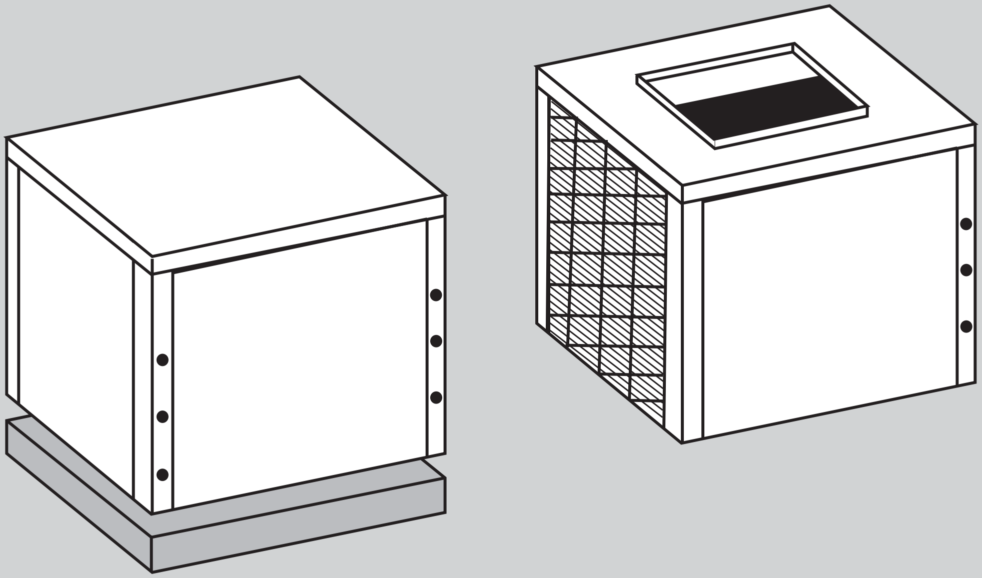
Installation and Maintenance Manual

CE Split Series



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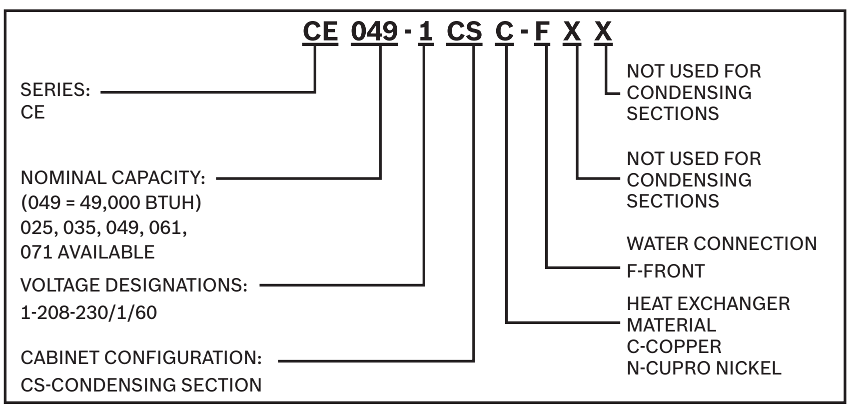
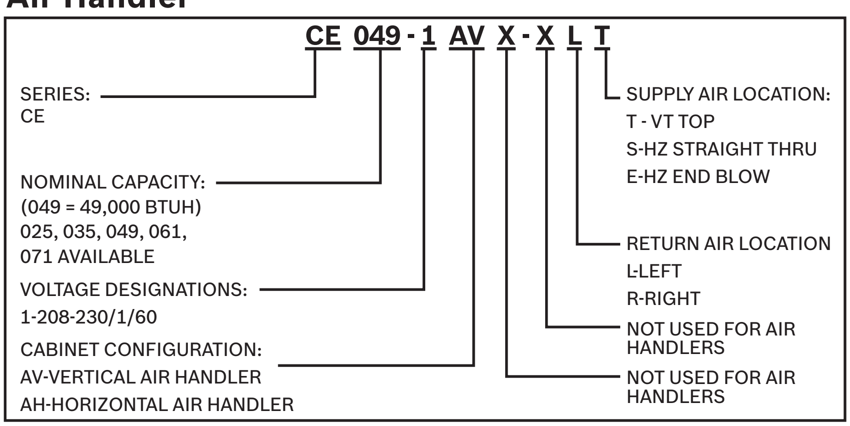
MODEL NOMENCLATURE

Condensing Section



Air Handler



INITIAL INSPECTION

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

GENERAL DESCRIPTION

These Split System Heat Pumps provide the best combination of performance and efficiency available. Safety devices are built into each unit to provide the maximum system protection possible when properly installed and maintained.

