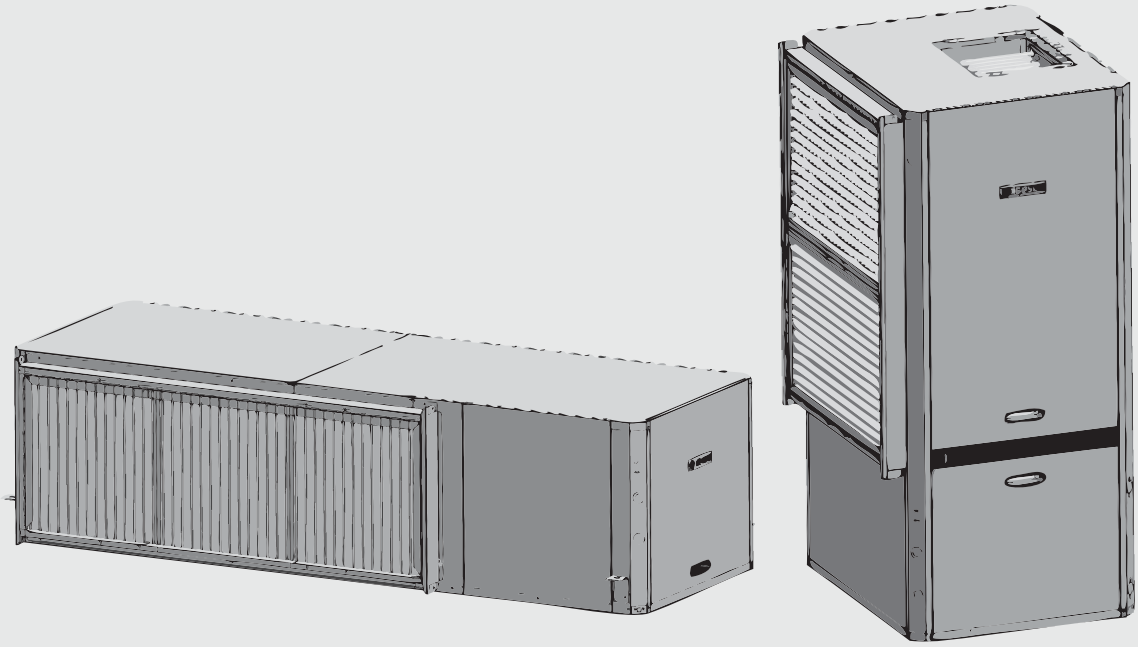


LM Series Heat Pump

LM024 | LM036 | LM048 | LM060 | LM070

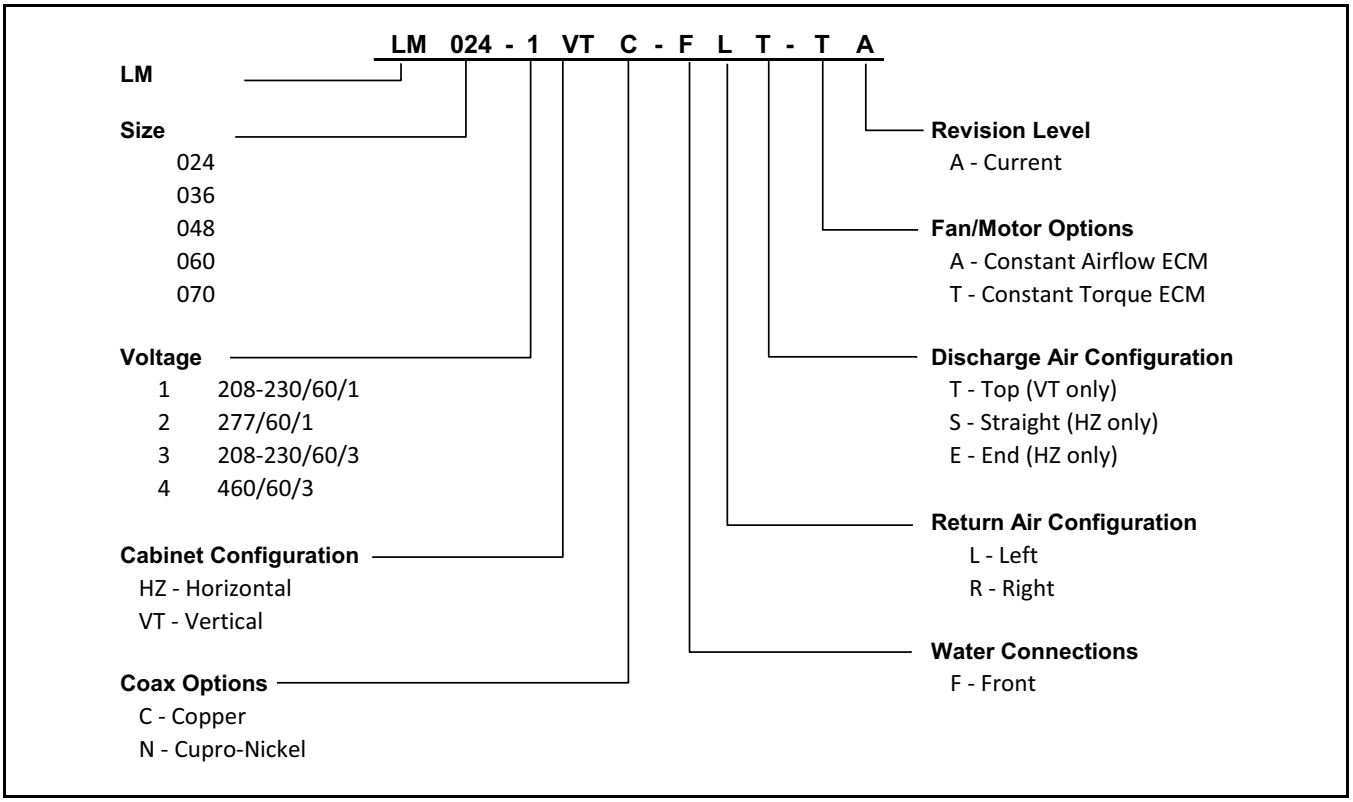
BOSCH

Installation, Operation and Maintenance Manual

8 733 905 315 (2014/07)

CONTENTS

MODEL NOMENCLATURE



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.**

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.

