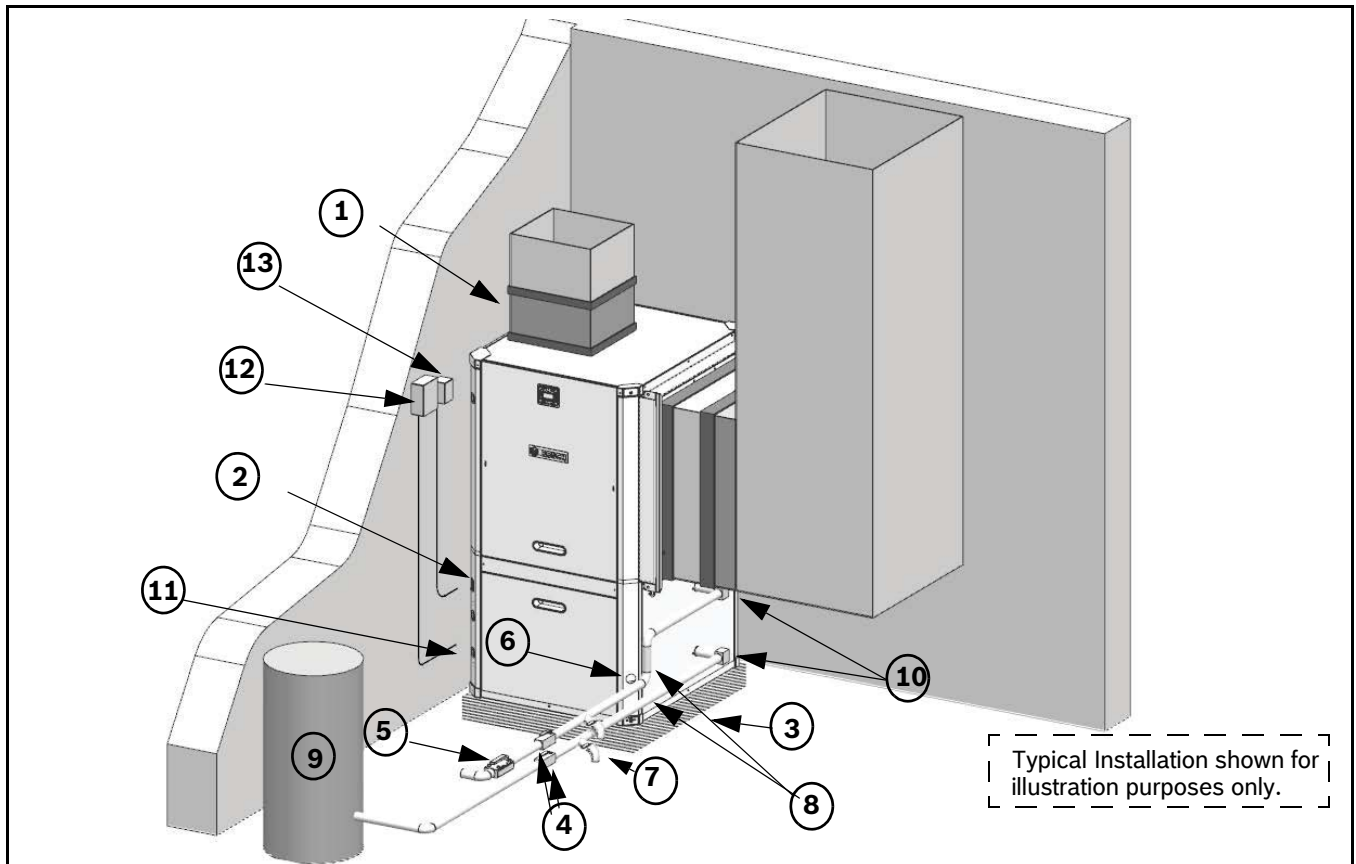


Figure # 111 Example System Set-up

- [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 insure 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.



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



Teflon tape sealer should be used when connecting to the unit to insure against leaks and possible heat exchanger fouling.