The CE Split Water-to-Air Heat Pumps are Underwriters Laboratories (UL) and (cUL) listed for safety. The Water-to- Air Heat Pumps are designed to operate with entering fluid temperature between 20°F to 80°F in the heating mode and between 50°F to 110°F in the cooling mode. Efficiencies and capacities will vary as entering fluid and return air temperatures vary.

50°F Min. EWT for well water applications with sufficient water flow to prevent freezing. Antifreeze solution is required for all closed loop applications where the fluid temperature may drop below 50°F. Cooling Tower/Boiler and Earth Coupled (Geo Thermal) applications should have sufficient antifreeze solution to protect against extreme conditions and equipment failure. Frozen water coils are not covered under warranty.

This product should not be used for temporarily heating/cooling during construction. Doing so may effect the units warranty.

MOVING AND STORAGE

If the equipment is not needed for immediate installation upon its arrival at the job site, it should be left in its shipping carton and stored in a clean, dry area. Units must only be stored or moved in the normal upright position as indicated by the "UP" arrows on each carton at all times. If unit stacking is required, stack units as follows: Vertical units no more than two high. Horizontal units no more than three high.

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. Untrained personnel can perform basic functions of maintenance such as cleaning coils and replacing filters.

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.

The air handler blower should only be operated when a duct is installed and secured to heat pump duct collar in order to avoid possible injury.

LOCATION

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

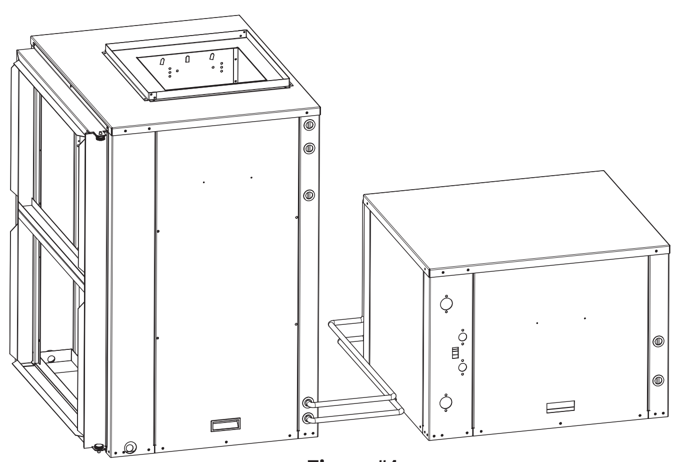


Figure #1

INSTALLATION

Remove all shipping blocks under blower housing.

The installer should comply with all local codes and regulations which govern the installation of this type of equipment. Local codes and regulations take precedent over any recommendations contained in these instructions. In lieu of local codes, the equipment should be installed in accordance with the recommendations made by the National electric code, and in accordance with the recommendations made by the National Board of Fire Underwriters. All local seismic codes for seismic restraint of equipment, piping, and duct work shall be strictly adhered to.

CONDENSING SECTION

Locate the condensing section in an area that provides sufficient space to make water and electrical connections, allowing easy removal of the access panels. A 36" clearance in front of the unit is recommended. This will ensure proper work space for service personnel to perform maintenance or repair.

If the condensing section is installed in a location where ambient temperatures can fall below freezing, some form of freeze protection should be employed such as anti-freeze. Where the use of anti-freeze is not possible for example in a ground water application the fluid circulating pump should operate continuously to prevent possible condenser freeze-up and to optimize overall system performance. Consult the factory in these instances for guidance.

Water freezes at 32°F. Frozen water coils are not covered under the limited product warranty. It is the installer's responsibility to insure that the condensing section is installed in a location or has the proper controls to prevent rupturing the water coil due to freezing conditions.

Do not remove the protective caps or plugs from the service valves until the refrigerant lines are run and ready for final connection.

AIR HANDLER

Locate the air handler unit in an indoor area that allows easy removal of the filter and access panels, and has enough room for service personnel to perform maintenance or repair. Provide sufficient room to make electrical and duct connections. A 36" clearance in front of the unit is recommended. If the unit is located in a confined space such as a closet, provisions must be made for return air to freely enter the space. On horizontal units, allow adequate room below the unit for a condensate drain trap. Sufficient space should be provided on the sides to allow for filter replacement on horizontal air handlers and in the front for vertical air handlers. The air handler units are not approved for outdoor installation; therefore, they must be installed inside the structure being conditioned.