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 PACKAGE

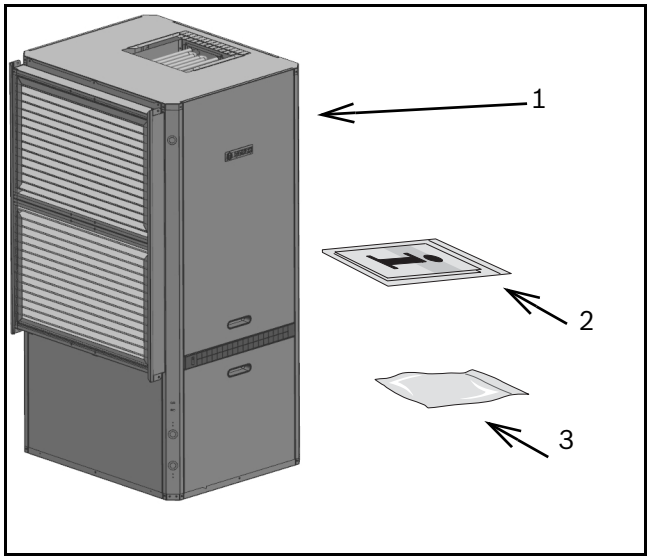


Figure # 1

[1] LM Series Water-to-Air Heat Pump
[2] Installation and Operation Manual
[3] Hanging Bracket Kit (Hz Units Only)

GENERAL DESCRIPTION

LM 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 LM 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.

50° Minimum Entering Water Temperature (EWT) 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.

LM Series Water-to-Air Heat Pumps are available in Vertical (VT) and Horizontal (HZ) configurations. VT and HZ units Discharge Air Orientation is Field Configurable with the purchase of a separate kit.

Several factory installed options are available: Hot Gas Reheat, Electric Heat, Sound Package, Smart Start, Constant Airflow Blower Motor, 2” 4-sided filter racks, MERV 8 & 13 filters, Differential Pressure Switch (DPS) Water Flow Proving Switch, Auxiliary Pump Relay, Air Flow Proving Sensor, Zone Valve and Internal Water Pump. See Pg#16 for more detail.

Electric Heat is available as a factory installed option **ONLY**.

Safety devices are built into each unit to provide the maximum system protection possible when properly installed and maintained. Each unit has an external LED error code display, allowing unit diagnosis without opening the cabinet.

Basic Horizontal Unit layout and connections are shown in Figure #2. For more detail on both the Vertical and Horizontal units, refer to the Dimensional Drawings on Pg#57 through Pg#60.

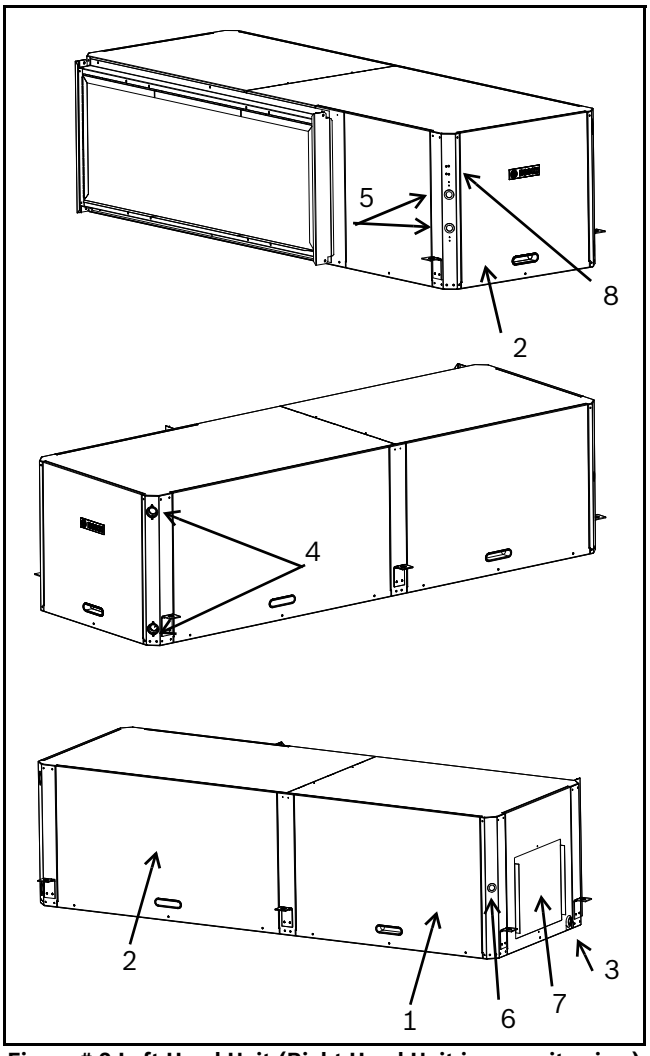


Figure # 2 Left-Hand Unit (Right-Hand Unit is opposite view)

[1] Air handler access panel
[2] Condensing section access panel
[3] Condensate drain connection
[4] Water connection
[5] Electrical connection knockout
[6] Electric Heat electrical connection knockout (Optional)
[7] Blower outlet (Supply Air)
[8] LED Error Code

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 6 ton units!

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

Horizontals 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, with 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.

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.

BLOWER CONFIGURABILITY

To change configuration of the LM unit requires the purchase of a separate Blower panel Conversion Kit. Please refer to the **Spare Parts List_8733911143** (On website www.fhp-mfg.com) and the **Blower Configurability IM_8733911121.**

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 #3)

Bend flanges **one at a time**, using standard sheet metal pliers or channel locks.

