
SM CS Series Heat pump

# Greensource

SM024 | SM036 | SM048 | SM060 | SM070

BOSCH

**Installation, Operation and Maintenance Manual**

8 733 920 846 (2015/01)

## CONTENTS

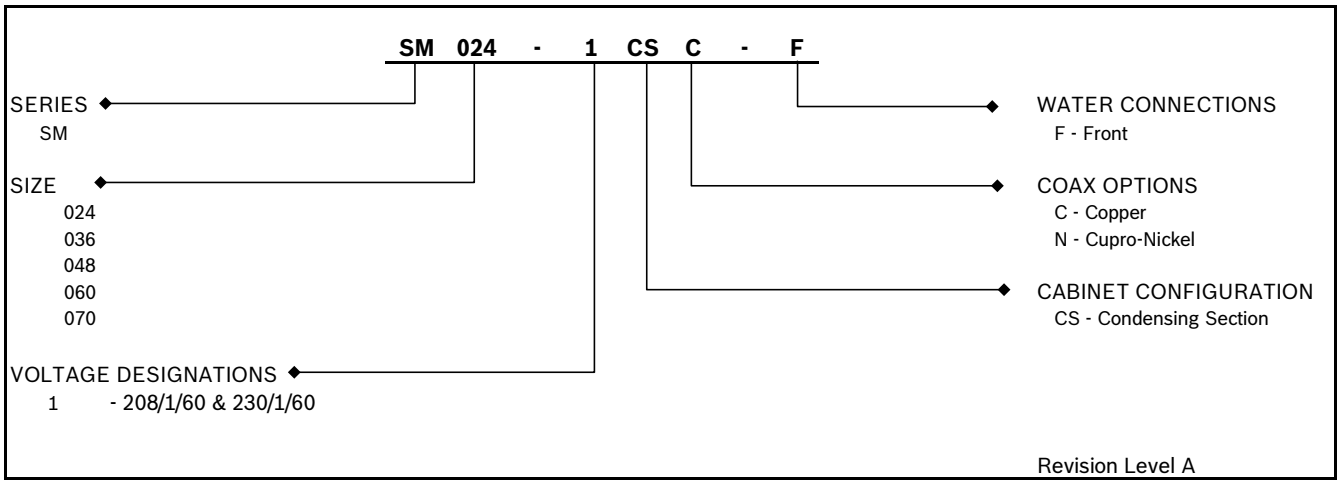


**Figure 1: CS/AH Pairings**

| UNIT MODEL | Paired Air Handler | | | | | |
|---|---|---|---|---|---|---|
| | Unit 1 | Unit 2 | Unit 3 | Unit 4 | Unit 5 | Unit 6 |
| SM024-1CSC | SM024-1AVX | SM024-1AHX | DX025-1VTX | DX025-1CCX | DX025-1UCX | DX035-1VTX |
| SM036-1CSC | SM036-1AVX | SM036-1AHX | DX035-1VTX | DX035-1CCX | DX035-1UCX | DX049-1VTX |
| SM048-1CSC | SM048-1AVX | SM048-1AHX | DX049-1VTX | DX049-1CCX | DX049-1UCX | |
| SM060-1CSC | SM060-1AVX | SM060-1AHX | DX061-1VTX | DX061-1CCX | DX061-1UCX | DX071-1VTX |
| SM070-1CSC | SM070-1AVX | SM070-1AHX | DX071-1VTX | DX071-1CCX | DX071-1UCX | |

**LEGEND:**
AVX BOSCH box style Vertical Air Handler
AHX BOSCH box style Horizontal Air Handler
CCX Cased coil
UCX Uncased coil
VTX BOSCH unitary style air handler

## MODEL NOMENCLATURE




## 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 sever 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

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.

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

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.

