

LV Series Heat Pump



LV007 Thru LV070



**BOSCH**

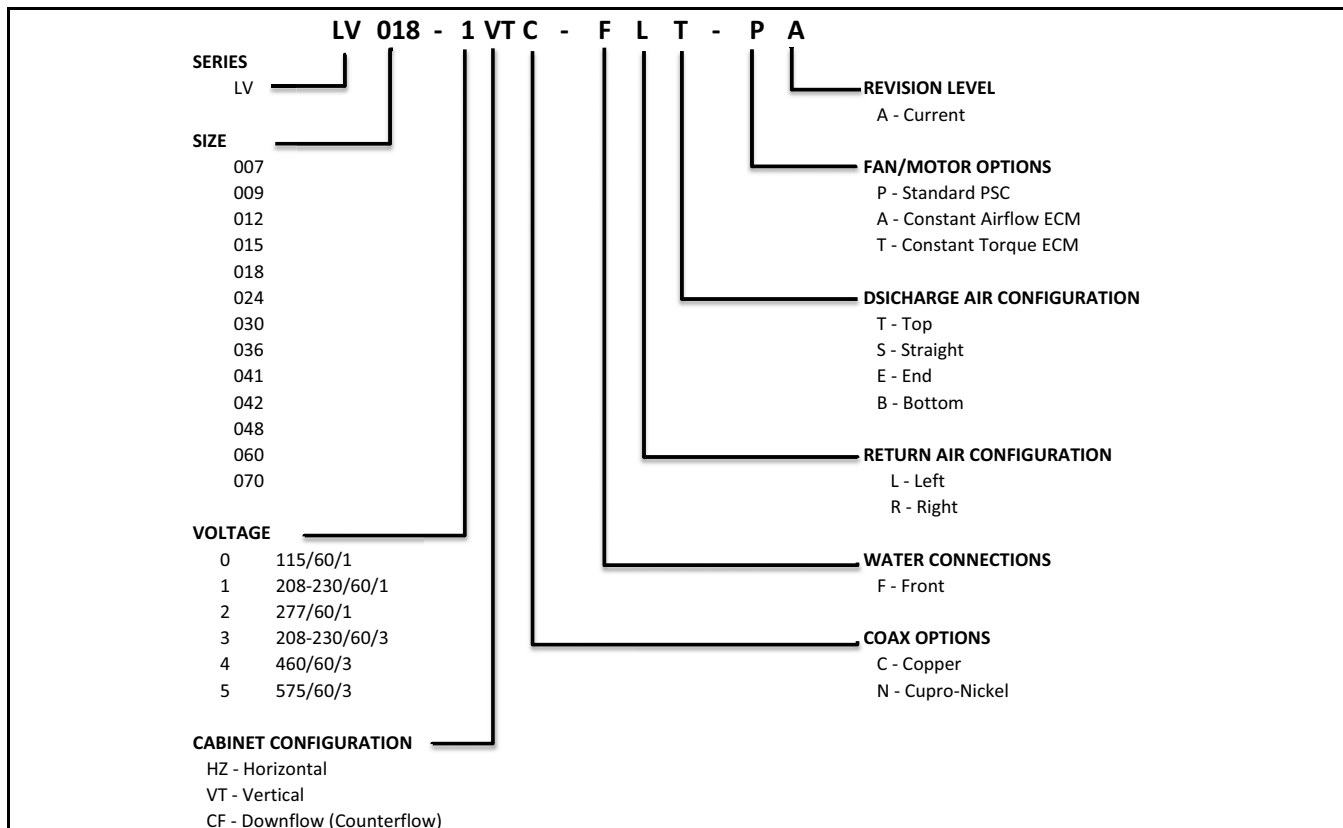
## Installation and Maintenance Manual

8 733 905 683 (2013/4)

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### MODEL NOMENCLATURE



### SAFETY CONSIDERATIONS



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.



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.



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.

## GENERAL DESCRIPTION

The LV series water-to-air heat pump provides an unmatched combination of performance, features and flexibility for both high performance new construction applications and replacement of existing water-to-air heat pumps. All units are certified by the Air conditioning, Heating and Refrigeration Institute (AHRI) to AHRI/ANSI/ASHRAE/ISO standard 13256-1 for water-to-air and brine-to-air heat pumps at both Water Loop Heat Pump and Ground Loop Heat Pump application points.

These units are safety listed with Intertek Test Labs (ETL) to cUL standard 1995. These units meet all current applicable requirements of ASHRAE 90.1.

LV series units are designed to operate with entering fluid temperatures between 50°F and 100°F in cooling and 50°F and 80°F in heating with the base configuration. With the extended range option, LV series models can operate with entering fluid temperatures between 40°F and 120°F in cooling and between 20°F and 90°F in heating. LV units can accommodate a wide range of air temperatures, however, standard LV models should not be used for 100% outside air without consulting the factory applications group. 100% outside air routinely requires higher levels of dehumidification than is available from equipment designed for return air applications.

LV series units are available in three basic configurations: vertical top supply air (VT), horizontal end supply air or straight through supply air (HZ) and counterflow down supply air (CF). Each of these configurations are available with either left or right hand return air. HZ models can have the supply air field converted from end discharge air to straight through with no extra parts required.

LV units are designed and rated for indoor installation only. LV units should not be installed in environments that fall below freezing or exceed 100°F ambient. LV cabinets are constructed of heavy gauge G-90 galvanized steel and will resist most common types of corrosion for the life of the equipment.

LV series units are offered with a wide range of factory installed options including: PSC, constant torque ECM or constant air flow ECM fan motors; hot gas reheat; hot gas bypass; internal 2 way valves; tin plated air coils; 2" 4-sided filter racks; MERV 13 filters (with constant airflow ECM motors); on board DDC controls; copper or cupro nickel water coils; water-side economizers and more.



Note that some options are offered in limited sizes and/or voltages.

On board safety features will protect the major unit components from damage under most foreseeable installation and operation problems.

## MOVING AND STORAGE

If the equipment is not needed for immediate installation upon arrival at the job site, it should be left in its packaging and stored in a clean, dry area. Units must be moved and stored in the normal upright position at all times.

Use caution to avoid damage to filter racks and duct flanges when storing or handling units.



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



Never stack units when transporting them.



When storing units:

Do not stack units larger than 6 tons capacity!

Do not stack vertical or counterflow units under 6 tons capacity more than 2 high

Do not stack horizontal units 6 tons capacity more than 3 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 is no visible damage. Note any damage or shortage on all copies of the freight bill. In the event of damage or a shortage it is the responsibility of the purchaser to file the necessary claims with the carrier. Concealed damage not discovered until after removing the units from packaging must be reported to the carrier within 24 hours of receipt.

## LOCATION

Locate the unit in an indoor area that allows easy access to the filter, front access panel and blower access panel, and has enough room for service personnel to perform maintenance and repair work. Provide sufficient room to make fluid, electrical and ductwork connections.

Locate the unit in conditioned space and avoid installation in corrosive environments.

If the unit is installed in a confined space, such as a closet, provisions must be made for return air to freely enter the face of the unit's air coil.

Unit condensate drains are not internally trapped. Allow room below the unit base for horizontal and counterflow models for an adequate condensate trap.



Do not locate the unit above supply piping.

Do not locate the unit in areas subject to freezing or in areas subject to temperature or humidity extremes.



LV series packaged units are not approved for outdoor installation. Units must be installed in conditioned space that is not subject to extremes of temperature or humidity to avoid cabinet sweating and/or equipment damage.



Do not use LV series units for temporary heating, air conditioning or ventilation during construction, especially when plastering, sanding or painting. Care should be taken to avoid introduction of dust, paint or debris into the air coil.

## WATER QUALITY



Failure to insure proper water quality and flow rates can shorten the life of the heat pump and potentially void the unit warranty.

Maintaining proper water quality is important for insuring a long and trouble free service life for an LV series heat pump.

For closed loop and boiler/tower systems water chemistry can be checked and easily maintained to insure that corrosive elements, dissolved oxygen and pH levels are kept in check. It is important to insure that any additive, antifreeze or corrosion inhibitor that is added to the water loop is compliant with all applicable laws and regulations and is compatible with copper, brass and bronze alloys. Insure that all recommended safety precautions are followed when handling or adding chemicals to the water loop.

For open loop systems, water quality is very important. Table #1 shows acceptable ranges for a variety of water quality factors. The three main concerns in open loop installations are scaling, corrosion and fouling.

In installations with hard water, scaling due to a buildup of carbonates on the heat exchanger wall can gradually degrade the heat pump performance over time. Heat pumps that are affected by scaling may exhibit low suction pressures in heating and high head pressures in cooling with a gradual loss of capacity and efficiency. Scaled heat exchangers can be cleaned by a qualified technician but care should be taken to avoid scaling in the first place.

To limit scaling, water flow rates should be kept at 3 gallons/minute per nominal cooling ton (a 10°F temperature rise in cooling) and care should be taken to avoid air in the water lines from suction side leaks. Cupro-nickel coils are generally recommended.

In installations with high hydrogen sulfide, chlorine or ammonia, corrosion is a potential problem. In these installations a cupro-nickel heat exchanger is recommended along with maintaining proper flow and keeping air out of the system. If water quality is outside of the values in Table #1, then a closed loop is recommended.

Fouling due to iron bacteria can also pose problems in some open loop installations. Iron bacteria fouling can quickly degrade system performance and plug heat exchangers.

Air in the water system will greatly accelerate the fouling or corrosion process.

**Table 1: Water Quality**

POTENTIAL PROBLEM	Water Characteristic	Acceptable Value	
		Copper	Cupro-Nickel
	pH (Acidity/Alkalinity)	7-9	7-9
SCALING	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
CORROSION	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
IRON FOULING	Iron (Fe <sup>2+</sup> Iron Bacteria Potential)	< 0.2 ppm	< 0.2 ppm
	Iron Oxide	< 1 ppm	< 1 ppm
EROSION	Suspended Solids	< 10 ppm, < 600 µm size **	< 10 ppm, < 600 µm size **
	Maximum Water Velocity	6 ft/sec	6 ft/sec
* No "rotten egg" smell present at < 0.5 ppm H <sub>2</sub> S.			
** Equivalent to 30 mesh strainer			

## INSTALLATION

The following are instructions to follow for installation of all LV Series components.

### Duct Flanges

LV heat pumps feature fold-out return and supply air duct flanges. These fold-out flanges allow the heat pumps to more easily fit through doorways and other tight spaces, and also prevent damage in shipping and handling.

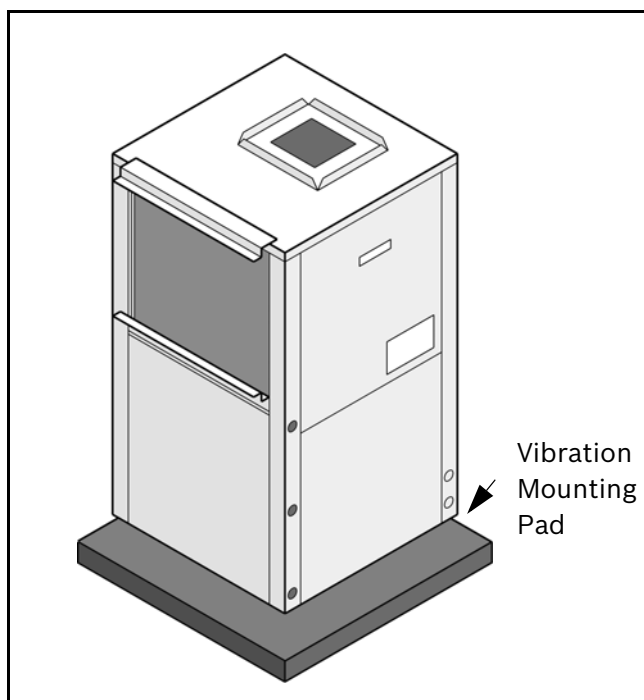
It is recommended that all fold-out flanges be folded-out once the heat pump is installed to insure that return and supply air flow is not obstructed. These flanges can be easily folded using standard or duckbill pliers. Once folded out these flanges can be used to support light ductwork loads.

## Mounting Vertical Units

LV Series vertical and counterflow units should be mounted level on a vibration absorbing pad slightly larger than the unit base in order to minimize vibration transmission from the unit to the building structure. See Figure #1. It is generally not necessary to anchor the unit unless required by local code.

All major service access for the LV Series vertical and counterflow models is from the front side of the unit. When installing the unit in a confined space such as a closet, insure that the service panel screws are accessible, that the filter can be replaced without damage and that water and electrical connections are accessible. For models with a unit mounted disconnect switch, make sure the switch can be easily seen and operated.

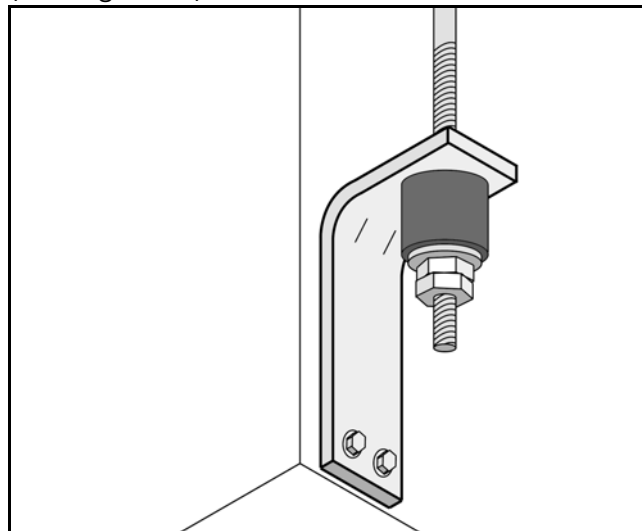
To reduce sound transmission, units should be installed using flexible electrical conduit and hose kits. Care should be taken to insure that no part of the unit cabinet is touching part of the building structure. For ducted return applications, a flexible duct connection should be used. Refer to Figure's #11, #12 and #13.



**Figure # 1 Mounting Vertical Units**

## 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 rods are usually attached to the unit corners by hanger bracket kits (P/N 930-008). (See Figure #2).



**Figure # 2 Hanger Bracket**

The rods must be securely anchored to the ceiling. Refer to the hanging bracket assembly and installation instructions (Included with the unit) for details.



Units larger than six tons include an integral angle iron frame with mounting holes present. (See unit horizontal detail drawing).

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.

## Converting Horizontal Supply Air Configuration

The supply air location on LV Series Horizontal units can be quickly field converted from end blow to straight through or vice-versa. To convert the supply air direction, follow the steps below:

1. If connected to power, shut off the unit and disconnect switch or circuit breaker.
2. Unscrew and remove the blower access panel.
3. Disconnect the wires from the unit electrical box to the blower motor. Note which speed taps are wired for units with PSC or constant torque motors.
4. Unscrew and carefully remove the blower panel with the blower and motor attached. Be careful not to damage the refrigerant coils or any other internal unit components.
5. Remove the blower support brackets from the bottom of the blower housing and relocate them to the top of the blower housing.
6. Turn the blower panel 180 degrees so that the blower support brackets are now at the bottom of the blower.
7. Insert the blower panel with the blower and motor into the desired location. Be careful not to damage the refrigerant coils or any other internal unit components. Screw the panel into place.
8. Replace the wires between the blower motor and electrical box. Make sure to connect wires to the proper speed taps.
9. Replace the blower access panel.
10. Reconnect power to the unit.

## Condensate Connections

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. (Heat Pumps are not internally trapped).

A vertical air vent is sometimes required to avoid air pockets. (See Figure #3).

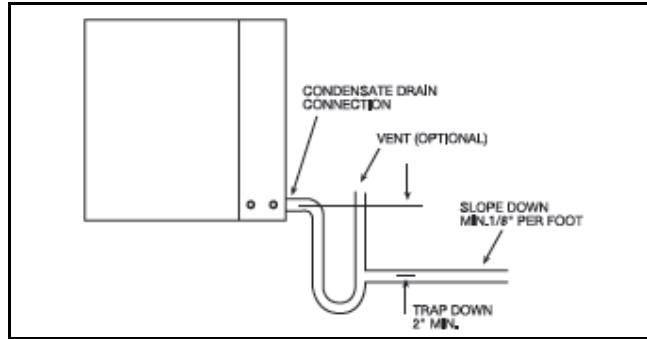


Figure # 3 Condensate Drain

The depth of the trap depends on the amount of positive or negative pressure on the drain pan. A second trap must not be included.

The horizontal unit should be pitched approximately 1/4" towards the drain in both directions, to facilitate condensate removal. (See Figure #4)

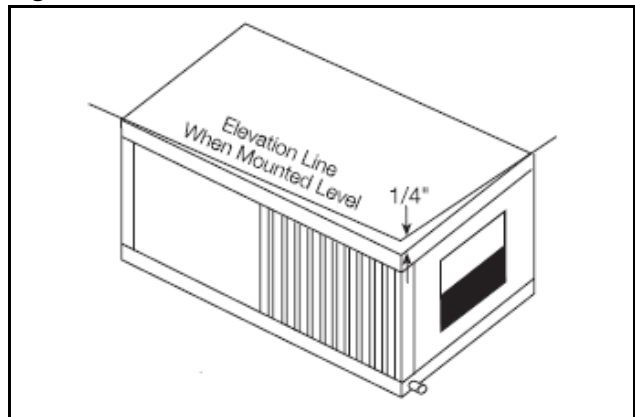


Figure # 4 Pitched Unit

## Duct System

All LV Series models are provided with a return air duct flange and supply air duct connections.

Refer to unit Dimensional Drawings for physical dimensions of the collar and flange. (Pg#49)

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 from 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 filter rack should be left in place on a free return system.



if the unit will be installed in a new installation with new duct work, the installation should be designed using current ASHRAE procedures for duct sizing. If the unit will be connected to an existing duct system, 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 must be installed. Be certain to 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 through the air grill 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 grill. 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 water connections on the unit. LV 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. Refer to Table #1.



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. (Refer to Table #1)

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. Always check carefully for water leaks and repair appropriately. Units are equipped with female pipe thread fittings. Consult the specification sheets for sizes.

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.

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



Water piping exposed to extreme, low ambient temperatures is subject to freezing



Never exceed the recommended water flow rates. Serious damage or erosion of the water to refrigerant heat exchanger could occur.

## Electrical - High Voltage

All field installed wiring must comply with the National Electric Code as well as all applicable local codes. Refer to the unit electrical data on the unit name plate for wire and branch circuit protection sizing. Supply power voltage and phasing should match the required voltage and phasing shown on the unit name plate. Operating the unit below the minimum voltage, above the maximum voltage or with incorrect phasing can result in poor system performance or damage to the heat pump. All field wiring should be installed by qualified and trained personnel. Refer to the unit wiring diagram for field connection requirements.



All power connections must be properly torque to avoid the risk of overheating.

Power wiring to the heat pump should be enclosed in flexible conduit to minimize the transmission of vibration from the unit cabinet to the building.

For heat pumps with unit mounted disconnect switches, field power should be connected to the marked terminals on the disconnect switch. For heat pumps without unit mounted disconnect switches (except for 460 volt units noted below and units with dual power supply), power is connected to the line (L) side of the compressor contactor and the ground lug in the unit electrical box.

### Models with Dual Power Supplies

For models with dual power supplies, one power supply feeds the compressor and a second power supply feeds the unit fan motor and control circuit. The compressor power supply should be connected to the line (L) side of the compressor contactor. The fan motor and control circuit power supply should be connected to a provided terminal block. Care should be taken to insure that each power supply meets the voltage, amperage and phase requirements of its load. Refer to the unit nameplates for requirements.