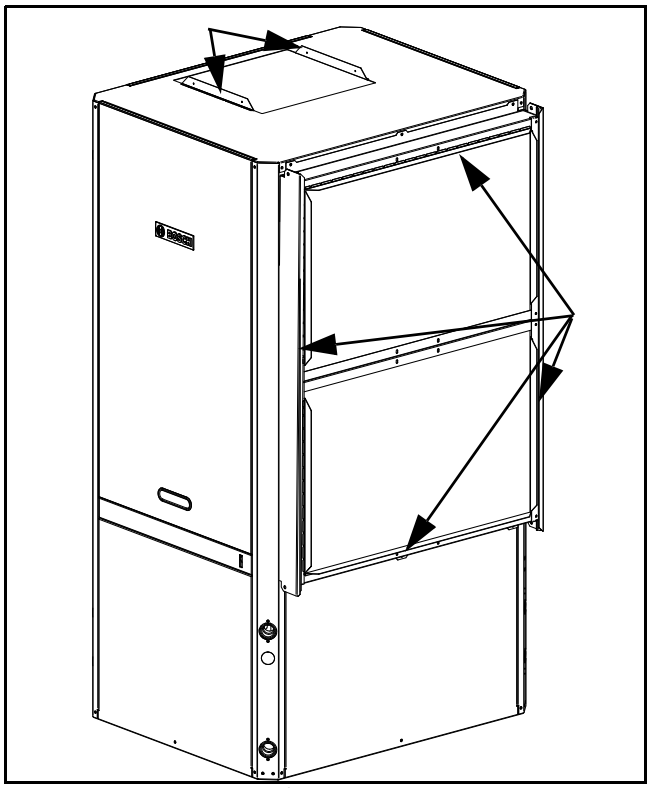


Figure # 3

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 #4).

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

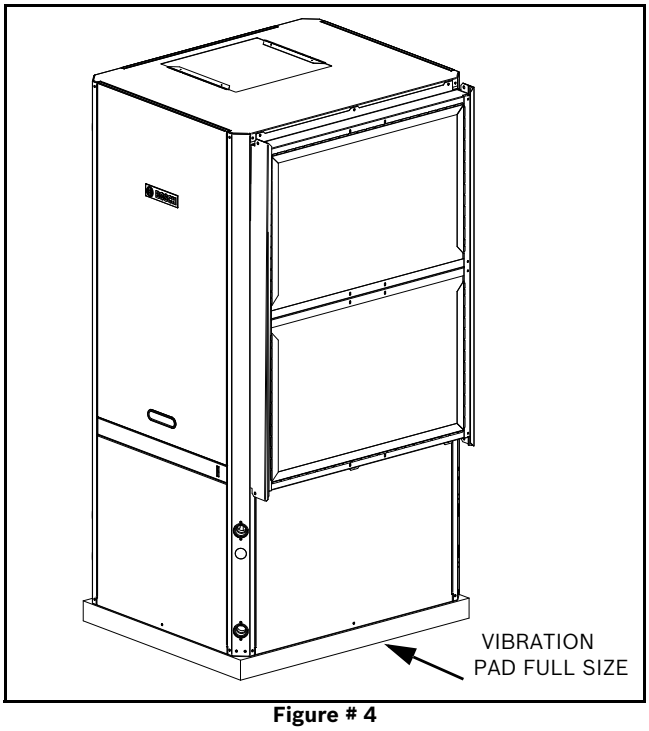


Figure # 4

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.

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 during heavy rains.

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 kit to facilitate suspended unit mounting using threaded rod.Hanging Brackets are to be installed as shown in figure #5.

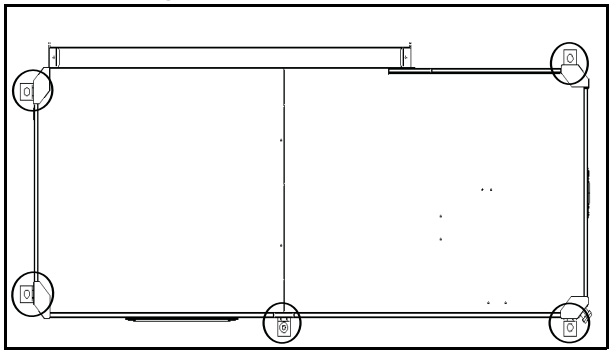


Figure # 5

This kit includes the following:

(5) Brackets

(5) Rubber Vibration isolators

(8) Screws #10x1/2 (not used for these models)

(10) Bolts 1/4-28x1/2” 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# 6

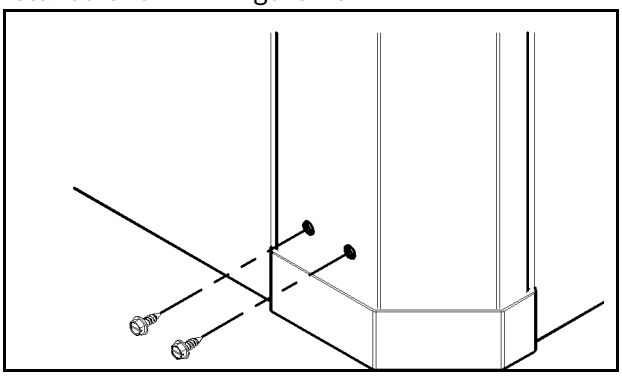


Figure # 6

2. Mount 5 brackets to unit corner post using the bolts provided in the kit as shown on figure #7.

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

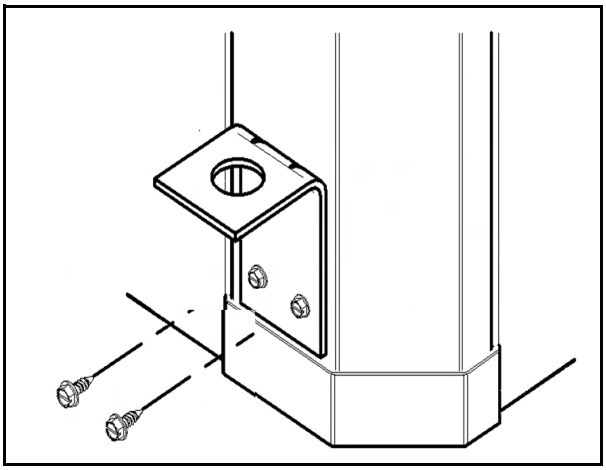


Figure # 7

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 #8.

4. Hang the unit and assemble the field provided thread rod, nuts and washers on to the brackets as shown in Figure#8.

Caution: Rods must be securely anchored to the ceiling.