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 SM CS PACKAGE

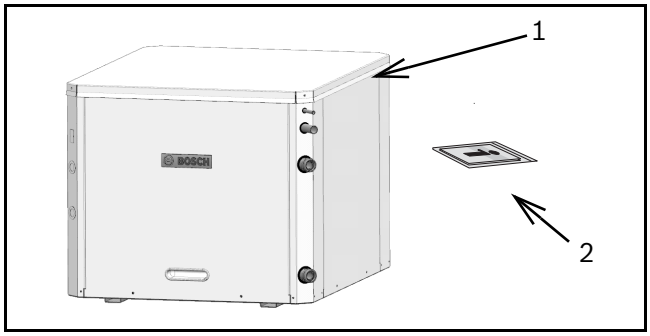



**Figure # 2**

[1] SM Series Water-to-Air Heat Pump: Condensing Section

[2] Installation and Operation Manual

## 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 C22.1 No 236 by Intertek-ETL. The Water-to-Air Heat Pumps are designed to operate with entering fluid temperature between 30°F to 90°F in the heating mode and between 40°F to 120°F in the cooling mode.

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. 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.

**Several factory installed options are available:** Heat Recovery Package, Smart Start Assist, DPS Water Flow Proving Switch, Auxiliary Pump Relay, and Comfort Alert Module.

Safety devices are built into each unit to provide the maximum system protection possible when properly installed and maintained.

## 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.

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

Do not stack units larger than 6 tons!

## 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

To maximize system performance, efficiency and reliability, and to minimize installation costs, it is always best to keep the refrigerant lines as short as possible. Every effort should be made to locate the air handler and the condensing section as close as possible to each other.

### Condensing Section

Locate the condensing section in an area that provides sufficient room to make water and electrical connections, and allows easy removal of the access panels, for service personnel to perform maintenance or repair.

The condensing section is designed for indoor use primarily; however, if the condensing section must be installed in an outdoors location where ambient temperatures can fall below freezing, some form of freeze protection should be employed such as a freeze-stat and/or a pump timer/starter to prevent possible condenser freeze-up and to optimize overall system performance.

## Air Handler

Locate the air handler 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 electrical and duct connections. If the unit is located in a confined space such as a closet, provisions must be made for return air to freely enter the space. On horizontal units, allow adequate room below the unit for a condensate drain trap.

The air handler 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.

Reference the Factory Manual for your AH or the Air Handler section of this manual for detailed installation and operation.

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 #3).

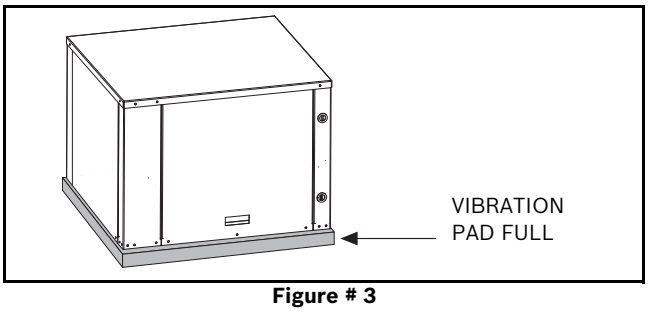



**Figure # 3**

## PIPING

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

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.

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.

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 female pipe thread fittings. Consult Unit Dimensional Drawings. (Pg#91 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.

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.

## ELECTRICAL

Refer to electrical component box layout. (Figure #4)

Field wiring must comply with local and national electric codes.

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

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 on Pg#30).

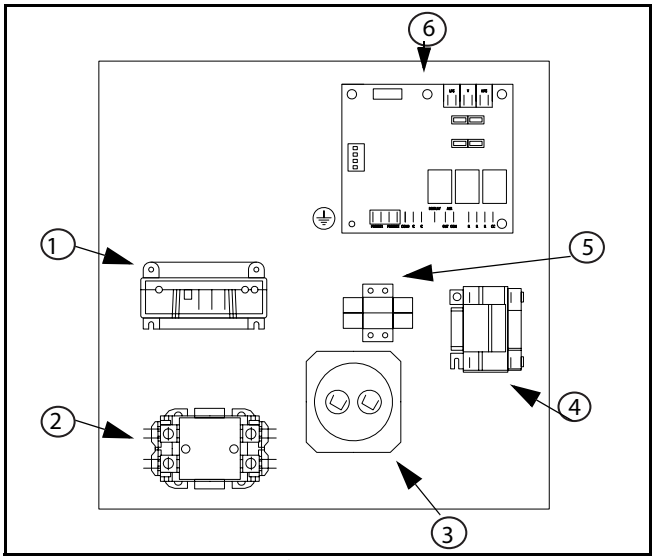



**Figure # 4**

[1] Comfort Alert Module (Option)
[2] Compressor contactor
[3] Capacitor
[4] Auxiliary Relay (DP/DT)
[5] Terminal block (Option)
[6] Unit Protection Module (UPM)