### 460 V Models with Constant Air Flow Motors (LV015-LV070)

460 volt LV heat pumps with the constant airflow motor option require a properly sized neutral wire with the power supply wiring in addition to the three high voltage wires and the ground wire. These units employ a 265 V motor that requires power from one phase of the 460 V supply and the neutral wire.



The power supply ground wire should never be used as a neutral wire.

For 460 V models with constant air flow motors and a unit mounted disconnect switch, the power wires and neutral wire should be connected to the appropriate terminals on the disconnect switch and its enclosure. For units without a disconnect switch, power and neutral wires should be connected to a provided 4 pole terminal block in the unit electrical box.

### Transformer Settings for 208/230 V Units

As factory built, all 208/230 V units are wired for 230 V operation unless the wire for 208 V option is ordered. For jobsites with a 208 V power supply, the primary leads on the unit transformer will need to be changed from 240 V to 208 V. Refer to the unit wiring diagram for details.

## Electrical - Low Voltage

For heat pumps with PSC or constant torque fan motors, all thermostat wiring is connected to a terminal block located in the unit electrical box. For heat pumps with a constant air flow fan motor, thermostat wiring is connected to a removable terminal strip located on the ECM motor control board located in the electrical box. Refer to the unit wiring diagram for connection details.



Never route control wiring through the same conduit as power supply wiring.

Unless provided with DDC controls, the LV heat pump can be controlled by most commonly available single stage heat pump thermostats. Note that the reversing valve on the LV series is energized when the unit is in the cooling mode. Thermostats should be located on an interior wall away from supply ducts. Avoid locations subject to direct sunlight or drafts, or external walls. Thermostat wiring should be 18 AWG. Refer to the installation instructions for the thermostat for further details.



Exceptionally long runs of thermostat wire should be avoided to prevent voltage drops in the control circuit.

LV heat pumps are supplied with a 50 VA control transformer as standard. Models with DDC, hot gas reheat or an economizer are supplied with a 75 VA transformer. 75 VA and 100 VA transformers are available as optional components for most models (size 018 and larger for 100 VA). The VA capacity of the transformer should be considered when connecting low voltage accessories to the heat pump such as thermostats or solenoid valves.

Table #2 shows the VA draw of factory mounted components in the LV heat pump. The total VA draw of the heat pump internal components plus any attached accessories must be lower than the VA capacity of the unit control transformer.



Exceeding the transformer capacity can result in low control voltage, erratic unit operation or damage to the heat pump.

**Table 2: Low Voltage VA Draw**

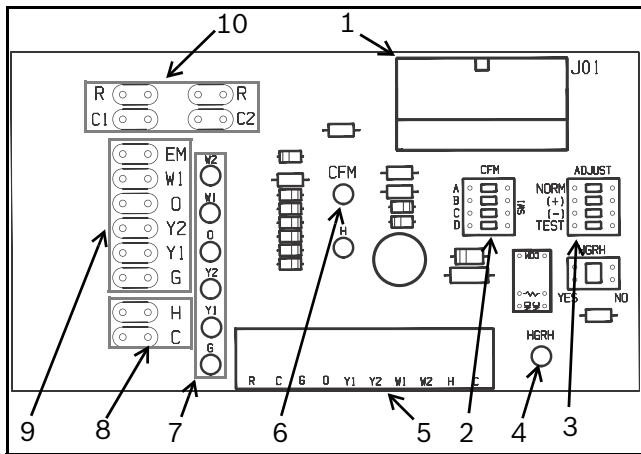
Standard Construction		Hot Gas Reheat or Economizer		Optional Components	
Component	VA	Component	VA	Component	VA
Blower Relay (PSC motors only)	6-7	Total from 'Standard'	22-26	Monitor Relay (VA draw per relay)	6-7
Reversing Valve Solenoid	8-9	Additional Control Relays	12-14	Internal 2 Way Motorized Valve	7
Compressor Contactor	6-8	Hot Gas Reheat Solenoid	8-9	LED Annunciator	1
UPM board	2				
<b>Total VA draw</b>	<b>22-26</b>	<b>Total VA draw</b>	<b>42-49</b>		

**UNITS CONTROLS - UPM**

**ECM Interface Board**

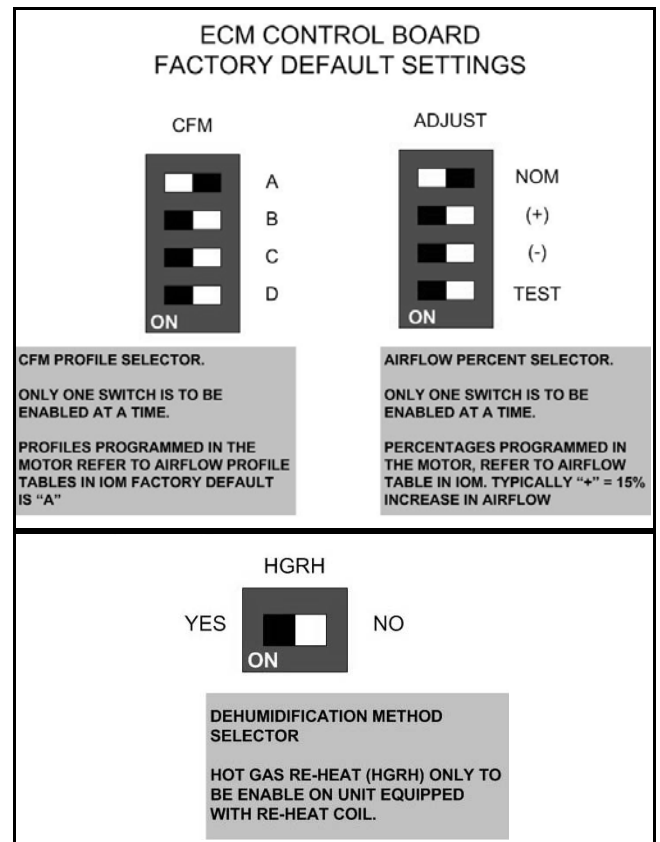
Thermostat wiring is connected to the 10 pin screw type terminal block on the lower center portion of the ECM Interface Board. In addition to providing a connecting point for thermostat wiring, the interface board also translates thermostat inputs into control commands for the Electronic Commutated Motor (ECM) DC fan motor and displays an LED indication of operating status. The thermostat connections and their functions are as follows:

- [9] Thermostat outputs
- [10] 24 VAC



**Figure # 5**

- [1] Motor harness plug
- [2] Blower CFM adjustment
- [3] Motor settings
- [4] Dehumidification indication
- [5] Thermostat digital inputs
- [6] CFM count indicator
- [7] Thermostat input status indication
- [8] Reheat digital outputs



**Figure # 6**

Y1	First Stage Compressor Operation
G	Fan
O	Reversing Valve (energized in cooling)
W1	Auxiliary Electric Heat (runs in conjunction with compressor)
NC	Transformer 24 VAC Common (extra connection)
C1	Transformer 24 VAC Common (primary connection)
R	Transformer 24 VAC Hot
H	Dehumidification Mode

Just above the connector block is a single red LED labeled CFM that will blink intermittently when the unit is running and may flicker when the unit is off. This LED indicates the air delivery of the blower at any given time. 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.



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

To the right of the thermostat connection block is a green LED labeled dehumidify. Just above and to the right of the thermostat connection block are two banks of DIP switches labeled ADJ and CFM. The ADJ bank DIP switches are labeled NORM, (+), (-), Test and HGHR position from the factory, however, airflow can be increased (+) or decreased (-) by 15% from the pre-programmed setting by relocating the DIP switch in this section. The TEST position is used to verify proper motor operation. If a motor problem is suspected, move the ADJ DIP switch to the TEST position and energize G on the thermostat connection block. If the motor ramps up to 100% power, then the motor itself is functioning normally. Always remember to replace the DIP switch to NORM, (+) or (-) after testing and reset the unit thermostat to restore normal operation.

HGRH switch is used to select operating mode between units equipped with:

1. Re-heat coils
2. Cool to dehumidify

When the HGRH DIP switch (Figure 7) is set to “YES” the heat pump is configured for hot gas reheat. With hot gas reheat, when there is a call for dehumidification (the “H” terminal on the thermostat is energized) the reheat digital outputs (Item 8 on Figure 6) will energize the hot gas reheat valve in the hot gas reheat circuit and the heat pump will start in dehumidification mode.

When the HGRH DIP switch is set to “NO” the heat pump is set for passive dehumidification. When “H” is energized and there is a call for cooling, the heat pump fan will operate at a lower speed to increase dehumidification while cooling. Note that in this mode, the heat pump will only dehumidify the space when it is running in cooling mode..



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.

The other DIP switch bank is used to select the proper program in the ECM motor for the unit.

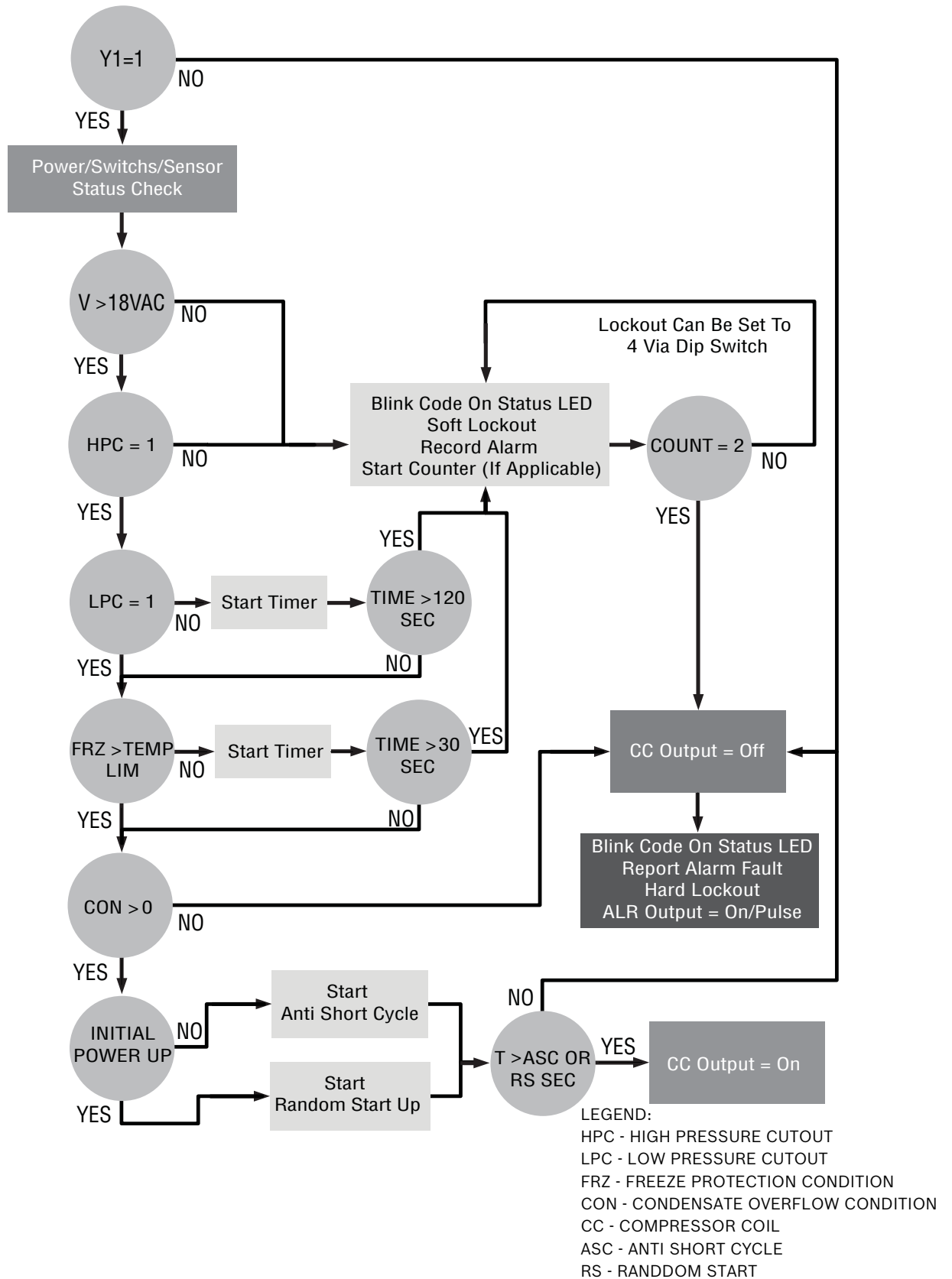


Always disconnect power before changing jumper positions on the interface board and reset the unit afterward.

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.

### Sequence of Operation

#### UPM Sequence of Operation (SOO) Flow Chart



## General

LV series heat pumps are designed to be controlled by a standard 1 heat / 1 cool heat pump thermostat. The heat pump control circuit operates on 24 VAC control voltage regardless of the unit supply voltage. If direct digital control is required then the heat pump needs to be supplied with a DDC control option.

Fan operation is controlled by the “G” terminal on the heat pump thermostat terminal block. When “G” is energized the unit fan motor will start operating. For heat pumps with PSC motors, the fan will immediately ramp up to 100% air flow. For heat pumps with constant torque ECM motors, the fan will ramp up to 100% air flow over a 30 second period. For heat pumps with constant air flow ECM motors the fan will ramp up to 70% air flow over a 30 second period if there is no call for compressor operation (“Y”). If there is a call for compressor operation along with a call for fan operation, then the fan will ramp to 100% air flow.

Compressor operation is controlled by the “Y” terminal on the heat pump thermostat terminal block. When “Y” is energized, a signal to start the compressor is sent to the Unit Protection Module (UPM). The UPM checks a number of safety features before then starting the compressor. If any of the safety features connected to the UPM is in a fault condition, the UPM will not start the compressor and will flash a fault code on the red status LED indicating the nature of the fault.

Additionally the UPM will delay compressor operation randomly on initial start up (random start delay) and will prevent the compressor from restarting with less than 5 minutes of off time (anti short cycle delay). Once all faults are cleared and the time delays are satisfied, the UPM will energize the compressor. The compressor will operate as long as the thermostat calls for “Y” and there are no faults. Refer to the troubleshooting chart for fault diagnostics.

## Cooling and Heating Modes

LV series heat pumps operate in cooling with the reversing valve energized. When the “O” terminal is energized, the heat pump will be in the cooling mode, however, will not be actively cooling until the “Y” and “G” terminals are also energized. If the “Y” and “G” terminals are energized without the “O” terminal, then the heat pump will operate in the heating mode.

## UPM Safety Features

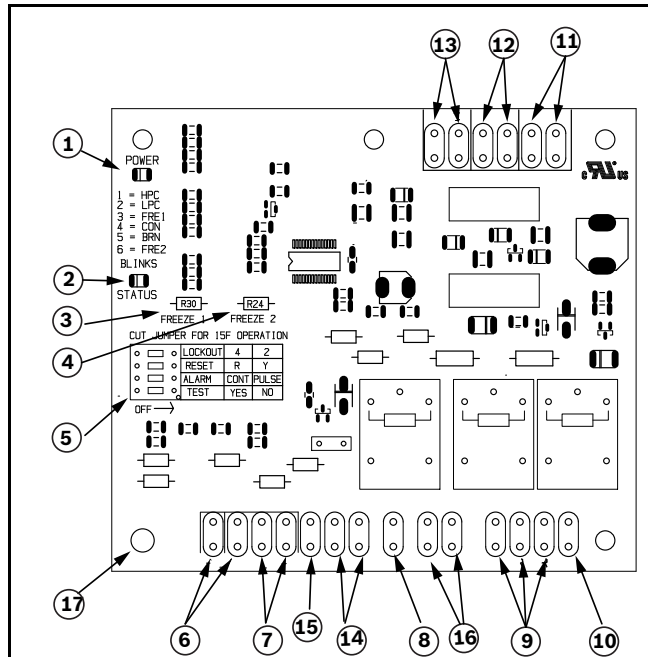


Figure # 7

- [1] Board Power Indicator
- [2] UPM Status LED Indicator
- [3] Water Coil Freeze Protection Temperature Selection
- [4] Air Coil Freeze Protection Temperature Selection
- [5] UPM Board Settings
- [6] Water Coil Freeze Connection
- [7] Air Coil Freeze Connection
- [8] LED 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.



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 expansion valve or capillary tube. 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.

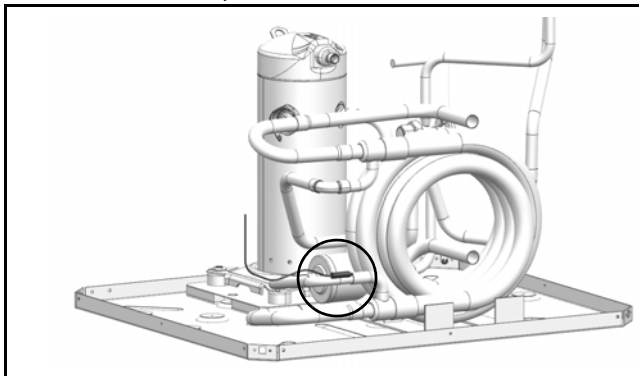


Figure # 8

- 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 30°F. (Figures #8 and #9)

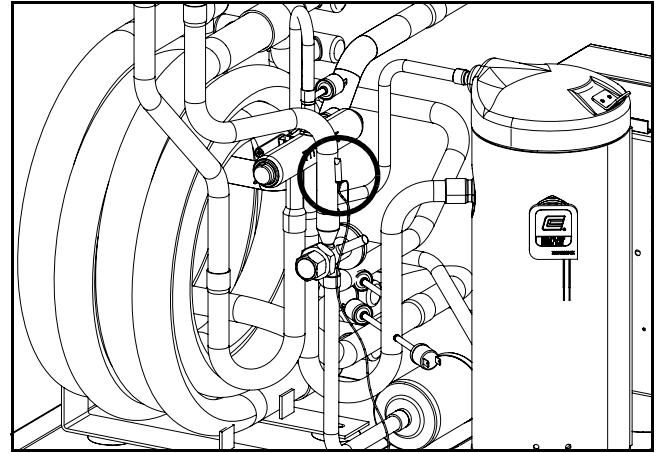


Figure # 9

- 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 #10)



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.

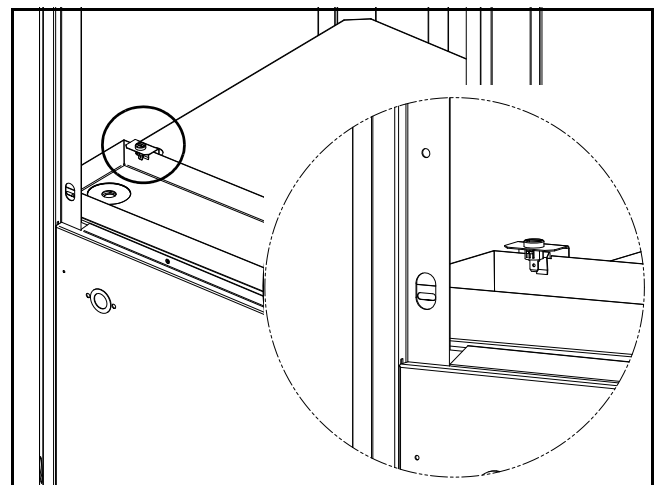


Figure # 10

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

Table 3: UPM Fault Blink Codes		
LED Blinks	Fault	Fault Criteria
None	None	All fault conditions nominal
1	High Pressure	Refrigerant discharge pressure has exceeded 600 PSIG
2	Low Pressure	Refrigerant suction pressure has fallen below 40 PSIG
3	Water Coil Freeze Condition	Refrigerant temperature to the water coil has fallen below 30°F for 30 seconds
4	Condensate Overflow	Condensate levels in the unit drain pan are too high
5	Air Coil Freeze Condition	Refrigerant temperature to the air coil has fallen below 30°F for 30 seconds
6	Brown Out	Control voltage has fallen below 18 VAC

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 (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.