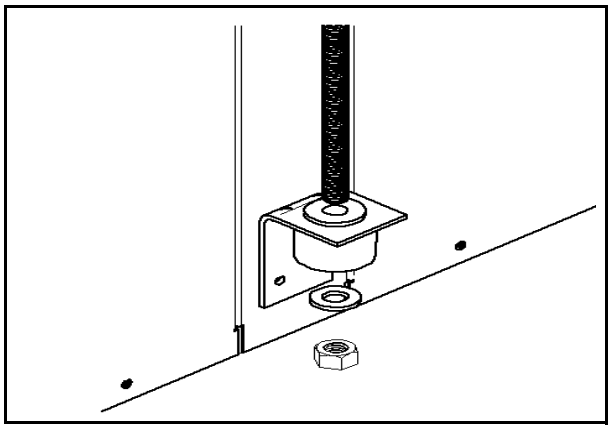


Figure # 8

CONDENSATE DRAIN

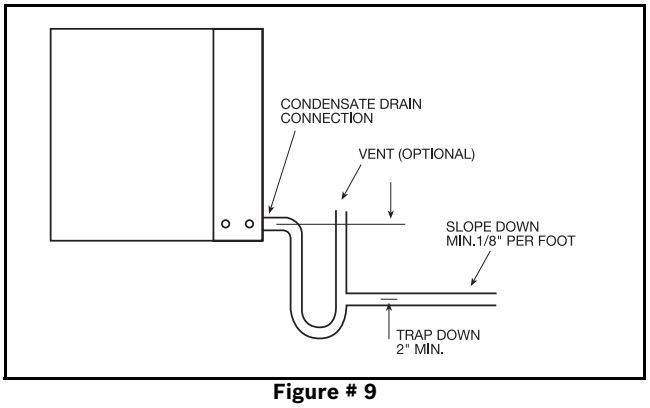


Figure # 9

A drain line must be connected to the heat pump and pitched away from the unit a minimum of 1/8” per foot to allow the condensate to flow away from the unit.

This connection must be in conformance with local plumbing codes. A trap must be installed in the condensate line to 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#57 through Pg#60)

A flexible connector is recommended for supply and return air duct connections on metal duct systems. All metal ducting should be insulated with a minimum of one inch duct insulation to avoid heat loss or gain and prevent condensate forming during the cooling operation. Application of the unit to uninsulated duct work is not recommended as the unit’s performance will be adversely affected.

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).

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

LM 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.

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#57 through Pg#60)

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. (Figures #10, 11, 12)

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#31through #36, Pg#40 through Pg#51).

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#40 through Pg#51 for wiring diagrams. See data plate for minimum circuit amp capacities and maximum fuse/ breaker sizing.