MOUNTING VERTICAL UNITS

Vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to minimize vibration transmission to the building structure. (See Figure #2).

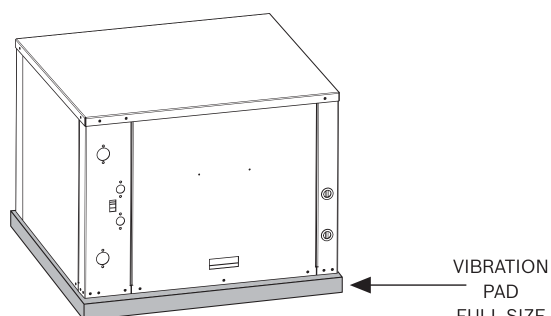


Figure #2

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 kit. (See Figure #3). The rods must be securely anchored to the ceiling. Refer to the hanging bracket assembly and installation instructions for details. All units require four mounting brackets at the corners. 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

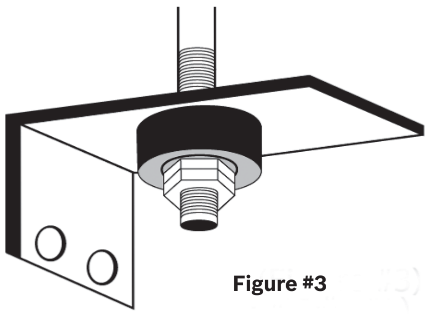


Figure #3

the heat pump must not come in direct contact with joists, trusses, walls, etc.

Some applications require an attic floor installation of the horizontal air handler 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.

CONDENSATE DRAIN

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

Make sure that the unused drain pan opening is plugged prior to operating the air handler.

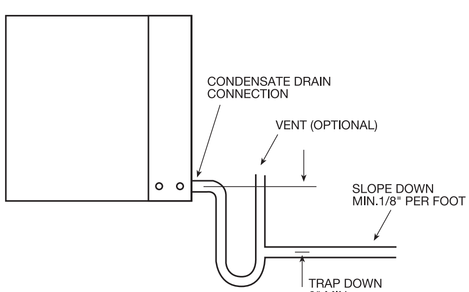


Figure #4

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

The horizontal air handler unit should be pitched approximately 1/4” towards the drain in both directions, to facilitate condensate removal. (See Figure #5)

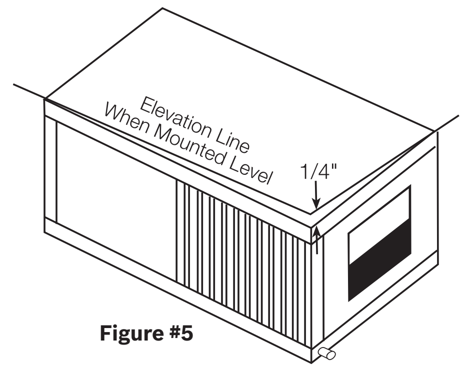


Figure #5

DUCT SYSTEM

A supply air outlet collar and return air duct flange are provided on all units to facilitate duct connections. See Unit Specifications for duct collar connection sizes in the back of this manual.

A flexible connector is recommended for supply and return air duct connections on metal duct systems. All metal ducting should be insulated with a minimum of one inch duct insulation to avoid heat loss or gain and prevent condensate forming during the cooling operation. Application of the unit to uninsulated duct work is not recommended as the unit’s performance will be adversely affected. Do not connect discharge ducts directly to the blower outlet. The factory provided air filter must be removed when using a filter back return air grill. The factory filter should be left in place on a free return system.

If the unit will be installed in a new installation which includes new duct work, the installation should be designed using current ASHRAE procedures for duct sizing. If the unit is to be connected to existing ductwork, 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 ductwork should be installed. Check for existing leaks and repair as necessary to ensure a tight air seal within duct. The duct system and all diffusers should be sized to handle the designed air flow quietly. To maximize sound attenuation of the unit blower, the supply and return air plenums should be insulated. There should be no direct straight air path thru the return air grille into the heat pump. The return air inlet to the heat pump must have at least one 90 degree turn away from the space return air grille. If air noise or excessive air flow are a problem, the blower speed can be changed to a lower speed to reduce air flow. (Refer to ECM motor interface board section in this manual and Figure #6)

ELECTRICAL

Always disconnect power to the unit before servicing to prevent injury or death due to electrical shock or contact with moving parts.