It is recommended to have a flow switch to prevent the unit from running if water flow is lost.

- **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 Thermostat Connections

## OPTIONS

### Extended Range Option

LV heat pumps are supplied standard with capillary style expansion device tuned to typical boiler/tower system operating conditions. For applications that will experience more extreme fluid flow rates or temperatures (heating fluid temperatures below 50°F and/or cooling fluid temperatures below 60°F or above 100°F), an extended range option is required.

The extended range option on the LV consists of a bi-flow, balanced port thermal expansion valve and an insulated water-to-refrigerant heat exchanger. With the extended range option installed LV units can provide heating with fluid temperatures as low as 25°F and as high as 80°F and cooling with fluid temperatures as low as 45°F and as high as 120°F.

### Unit Mounted Non-Fused Disconnect Switch

LV heat pumps can be supplied with an optional unit mounted disconnect switch mounted to the electrical corner post of the unit.

Field electrical wiring is connected to the switch and the switch then routes power to the heat pump electrical box. When the switch is in the "OFF" position, the heat pump electrical box is completely de-energized.

## Hot Gas Reheat

(Available on size 015 and larger)

LV series heat pumps size 015 and larger can be provided with hot gas reheat for active dehumidification. In operation hot gas reheat dehumidifies space by cooling the air and removing moisture and then reheating the air back to a neutral temperature using waste heat from the compressor. The net effect is to decrease the relative humidity of the space without changing the sensible temperature.

The major components of the hot gas reheat option are the hot gas reheat coil, the reheat solenoid valve and the control circuit. When the control circuit energizes the heat pump in reheat mode, the heat pump will operate in the cooling mode. The hot gas solenoid valve diverts the compressor discharge gas to the reheat coil which is mounted downstream of the unit evaporator. This hot gas re-heats the cooled air coming off of the evaporator.

To function, heat pumps with hot gas reheat must be controlled by both a thermostat and a humidistat (or a combination thermostat/humidistat). The humidistat must provide a dry contact closure on a rise in humidity above set point.



Note that the ability of the reheat coil to reheat cooled air back to a neutral temperature is affected by the water temperature of the system.

At water temperatures of 85 deg F, the reheat coil can recover 95% to 100% of the sensible capacity of the evaporator. At water temperatures below 60 deg F, the reheat coil can only recover 5% to 25% of the sensible capacity of the evaporator. Refer to the unit wiring diagram for control circuit details.

## Hot Gas Bypass

(Available on size 024 and larger)

The hot gas bypass option can be used to reduce cooling capacity in low air temperature applications such as applications with a large percentage of outside air.

As the air temperature entering the unit drops, the suction pressure and evaporating temperature start to drop as well.

At an evaporating temperature of 40°F the hot gas bypass valve will start to divert a portion of the hot compressor discharge gas to the low temperature liquid entering the evaporator coil. This hot gas serves to warm the evaporator coil and reduces the cooling capacity of the heat pump.



Note that the hot gas bypass valve is inoperative in the heating mode.

## Internal 2-Way Water Valve

In many applications, including variable pumping and well water installations, a motorized water valve is required on the heat pump water circuit. On the LV series this water valve can be factory mounted and wired internally to the unit.

The LV series internal water valve option features a 24VAC motorized water valve rated to 450 psig working pressure. This valve is wired to open on a thermostat call for compressor operation (heating or cooling) and will remain open as long as the thermostat calls. The valve can remain seated with up to 20 psi of back pressure on all sizes.

The valve consists of two main parts: the valve body and the actuator. The valve body is brazed into the leaving water line of the heat pump and is a permanent part of the unit. The valve actuator can be easily removed from the valve body for service.

Refer to the water side pressure drop table in the troubleshooting section of this manual to determine the appropriate pressure drop across the heat pump with and without the water valve option.



Note that the 2-Way Water Valve option will add additional pressure drop between the water in and water out connections of the heat pump.



Note that this water valve cannot be used as an isolation valve.

## Economizer

LV series heat pumps can be provided an optional water side economizer. The water side economizer option allows a cooling demand to be satisfied by circulating cold water through a water-to-air heat exchanger (economizer coil) mounted to the return air opening of the heat pump instead of energizing the compressor. The major components of the economizer option are the water-to-air heat exchanger, the three way water diverting valve, the aquastat and the unit control circuit.

The economizer option operates in the following sequence:

- When the unit thermostat calls for cooling operation AND the economizer aquastat indicates that the supply water temperature is below the aquastat set point, then heat pump switches from compressor cooling to economizer cooling mode.
- In economizer cooling mode the three way diverting valve shifts, diverting water through the economizer coil and then to the condenser coil. The unit fan operates but the compressor does not start. This mode effectively cools the air passing through the heat pump with the cold water supply instead of compressor cooling.
- If the call for cooling is satisfied, then the heat pump fan simply shuts off.
- If, during a call for cooling, the supply water temperature climbs above the aquastat set point, then the three way valve will divert water back to the condenser coil and the heat pump compressor will start in the cooling mode.



Note that the economizer coil incorporates its own drain pan to collect condensate from the coil. This pan **MUST** be independently trapped and piped into the drain line for the heat pump.

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The LV series economizer option is designed for **free return** applications. If the heat pump is to be connected to return air duct work, the economizer may need to be slightly modified.

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The LV series economizer is designed for **cooling only**. If heating economizer operation is desired, consult the factory for applications and design information.

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Refer to the unit wiring diagram for control circuit details.

## LED Annunciator

LV series heat pumps can be equipped with an optional LED annunciator kit. This LED kit can provide 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).

## Flow Proving Switch

LV series heat pumps can be equipped with an optional flow proving switch. This device senses a pressure drop across the water side of the condenser coil indicating water flow. When the pressure drop rises to a pre-set value, the flow proving switch will enable the compressor. If the pressure drop across the condenser does not reach the required value, then the unit compressor is disabled.

## DDC Controls

Factory mounted DDC controls are available as an option on LV series heat pumps. Please refer to the DDC control manuals and literature for details on this option.

## APPLICATION CONSIDERATIONS

### Boiler/Cooling Tower Systems

To assure adequate cooling and heating performance, the cooling tower and boiler water loop temperature should be maintained between 50°F to 75°F in the heating mode and 60°F to 110°F in the cooling mode. In the cooling mode, heat is rejected from the unit into the water loop. A cooling tower provides evaporative cooling to the loop fluid; thus, maintaining a constant supply temperature to the unit. When utilizing an open cooling tower, chemical water treatment is mandatory to ensure the water is free of corrosive materials.

A secondary heat exchanger (plate frame between the unit and the open cooling tower) may also be used. In the heating mode, heat is absorbed from the water loop to the unit. A boiler can be utilized to maintain the loop within the proper temperature range.



It is imperative that all air is eliminated from the closed loop side of the heat exchanger to prevent condenser fouling.

No unit should be connected to the supply or return piping until the water system has been completely cleaned and flushed to remove 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. See Figure #11

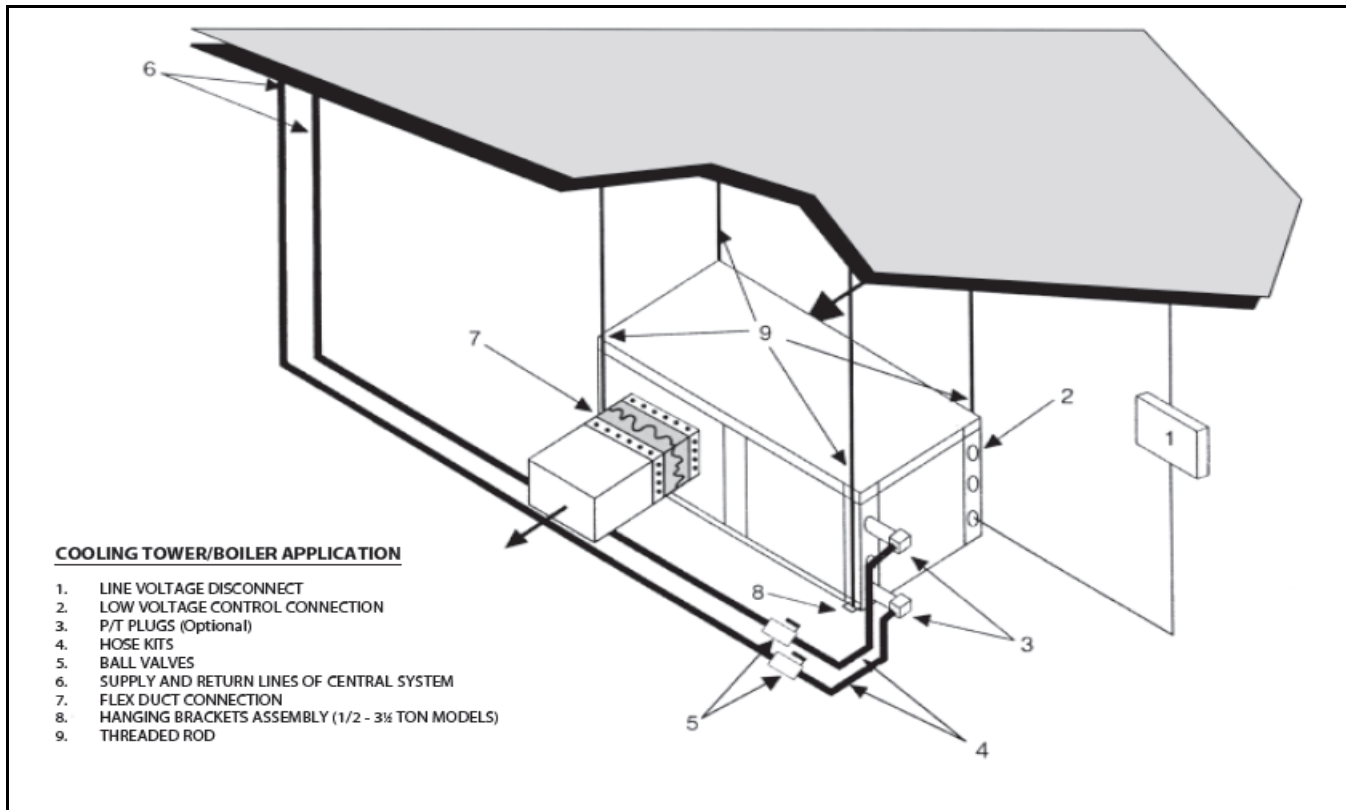


Figure # 11 Cooling/Boiler Application



Note: See Figure #3 for Condensate Drain

### Geothermal Closed Loop Systems

Operation of an LV Series unit on a closed loop application requires the extended range option.



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 Ground Loop Pumping Package (GLP), makes the installation easy. Anti-freeze solutions must be utilized when low loop temperatures are expected to occur. Refer to the installation manuals for more specific instructions. See Figure #12

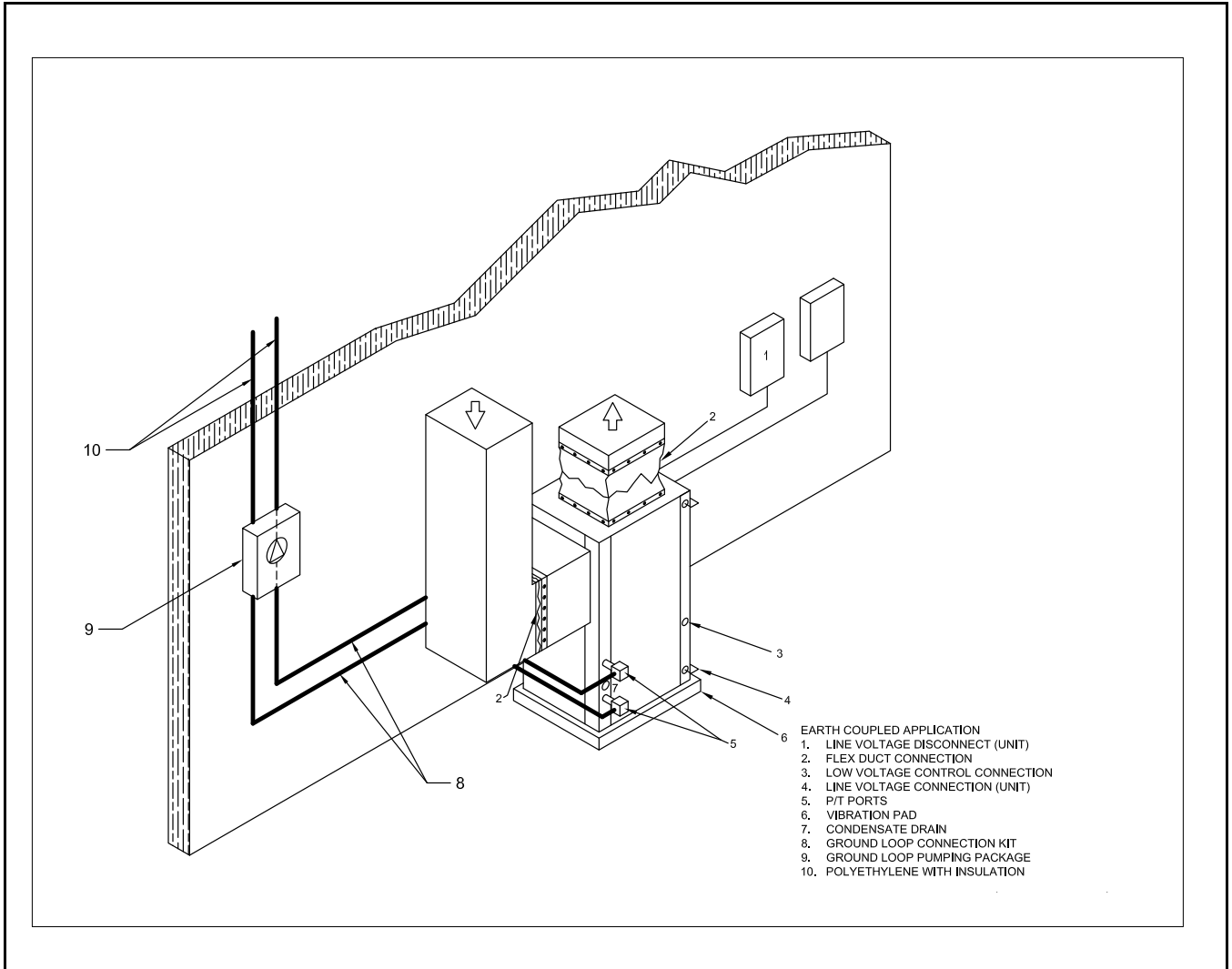


Figure # 12 Earth Coupled Application



Note: See Figure #3 for Condensate Drain

## Open Well Water Systems

When a water well is used exclusively for supplying water to the heat pump, the pump should operate only when the heat pump operates. A 24 volt, double pole single throw (DP/ST) contactor can be used to operate the well pump with the heat pump. When two or more units are supplied from one well, the pump can be wired to operate independently from either unit. Two 24-volt double pole single throw relays wired in parallel are required.

An upsized VA transformer may be required in either case. The discharge water from the heat pump is not contaminated in any manner and can be disposed of in various ways depending on local codes (i.e. discharge well, dry well, storm sewer, drain field, stream, pond, etc.) Figure #13

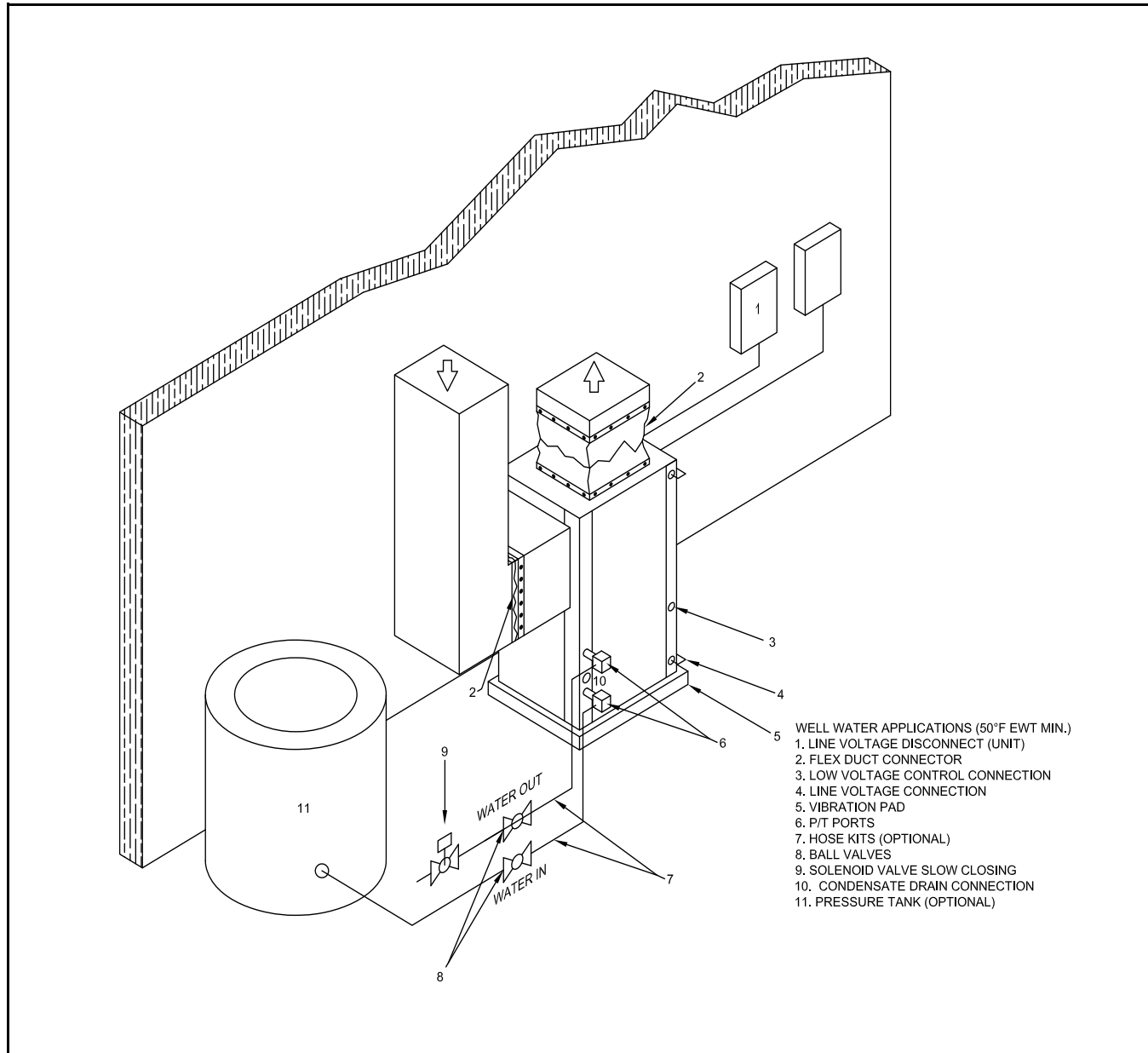


Figure # 13 Well Water Applications



Note: See Figure #3 for Condensate Drain

## CERTIFIED PERFORMANCE TABLE

Table 4: LV Series AHRI Ratings

MODEL	PSC Motor (Base)							
	WLHP				GLHP			
	Cooling Capacity	EER	Heating Capacity	COP	Cooling Capacity	EER	Heating Capacity	COP
LV007	6,100	12.20	7,800	5.30	6,800	15.10	4,900	3.40
LV009	8,200	12.40	9,900	4.70	8,700	14.60	5,700	3.20
LV012	10,900	11.80	13,000	4.30	11,800	14.00	8,700	3.10
LV015	13,400	12.10	16,100	4.20	14,200	14.00	11,300	3.10
LV018	19,400	13.40	22,200	4.60	21,200	15.80	14,300	3.50
LV024	23,400	13.40	26,600	4.40	25,000	15.50	17,000	3.40
LV030	29,200	13.10	33,400	4.30	31,000	15.30	20,900	3.20
LV036	37,900	14.70	41,800	4.60	39,900	16.90	26,900	3.50
LV041	39,500	13.60	44,600	4.20	41,200	15.60	29,400	3.30
LV042	40,000	12.60	46,300	4.20	42,600	14.50	31,000	3.20
LV048	45,900	12.90	56,400	4.30	48,800	14.90	35,400	3.40
LV060	57,900	13.20	67,200	4.20	60,100	15.00	46,900	3.20
LV070	64,000	13.30	72,800	4.40	66,400	15.00	50,800	3.40
MODEL	ECM Motor (Option)							
	WLHP				GLHP			
	Cooling Capacity	EER	Heating Capacity	COP	Cooling Capacity	EER	Heating Capacity	COP
LV015	13,700	13.90	15,500	4.40	14,400	16.20	10,700	3.30
LV018	19,700	14.20	21,900	4.70	21,500	17.00	14,100	3.60
LV024	23,800	14.30	26,200	4.60	25,400	16.50	16,700	3.50
LV030	30,000	14.80	32,800	4.60	31,600	17.40	20,400	3.40
LV036	38,200	15.40	41,400	4.70	40,200	17.70	26,500	3.60
LV041	40,500	15.70	43,700	4.40	42,200	17.70	28,500	3.60
LV042	40,900	14.10	45,300	4.40	43,500	16.30	30,100	3.50
LV048	46,800	14.10	55,600	4.50	49,600	16.20	34,600	3.60
LV060	59,000	14.10	66,400	4.20	61,100	16.40	46,200	3.30
LV070	65,200	14.60	71,800	4.60	67,600	16.60	50,000	3.50