## Safety Devices and the UPM Controller

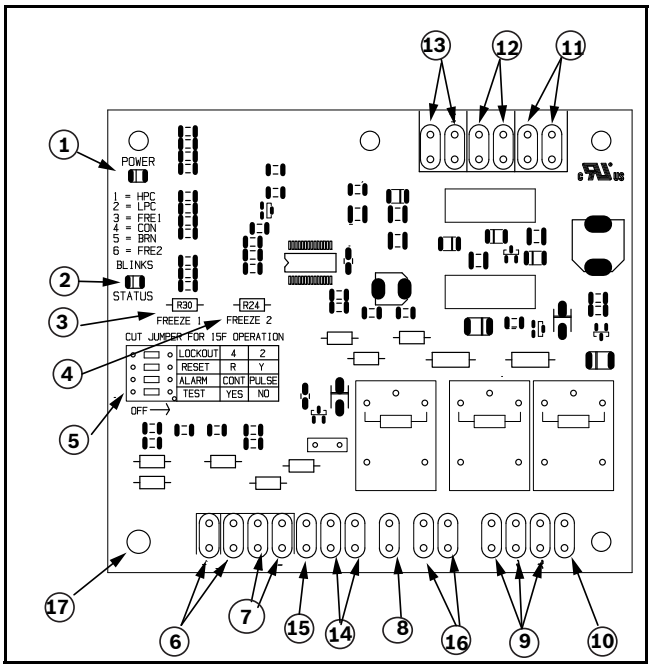



**Figure # 5**

[1] Board Power Indicator
[2] UPM Status LED Indicator
[3] Water Coil Freeze Protection Temperature Selection [R30]
[4] UPM Board Settings
[5] Water Coil Freeze Connection
[6] 24VAC Power Input
[7] Compressor Contact Output
[8] High Pressure Switch Connection
[9] Call for Compressor Y1
[10] Low Pressure Switch Connection
[11] 24VAC Power Common
[12] Dry Contact
[13] 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 #5.

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 30°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 #5, item [3] for resistor location), Refer to Figure #6 for sensor location.

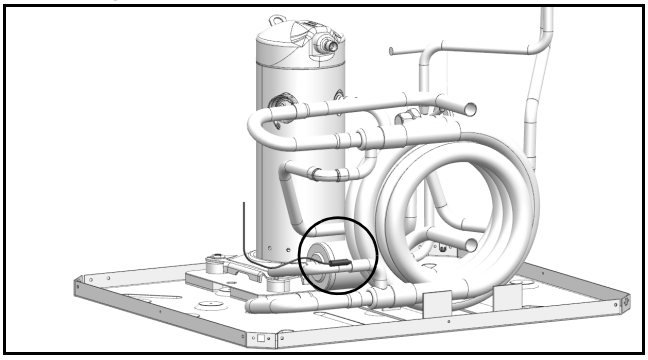


**Figure # 6**

If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze1 R30 resistor set to 30°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.

| UPM Board Factory Default Settings | |
|---|---|
| TEMP | 30°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.

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 30°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 30°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. It 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.

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.

## 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.

## 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).

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.