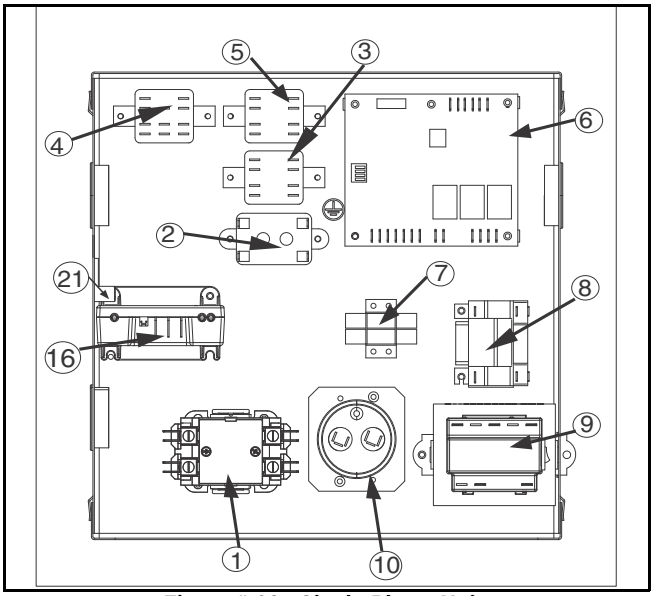


Figure # 10 - Single Phase Unit

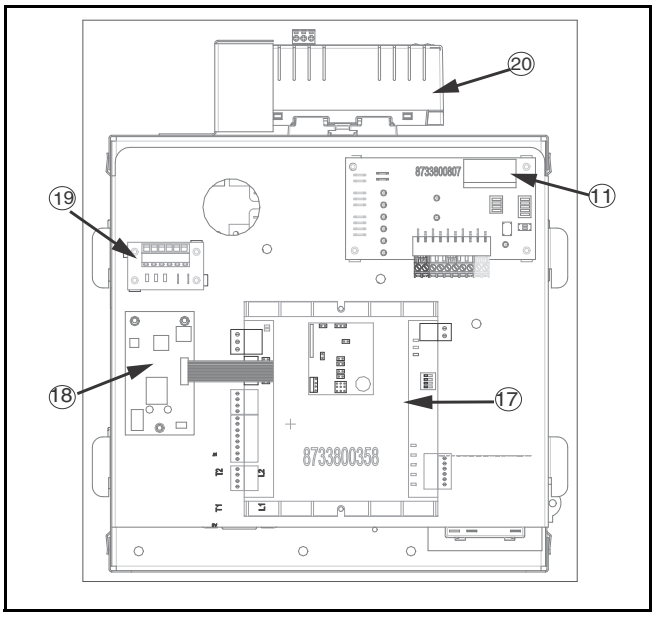


Figure # 11 EBox Cover

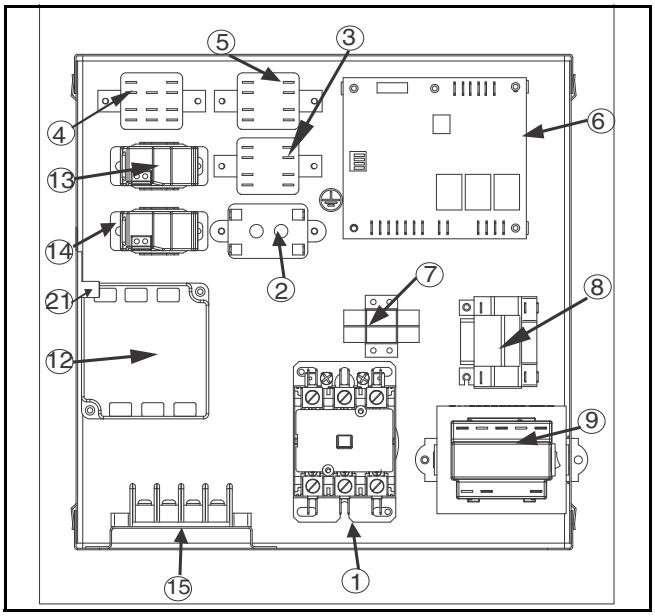


Figure # 12 Three Phase Unit

[1] Compressor contactor
[2] Emergency Relay (Option)
[3] Second Stage Relay
[4] Hot Gas Reheat Relay (Option)
[5] Cooling Relay
[6] Unit Protection Module (UPM)
[7] Terminal block Low-Voltage
[8] Auxiliary Relay (Option)
[9] Transformer
[10] Capacitor
[11] ECM Interface Board (Option, mounts on E-Box cover)
[12] Phase Monitor
[13] Fan Status Switch (Option)
[14] Pump Status Switch (Option)
[15] Terminal Block 460V Units (Option)
[16] Comfort Alert Module (Option)
[17] DDC (Option)
[18] LonWorks Card (Option)
[19] Input Expansion Module (Option)
[20] Smart Start Assist (Option)
[21] Ground Lug

Safety Devices and the UPM Controller

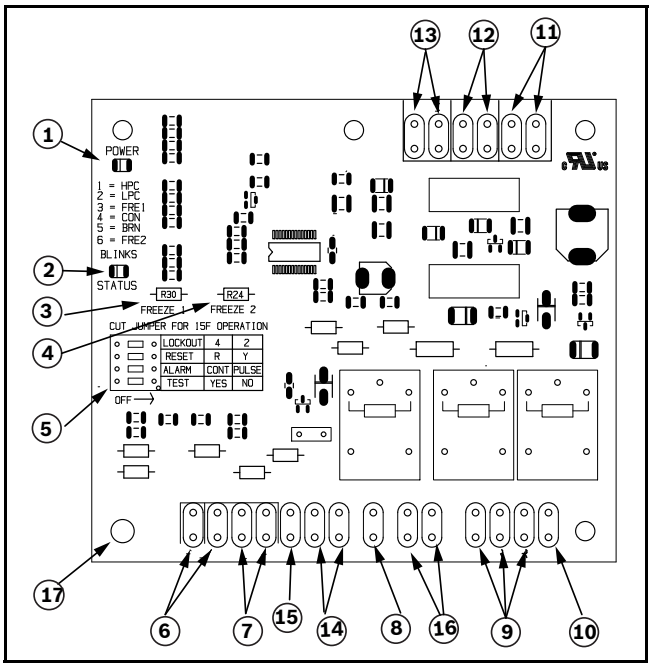


Figure # 13

[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
[7] Air Coil Freeze Connection
[8] LED Status-Diagnostic 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 #14.

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 25°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 #14, item [3] for resistor location. (Refer to Figure #15 for sensor location)

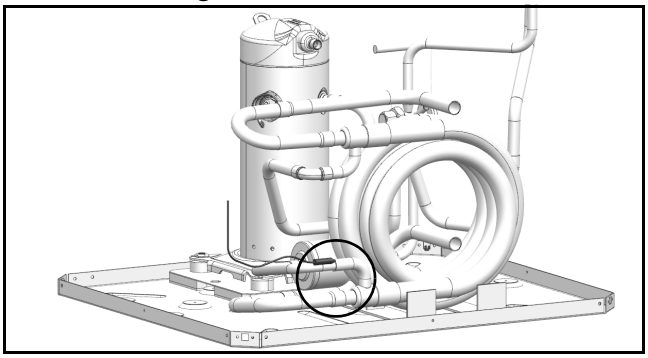


Figure # 14

If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze1 R30 resistor set to 25°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 between 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 25°F. (Figure#15)

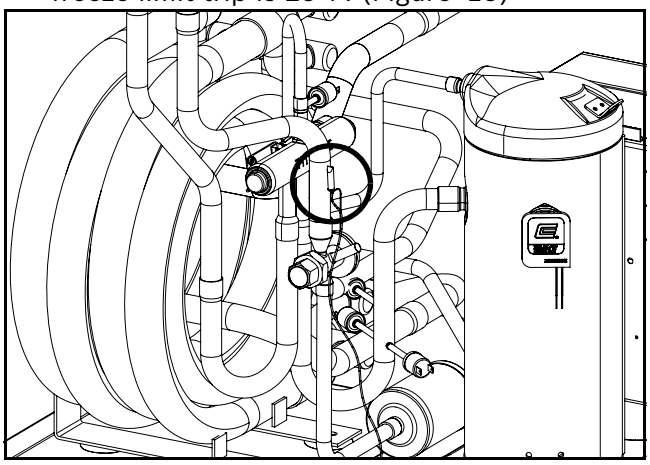


Figure # 15

- 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 #16)

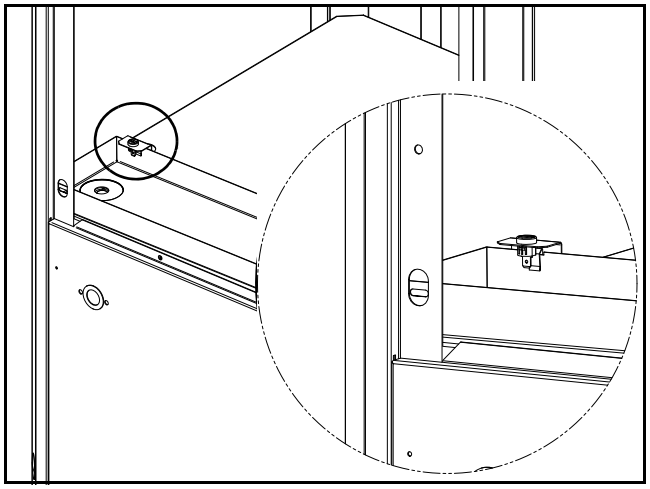


Figure # 16

UPM Board Factory Default Settings	
TEMP	25°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. If, after 120 seconds 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 LED 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.

- **LED ANNUNCIATOR:** This LED kit provides a quick visual indication of whether or not a heat pump is energized and if it has locked out on a fault. The LED kit is mounted to the electrical corner post of the heat pump and employs high intensity LED's for better visibility. The LED kit will exactly mirror the LED blink codes on the UPM board (refer to the blink code table in the UPM sequence of operation).
- **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 (three (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.
Refer to page #10 for more information.