**Notes:**

GLHP ratings require an extended range option

ECM motors can be either constant torque or constant CFM

Ratings based upon AHRI/ANSI 13256-1 with 1" disposable filter

## FAN MOTOR OPTIONS

### Permanent Split Capacitor Motors (PSC)

The standard motor for all LV series heat pumps is a PSC motor. For all models other than 575 V units, the supplied motor is a three speed motor. 575 V motors are single speed. If a speed change is required, follow the instructions below:

1. Disconnect power to the heat pump.
2. For units with leaded motors, remove the front access cover.
3. Remove the fan speed wire from the fan relay. Clip the ¼” quick connect from the lead and cap the unused lead.

4. Uncap the desired fan speed wire and terminate with a ¼” quick connect. Connect to the fan relay.
5. If the motor is a 460 V motor and the speed is changed from high to medium or low, connect the high speed motor lead to the orange intermediate winding lead instead of simply capping it.

Refer to the PSC motor performance tables for heat pump blower performance with the PSC motor option.

Model	Fan Speed	Rated Airflow												
			0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20
LV-007	Low		370	340	295	250	-	-	-	-	-	-	-	-
	Med	300	390	360	330	300	260	-	-	-	-	-	-	-
	Hi		410	380	350	315	280	210	-	-	-	-	-	-
LV-009	Low		370	340	295	250	-	-	-	-	-	-	-	-
	Med		390	360	330	300	260	-	-	-	-	-	-	-
	Hi	350	410	380	350	315	280	210	-	-	-	-	-	-
LV-012	Low		300	290	290	300	-	-	-	-	-	-	-	-
	Med		380	380	360	330	290	-	-	-	-	-	-	-
	Hi	400	420	400	380	360	340	320	-	-	-	-	-	-
LV-015	Low		320	300	280	-	-	-	-	-	-	-	-	-
	Med		380	370	360	340	330	-	-	-	-	-	-	-
	Hi	500	520	500	480	460	430	400	340	-	-	-	-	-
LV-018	Low		720	710	700	-	-	-	-	-	-	-	-	-
	Med	650	810	790	760	730	680	590	-	-	-	-	-	-
	Hi		1010	970	920	870	800	680	530	340	-	-	-	-
LV-024	Low		750	740	710	670	620	-	-	-	-	-	-	-
	Med		830	820	800	770	720	620	-	-	-	-	-	-
	Hi	850	1050	1000	950	910	840	710	570	490	-	-	-	-
LV-030	Low		975	910	870	740	640	-	-	-	-	-	-	-
	Med		1050	980	920	830	760	700	-	-	-	-	-	-
	Hi	950	1250	1170	1120	1070	940	830	740	650	-	-	-	-
LV-036	Low		1290	1250	1200	1150	1080	1000	-	-	-	-	-	-
	Med		1410	1350	1290	1220	1150	1060	900	-	-	-	-	-
	Hi	1200	1500	1440	1370	1290	1210	1120	1000	900	-	-	-	-



**Table 5: PSC Motor Performance Data**

<b>LV-041</b>	Low		990	990	970	950	920	860	-	-	-	-	-	-
	Med		1220	1190	1150	1120	1080	1020	940	-	-	-	-	-
	Hi	1200	1450	1380	1320	1250	1190	1120	1040	960	-	-	-	-
<b>LV-042</b>	Low		1210	1210	1190	1160	1120	1080	-	-	-	-	-	-
	Med		1460	1450	1430	1390	1330	1250	1160	-	-	-	-	-
	Hi	1400	1750	1710	1670	1620	1560	1460	1330	1210	1080	-	-	-
<b>LV-048</b>	Low		1450	1440	1420	1400	1360	1320	-	-	-	-	-	-
	Med		1700	1670	1630	1580	1530	1470	1400	-	-	-	-	-
	Hi	1600	1930	1870	1810	1740	1670	1600	1520	1430	1340	-	-	-
<b>LV-060</b>	Low		1560	1550	1540	1530	1505	1475	1440	1400	-	-	-	-
	Med		1890	1880	1870	1860	1825	1790	1730	1670	1590	1500	-	-
	Hi	2000	2220	2200	2150	2100	2050	2000	1940	1870	1800	1700	1590	-
<b>LV-070</b>	Low		1570	1560	1550	1540	1530	1505	1475	1440	1400	-	-	-
	Med		1900	1890	1880	1870	1860	1825	1790	1730	1670	1590	1500	-
	Hi	2100	2240	2220	2200	2150	2100	2050	2000	1940	1870	1800	1700	1590

Note: 575V models employ 1 speed motors (high only)

## 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 LV series is offered with a 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.

**Table 6: Constant Torque Blower Motor Data**

Model	Tap #	Rated Airflow												
			0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20
LV-015	1		480	440	410	370	340	-	-	-	-	-	-	-
	2		530	490	450	420	380	340	-	-	-	-	-	-
	3	500	600	560	510	470	440	410	370	-	-	-	-	-
	4		650	600	560	520	500	480	440	380	-	-	-	-
	5		710	660	620	580	550	520	490	470	-	-	-	-
LV-018	1		630	590	560	530	490	-	-	-	-	-	-	-
	2	650	720	700	670	630	600	560	-	-	-	-	-	-
	3		790	770	750	710	670	620	560	-	-	-	-	-
	4		910	890	850	810	740	670	590	520	-	-	-	-
	5		1010	970	920	860	810	750	660	530	-	-	-	-
LV-024	1		650	610	580	560	520	-	-	-	-	-	-	-
	2		740	720	690	660	620	570	-	-	-	-	-	-
	3		850	830	800	770	730	690	630	-	-	-	-	-
	4	850	950	920	890	870	840	820	770	650	-	-	-	-
	5		1160	1110	1050	990	920	800	670	560	-	-	-	-
LV-030	1		1020	1000	970	920	-	-	-	-	-	-	-	-
	2		1110	1060	1000	940	880	850	-	-	-	-	-	-
	3	950	1120	1070	1010	960	900	850	740	-	-	-	-	-
	4		1160	1080	1010	950	880	840	750	550	-	-	-	-
	5		1150	1090	1020	960	890	850	760	540	-	-	-	-
LV-036	1		1120	1090	1055	1030	1000	-	-	-	-	-	-	-
	2		1260	1230	1200	1170	1140	1080	-	-	-	-	-	-
	3	1200	1330	1293	1253	1210	1167	1100	1030	-	-	-	-	-
	4		1400	1357	1307	1250	1193	1120	1040	963	-	-	-	-
	5		1470	1420	1360	1290	1220	1140	1050	970	890	-	-	-

**Table 6: Constant Torque Blower Motor Data**

<b>LV-041</b>	1		985	955	920	890	-	-	-	-	-	-	-	-
	2		1130	1100	1070	1030	1000	-	-	-	-	-	-	-
	3	1200	1210	1180	1143	1100	1060	1010	-	-	-	-	-	-
	4		1290	1260	1217	1170	1120	1050	977	-	-	-	-	-
	5		1370	1340	1290	1240	1180	1090	1000	920	-	-	-	-
<b>LV-042</b>	1		1270	1250	1230	1210	-	-	-	-	-	-	-	-
	2		1440	1420	1410	1410	1400	1380	1340	-	-	-	-	-
	3	1400	1540	1530	1510	1500	1490	1470	1430	1350	-	-	-	-
	4		1650	1630	1610	1600	1580	1530	1460	1360	1240	-	-	-
	5		1730	1720	1700	1670	1620	1570	1490	1380	1260	1100	-	-
<b>LV-048</b>	1		1390	1370	1350	1320	-	-	-	-	-	-	-	-
	2		1600	1580	1550	1530	1510	-	-	-	-	-	-	-
	3	1600	1730	1700	1670	1650	1630	1600	1580	1540	-	-	-	-
	4		1830	1810	1780	1760	1740	1710	1670	1600	1520	-	-	-
	5		1930	1910	1880	1860	1830	1780	1720	1640	1540	1420	-	-
<b>LV-060</b>	1		1900	1880	1860	1820	-	-	-	-	-	-	-	-
	2		2000	1970	1950	1920	1890	1860	-	-	-	-	-	-
	3	2000	2110	2090	2060	2030	2010	1970	1940	1910	1880	-	-	-
	4		2220	2200	2170	2140	2110	2080	2050	2060	2050	2000	1920	-
	5		2340	2320	2290	2260	2230	2210	2180	2150	2110	2070	2000	1930
<b>LV-070</b>	1		2050	2010	1970	1930	-	-	-	-	-	-	-	-
	2		2150	2120	2080	2030	1990	1960	-	-	-	-	-	-
	3	2100	2270	2230	2200	2160	2120	2080	2040	2010	1980	-	-	-
	4		2390	2350	2320	2280	2250	2200	2160	2130	2100	2070	2030	-
	5		2520	2480	2450	2420	2380	2330	2290	2260	2220	2170	2100	2020

updated 1/15/13

## Constant Airflow Motors (ECM)

For installations where constant air delivery is critical or where external static pressure drop can vary greatly (such as with high MERV value filters) the LV series is offered with a constant air flow ECM motor option. This option provides ECM motor efficiency combined with a constant air delivery across a wide range of external static pressures. These motors dynamically adjust their power output to precisely match the desired air flow on a pre-programmed fan curve. Additionally these motors feature:

1. A low CFM ventilation feature that circulates air at 70% of full load when fan only is called.
2. A passive dehumidification mode that reduces air flow during a cooling call when dehumidification is also required – this reduces the sensible heat ratio of the cooling coil and extends cooling run time to more effectively dehumidify. (refer to the ECM Interface Board section of this manual)

3. 3 speed settings per model. Units are factory set to “NORM” but can be field adjusted to “+” to increase CFM by 15% or to “-“ to reduce CFM by 15%. (refer to the ECM Interface Board section of this manual)
4. A “TEST” mode that operates the motor at a 70% torque setting. This setting can be used to diagnose programming problems in the motor itself. (refer to the ECM Interface Board section of this manual)
5. A CFM indicator light that provides a blink for each 100 CFM of air delivered (note that this blink code is approximate and should not replace test and balancing).

Refer to the constant air flow motor performance tables for heat pump blower performance with the constant air flow motor option.

**Table 7: Constant Airflow Motor Performance Table**

Model	Fan Speed	Rated Airflow													
			0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	
LV-015	A - Low		450	450	450	450	450	450	450	450	440	440	430	-	-
	A - Normal	500	500	500	500	500	500	500	500	500	480	470	460	-	-
	A - Hi		580	580	580	580	580	580	580	580	570	560	550	-	-
LV-018	B - Low		550	540	540	540	540	540	540	540	530	520	500	-	-
	B - Normal	650	650	650	650	650	650	650	650	640	630	610	590	-	-
	B - Hi		750	750	750	750	750	750	750	740	730	710	690	-	-
LV-024	C - Low		720	720	720	720	720	720	720	720	700	650	560	-	-
	C - Normal	850	850	850	850	850	850	850	850	850	850	800	700	-	-
	C - Hi		960	960	960	960	960	960	960	960	960	880	790	-	-
LV-030	D - Low		810	810	810	810	810	810	810	810	810	810	810	-	-
	D - Normal	950	950	950	950	950	950	950	950	950	950	950	950	-	-
	D - Hi		1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	-	-
LV-036	A - Low		1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	-	-
	A - Normal	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	-	-
	A - Hi		1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	-	-
LV-041	A - Low		1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	-	-
	A - Normal	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	-	-
	A - Hi		1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	-	-

Table 7: Constant Airflow Motor Performance Table

<b>LV-042</b>	B - Low		1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	-	-	
	B - Normal	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	-	-
	B - Hi		1630	1630	1630	1630	1630	1630	1630	1630	1630	1630	1630	-	-
<b>LV-048</b>	A - Low		1360	1360	1360	1360	1360	1360	1360	1360	1360	1360	1360	-	-
	A - Normal	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	-	-
	A - Hi		1840	1840	1840	1840	1840	1840	1840	1840	1840	1840	1840	-	-
<b>LV-060</b>	A - Low		1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	-
	A - Normal	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	-
	A - Hi		2220	2220	2220	2220	2220	2220	2220	2220	2220	2220	2220	2220	-
<b>LV-070</b>	B - Low		1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	-
	B - Normal	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	-
	B - Hi		2330	2330	2330	2330	2330	2330	2330	2330	2330	2330	2330	2330	-

Note: Air flow is 70% of tabulated values during fan only operation. Air flow is 80% of tabulated value during passive dehumidification mode when enabled.

## STANDARD BLOWER MOTOR

Table 8: Electrical Data Table - Standard Blower Motor

MODEL	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor			Fan Motor	Fan Motor HP	Total Unit FLA	Min Circuit	Max Fuse
				QTY	RLA	LRA					
LV007	1	208-230/60/1	187/253	1	2.6	17.7	0.96	0.1	3.56	4.2	15
	2	265/60/1	238/292	1	2.6	13.5	0.96	0.1	3.56	4.2	15
LV009	1	208-230/60/1	187/253	1	3.4	22.2	0.96	0.1	4.36	5.2	15
	2	265/60/1	238/292	1	2.9	18.8	0.85	0.1	3.75	4.5	15
LV012	0	115/60/1	103/126	1	9.6	58.4	2.2	0.1	11.8	14.2	20
	1	208-230/60/1	187/253	1	4.6	28	0.96	0.1	5.56	6.7	15
	2	265/60/1	238/292	1	3.8	22.2	0.85	0.1	4.65	5.6	15
LV015	1	208-230/60/1	187/253	1	5.6	29	0.96	0.1	6.56	8.0	15
	2	265/60/1	238/292	1	4.6	20	0.85	0.1	5.45	6.6	15
LV018	1	208-230/60/1	187/253	1	6.5	43	1.8	0.25	8.3	9.9	15
	2	265/60/1	238/292	1	5.8	46	1.6	0.25	7.4	8.9	15
LV024	1	208-230/60/1	187/253	1	7.4	43	1.8	0.25	9.2	11.1	15
	2	265/60/1	238/292	1	6.7	46	1.6	0.25	8.3	10.0	15
	3	208-230/60/3	187/253	1	5.9	63	1.8	0.25	7.7	9.2	15
	4	460/60/3	414/506	1	2.9	30	0.9	0.25	3.8	4.5	15
LV030	1	208-230/60/1	187/253	1	9.9	54	1.8	0.25	11.7	14.2	20
	2	265/60/1	238/292	1	8.5	46	1.6	0.25	10.1	12.2	20
	3	208-230/60/3	187/253	1	6.9	63	1.8	0.25	8.7	10.4	15
	4	460/60/3	414/506	1	5.4	30	0.9	0.25	6.3	7.7	15
LV036	1	208-230/60/1	187/253	1	13	74	4.4	0.5	17.4	20.7	30
	2	265/60/1	238/292	1	11.3	67	3.3	0.5	14.6	17.4	25
	3	208-230/60/3	187/253	1	7.8	68	4.4	0.5	12.2	14.2	20
	4	460/60/3	414/506	1	3.9	34	1.8	0.5	5.7	6.7	15
LV041	1	208-230/60/1	187/253	1	13.6	88	4.4	0.5	18	21.4	35
	3	208-230/60/3	187/253	1	8.8	68	4.4	0.5	13.2	15.4	20
	4	460/60/3	414/506	1	4.4	34	1.8	0.5	6.2	7.3	15
LV042	1	208-230/60/1	187/253	1	13.6	88	4.4	0.5	18	21.4	35
	3	208-230/60/3	187/253	1	8.8	68	4.4	0.5	13.2	15.4	20
	4	460/60/3	414/506	1	4.4	34	1.8	0.5	6.2	7.3	15
LV048	1	208-230/60/1	187/253	1	15.7	84	4.4	0.75	20.1	24.0	35
	3	208-230/60/3	187/253	1	11	88	4.4	0.75	15.4	18.2	25
	4	460/60/3	414/506	1	5.4	44	2.8	0.75	8.2	9.6	15
	5	575/60/3	517/633	1	4.4	36	2.6	0.75	7	8.1	15
LV060	1	208-230/60/1	187/253	1	26.3	134	5.5	0.75	31.8	38.4	60
	3	208-230/60/3	187/253	1	15.6	110	5.5	0.75	21.1	25.0	40
	4	460/60/3	414/506	1	7.8	52	2.8	0.75	10.6	12.6	20
	5	575/60/3	517/633	1	5.8	38.9	2.6	0.75	8.4	9.9	15

**Table 8: Electrical Data Table - Standard Blower Motor**

<b>LV070</b>	1	208-230/60/1	187/253	1	28.3	178	5.5	0.75	33.8	40.9	60
	3	208-230/60/3	187/253	1	19.2	136	5.5	0.75	24.7	29.5	45
	4	460/60/3	414/506	1	8.7	66.1	2.8	0.75	11.5	13.7	20
	5	575/60/3	517/633	1	6.9	55.3	2.6	0.75	9.5	11.2	15