All field wiring must comply with local and national fire, safety and electrical codes. Power to the unit must be within the operating voltage range indicated on the unit's nameplate.

Operating the unit with improper line voltage or with excessive phase imbalance is hazardous to the unit and constitutes abuse and is not covered under warranty.

Properly sized fuses or HACR circuit breakers must be installed for branch circuit protection. See equipment rating plates for maximum size.

Both the air handler and condensing units are provided with a concentric knock-out in the front right corner post for attaching common trade sizes of conduit. Route power supply wiring through this opening. Flexible wiring and conduit should be used to isolate vibration and noise from the building structure. Be certain to connect the ground lead to the ground lug in each of the control boxes. Connect the power leads as indicated on the unit wiring diagrams. (Refer to Figure#12)

ELECTRIC HEATER PACKAGE OPTION

Factory installed internal electric heater packages are available for all units. Two circuit breakers are required when heater packages are utilized. The circuit breakers for the heater package provide power for the heater elements, the blower motor and the control circuit for the unit. The circuit breaker for the unit provides power for the compressor. This allows the electric heaters to continue to operate along with the blower motor in the case of unit compressor and/or compressor power supply failure. See HP Series Heater Kit Instructions for field installation. Each CE Series model has a number of heater sizes available. Refer to Figure #7 for heater package compatibility with specific CE Series units, models nomenclature and electrical data.

LOW VOLTAGE CONTROL WIRING

The CE series units incorporate the ECM variable speed fan motor and control interface board. The thermostat should be connected to the air handlers and then from the air handler to the condensing section. The low voltage power supply is located in the air handler.

In this application utilize a 9 conductor cable from the thermostat to the air handler and 7 conductor cable from the air handler to the condensing section.

Each model has a number of heater sizes available. Refer to Figure #7 for heater package compatibility with specific units, model nomenclature and electrical data.

Figure 6: Motor Profile Air Flow Table CFM Two Stage Units

Model	Fan Only	Y1 COOL/ HEAT	Y2 COOL/ HEAT	AUX HEAT	EMERG HEAT	PLUS ADJ	MINUS ADJ	TAP COOL/ HEAT/DELAY
CE025	450	500	800	800	800	900	700	A
CE035	700	800	1200	1200	1200	1400	1000	A
CE049	900	1000	1600	1600	1600	1800	1400	B
CE061	1200	1400	2000	2000	2000	2100	1900	A
CE071	1600	1600	2200	2200	2200	2300	1900	A

Figure 7: Heater Package Compatibility

Model	Heater Model	KW	Heater Amps		Circuit	MCA		Max. Fuse		AWG Min.
			208V	240V		208V	240V	208V	240V	
CE025 thru 035	HP050-1XS	4.8	17.3	20.0	L1/L2	27.1	30.4	30	30	8
CE049 thru 071	HP050-1XM	4.8	17.3	20.0	L1/L2	27.1	30.4	30	30	8
CE025 thru 035	HP075-1XS	7.2	23.6	30.0	L1/L2	34.9	42.9	40	45	8
CE049 thru 071	HP075-1XM	7.2	23.6	30.0	L1/L2	35.7	43.8	40	45	8
CE025 thru 035	HP100-1XS	9.6	34.7	40.0	L1/L2	48.8	55.4	50	60	6
CE049 thru 071	HP100-1XM	9.6	34.7	40.0	L1/L2	49.5	56.3	50	60	6
CE049 thru 071	HP150-1XM HP150-1XM	14.4 14.4	52.0 34.7 17.3	60.0 40.0 20.0	SINGLE L1/L2 L3/L4	71.2 49.5 21.7	81.3 56.3 25.0	80 60 25	90 60 25	4 6 10
CE049 thru 071	HP200-1XM HP200-1XM	19.2 19.2	69.3 34.7 34.7	80.0 40.0 40.0	SINGLE L1/L2 L3/L4	92.9 49.5 43.4	106.3 56.3 50.0	100 50 45	110 60 50	2 6 6

All heaters rated single phase 60 Hz, and include unit fan load. All fuses type "D" time delay or HACR type breaker or HRC FORM 1. Wire size based on 60 deg. C copper conductors.