Freeze sensor will not guard against 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- Constant Airflow Motor (Option)

Refer to Figure #17, 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 signlas to unit's UPM board. The thermostat connections and their functions are as follows:

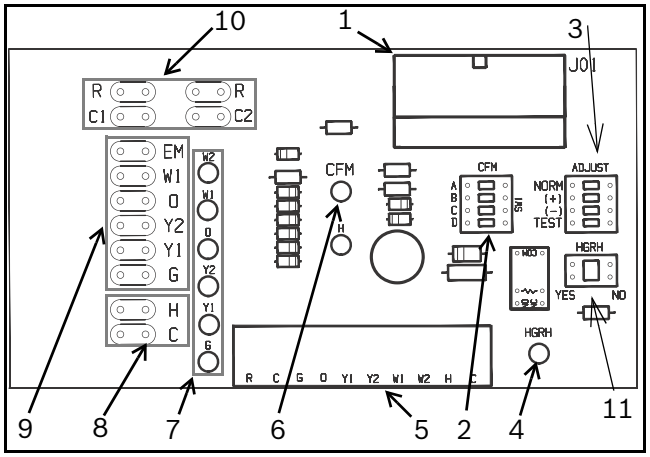


Figure # 17

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

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

- CFM count indicator (See Figure #17, item [6]) blinks to indicate approximate airflow in CFM and may flicker when unit is off.
- Each blink of the LED represent approximately 100 CFM of air delivery so if the LED blinks 12 times, pauses, blinks 12 times, etc. the blower is delivering approximately 1200 CFM.

Thermostat Outputs	
Y1	First Stage Compressor Operation
Y2	Second Stage Compressor Operation
G	Fan
O	Reversing Valve (energized in cooling)
W1	Auxiliary Electric Heat (runs in conjunction with compressor)
EM/W2	Emergency Heat (electric heat only)
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 #18, items [2] & [3]) allows airflow adjustment to meet application requirements and to ease troubleshooting.

Only one switch can be enabled at a time. Refer to Figure #29 for each airflow setting.

- CFM Selector (FIg #18 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%.

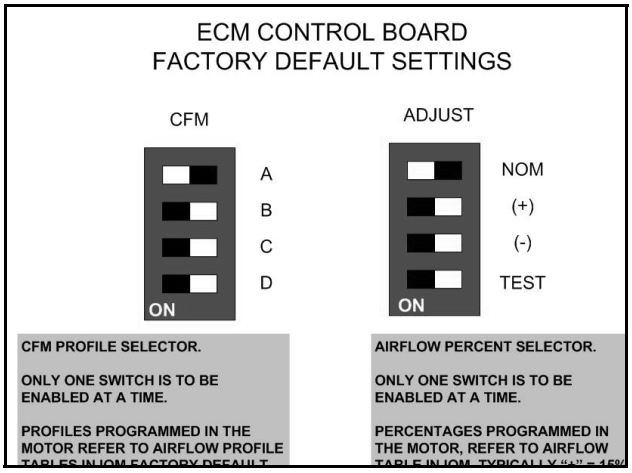


Figure # 18

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 position on the interface board and reset the unit afterward.

Dehumidification Method Selector

Dehumidification method selector (Figure #19 item [11]) is used to select between the following two methods:

1. 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 #19, 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 #19 item [11]) should be selected to ‘NO’.

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

Dehumidification indicator LED (Figure #17, item [4]) will energize when dehumidification call is present.

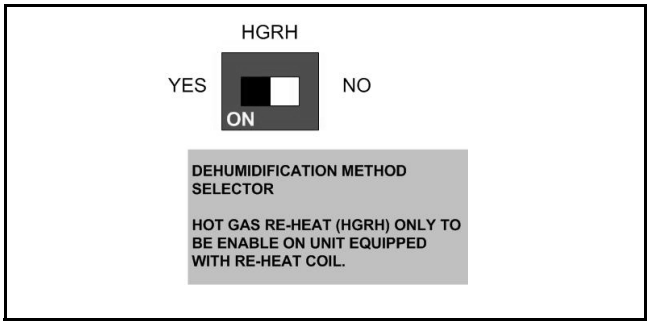


Figure # 19

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.

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:

1. Disconnect power to the heat pump.
2. Remove the blower access panel.
3. 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#37)

OPTIONS

Number of factory installed options are available on LM 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 LM 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.

The reheat option consists of a refrigerant to air heat exchanger (reheat coil) mounted down stream of the evaporator coil. 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.

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 LM series. Electric heating elements can operate along with reverse cycle heating as auxiliary heat or in lieu of reverse cycle 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 .

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	LM024	LM036	LM048	LM060	LM070
Kw05	3.6	4.8	1	12300	16300	x	x	x	x	x
Kw10	7.2	9.6	2	24600	32700		x	x	x	x
Kw15	10.8	14.4	2	36900	49100			x	x	x
Kw20	14.4	19.2	2	49200	63400				x	x
x available										

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.

Please refer to the ECM Interface Board Section (Pg. 14) for more information.

Fan Status Switch

The fan status switch is a Current Transformer (CT) that monitors the current flow to the supply fan motor. It's default is Normally Open (NO) circuit when the motor is not running, and closes once it senses current flow.

Pump Status Switch

The pump status switch is a Current Transformer (CT) that monitors the current flow from the condenser pump motor. It's default is Normally Open (NO) when the motor is not running, and closes once it senses current flow.

DPS Water Flow Proving

The DPS water flow proving switch is a factory installed option available for the LM 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 the refrigerant heat exchanger. When the pressure drop between the water in and water out lines reaches a pre-set value, compressor operation is enabled.

Valve End Switch

The leaving water valves are all equipped with Valve End Switches (VES) and it is a factory installed option available for the LM series.

The VES prevents compressor operation if the valve is not fully open. This prevents short-cycling due to low water through the water-to-refrigerant heat exchanger in the heat pump.

The VES only closes once the leaving water valve is fully open. The valve is activated by the compressor call (Y1) signal.

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 #20)

Figure # 20

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.

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.