## Constant Torque ECM Blower Motor

Table 9: Electrical Data Table - Constant Torque ECM Blower Motor

MODEL	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor			Fan Motor	Fan Motor HP	Total Unit FLA	Min Circuit	Max Fuse
				QTY	RLA	LRA					
LV015	1	208-230/60/1	187/253	1	5.6	29	2.8	0.33	8.4	9.8	15
	2	265/60/1	238/292	1	4.6	20	2.6	0.33	7.2	8.4	15
LV018	1	208-230/60/1	187/253	1	6.5	43	2.8	0.33	9.3	10.9	15
	2	265/60/1	238/292	1	5.8	46	2.6	0.33	8.4	9.9	15
LV024	1	208-230/60/1	187/253	1	7.4	43	2.8	0.33	10.2	12.1	15
	2	265/60/1	238/292	1	6.7	46	2.6	0.33	9.3	11.0	15
	3	208-230/60/3	187/253	1	5.9	63	2.8	0.33	8.7	10.2	15
	4	460/60/3	414/506	1	2.9	30	2.1	0.5	5	5.7	15
LV030	1	208-230/60/1	187/253	1	9.9	54	2.8	0.33	12.7	15.2	25
	2	265/60/1	238/292	1	8.5	46	2.6	0.33	11.1	13.2	20
	3	208-230/60/3	187/253	1	6.9	63	2.8	0.33	9.7	11.4	15
	4	460/60/3	414/506	1	5.4	30	2.1	0.5	7.5	8.9	15
LV036	1	208-230/60/1	187/253	1	13	74	4.1	0.5	17.1	20.4	30
	2	265/60/1	238/292	1	11.3	67	3.9	0.5	15.2	18.0	25
	3	208-230/60/3	187/253	1	7.8	68	4.1	0.5	11.9	13.9	20
	4	460/60/3	414/506	1	3.9	34	2.1	0.5	6	7.0	15
LV041	1	208-230/60/1	187/253	1	13.6	88	6	0.75	19.6	23.0	35
	3	208-230/60/3	187/253	1	8.8	68	6	0.75	14.8	17.0	25
	4	460/60/3	414/506	1	4.4	34	4.6	0.75	9	10.1	15
LV042	1	208-230/60/1	187/253	1	13.6	88	6	0.75	19.6	23.0	35
	3	208-230/60/3	187/253	1	8.8	68	6	0.75	14.8	17.0	25
	4	460/60/3	414/506	1	4.4	34	4.6	0.75	9	10.1	15
LV048	1	208-230/60/1	187/253	1	15.7	84	6	0.75	21.7	25.6	40
	3	208-230/60/3	187/253	1	11	88	6	0.75	17	19.8	30
	4	460/60/3	414/506	1	5.4	44	4.6	0.75	10	11.4	15
LV060	1	208-230/60/1	187/253	1	26.3	145	7.6	1	33.9	40.5	60
	3	208-230/60/3	187/253	1	15.6	123	7.6	1	23.2	27.1	40
	4	460/60/3	414/506	1	7.8	70	4	1	11.8	13.8	20
LV070	1	208-230/60/1	187/253	1	28.3	158	7.6	1	35.9	43.0	70
	3	208-230/60/3	187/253	1	19.2	155	7.6	1	26.8	31.6	50
	4	460/60/3	414/506	1	8.7	75	4	1	12.7	14.9	20



## Constant CFM ECM Blower Motor

Table 10: Electrical Data Table - Constant CFM ECM Blower Motor

MODEL	Voltage Code	Rated Voltage	Voltage Min/Max	Compressor			Fan Motor	Fan Motor HP	Total Unit FLA	Min Circuit	Max Fuse
				QTY	RLA	LRA					
LV015	1	208-230/60/1	187/253	1	5.6	29	2.8	0.33	8.4	9.8	15
	2	265/60/1	238/292	1	4.6	20	2.6	0.33	7.2	8.4	15
LV018	1	208-230/60/1	187/253	1	6.5	43	2.8	0.33	9.3	10.9	15
	2	265/60/1	238/292	1	5.8	46	2.6	0.33	8.4	9.9	15
LV024	1	208-230/60/1	187/253	1	7.4	43	2.8	0.33	10.2	12.1	15
	2	265/60/1	238/292	1	6.7	46	2.6	0.33	9.3	11.0	15
	3	208-230/60/3	187/253	1	5.9	63	2.8	0.33	8.7	10.2	15
	4	460/60/3	414/506	1	2.9	30	2.6	0.33	5.5	6.2	15
LV030	1	208-230/60/1	187/253	1	9.9	54	2.8	0.33	12.7	15.2	25
	2	265/60/1	238/292	1	8.5	46	2.6	0.33	11.1	13.2	20
	3	208-230/60/3	187/253	1	6.9	63	2.8	0.33	9.7	11.4	15
	4	460/60/3	414/506	1	5.4	30	2.6	0.33	8	9.4	15
LV036	1	208-230/60/1	187/253	1	13	74	4.3	0.5	17.3	20.6	30
	2	265/60/1	238/292	1	11.3	67	4.1	0.5	15.4	18.2	25
	3	208-230/60/3	187/253	1	7.8	68	4.3	0.5	12.1	14.1	20
	4	460/60/3	414/506	1	3.9	34	4.1	0.5	8	9.0	15
LV041	1	208-230/60/1	187/253	1	13.6	88	6.8	0.75	20.4	23.8	35
	3	208-230/60/3	187/253	1	8.8	68	6.8	0.75	15.6	17.8	25
	4	460/60/3	414/506	1	4.4	34	5.5	0.75	9.9	11.0	15
LV042	1	208-230/60/1	187/253	1	13.6	88	6.8	0.75	20.4	23.8	35
	3	208-230/60/3	187/253	1	8.8	68	6.8	0.75	15.6	17.8	25
	4	460/60/3	414/506	1	4.4	34	5.5	0.75	9.9	11.0	15
LV048	1	208-230/60/1	187/253	1	15.7	84	6.8	0.75	22.5	26.4	40
	3	208-230/60/3	187/253	1	11	88	6.8	0.75	17.8	20.6	30
	4	460/60/3	414/506	1	5.4	44	5.5	0.75	10.9	12.3	15
LV060	1	208-230/60/1	187/253	1	26.3	145	9.1	1	35.4	42.0	60
	3	208-230/60/3	187/253	1	15.6	123	9.1	1	24.7	28.6	45
	4	460/60/3	414/506	1	7.8	70	6.9	1	14.7	16.7	20
LV070	1	208-230/60/1	187/253	1	28.3	158	9.1	1	37.4	44.5	70
	3	208-230/60/3	187/253	1	19.2	155	9.1	1	28.3	33.1	50
	4	460/60/3	414/506	1	8.7	75	6.9	1	15.6	17.8	25

## UNIT START UP

1. Set the thermostat to the highest setting.
  2. Set the thermostat system switch to “COOL”, and the fan switch to the “AUTO” position. The reversing valve solenoid should energize. The compressor and fan should not run.
  3. Reduce the thermostat setting approximately 5 degrees below the room temperature.
  4. Verify the heat pump is operating in the cooling mode.
  5. Turn the thermostat system switch to the “OFF” position. The unit should stop running and the reversing valve should de energize.
  6. Leave the unit off for approximately (5) minutes to allow for system equalization.
  7. Turn the thermostat to the lowest setting.
  8. Set the thermostat switch to “HEAT”.
  9. Increase the thermostat setting approximately 5 degrees above the room temperature.
  10. Verify the heat pump is operating in the heating mode.
  11. Set the thermostat to maintain the desired space temperature.
  12. Check for vibrations, leaks, etc.
2. An annual “checkup” is recommended by a licensed refrigeration mechanic. Recording the performance measurements of volts, amps, and water temperature differences (both heating and cooling) is recommended. This data should be compared to the information on the unit’s data plate and the data taken at the original startup of the equipment.
  3. Lubrication of the blower motor is not required, however may be performed on some motors to extend motor life. Use **SAE-20** non-detergent electric motor oil.
  4. The condensate drain should be checked annually by cleaning and flushing to insure proper drainage.
  5. Periodic lockouts almost always are caused by air or water flow problems. The lockout (shutdown) of the unit is a normal protective measure in the design of the equipment. If continual lockouts occur call a mechanic immediately and have them check for: water flow problems, water temperature problems, air flow problems or air temperature problems. Use of the pressure and temperature charts for the unit may be required to properly determine the cause.

## MAINTENANCE

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



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

### Unit Check Out Sheet

#### Customer Data

Customer Name \_\_\_\_\_ Date \_\_\_\_\_  
 Address \_\_\_\_\_  
 Phone \_\_\_\_\_ Unit Number \_\_\_\_\_

#### Unit Nameplate Data

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

#### Operating Conditions

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

\* Required for Troubleshooting ONLY

#### Auxiliary Heat

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

Bosch Group  
 601 NW 65th Court  
 Fort Lauderdale, FL 33309  
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 Fax: (800) 776-5529



MAIL TO: Bosch.Fhp.TechSupport@us.bosch.com  
 or scan the QR code and attach picture of this form with  
 the information requested.

**TROUBLESHOOTING**

UNIT TROUBLESHOOTING					
Problem	Mode		Check	Possible Cause	Action
	Cooling	Heating			
<b>No compressor operation but fan runs</b>	X		Is fault LED Blinking 1 time?	High Pressure fault - no or low water flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.
				High Pressure fault - high water temperature	Check water temperature - is it in range?
				High Pressure fault - fouled or scaled water coil	Check for proper flow rate and water temperature, but low water side temp rise in cooling
		X		High Pressure fault - no or low air flow	Check fan motor for proper operation.
					Check air filter
					Inspect air coil for dirt/debris
					Check duct work - are dampers closed or blocked?
	X		Is fault LED Blinking 2 times?	Low Pressure fault - no or low air flow	Check fan motor for proper operation.
					Check air filter
					Inspect air coil for dirt/debris
				Low Pressure fault - low refrigerant	Check refrigerant pressure with gauge set
		X		Low Pressure fault - no or low water flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.
				75Unit	Check for proper flow rate and water temperature, but low water side temp drop in heating.
				Low Pressure fault - low refrigerant	Check refrigerant pressure with gauge set
		X	Is fault LED Blinking 3 times?	Freeze fault, water coil - no or low water flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.
Freeze fault - low water temperature				Check water temperature - is it below 40 deg entering? If heat pump is connected to a closed loop with antifreeze check that the "FREEZE 1" resistor on the UPM board has been cut to set the unit to antifreeze mode (see UPM features on pages 15-17).	
Freeze fault - low refrigerant				Check refrigerant pressure with gauge set	

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

## UNIT TROUBLESHOOTING

Problem	Mode		Check	Possible Cause	Action
<b>No compressor operation but fan runs</b>	X	X	No fault LED - contactor energized	Open compressor overload	Check for supply voltage at the load side of the contactor. For 3 phase models check phase rotation and voltage at all 3 phases.
				Poor wiring connections	Look for signs of heat on the wiring insulation. Check that all wiring connections are secure and properly torqued.
				Burned out compressor	Does compressor hum when power is applied? If not check the resistance of the compressor windings using the values shown in the compressor characteristics chart. Note that the compressor must be cool (70 deg F) when checking the windings.
<b>No compressor or fan operation</b>	X	X	Power LED on	Bad thermostat connection / faulty thermostat	Check thermostat and wiring. Check unit terminal block for 24 VAC between "Y" and "C" and "G" and "C".
			Power LED off	Low or no supply power	Insure that the supply voltage to the unit is with in the range shown on the unit data plate.
				Faulty control transformer	Check for 24 VAC between "R" and "C" on the unit terminal block. For 75 and 100 VA transformers, check that the transformer circuit breaker has not tripped. Check low voltage circuit for overload conditons or short circuits before replacing the transformer.
<b>No fan operation - PSC motor</b>	X	X	Fan relay energized	Faulty motor	check supply voltage from the fan relay to the motor. Check that all motor wires are secure. With power off spin the motor shaft - noise, resistance or uneven motion can be signs of motor failure.
			Fan relay not energized	No fan operation signal	Check for 24 VAC across the fan relay coil. Check all wiring connections.
				Bad fan relay	If the relay coil is energized but the relay does not pull in, check the resistance across the relay coil - an open circuit is an indicator of a faulty relay.
<b>No fan operation - constant torque motor</b>	X	X		No fan operation signal	Check for 24 VAC between "G" and "C". Check all wiring connections.
				Loose wiring	Check all wiring connections at motor and control box.
				Faulty motor	Check supply voltage to the motor. Check that all motor wires are secure. With power off spin the motor shaft - noise, resistance or uneven motion can be signs of motor failure.

UNIT TROUBLESHOOTING					
Problem	Mode		Check	Possible Cause	Action
<b>No fan operation - constant airflow motor</b>	X	X		No fan operation signal	Check for 24 VAC between "G" and "C". Check all wiring connections. Make sure that the thermostat connection plug is securely connected.
				Loose wiring	Check all wiring connections at motor and control box. Check that power and control harnesses are securely connected.
				Interface board problems	Make sure that the interface board is not damaged and that all DIP switches are in the proper configuration (refer to the blower performance tables).
				Faulty motor	Check supply voltage to the motor. Check that all motor wires are secure. Move the "TEST" DIP switch to "ON" and the other switches to "OFF" on the "ADJUST" switch block on the interface board - the motor should run at 70% torque when "G" is called. With power off spin the motor shaft - noise, resistance or uneven motion can be signs of motor failure.
<b>Unit not shifting into cooling</b>	X		Reversing valve solenoid energized	Faulty solenoid	Check that the reversing valve solenoid is receiving 24 VAC. If so, check the resistance of the solenoid - an open circuit may indicate a burned out solenoid.
			Reversing valve solenoid not energized	Miswired/faulty thermostat	Check that the reversing valve thermostat wire is connected to the "O" terminal of the thermostat. Check for a contact closure between "O" and "R".
				Loose wire on "O" terminal	Check that the wires from the thermostat to the unit are securely connected and that the wires from the electrical box to the reversing valve are connected.
<b>Excessively cold supply air temperature in cooling or excessively hot supply air temperature in heating</b>	X	X	Reduced air flow	Dirty Filter	Replace filter.
				Fan speed too low	Consult blower performance table and increase fan speed if possible.
				Excessive duct pressure drop	Consult blower performance table and increase fan speed if possible.
<b>Excessively warm supply air temperature in cooling and/or excessively cool air in heating</b>	X	X	Air flow too high	Fan speed setting too high	Consult blower performance table and reduce fan speed if possible.
			High or low water temperature	Inlet water temperature out of range	Check unit capacity vs. water temperature.
			Air leakage	Leaky duct work	Inspect duct work.
			Loss of refrigeration capacity	Low refrigerant	Check refrigerant pressures with gauge set.

### UNIT TROUBLESHOOTING

Problem	Mode		Check	Possible Cause	Action
<b>High humidity</b>	X		Air flow too high	Fan speed setting too high	Consult blower performance table and reduce fan speed if possible.
			Loss of refrigeration capacity	Low refrigerant	Check refrigerant pressures with gauge set.
			Short cycling	Unit oversized	Check unit performance against building load calculations.
				Poor thermostat location	Make sure that thermostat is not located by a supply air duct .
<b>Objectionable noise levels</b>	X	X	Air noise	Poor duct work/grille design	Insure duct work and grilles are properly sized for unit air flow.
				Fan speed setting too high	Consult blower performance table and reduce fan speed if possible.
			Structure bourne noise	Unit not mounted on full vibration pad	Mount unit on a vibration pad (see page 7).
				Unit not connected with flexible conduit, water lines and/or duct work	Install unit in accordance with instructions on pages 6-8.
	Unit cabinet touching wall or other building component	Adjust unit location to avoid unit touching structure.			
	X		Compressor noise	High water temperature or low water flow rate elevating head pressure	Increase water flow rate and/or reduce water temperature if possible.
				Scaled or fouled water coil elevating heat pressure	Clean/descale water coil.
				Low air flow elevating head pressure	Check filter.
	Increase fan speed.				
	X	X	Water hammer	Fast closing valves installed	change valves to slow-close type.



### TEMPERATURE/PRESSURE TABLE

OPERATING DATA										
MODEL	ENTERING WATER TEMP, °F	WATER FLOW GPM	COOLING				HEATING			
			SUCTION PRESSURE PSIG	DISCHARGE PRESSURE PSIG	WATER TEMP RISE, °F	AIR TEMP DROP, °F	SUCTION PRESSURE PSIG	DISCHARGE PRESSURE PSIG	WATER TEMP DROP, °F	AIR TEMP RISE, °F
LV007	30°	1.4					65-80	282-344	6-7	14-17
		1.9					73-89	294-359	3-4	15-18
	40°	1.4	106-129	146-178	17-21	18-22	80-98	299-365	7-9	16-20
		1.9	102-124	133-162	10-13	19-23	89-108	311-380	4-5	17-21
	50°	1.4	115-141	180-220	17-20	17-21	95-116	315-385	9-11	19-23
		1.9	111-135	163-200	10-12	18-23	105-128	329-402	5-7	20-24
	60°	1.4	124-152	213-261	16-19	17-21	109-133	332-406	11-13	21-26
		1.9	120-146	194-237	10-12	18-22	121-148	346-423	6-8	22-27
	70°	1.4	134-163	247-302	15-19	17-20	124-151	349-427	12-15	23-28
		1.9	128-157	225-275	9-11	18-21	138-168	364-444	7-9	25-30
	80°	1.4	143-175	281-343	14-18	16-20	138-169	366-447	14-17	26-31
		1.9	137-168	255-312	9-11	17-21	154-188	381-466	8-10	27-33
	90°	1.4	152-186	315-385	14-17	16-19	153-187	383-468	16-19	28-34
		1.9	146-179	286-350	8-10	17-20	170-208	399-487	9-12	29-36
100°	1.4	161-197	349-426	13-16	15-19					
	1.9	155-190	317-387	8-10	16-20					
LV009	30°	1.8					91-111	251-307	5-6	21-25
		2.4					95-116	256-313	3-4	22-26
	40°	1.8	112-137	144-176	14-17	22-27	107-130	267-327	6-7	24-29
		2.4	106-130	137-167	10-12	23-28	112-137	273-333	4-5	25-30
	50°	1.8	116-142	177-217	13-16	21-26	123-150	284-347	7-9	27-33
		2.4	111-135	169-206	9-12	22-27	129-158	289-353	5-6	28-34
	60°	1.8	121-148	211-258	13-16	21-26	139-170	300-366	8-10	30-37
		2.4	115-140	200-245	9-11	22-27	146-179	306-374	6-7	32-39
	70°	1.8	126-154	245-299	13-15	20-25	156-190	316-386	9-12	33-41
		2.4	119-146	232-284	9-11	21-26	163-200	322-394	7-8	35-43
	80°	1.8	130-159	278-340	12-15	20-24	172-210	332-406	11-13	36-44
		2.4	124-151	264-323	9-11	21-26	180-220	339-414	8-9	38-47
	90°	1.8	135-165	312-381	12-15	19-24	188-230	349-426	12-15	39-48
		2.4	128-157	296-362	9-10	20-25	197-241	355-434	8-10	41-51
100°	1.8	140-171	345-422	12-14	19-23					
	2.4	133-162	328-401	8-10	20-24					