### Consult the specification sheets for piping 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 #112)

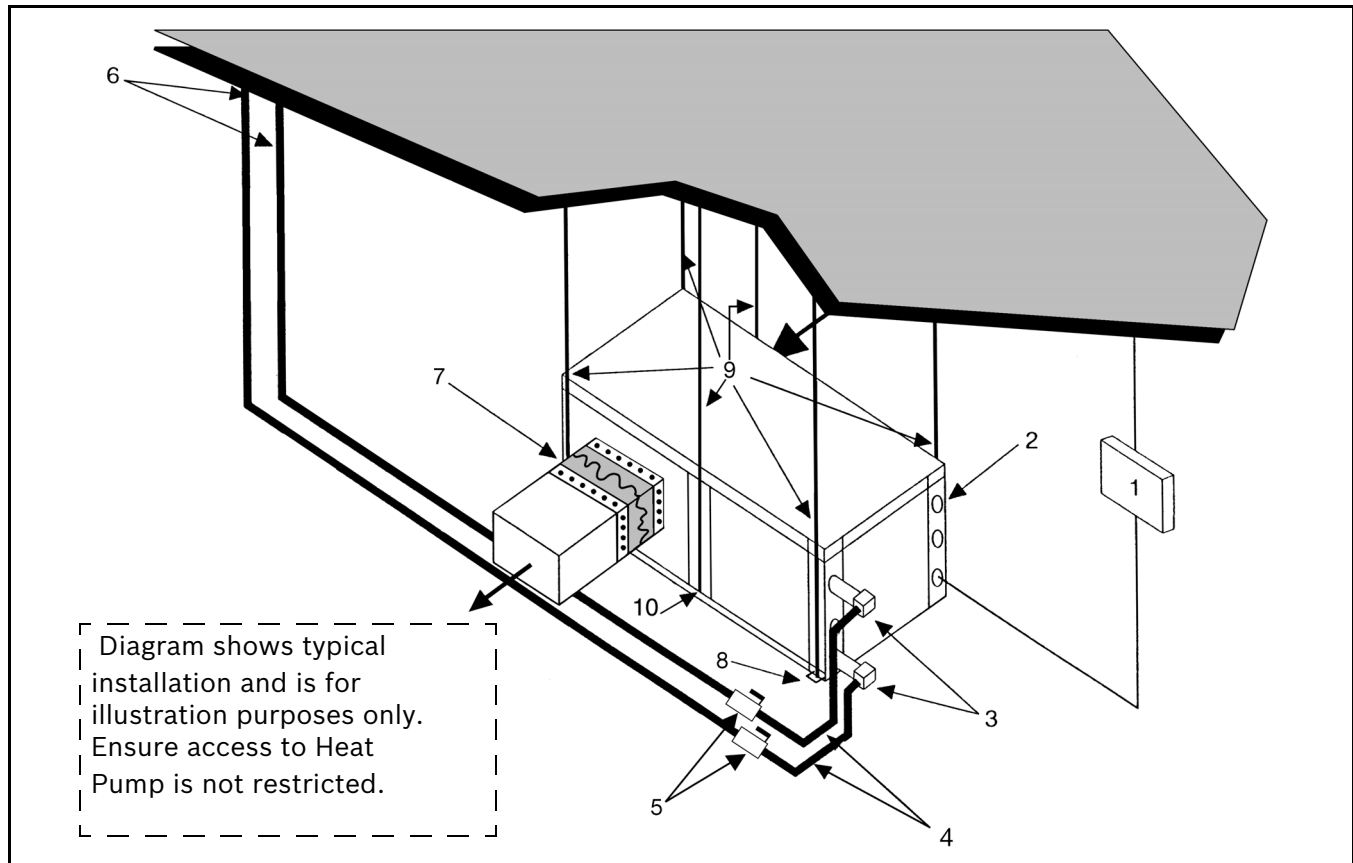


Figure # 112

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

## 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 the Ground Loop Pumping Package (GLP), makes the

installation easy. Anti-freeze solutions are utilized when low evaporating conditions are expected to occur. Refer to the GLP installation manuals for more specific instructions. (Figure #113)