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

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

Heating Mode

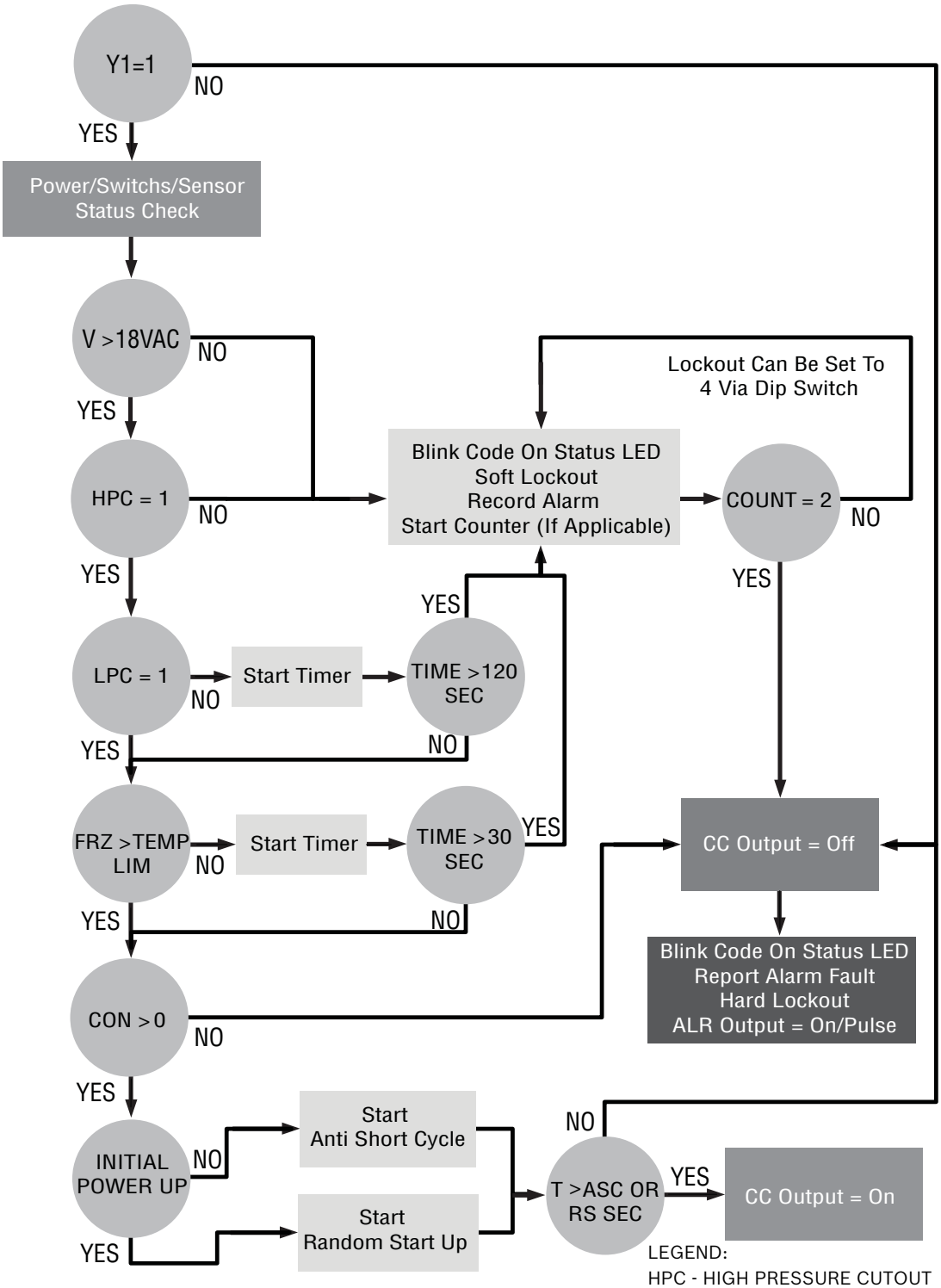
The first two stages of heating (Y1 & Y2) operate in the same manner as cooling, but with the reversing valve de-energized. On a call for auxiliary heat (W1), the fan ramps up to auxiliary heat air fl ow immediately and the electric heater package is energized along with the compressor. As the thermostat 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 lock 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 #21)

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#29)

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 # 21

APPLICATION CONSIDERATIONS

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.

Consult the specification sheets for piping sizes. Teflon tape sealer should be used when connecting to the unit 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.

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 #22)