LV012	30°	2.6					73-89	266-325	5-6	15-18
		3					77-94	272-333	3-4	16-19
	40°	2.6	117-143	189-231	14-17	18-22	86-105	279-341	6-7	17-21
		3	112-137	178-217	8-9	19-24	90-110	286-350	4-5	18-22
	50°	2.6	126-154	221-270	14-17	18-21	162-198	293-358	7-8	20-24
		3	121-148	207-253	8-9	19-23	170-208	300-366	5-6	21-25
	60°	2.6	131-160	252-308	13-16	17-21	110-134	306-374	8-10	22-27
		3	125-153	237-290	8-9	18-22	115-141	314-383	6-7	23-29
	70°	2.6	135-165	284-347	13-16	17-20	122-150	320-391	9-11	24-30
		3	130-158	266-326	7-9	18-22	129-157	327-400	6-8	26-32
	80°	2.6	140-171	320-391	13-16	16-20	134-164	333-407	11-13	27-33
		3	134-164	300-367	7-9	17-21	141-172	341-417	7-9	28-35
90°	2.6	144-176	360-440	13-16	16-19	147-179	347-424	12-14	29-36	
	3	138-169	338-414	7-9	17-21	154-188	355-434	8-10	31-38	
100°	2.6	149-182	405-495	13-15	15-19					
	3	143-174	381-465	7-9	16-20					
LV015	30°	2.8					74-90	244-299	3-4	13-15
		3.8					78-95	251-306	2-3	13-16
	40°	2.8	122-149	183-224	14-18	19-23	87-106	257-314	4-5	15-18
		3.8	117-143	172-210	8-10	20-24	91-111	263-322	3-3	16-19
	50°	2.8	131-160	214-261	14-18	18-22	164-201	269-329	5-6	17-20
		3.8	126-154	201-245	8-10	19-24	173-211	276-337	3-4	18-22
	60°	2.8	136-166	244-298	14-17	18-22	111-136	282-344	6-7	19-23
		3.8	131-160	230-281	8-10	19-23	117-143	289-353	4-5	20-24
	70°	2.8	141-172	275-336	14-17	17-21	124-152	294-360	7-8	21-25
		3.8	135-165	258-316	8-10	18-22	131-160	302-369	5-6	22-27
	80°	2.8	145-178	310-378	14-17	17-20	136-166	307-375	8-9	23-28
		3.8	140-171	291-356	8-10	18-22	143-175	314-384	5-6	24-30
90°	2.8	150-183	349-426	14-17	16-20	149-182	319-390	8-10	25-30	
	3.8	144-176	328-401	8-9	17-21	156-191	327-400	6-7	26-32	
100°	2.8	155-189	392-480	13-16	16-19					
	3.8	149-182	369-451	8-9	17-21					
LV018	30°	3					65-80	282-344	6-7	14-17
		5					73-89	294-359	3-4	15-18
	40°	3	121-148	184-225	17-21	18-22	80-98	299-365	7-9	16-20
		5	117-143	167-204	10-13	19-23	89-108	311-380	4-5	17-21
	50°	3	123-151	222-271	17-20	17-21	95-116	315-385	9-11	19-23
		5	119-145	202-247	10-12	18-23	105-128	329-402	5-7	20-24
	60°	3	125-153	260-318	16-19	17-21	109-133	332-406	11-13	21-26
		5	120-147	237-289	10-12	18-22	121-148	346-423	6-8	22-27
	70°	3	127-155	298-365	15-19	17-20	124-151	349-427	12-15	23-28
		5	122-149	271-331	9-11	18-21	138-168	364-444	7-9	25-30
	80°	3	129-158	336-411	14-18	16-20	138-169	366-447	14-17	26-31
		5	124-152	306-374	9-11	17-21	154-188	381-466	8-10	27-33
90°	3	131-160	374-458	14-17	16-19	153-187	383-468	16-16	28-34	
	5	126-154	340-416	8-10	17-20	170-208	399-487	9-12	29-36	
100°	3	133-162	413-504	13-16	15-19					
	5	128-156	375-458	8-10	16-20					

LV024	30°	5					72-87	296-361	5-6	21-25
		7					75-92	301-368	3-4	22-26
	40°	5	114-139	155-190	14-17	22-27	88-107	314-384	6-7	24-29
		7	108-132	147-180	10-12	23-28	92-112	321-392	4-5	25-30
	50°	5	116-142	192-234	13-16	21-26	104-127	333-407	7-9	27-33
		7	111-135	182-222	9-12	22-27	109-133	340-415	5-6	28-34
	60°	5	119-146	228-279	13-16	21-26	120-146	352-430	8-10	30-37
		7	113-138	217-265	9-11	22-27	125-153	359-439	6-7	32-39
	70°	5	122-149	264-323	13-15	20-25	136-166	371-453	9-12	33-41
		7	116-142	251-307	9-11	21-26	142-174	378-462	7-8	35-43
	80°	5	125-152	301-368	12-15	20-24	152-185	389-476	11-13	36-44
		7	118-145	286-349	9-11	21-26	159-194	397-485	8-9	38-47
	90°	5	127-156	337-412	12-15	19-24	168-205	408-499	12-15	39-48
		7	121-148	320-392	9-10	20-25	176-215	416-509	8-10	41-51
100°	5	130-159	374-457	12-14	19-23					
	7	124-151	355-434	8-10	20-24					
LV030	30°	3.5					73-89	266-325	5-6	15-18
		7.5					77-94	272-333	3-4	16-19
	40°	3.5	117-143	189-231	14-17	18-22	86-105	279-341	6-7	17-21
		7.5	112-137	178-217	8-9	19-24	90-110	286-350	4-5	18-22
	50°	3.5	126-154	221-270	14-17	18-21	162-198	293-358	7-8	20-24
		7.5	121-148	207-253	8-9	19-23	170-208	300-366	5-6	21-25
	60°	3.5	131-160	252-308	13-16	17-21	110-134	306-374	8-10	22-27
		7.5	125-153	237-290	8-9	18-22	115-141	314-383	6-7	23-29
	70°	3.5	135-165	284-347	13-16	17-20	122-150	320-391	9-11	24-30
		7.5	130-158	266-326	7-9	18-22	129-157	327-400	6-8	26-32
	80°	3.5	140-171	320-391	13-16	16-20	134-164	333-407	11-13	27-33
		7.5	134-164	300-367	7-9	17-21	141-172	341-417	7-9	28-35
	90°	3.5	144-176	360-440	13-16	16-19	147-179	347-424	12-14	29-36
		7.5	138-169	338-414	7-9	17-21	154-188	355-434	8-10	31-38
100°	3.5	149-182	405-495	13-15	15-19					
	7.5	143-174	381-465	7-9	16-20					
LV036	30°	4.5					74-90	244-299	3-4	13-15
		9					78-95	251-306	2-3	13-16
	40°	4.5	122-149	183-224	14-18	19-23	87-106	257-314	4-5	15-18
		9	117-143	172-210	8-10	20-24	91-111	263-322	3-3	16-19
	50°	4.5	131-160	214-261	14-18	18-22	164-201	269-329	5-6	17-20
		9	126-154	201-245	8-10	19-24	173-211	276-337	3-4	18-22
	60°	4.5	136-166	244-298	14-17	18-22	111-136	282-344	6-7	19-23
		9	131-160	230-281	8-10	19-23	117-143	289-353	4-5	20-24
	70°	4.5	141-172	275-336	14-17	17-21	124-152	294-360	7-8	21-25
		9	135-165	258-316	8-10	18-22	131-160	302-369	5-6	22-27
	80°	4.5	145-178	310-378	14-17	17-20	136-166	307-375	8-9	23-28
		9	140-171	291-356	8-10	18-22	143-175	314-384	5-6	24-30
	90°	4.5	150-183	349-426	14-17	16-20	149-182	319-390	8-10	25-30
		9	144-176	328-401	8-9	17-21	156-191	327-400	6-7	26-32
100°	4.5	155-189	392-480	13-16	16-19					
	9	149-182	369-451	8-9	17-21					

LV042	30°	6					64-78	248-303	5-6	15-18
		10					67-82	254-311	3-4	16-19
	40°	6	109-134	183-224	18-22	19-23	75-91	261-319	6-8	17-21
		10	105-128	172-210	10-12	20-25	79-96	267-327	4-5	18-23
	50°	6	118-144	214-261	18-22	19-23	142-173	273-334	8-10	20-24
		10	113-138	201-245	10-12	20-24	149-182	280-342	5-7	21-26
	60°	6	122-149	244-298	17-21	18-22	96-117	286-349	9-11	22-27
		10	117-143	230-281	10-12	19-24	101-123	293-358	6-8	24-29
	70°	6	126-154	275-336	17-21	18-22	107-131	299-365	11-13	25-30
		10	121-148	258-316	10-12	19-23	113-138	306-374	7-9	26-32
	80°	6	130-159	310-378	17-21	17-21	117-143	311-380	12-15	27-33
		10	125-153	291-356	10-12	18-22	123-151	319-390	8-10	29-35
90°	6	134-164	349-426	17-20	17-20	128-157	324-396	13-16	29-36	
	10	129-158	328-401	9-12	18-22	135-165	332-406	9-11	31-38	
100°	6	139-170	392-480	16-20	16-20					
	10	133-163	369-451	9-11	17-21					
LV048	30°	6					71-87	277-339	6-7	15-19
		10					75-92	284-347	4-5	16-20
	40°	6	118-144	194-237	21-25	19-23	84-102	291-356	7-9	18-22
		10	113-138	182-223	12-14	20-24	88-108	299-365	5-6	19-23
	50°	6	127-155	226-276	21-25	18-22	159-194	305-373	9-11	20-25
		10	122-149	213-260	12-14	19-24	167-204	313-383	6-7	21-26
	60°	6	131-160	259-316	21-25	18-22	108-132	320-391	10-13	23-28
		10	126-154	243-297	12-14	19-23	113-138	328-400	7-9	24-29
	70°	6	136-166	291-355	20-25	17-21	120-147	334-408	12-15	25-31
		10	130-159	273-334	12-14	18-22	126-154	342-418	8-10	27-32
	80°	6	140-171	328-401	20-24	17-20	131-161	348-425	14-17	27-34
		10	135-165	308-377	11-14	18-22	138-169	356-436	9-11	29-36
90°	6	145-177	369-451	20-24	16-20	144-176	362-442	15-18	30-37	
	10	139-170	347-424	11-14	17-21	151-185	371-453	10-12	32-39	
100°	6	149-183	415-508	19-24	16-19					
	10	143-175	391-477	11-14	17-21					
LV060	30°	8					68-84	256-313	5-7	19-23
		12					73-89	261-319	4-5	20-25
	40°	8	113-138	173-212	18-22	19-23	81-99	277-339	7-8	22-26
		12	110-134	162-198	12-14	20-24	86-105	283-346	5-6	23-28
	50°	8	116-142	207-253	17-21	19-23	93-114	299-365	8-9	24-29
		12	112-137	193-236	12-14	19-24	99-121	305-373	6-7	25-31
	60°	8	118-145	240-293	17-21	18-23	106-129	321-392	9-11	26-32
		12	115-140	224-274	11-14	19-23	113-138	327-400	7-8	28-34
	70°	8	121-148	273-334	17-21	18-22	118-145	342-418	10-12	29-35
		12	117-143	255-312	11-14	19-23	126-154	349-427	8-9	30-37
	80°	8	123-151	307-375	16-20	18-22	131-160	364-444	11-14	31-38
		12	120-146	287-350	11-13	19-23	139-170	371-454	8-10	33-40
90°	8	126-154	340-416	16-20	18-22	143-175	385-471	12-15	33-41	
	12	122-149	318-388	11-13	18-22	152-186	393-480	9-11	35-43	
100°	8	128-157	373-456	16-19	17-21					
	12	125-152	349-426	11-13	18-22					

LV070	30°	12					68-84	256-313	5-7	19-23
		16					73-89	261-319	4-5	20-25
	40°	12	117-143	182-222	15-19	21-26	81-99	277-339	7-8	22-26
		16	114-139	170-208	11-14	22-27	86-105	283-346	5-6	23-28
	50°	12	120-147	215-263	15-18	20-25	93-114	299-365	8-9	24-29
		16	117-143	201-246	11-14	21-26	99-121	305-373	6-7	25-31
	60°	12	123-150	248-304	14-17	20-24	106-129	321-392	9-11	26-32
		16	119-146	232-284	11-13	21-25	113-138	327-400	7-8	28-34
	70°	12	126-154	282-344	14-17	19-24	118-145	342-418	10-12	29-35
		16	122-149	263-322	10-13	20-25	126-154	349-427	8-9	30-37
	80°	12	129-157	315-385	13-16	19-23	131-160	364-444	11-14	31-38
		16	125-153	294-360	10-12	19-24	139-170	371-454	8-10	33-40
	90°	12	132-161	348-426	13-16	18-22	143-175	385-471	12-15	33-41
		16	128-156	326-398	10-12	19-23	152-186	393-480	9-11	35-43
	100°	12	134-164	382-466	12-15	17-21				
		16	131-160	357-436	9-11	18-22				

**WATERSIDE PRESSURE DROP TABLE**

<b>Model</b>	<b>Water Flow Rate (GPM)</b>	<b>Water Side Pressure Drop with out Internal Valve (PSI)</b>	<b>Water Side Pressure Drop with Internal Valve (PSI)</b>
<b>LV007</b>	1.5	0.7	1.0
	2	1.1	1.7
	2.5	1.7	2.5
<b>LV009</b>	2	1.7	2.2
	2.5	2.5	3.3
	3	3.5	4.6
<b>LV012</b>	2.5	2.6	3.4
	3	3.6	4.7
	3.5	4.8	6.2
<b>LV015</b>	3	3.9	5.0
	4	6.5	8.3
	5	9.8	12.5
<b>LV018</b>	4	2.7	4.5
	5	4.0	6.7
	6	5.6	9.3
<b>LV024</b>	4	2.8	3.3
	6	5.8	6.8
	8	9.7	11.4
<b>LV030</b>	5	3.0	3.7
	7.5	6.2	7.7
	9	8.6	10.7
<b>LV036</b>	6	2.6	3.6
	9	5.4	7.5
	12	9.1	12.6
<b>LV041</b>	7	3.6	5.0
	10	6.9	9.5
	13	11.1	15.2
<b>LV042</b>	7	3.6	5.0
	10	6.9	9.4
	13	11.1	15.1
<b>LV048</b>	8	1.4	2.1
	12	2.8	4.4
	15	4.2	6.6
<b>LV060</b>	10	2.3	3.5
	15	4.8	7.2
	18	6.7	10.0
<b>LV070</b>	11	2.9	4.2
	16	5.7	8.3
	18	7.0	10.3

All values based upon pure water at 70 deg F.

## COMPRESSOR CHARACTERISTICS

Model	Voltage Code	Rated Voltage	Compressor Description	Compressor Data Plate			Cold Winding Resistance Values (+/- 10%)			Run Capacitor (µF/V)
				Phase	RLA	LRA	Single Phase		Three Phase Line-Line	
							R-C	S-C		
LV007 VT & CF	1	208-230/60/1	RGA5453BXD	1	2.6	17.7	4.08	6.63	-	15/370
	2	265/60/1	RGA5453BXV	1	2.6	13.5	5.34	6.77	-	15/440
LV007 HZ	1	208-230/60/1	HGA5453BXD	1	2.6	17.7	4.08	6.63	-	15/370
	2	265/60/1	HGA5453BXV	1	2.6	13.5	5.34	6.77	-	15/440
LV009 VT & CF	1	208-230/60/1	RGA5471BXD	1	3.4	22.2	2.95	7.35	-	15/370
	2	265/60/1	RGA5471BXV	1	2.9	18.8	4.27	10.74	-	10/440
LV009 HZ	1	208-230/60/1	HGA5471BXD	1	3.4	22.2	2.95	7.35	-	15/370
	2	265/60/1	HGA5471BXV	1	2.9	18.8	4.27	10.74	-	10/440
LV012 VT & CF	0	115/60/1	RGA5494BAA	1	9.6	58.4	0.58	3.149	-	35/370
	1	208-230/60/1	RGA5494BXD	1	4.6	28	2.3	5.9	-	20/370
	2	265/60/1	RGA5494BXV	1	3.8	22.2	3.47	8.7	-	15/440
LV012 HZ	0	115/60/1	HGA5494BAA	1	9.7	58.4	0.58	4	-	35/370
	1	208-230/60/1	HGA5494BXD	1	4.6	27.9	2.3	5.9	-	20/370
	2	265/60/1	HGA5494BXV	1	3.8	22.2	3.47	8.69	-	15/440
LV015	1	208-230/60/1	RGA5512BXD	1	5.6	29	2.31	5.45	-	25/440
	2	265/60/1	RGA5512BXV	1	4.6	20	3.58	7.39	-	15/440
LV018	1	208-230/60/1	H82J153ABCA	1	6.5	43	1.431	2.383	-	30/370
	2	265/60/1	H82J153ABHA	1	5.8	46	1.4	2.4	-	30/440
LV024	1	208-230/60/1	H82J183ABCA	1	7.4	43	1.431	2.383	-	35/370
	2	265/60/1	H82J183ABHA	1	6.7	46	1.4	2.4	-	30/440
	3	208-230/60/3	H82J183DBLA	3	5.9	63	-	-	1.362	-
	4	460/60/3	H82J183DBVA	3	2.9	30	-	-	5.329	-
LV030	1	208-230/60/1	H82J223ABCA	1	9.9	54	0.982	1.729	-	35/370
	2	265/60/1	H82J223ABHA	1	8.5	46	1.4	2.46	-	30/440
	3	208-230/60/3	H82J223DBLA	3	6.9	63	-	-	1.362	-
	4	460/60/3	H82J223DBVA	3	3.6	30	-	-	5.329	-
LV036	1	208-230/60/1	H82J283ABCA	1	13.0	74	0.819	1.634	-	40/370
	2	265/60/1	H82J293ABHA	1	11.3	67	0.802	1.76	-	35/440
	3	208-230/60/3	H82J283DBLA	3	7.8	68	-	-	1.152	-
	4	460/60/3	H82J283DBVA	3	3.9	34	-	-	4.606	-
LV042	1	208-230/60/1	H82J323ABCA	1	13.6	88	0.656	1.558	-	45/370
	2	265/60/1	H82J323ABHA	1	12.0	67	0.802	1.76	-	35/370
	3	208-230/60/3	H82J323DBLA	3	8.8	68	-	-	1.152	-
	4	460/60/3	H82J323DBVA	3	4.4	34	-	-	4.606	-
LV048	1	208-230/60/1	H82J37MABCA	1	15.7	84	0.54	1.6	-	45/370
	3	208-230/60/3	H82J37MDBLA	3	11.0	88	-	-	0.928	-
	4	460/60/3	H82J37MDBVA	3	5.4	44	-	-	3.593	-
	5	575/60/3	H82J37MDBFA	3	4.4	36	-	-	5.678	-
LV060	1	208-230/60/1	ZP54K5E-PFV-130	1	26.3	134	0.453	0.792	-	80/370
	3	208-230/60/3	ZP54K5E-TF5-130	3	15.6	110	-	-	0.68	-
	4	460/60/3	ZP54K5E-TFD-130	3	7.8	52	-	-	3.2	-
	5	575/60/3	ZP54K5E-TFE-130	3	5.8	38.9	-	-	5.33	-
LV070	1	208-230/60/1	ZP57K5E-PFV-130	1	28.3	178	0.97	0.365	-	80/370
	3	208-230/60/3	ZP57K5E-TF5-130	3	19.2	136	-	-	0.6	-
	4	460/60/3	ZP57K5E-TFD-130	3	8.7	67.1	-	-	2.52	-
	5	575/60/3	ZP57K5E-TFE-130	3	6.9	55.3	-	-	3.74	-