Units supplied with internal electric heat require two (2) separate power supplies: one for the unit compressor and one for the electric heater elements, blower motor and control circuit. Refer to Figure #7 for wiring instructions, minimum circuit ampacities and maximum fuse/breaker sizing.

Connection point logic is as follows:

Table 1: Low Voltage Connection Points

Function	From Thermostat	To Air Handler	From Air Handler	To Condensing Section
24 HVAC Common	C	C1	C	C
24 VAC Hot	R	R	R	R
Fan Operation	G	G		
Reversing Valve (3)	O	O	O	O
1st Stage Compressor Operation	Y1	Y1	Y1	Y1
2nd Stage Compressor Operation	Y2	Y2	Y2	Y2
Condensate Sensor (1)			CS	CS
Alarm Output (From UPM) (2)	L	Splice		ALR
Auxilliary Electric Heat (4)	W/W1/W2	W1		
Emergency Heat (4)	E	EM/W2		

TABLE 1 NOTES

1. For the condensate overflow sensor, connect 'CS' at the condensing section to 'CS' at the air handler. Be sure to ground power supply.
2. If service LED is utilized connect 'ALR' terminal on the UPM board to 'L' on the thermostat sub base. The wiring may be spliced in the air handling unit. The ALR output is always dry contact between the OUT and COM Terminals. See Thermostat connections section of this manual for additional information.
3. 'O' – reversing valve is energized in the cooling mode. Fail safe is to heating.
4. Utilized when electric strip heater package present.

ECM INTERFACE BOARD

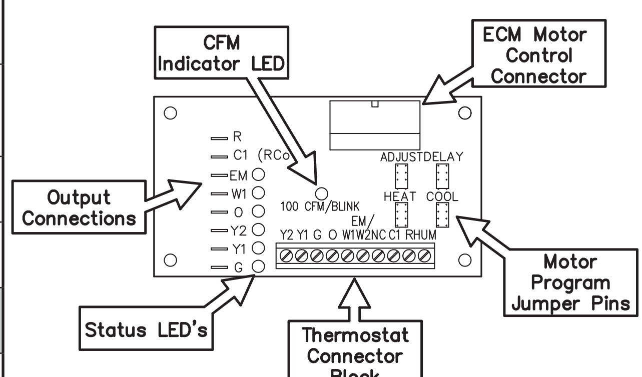


Figure #8 - ECM Interface Board

THERMOSTAT CONNECTIONS

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 variable speed programmable ECM DC fan motor and displays an LED indication of operating status. The thermostat connections and their functions are as follows:

Y2	Second Stage Compressor Operation
Y1	First Stage Compressor Operation
G	Fan
O	Reversing Valve (energized in cooling)
W1	Auxiliary Electric Heat (runs in conjunction with compressor)
EM/W2	Emergency Heat (electric heat only)
NC	Transformer 24 VAC Common (extra connection)
C1	Transformer 24 VAC Common (primary connection)
R	Transformer 24 VAC Hot
HUM	Dehumidification Mode

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.

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

To the left of the thermostat connection block are a row of 2 red and 4 green LED's. These LED's indicate the operating status of the unit. They are labeled as follows:

EM (red)	Emergency Heat On
W1 (red)	Auxiliary Heat On
O (green)	Reversing Valve Energized, unit is in cooling mode
Y2 (green)	Second Stage Compressor On
Y1 (green)	First Stage Compressor On
G (green)	Fan On

Just above the connector block is a single red LED labeled CFM that will blink intermittently when the unit is running. This LED indicates the air delivery of the blower at any given time. Each blink of the LED represent 100 CFM of air delivery so if the LED blinks 12 times, pauses, blinks 12 times, etc. the blower is delivering 1200 CFM. Refer to Figure #6 for factory programmed air delivery settings for the CE Split Series.

Just above and to the right of the thermostat connection block are four sets of jumper pins labeled ADJ, DELAY, HEAT and COOL. The ADJ set of pins are labeled NORM, (+), (-) and TEST. AP units will all be set on the NORM position from the factory, however, airflow can be increased (+) or decreased (-) by 15% from the pre-programmed setting by relocating the jumper in this section. The TEST position is used to verify proper motor operation. If a motor problem is suspected, move the ADJ jumper 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 jumper to NORM, (+) or (-) after testing and reset the unit thermostat to restore normal operation.

Do not set the ADJ jumper 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 three sets of jumper pins are used to select the proper program in the ECM motor for the unit. Refer to Figure #7 for the proper jumper placement.