## 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 #7)


**Figure # 7**

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.Heat Recovery Package

## 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 520-105) is recommended.

### HR Water Piping

All hot water piping MUST be a minimum of 3/8t O.D. copper tube to a maximum distance of fifteen (15) feet. For distances beyond fifteen feet but not exceeding sixty (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 #8)

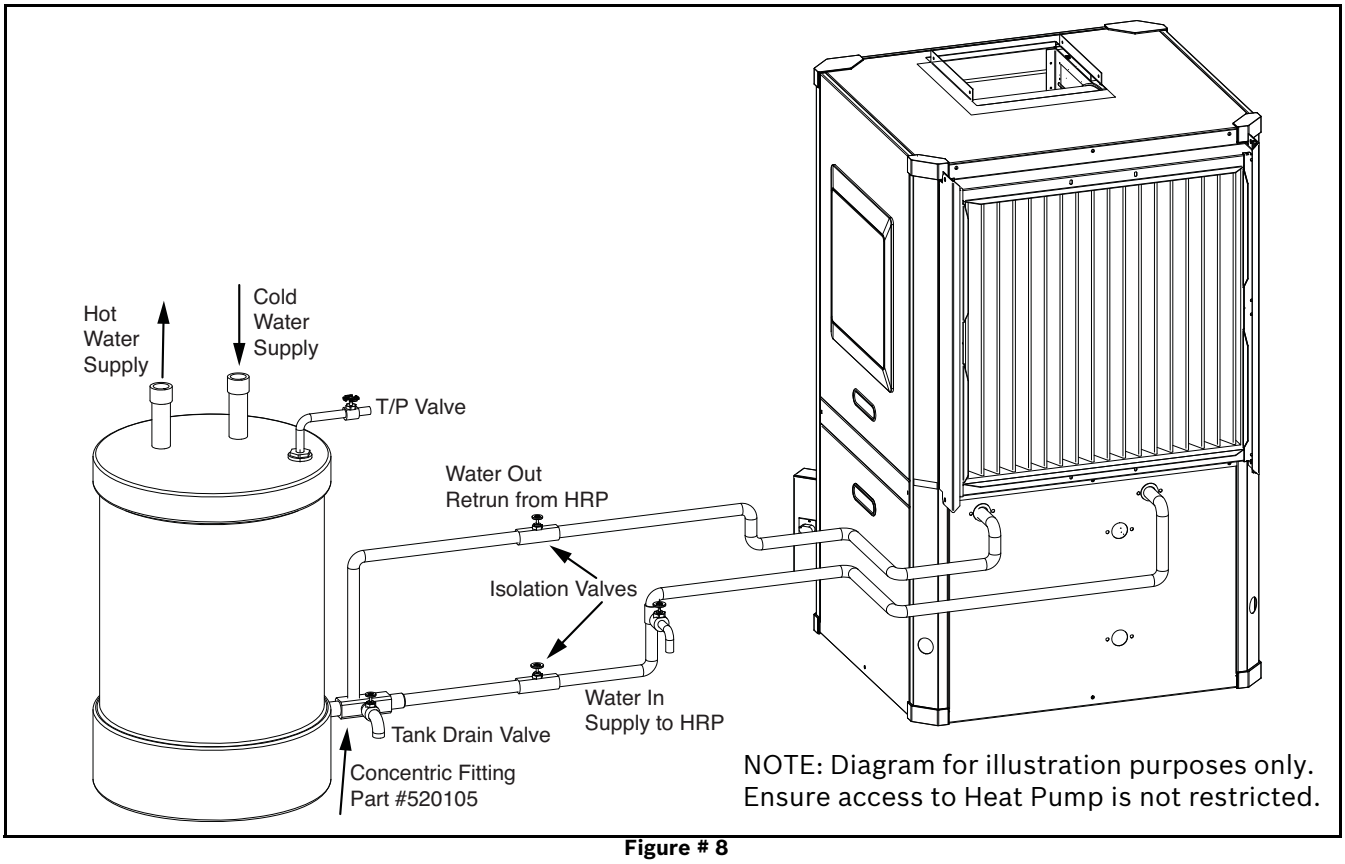



**Figure # 8**

## 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 by depressing the schrader valve on the HR Unit. Allow all air to bleed out until water appears at the valve.

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

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

## Initial Start-Up

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.