**WATER COIL VOLUME**

Configuration			Left Hand Return				Right Hand Return			
Model	Total		Left Front*	Right Front*	Left Back	Right Back	Left Front*	Right Front*	Left Back	Right Back
LV007-HZ	Lbs	98	28	21	25	24	21	28	24	25
	kg	45	13	10	11	11	10	13	11	11
LV009-HZ	Lbs	103	29	23	26	25	23	29	25	26
	kg	47	13	10	12	11	10	13	11	12
LV012-HZ	Lbs	105	29	24	26	26	24	29	26	26
	kg	48	13	11	12	12	11	13	12	12
LV015-HZ	Lbs	127	36	28	34	29	28	36	29	34
	kg	58	16	13	15	13	13	16	13	15
LV018-HZ	Lbs	177	57	36	48	37	36	57	37	48
	kg	80	26	16	22	17	16	26	17	22
LV024-HZ	Lbs	181	58	37	48	38	37	58	38	48
	kg	82	26	17	22	17	17	26	17	22
LV030-HZ	Lbs	194	61	41	52	41	41	61	41	52
	kg	88	28	18	23	19	18	28	19	23
LV036-HZ	Lbs	237	71	49	66	52	49	71	52	66
	kg	108	32	22	30	24	22	32	24	30
LV042-HZ	Lbs	231	70	47	64	50	47	70	50	64
	kg	105	32	21	29	23	21	32	23	29
LV048-HZ	Lbs	268	87	60	62	60	60	87	60	62
	kg	122	39	27	28	27	27	39	27	28
LV060-HZ	Lbs	288	88	65	69	66	65	88	66	69
	kg	131	40	29	31	30	29	40	30	31
LV070-HZ	Lbs	316	98	72	76	70	72	98	70	76
	kg	143	44	32	35	32	32	44	32	35

\*Front is control box end

**CORNER WEIGHTS (HZ)**

LV Series	Coaxial Coil Volume (gal)
007	0.04
009	0.06
012	0.08
015	0.09
018	0.14
024	0.14
030	0.24
036	0.27
041	0.27
042	0.27
048	0.49
060	0.62
070	0.62



WIRING DIAGRAMS

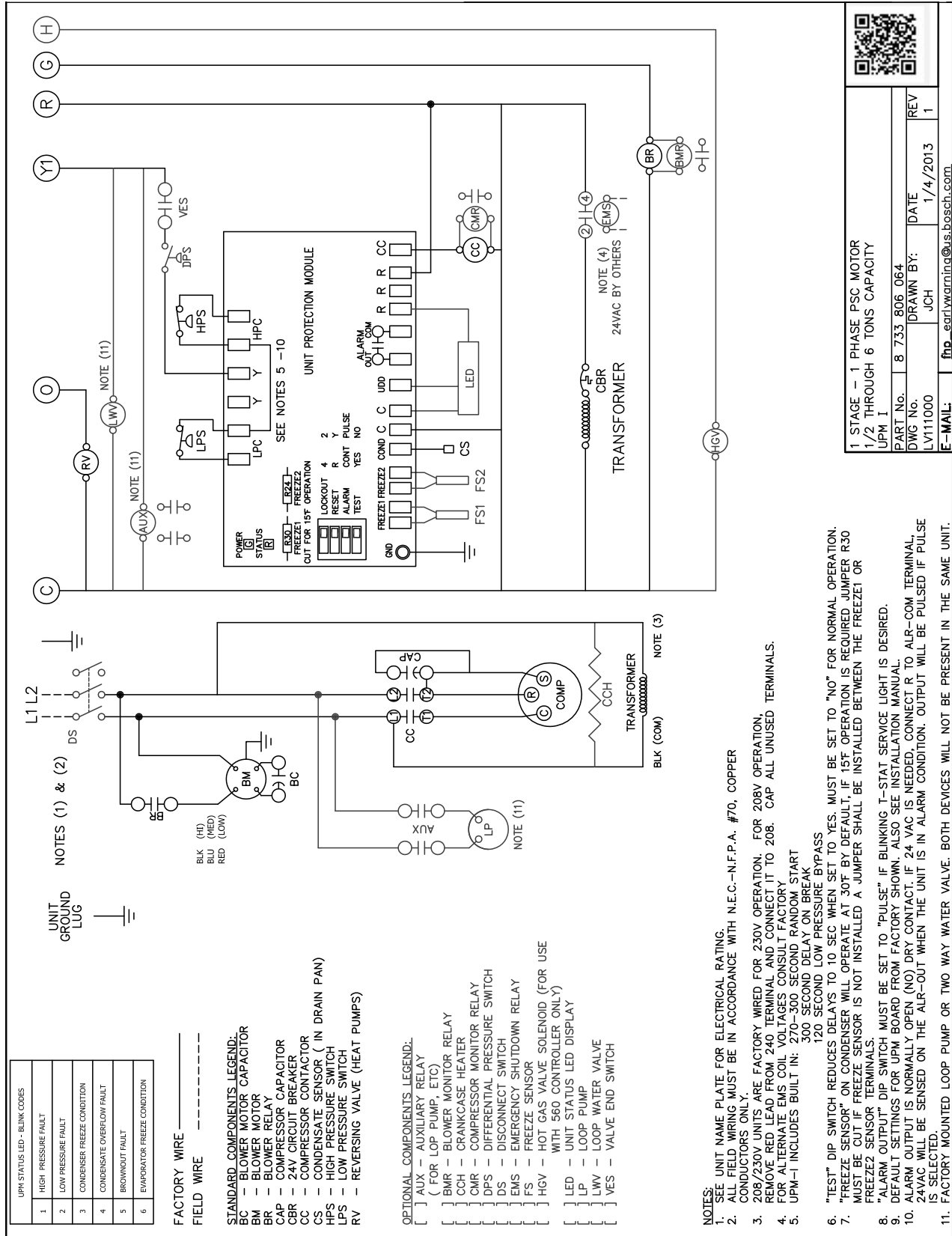


Figure # 14 Dwg LV111000- Single Phase Base Unit, PSC Fan Motor

1 STAGE - 1 PHASE PSC MOTOR  
 1/2 THROUGH 6 TONS CAPACITY  
 UPM 1

PART No.	8 733 806 064	DATE	1/4/2013
DWG No.	LV111000	DRAWN BY:	JCH
REV		REV	1

E-MAIL: [fnp\\_eatlwarning@us.bosch.com](mailto:fnp_eatlwarning@us.bosch.com)

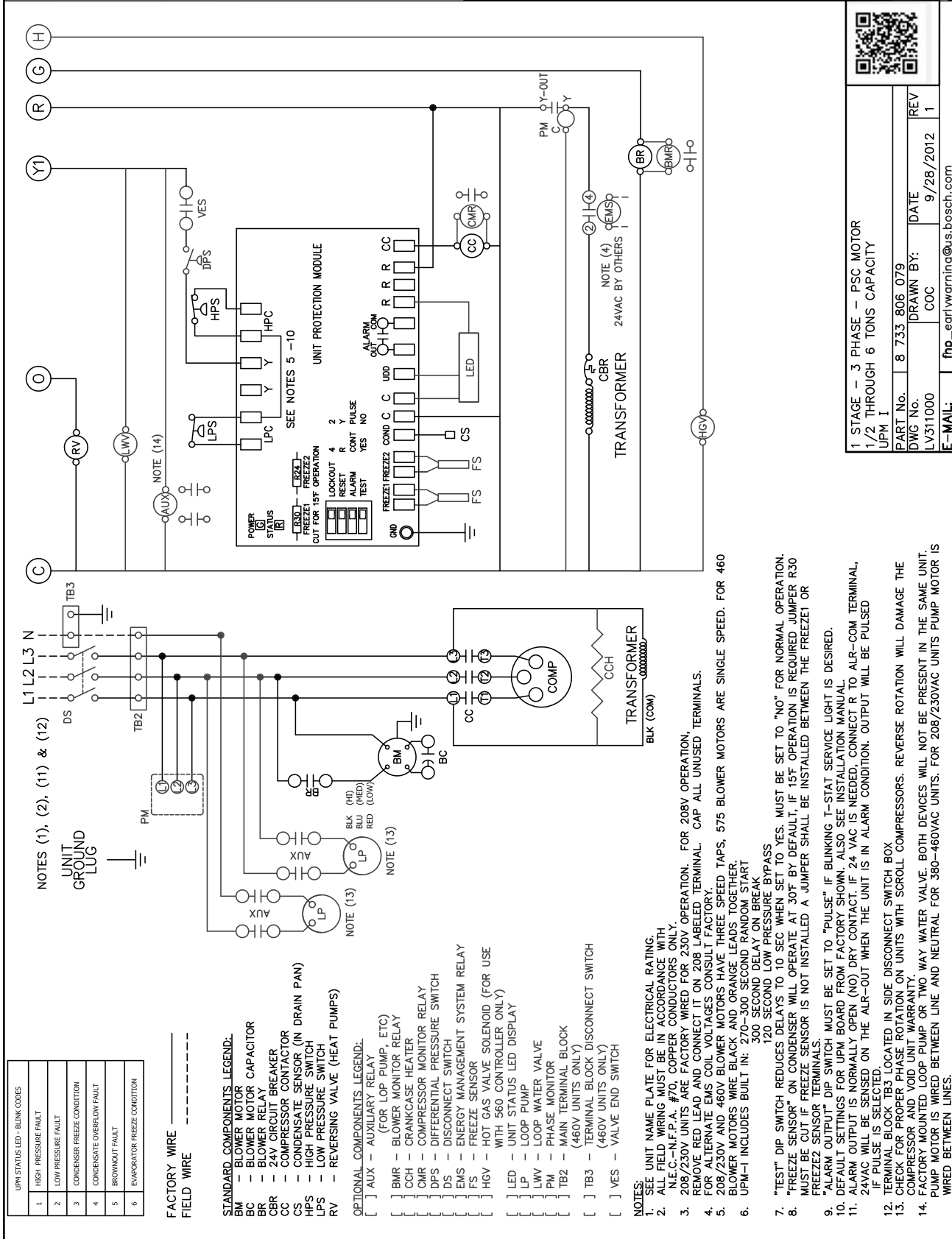



Figure # 15 Dwg 311000

	
1 STAGE - 3 PHASE - PSC MOTOR 1/2 THROUGH 6 TONS CAPACITY UPM 1	
PART No.	8 733 806 079
DWG No.	LV311000
DATE	9/28/2012
REV	1
E-MAIL: <a href="mailto:fpn_eartvwarmind@us.bosch.com">fpn_eartvwarmind@us.bosch.com</a>	

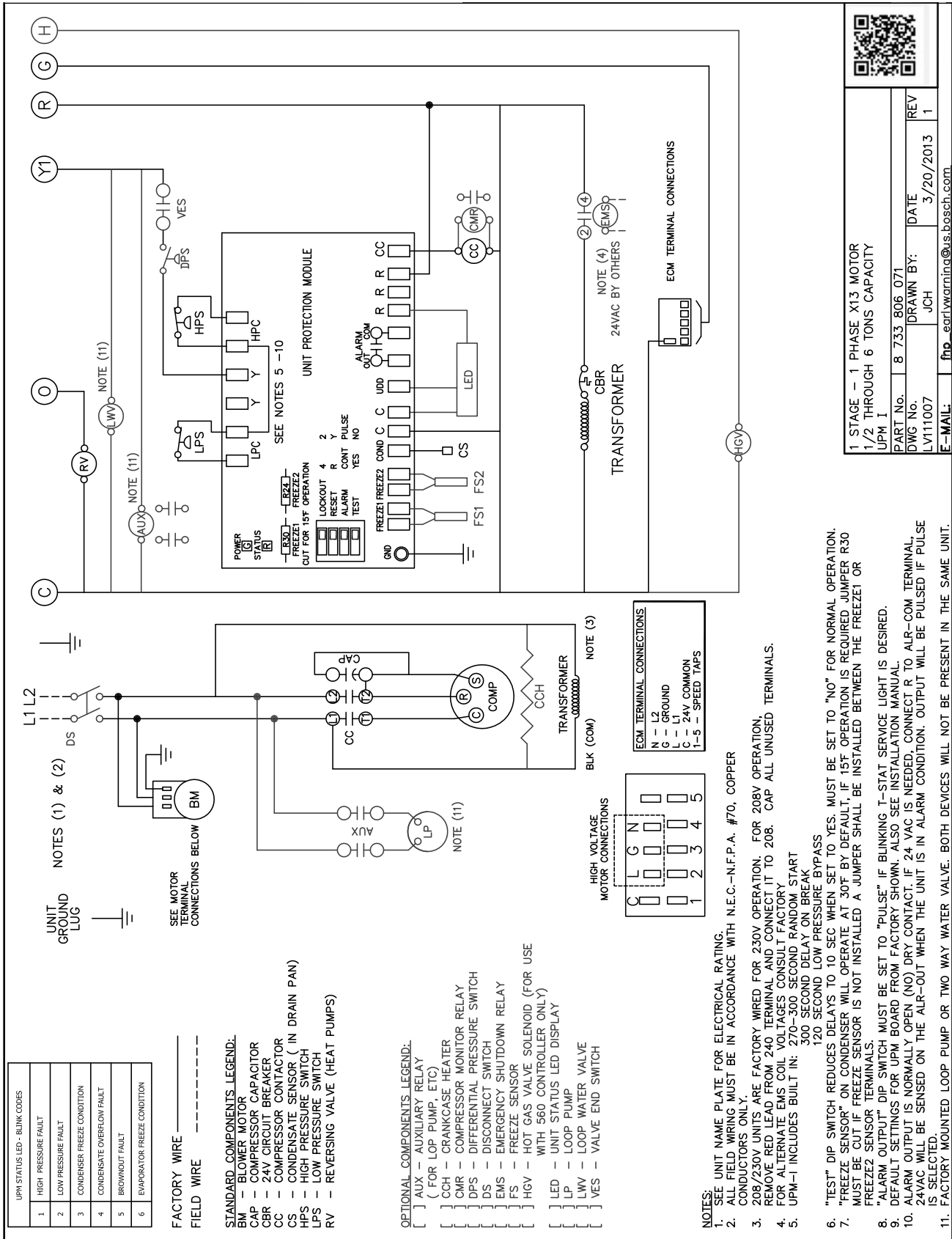


Figure # 16 Dwg LV111007- Single Phase Base Unit, Constant Torque ECM Fan Motor

1 STAGE - 1 PHASE X13 MOTOR  
 1/2 THROUGH 6 TONS CAPACITY  
 UPM I

PART No. 8 733 806 071  
 DWG No. LV111007  
 DRAWN BY: JCH  
 DATE 3/20/2013  
 REV 1

E-MAIL: fno\_eorl@warrina@us.bosch.com

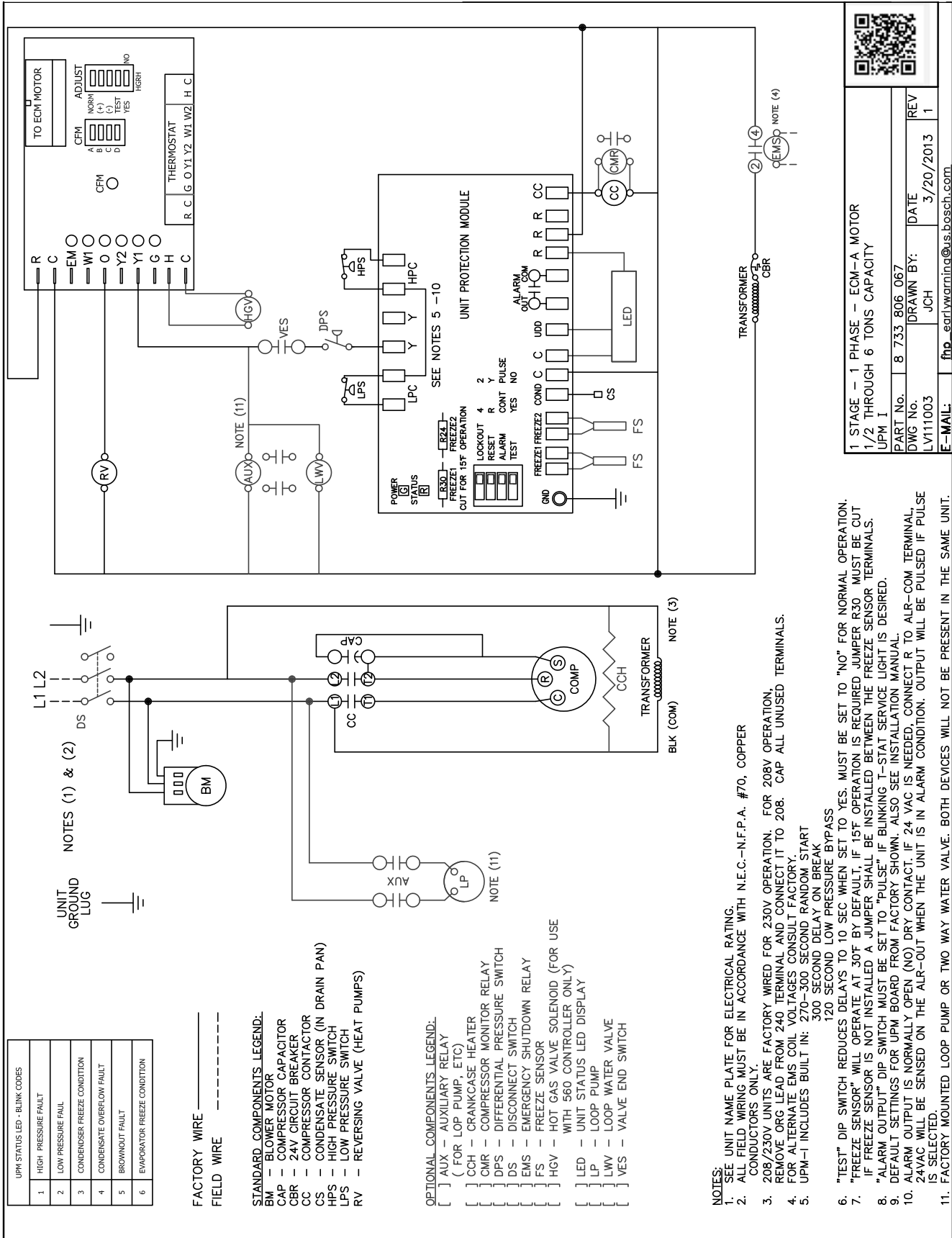


Figure # 17 Dwg LV111003 - Single Phase Base Unit, Constant Airflow ECM Fan Motor



1 STAGE - 1 PHASE - ECM-A MOTOR  
 1/2 THROUGH 6 TONS CAPACITY  
 UPM 1

PART No.	8 733 806 067	DATE	3/20/2013
DWG No.	LV111003	JCH	REV 1

E-MAIL: [frp\\_earl@wiring.us.bosch.com](mailto:frp_earl@wiring.us.bosch.com)