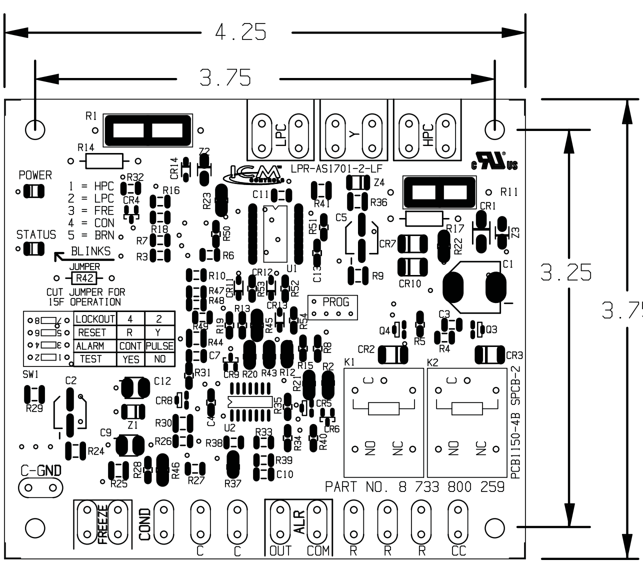
To the left of the red and green status LED's is a row of 1/4" male quick connects. These are used to pass thermostat inputs on to the rest of the control circuit. Remember to always turn off unit power at the circuit breaker before attaching or disconnecting any wiring from these connections to avoid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

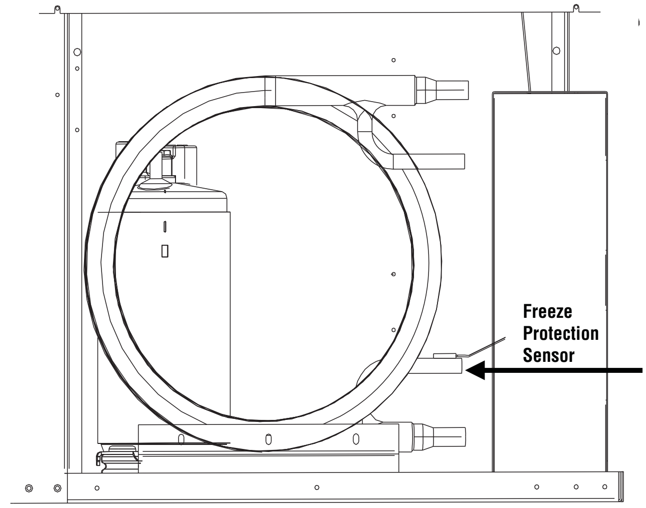
SAFETY DEVICES AND THE UPM CONTROLLER

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.
- Optional freeze protection sensor, mounted close to condensing water coil, monitors refrigerant temperature between condensing water coil and thermal expansion valve. If temperature drops below or remains at freeze limit trip for 30 seconds, the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit trip is 30°F, however this can be changed to 15°F by cutting the R42 resistor located on top of DIP switch SW1.
- The optional condensate overflow protection sensor (standard on horizontal units) is located in the drain pan of the unit and connected to the ‘COND’ terminal on the UPM board.





If freeze protection sensor is not installed, a jumper between freeze contacts must be installed on the UPM board otherwise unit will not start.

The UPM includes the following features:

- **ANTI-SHORT CYCLE TIME**—5 minute delay on break timer to prevent compressor short cycling.
- **RANDOM START**—Each controller has a unique random start delay ranging from 270 to 300 seconds to reduce the chances of multiple units simultaneously starting after initial power up or after a power interruption, creating a large electrical spike.
- **LOW PRESSURE BYPASS TIMER**—If the compressor is running and the low pressure switch opens, then the control will keep the compressor on for 120 seconds. After 2 minutes if the low pressure switch remains open, the control 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 lock out and need to be reset.
- **BROWNOUT/SURGE/POWER INTERRUPTION PROTECTION**—The brownout protection in the UPM board will shut down the compressor if the incoming power falls below 18 VAC. The compressor will remain off till the voltage goes above 18 VAC and the 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 24 VAC output is needed R must be wired to the ALR-COM terminal; 24VAC

will be available on the ALR-OUT terminal when the unit is in alarm condition. If pulse is selected the alarm output will be pulsed. The fault output will depend on the dip switch setting for "ALARM". If it 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 explanations. The remote device must have a malfunction detection capability when the UPM board is set to "PULSE".