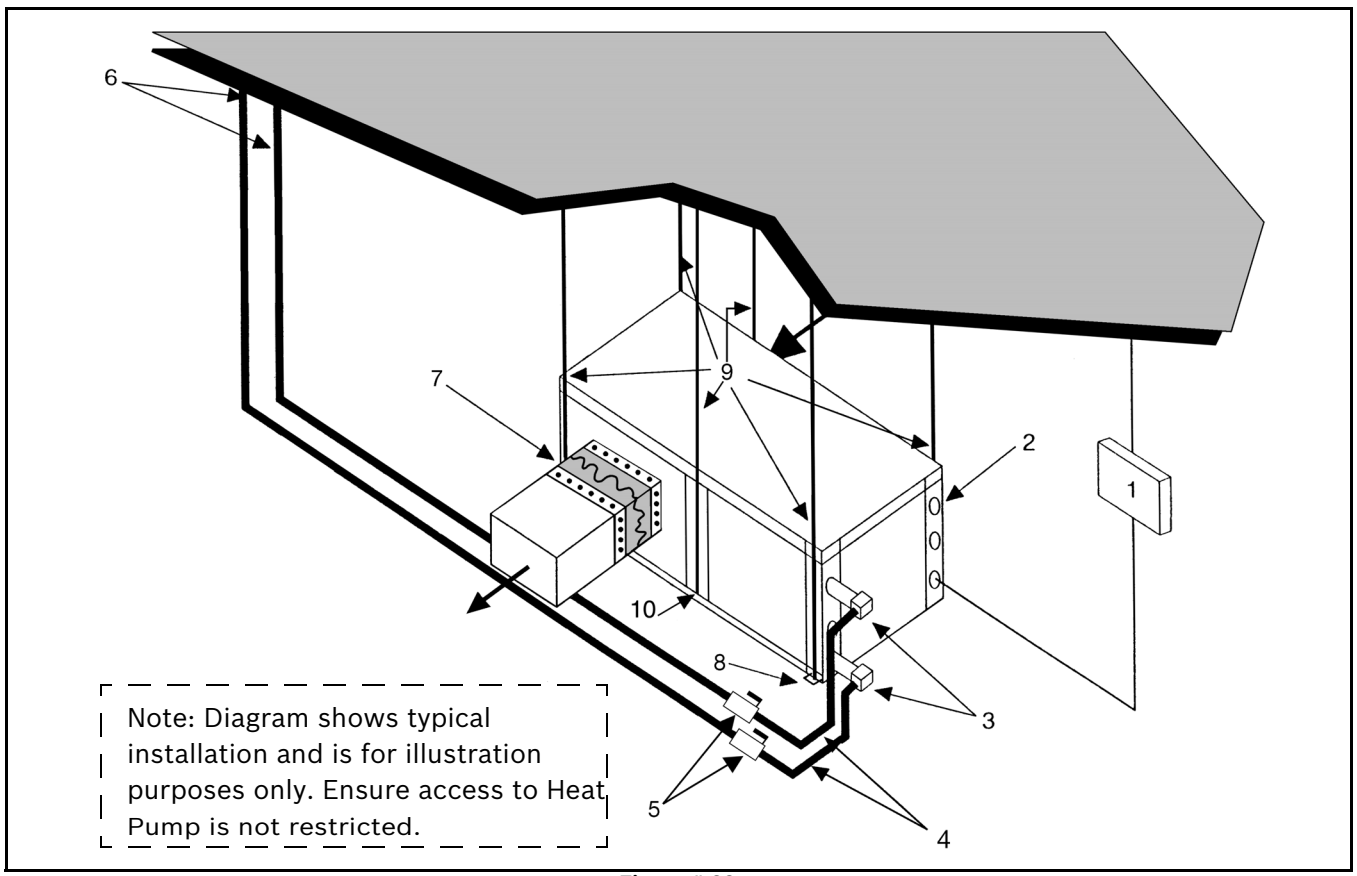


Figure # 22

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

Geothermal Systems

Closed loop and pond applications require specialized design knowledge. No attempt at these installations should be made unless the dealer has received specialized training. Utilizing 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 #23)

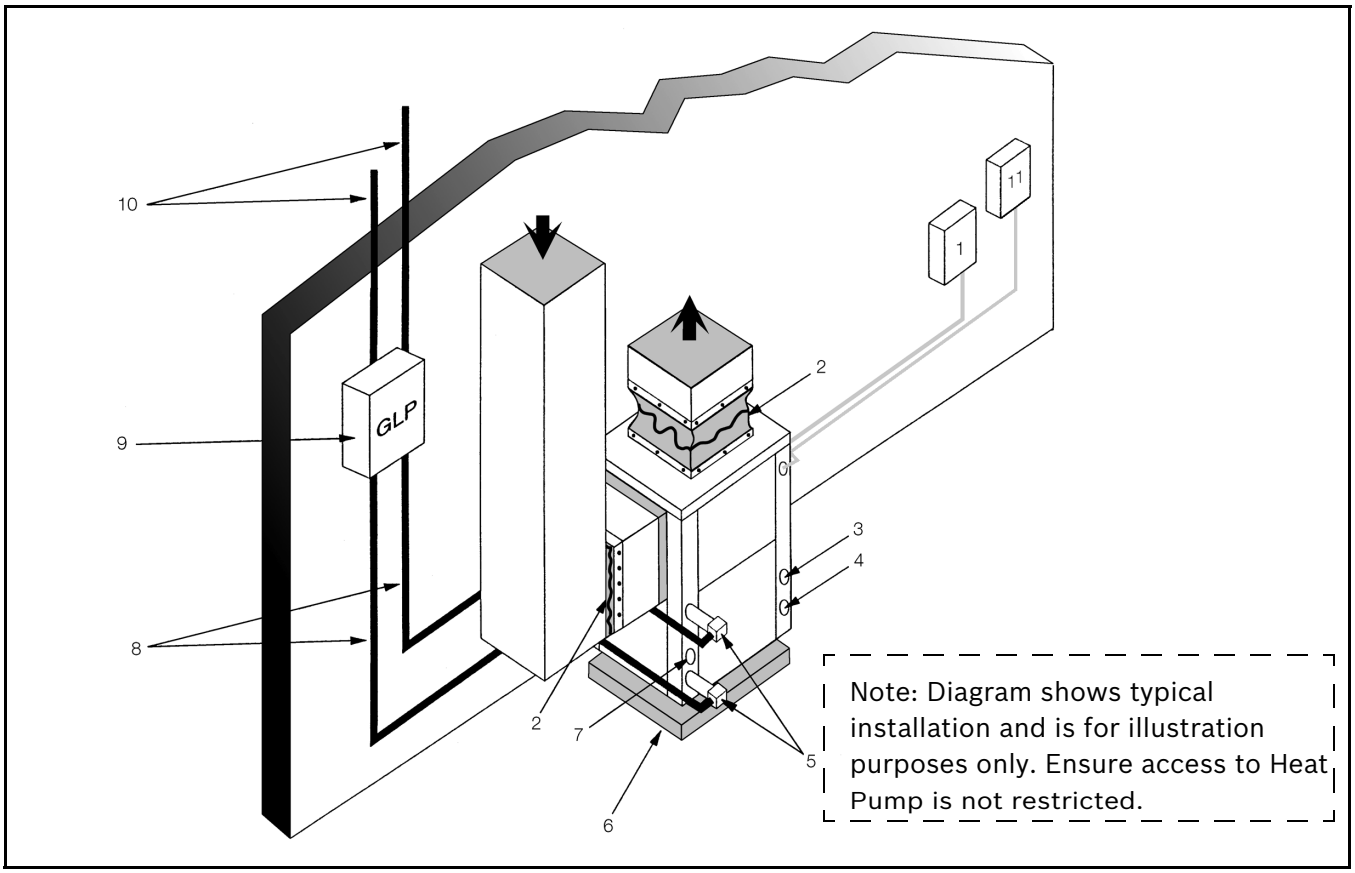


Figure # 23

[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)