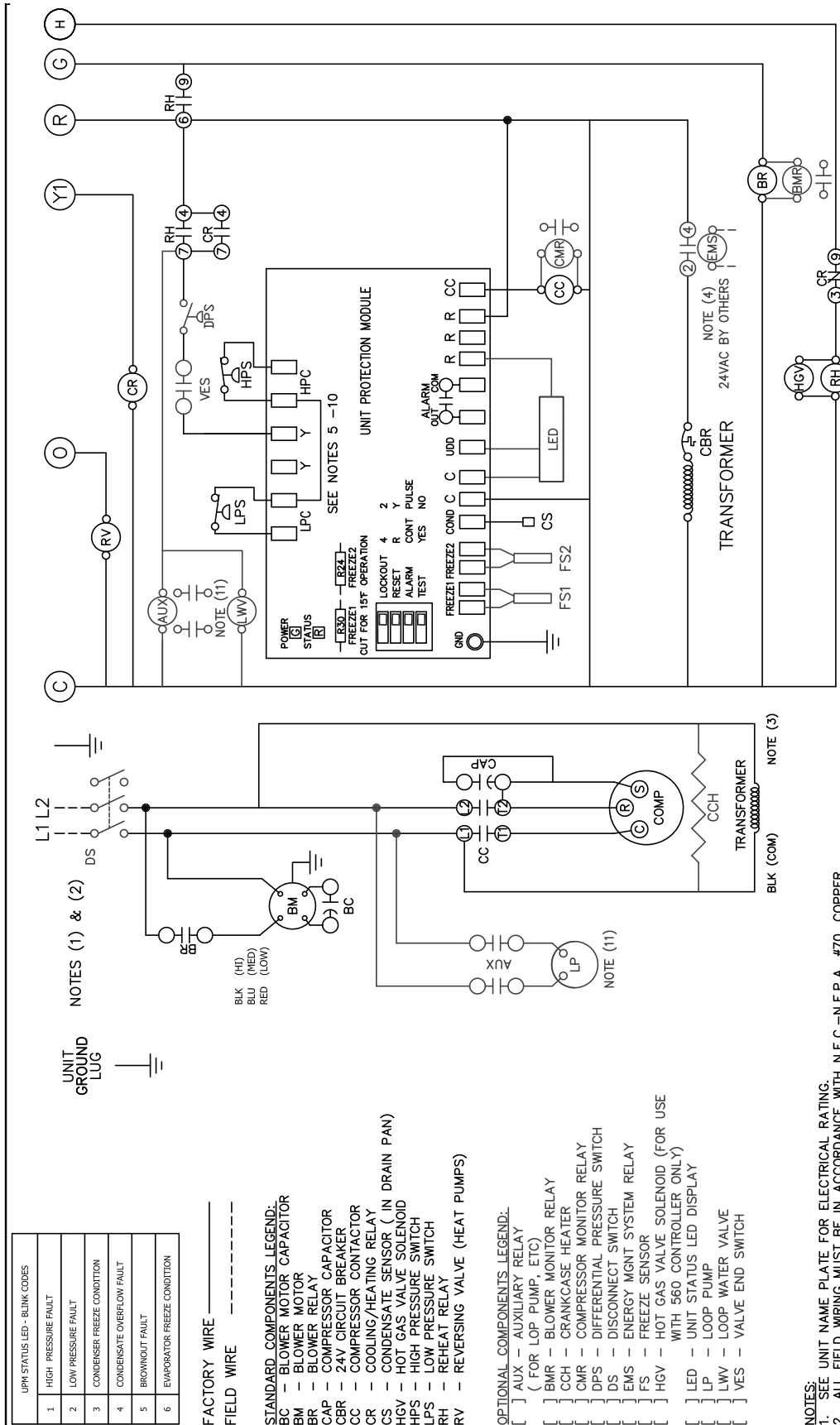



Figure # 18 Dwg LV111001 - Three Phase Base Unit, PSC Fan Motor



1 STAGE - 1 PHASE PSC MOTOR	
1/2 THROUGH 6 TONS CAPACITY - HOT GAS REHEAT UPM 1	
PART No.	8.733.806.065
DWG No.	LV111001
E-MAIL:	frp_earlwarina@us.bosch.com
DRAWN BY:	JCH
DATE:	1/4/2013
REV	1

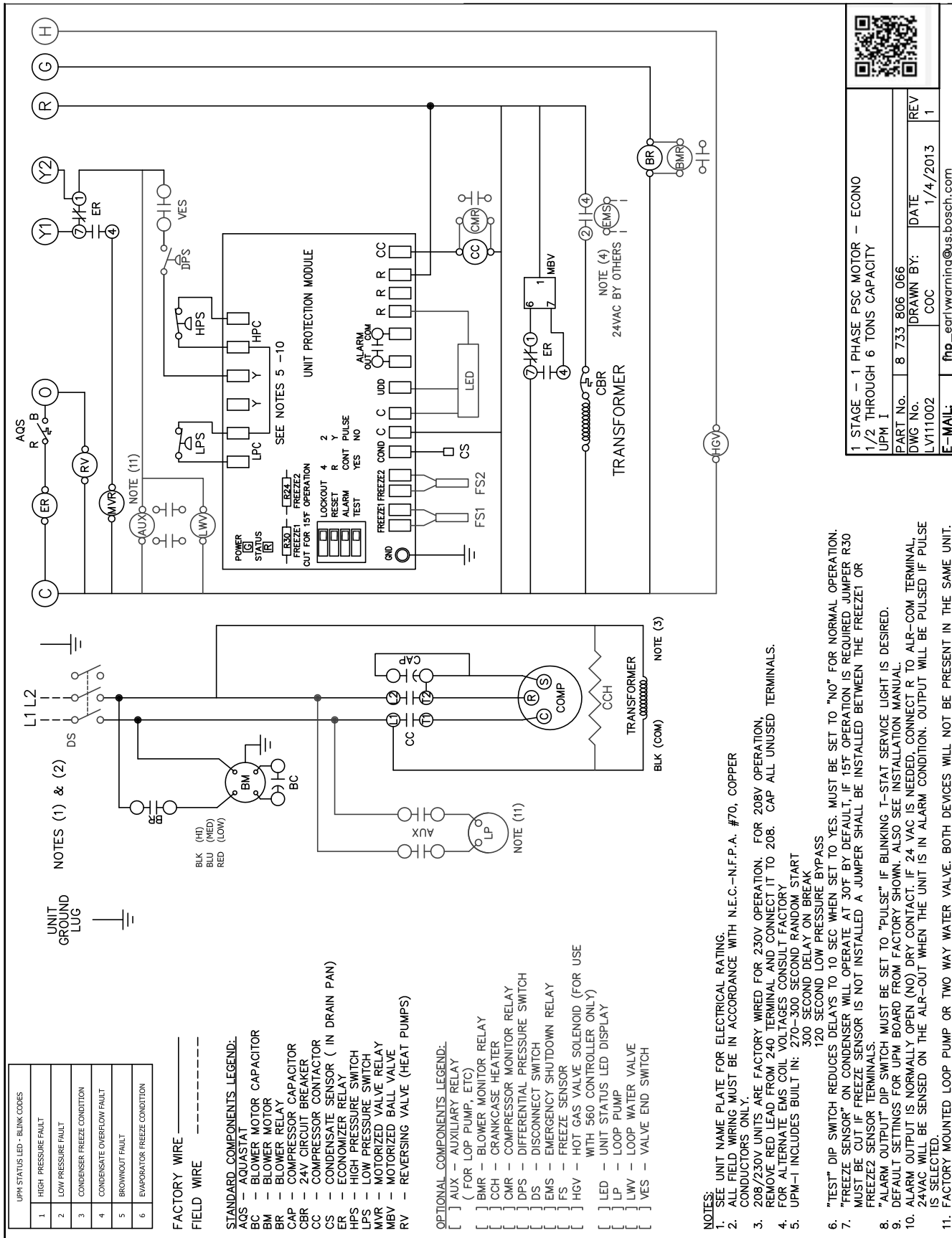


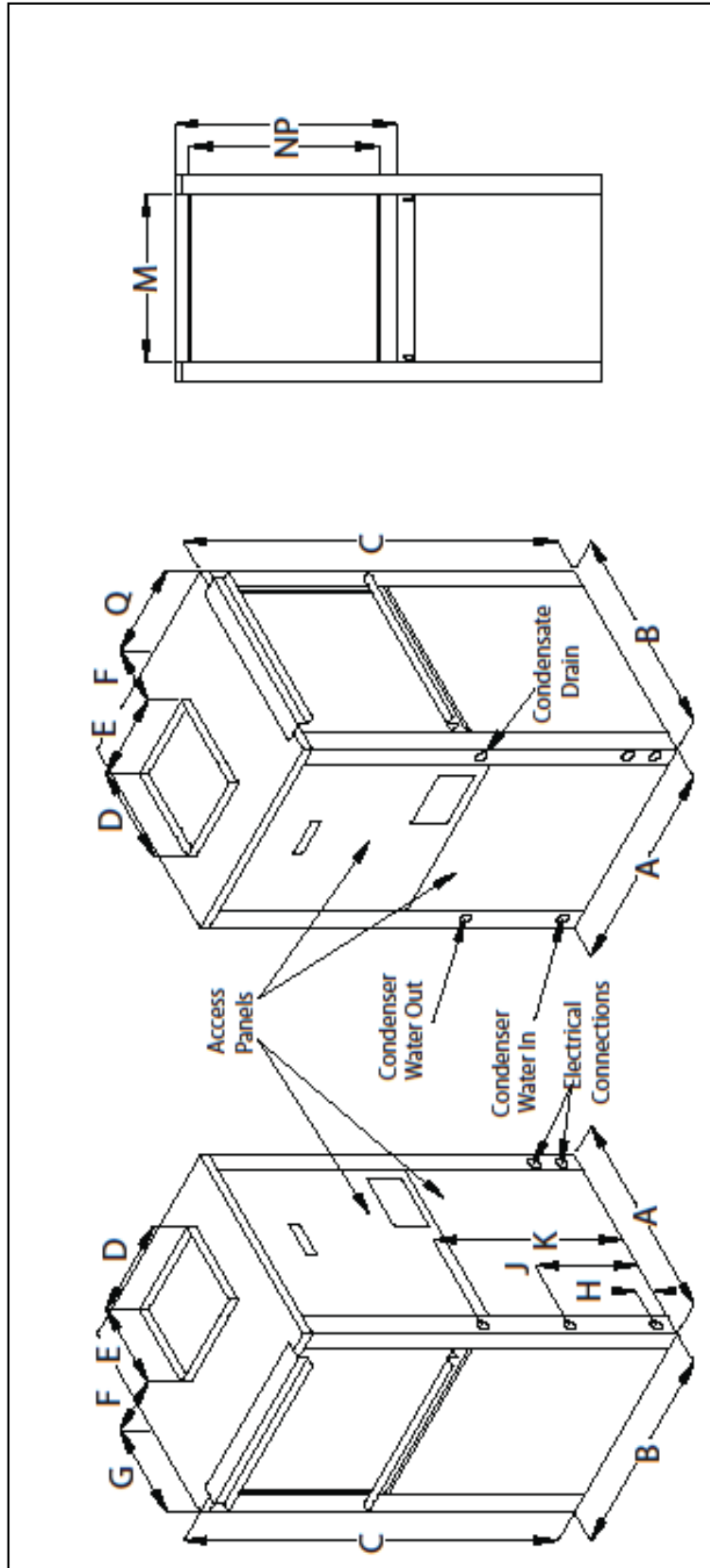
Figure # 19 Dwg LV111002- Single Phase Unit with Waterside Economizer, PSC Fan Motor



# DIMENSIONAL DRAWINGS

## Vertical

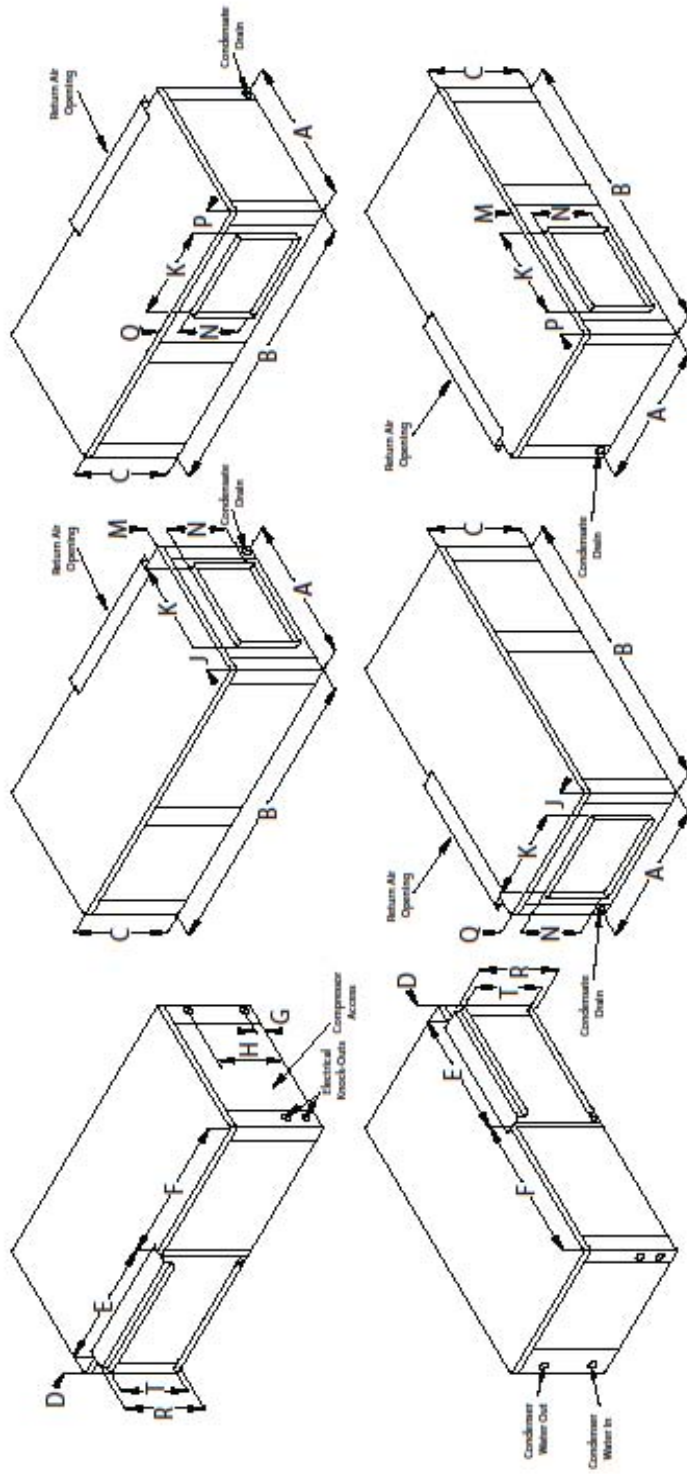
Vertical MODEL	A		B		C		D		E		F		G		H		J		K		M		N		P		Q		Condenser Water Connections		Recommended Standard Replacement Nominal Filter Size	
	Width	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	R/A Duct Flg Width	R/A Duct Flg Height	Filter Rack	Condenser Water Connections	Condenser Water Connections	Condenser Water Connections	Condenser Water Connections	Condenser Water Connections			
LV007	19	19	24.25	10	8	4.5	9.5	2.44	9.68	13.87	16	8	10	5.6	3/4" F.P.T.	10x16x1																
LV009	19	19	24.25	10	8	4.5	9.5	2.44	9.68	13.87	16	8	10	5.6	3/4" F.P.T.	10x16x1																
LV012	19	19	24.25	10	8	4.5	9.5	2.44	9.68	13.87	16	8	10	5.6	3/4" F.P.T.	10x16x1																
LV015	21.5	21.5	32.25	10	8	5.75	12.1	2.85	8.45	15.87	20	14	16	8.1	3/4" F.P.T.	16x20x1																
LV018	21.5	21.5	32.25	14	14	3.6	4.8	2.85	8.45	15.87	20	14	16	4.8	3/4" F.P.T.	16x20x1																
LV024	21.5	21.5	39.25	14	14	3.6	4.8	2.8	14.95	18.87	20	18	20	4.8	3/4" F.P.T.	20x20x1																
LV030	21.5	21.5	39.25	14	14	3.6	4.8	2.8	14.95	18.87	20	18	20	4.8	3/4" F.P.T.	20x20x1																
LV036	21.5	26	43.25	15.5	14	6.5	4.2	2.75	10.77	18.87	24	22	24	4.2	3/4" F.P.T.	24x24x1																
LV041	21.5	21.5	39.25	15.5	14	2	4.2	2.8	14.95	18.87	20	18	20	4.2	3/4" F.P.T.	20x20x1																
LV042	21.5	26	43.25	15.5	14	6.5	4.2	2.75	10.77	18.87	24	22	24	4.2	3/4" F.P.T.	24x24x1																
LV048	24	32.5	45.25	18	14	10	6	3.26	13.2	20.87	30	22	24	6	1" F.P.T.	24x30x1																
LV060	24	32.5	45.25	18	14	10	6	3.26	13.2	20.87	30	22	24	6	1" F.P.T.	24x30x1																
LV070	26	33.25	58.25	18	15.5	10.8	7	2.92	13.36	25.87	30	30	32	7	1" F.P.T.	16x30x1 (2)																





Horizontal

MODEL	A		B	C	D	E	F	G	H	J	K	M	N	P	Q	R	T	Condenser Water Connections
	Width	Height																
LV007	19	33	11.5	1.5	16.15	15.35	2.38	9.625	5.13	5.8125	6.22	3.6	5.13	1.66	14.5	8.6	3/4" F.P.T.	
LV009	19	33	11.5	1.5	16.15	15.35	2.38	9.625	5.13	5.8125	6.22	3.6	5.13	1.66	14.5	8.6	3/4" F.P.T.	
LV012	19	33	11.5	1.5	16.15	15.35	2.38	9.625	5.13	5.8125	6.22	3.6	5.13	1.66	14.5	8.6	3/4" F.P.T.	
LV015	22	43	17	1.5	20.15	21.35	2.86	15.38	6.9	5.95	9.8	3.6	6.4	3.64	18.5	15	3/4" F.P.T.	
LV018	22	43	17	1.5	20.15	21.35	2.86	15.38	5.7	8.6	6.36	9.15	5.2	1.5	18.5	15	3/4" F.P.T.	
LV024	22	43	17	1.5	25.15	16.35	2.86	14.13	5.7	8.6	6.36	9.15	5.2	1.5	23.5	15	3/4" F.P.T.	
LV030	22	43	17	1.5	25.15	16.35	2.86	14.13	5.7	8.6	6.36	9.15	5.2	1.5	23.5	15	3/4" F.P.T.	
LV036	22	54.5	19	1.5	30	23	2.85	16.13	6.9	8.63	7.75	9.8	6.4	1.46	28.5	17	3/4" F.P.T.	
LV041	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LV042	22	54.5	19	1.5	30	23	2.85	16.13	6.9	8.63	7.75	9.8	6.4	1.46	28.5	17	3/4" F.P.T.	
LV048	25	54.5	21	1.5	34.6	18.4	2.86	18.13	7.5	10	7.7	10.86	7	2.4	33	19	1" F.P.T.	
LV060	25	54.5	21	1.5	34.6	18.4	2.86	18.13	7.5	10	7.7	10.86	7	2.4	33	19	1" F.P.T.	
LV070	25	65	21	1.5	48.1	15.4	2.86	18.13	6.5	11.26	7	12	6	1.93	46.5	19	1" F.P.T.	



## NOTES





# BOSCH

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