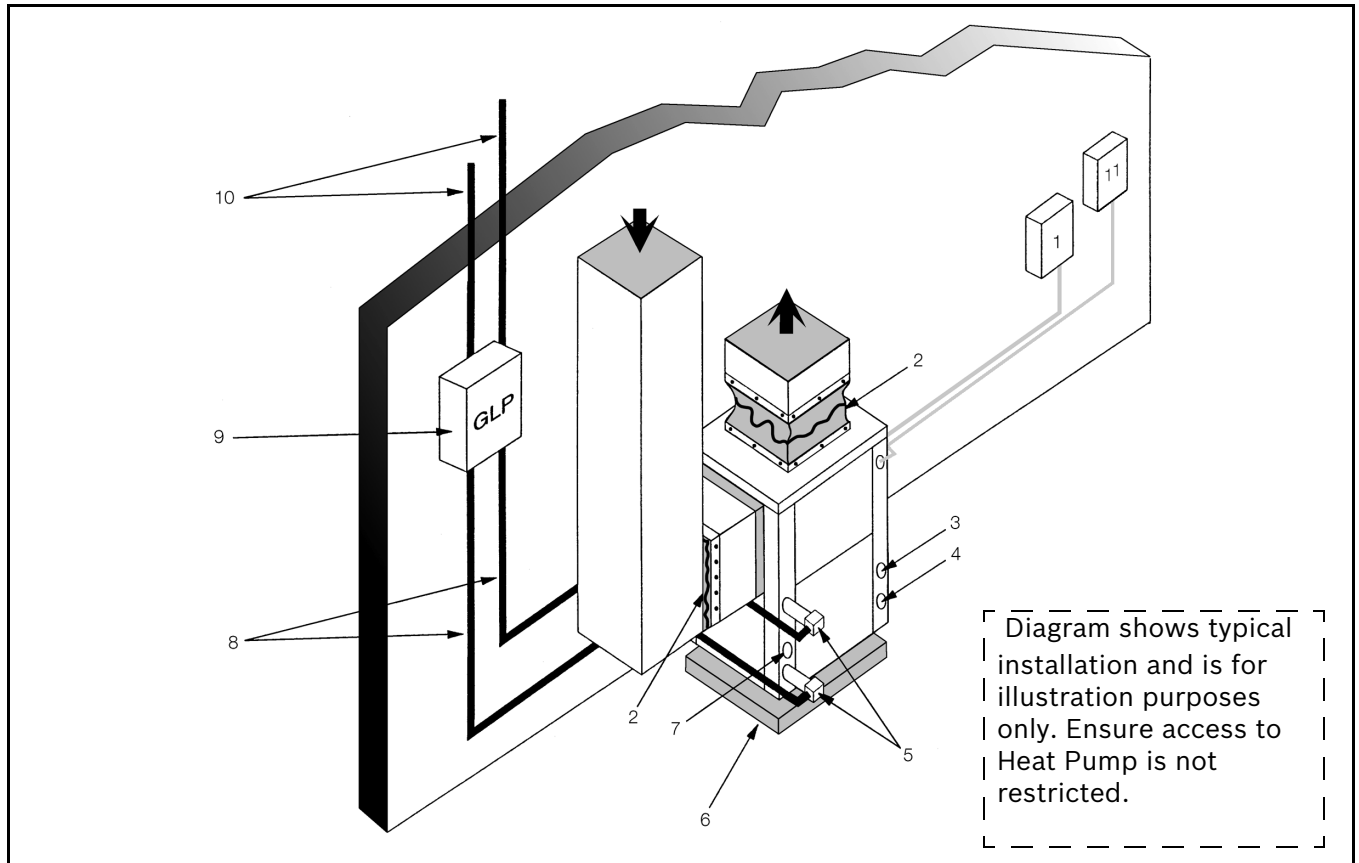


Figure # 113

- [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)