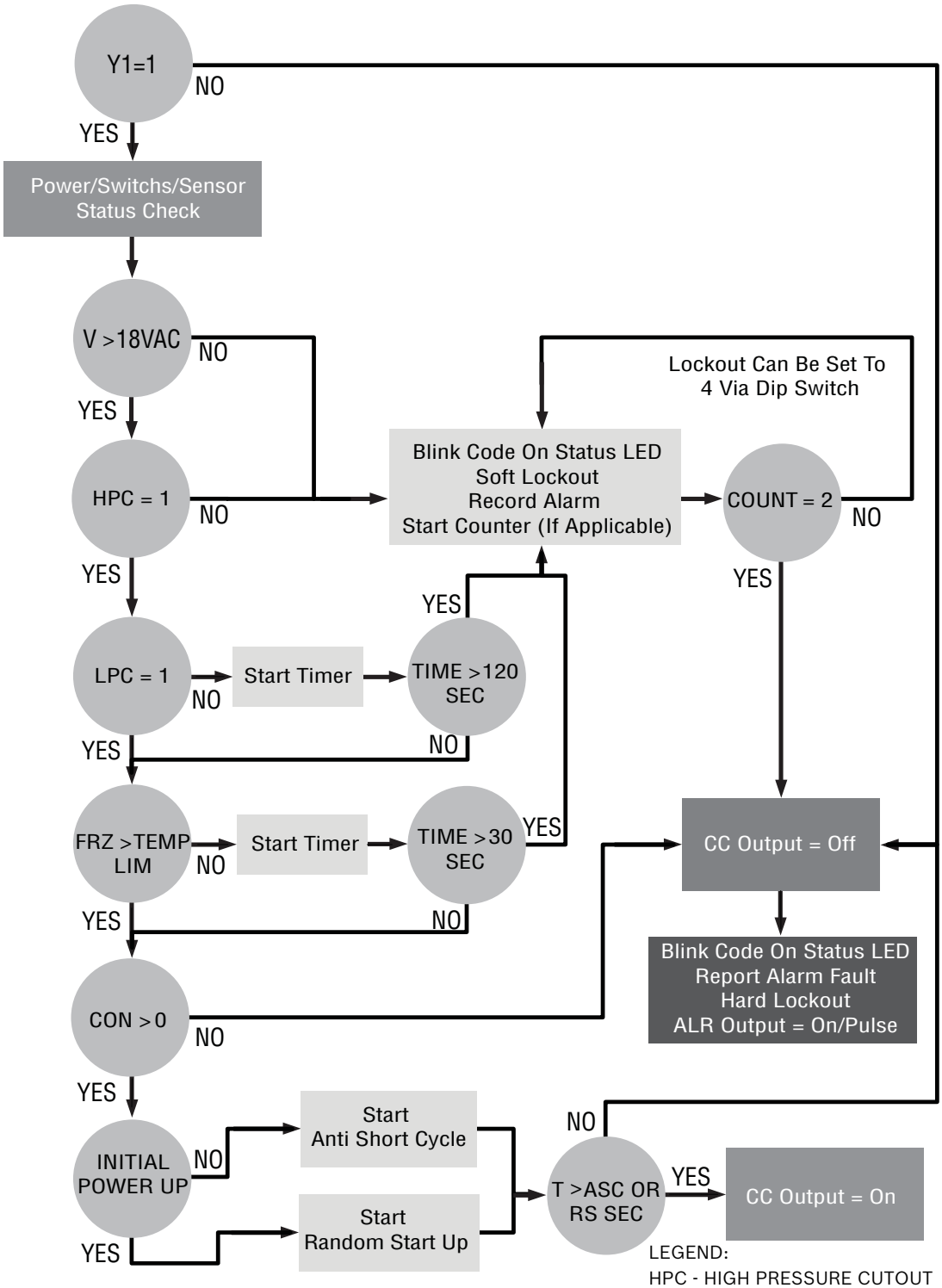
As the thermostat is satisfied, the heaters will shut off as soon as W1 is de-energized, and the compressors will remain on until the thermostat stages are satisfied.