- **TEST DIP SWITCH**—A test dip switch is provided to reduce all time delay settings to 10 seconds during troubleshooting or verification of unit operation. Note that operation of the unit while in test mode can lead to accelerated wear and premature failure of the unit. The "TEST" switch must be set back to "NO" for normal operation.
- **FREEZE SENSOR**—The freeze sensor input is active all the time, if a freeze option is not selected the freeze terminals will need a jumper. There are 2 configurable freeze points, 30°F & 15°F. The unit will enter a soft lock out until the temperature climbs above the set point and the anti-short cycle time delay has expired. The freeze sensor will shut the compressor output down after 90 seconds of water flow loss and report a freeze condition. It is recommended to have a flow switch to prevent the unit from running if water flow is lost.

If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the "Freeze" jumper R42 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.

- **L.E.D. FAULT INDICATION**—Two L.E.D. indicators are provided:
  - Green: Power L.E.D. indicates 18–30 VAC present at the board.
  - Red: Fault indicator with blink codes as follows:
    - One blink—High pressure lockout
    - Two blinks—Low pressure lockout
    - Three blinks—Freeze sensor lockout
    - Four blinks—Condensate overflow
    - Five blinks—Brownout
- **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".

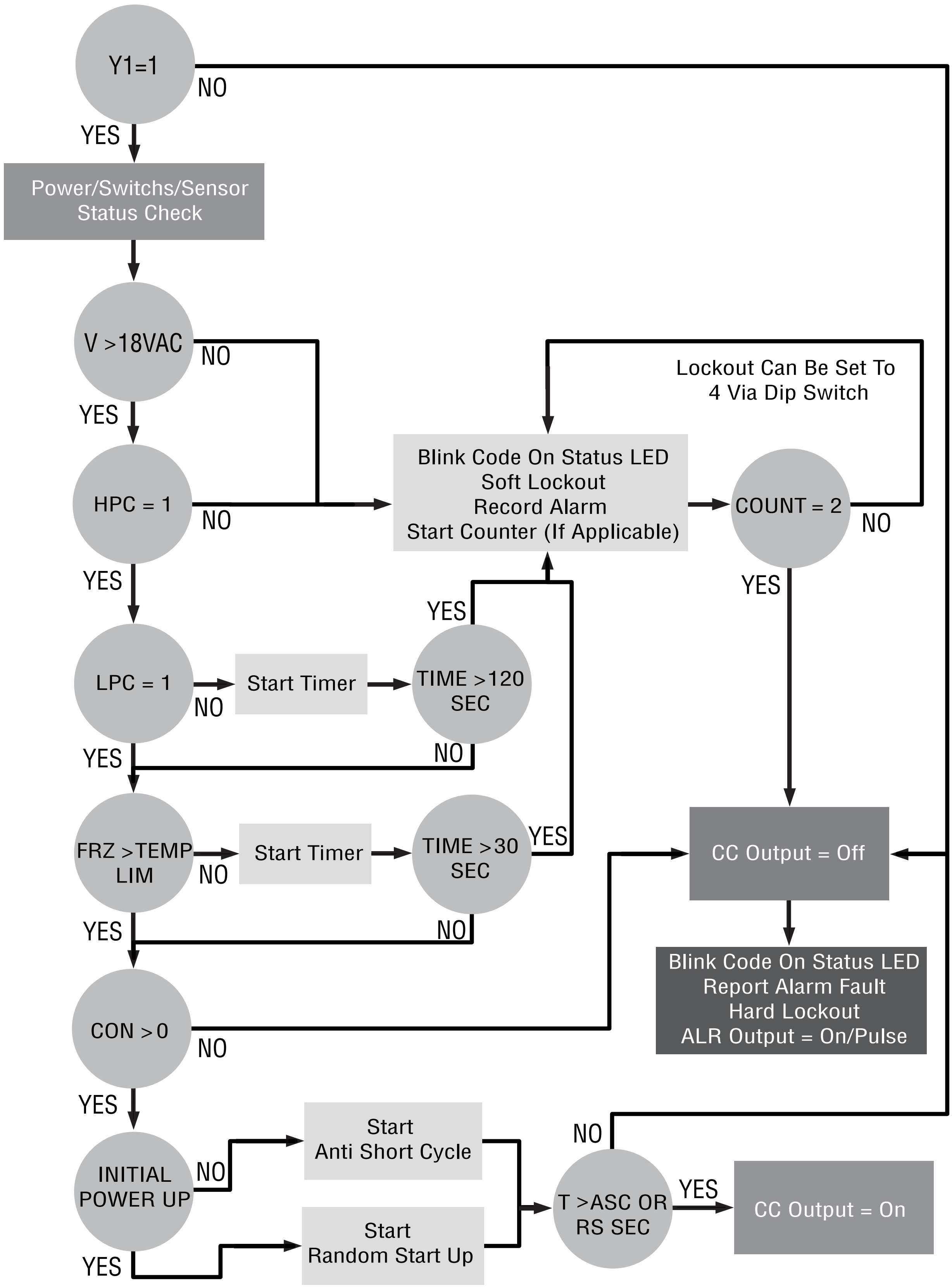
The blower motor will remain active during a lockout condition.