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 #9)

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#107)

## UPM Sequence of Operation (SOO) Flow Chart




LEGEND:
HPC - HIGH PRESSURE CUTOUT
LPC - LOW PRESSURE CUTOUT
FRZ - FREEZE PROTECTION CONDITION
CON - CONDENSATE OVERFLOW CONDITION
CC - COMPRESSOR COIL
ASC - ANTI SHORT CYCLE
RS - RANDDOM START

**Figure # 9**

# 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 #10)

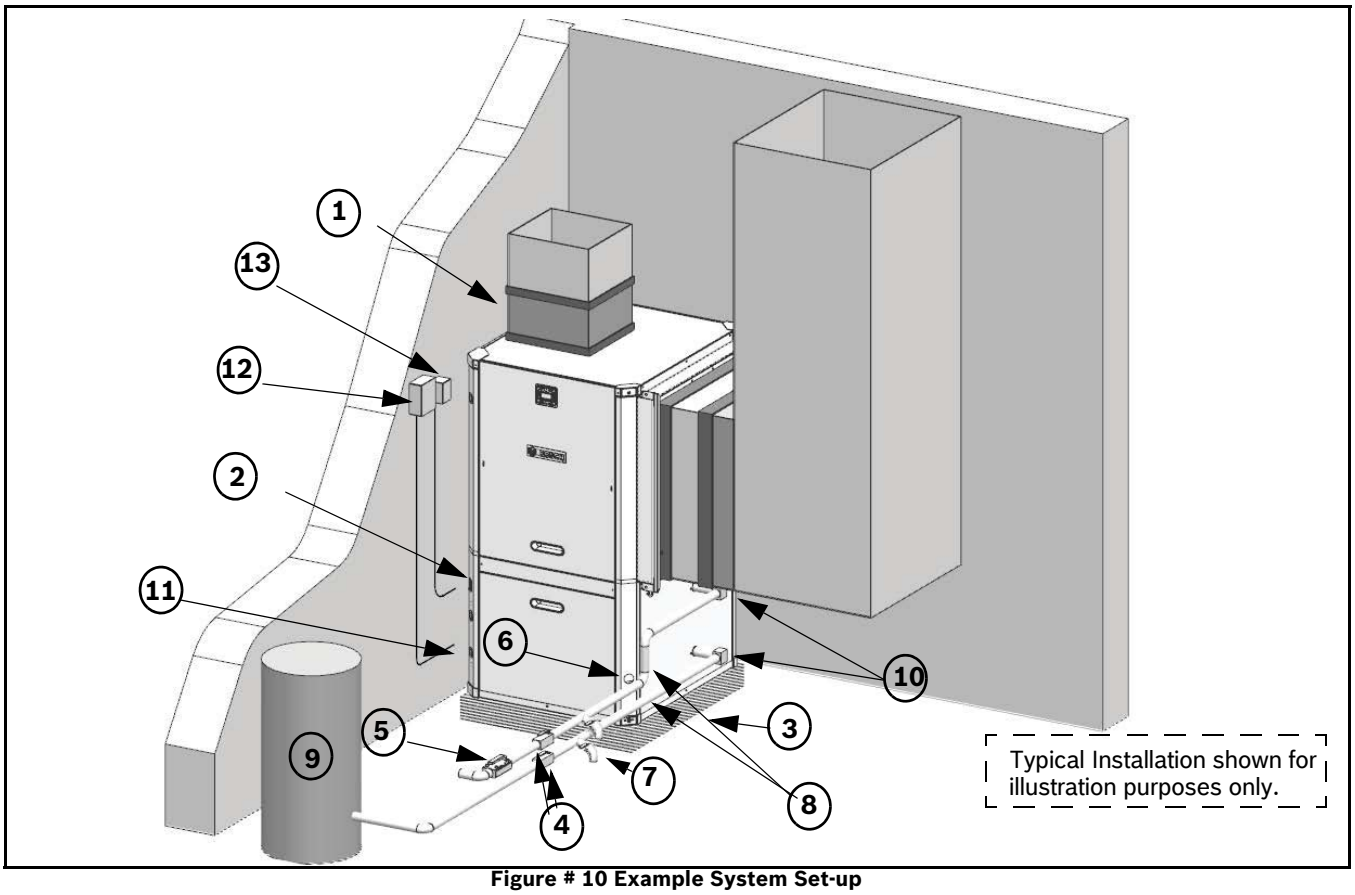



**Figure # 10 Example System Set-up**

[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.

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.

## 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 #11)

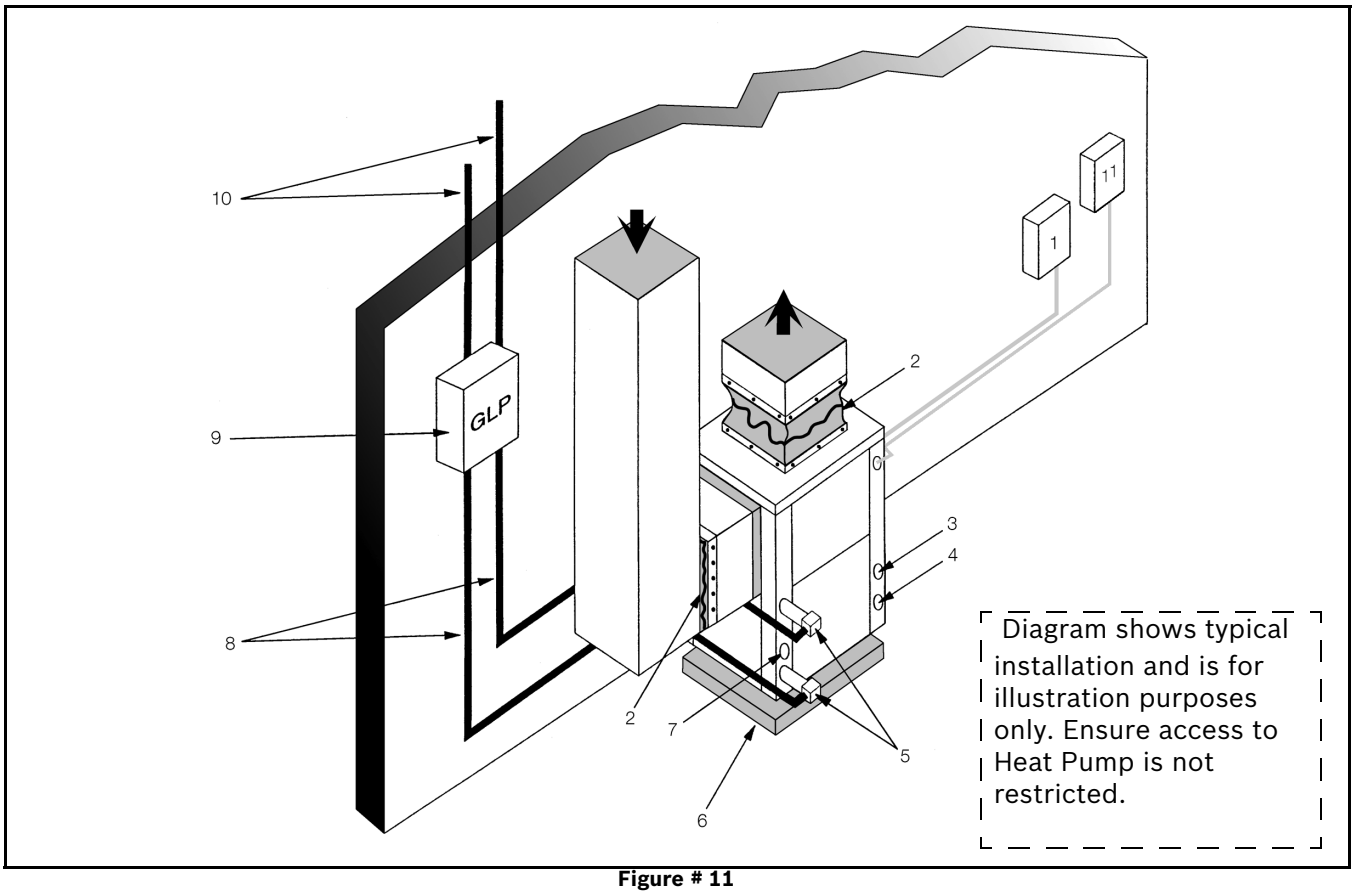



**Figure # 11**

[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)