- **UPM BOARD DEFAULT SETTINGS**—Your UPM board will come from the factory with the following default settings:
  - **Freeze**—"Terminals not jumped" on all the time
  - **Temp**—30°F
  - **Lockout**—2
  - **Reset**—"Y"
  - **Alarm**—"PULSE"
  - **Test**—"NO"
  - **Dry Contact**—"Normally Open (NO)"

Considerations

1. Always check incoming line voltage power supply and secondary control voltage for adequacy. Transformer primaries are dual tapped for 208 and 230 volts. Connect the appropriate tap to ensure a minimum of 18 volts secondary control voltage. 24 volts is ideal for best operation.

UPM Sequence of Operation (SOO) Flow Chart



2. Long length thermostat and control wiring leads may create voltage drop. Increase wire gauge or up-size transformers may be required to insure minimum secondary voltage supply.
3. FHP recommends the following guidelines for wiring between a thermostat and the unit: 18 GA up to 60 foot, 16 GA up to 100 ft and 14 GA up to 140 ft.
4. Do not apply additional controlled devices to the control circuit power supply without consulting the factory. Doing so may void equipment warranties.
5. Check with all code authorities on requirements involving condensate disposal/over flow protection criteria.

SEQUENCE OF OPERATION

Cooling Mode

See Typical Wiring Diagram at the end of the manual. Energizing the "O" terminal energizes the unit reversing valve in the cooling mode. The fan motor starts when the "G" terminal is energized.

When the thermostat calls for cooling (Y), the loop pump or solenoid valve if present is energized and compressor will start.

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

Note that a fault condition initiating a lockout will de-energize the compressor.

Heating Mode

Heating operates in the same manner as cooling, but with the reversing valve de-energized. The compressor will run until the desired setpoint temperature on the thermostat is achieved.

Once the thermostat is satisfied, the compressor shuts down and the fan ramps down in either fan only mode or turns off over a span of 30 seconds. Auxiliary electric heating coils are not available on the EP product line.

UNIT OPTIONS
HOT GAS REHEAT (HGR)

Hot gas reheat allows the user to not only control space temperature, but also humidity levels within the conditioned space. An excess of moisture in the space can allow mold growth leading to damage in the structure or interior surfaces as well as reducing the air quality and creating an unhealthy environment.

The typical control of a unit is by a thermostat that senses the temperature in the space. By utilizing a humidistat in addition to the thermostat we are able to monitor the humidity levels in the space as well. The HGR option allows cooling and dehumidification to satisfy both the thermostat and humidistat.

PIPING

WATER PIPING

⚠ *Water piping exposed to extreme low ambient temperatures are subject to freezing. Remember water freezes at 32°F.*

Supply and return piping must be as large as the water connections on the condensing section (larger on long runs). Never use flexible hoses of a smaller inside diameter than that of the water connections on the unit. The condensing sections are supplied with either a copper or optional cupro-nickel condenser.

⚠ *Galvanized pipe or fittings are not recommended for use with these units due to the possible galvanic corrosion.*

Both the supply and discharge water lines will sweat if subject to low water temperature. These lines should be insulated to prevent damage from condensation.

All manual flow valves used in the system must be ball valves. Globe and gate valves must not be used due to high pressure drop and poor throttling characteristics.

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

⚠ *Improper heat exchanger water flow due to piping, valving or improper pump operation is hazardous to the unit and constitutes abuse which will void the heat exchanger and compressor warranty.*

All condensing sections 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 over tighten 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.

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 double pole single throw (DP/ST) contactor (Figure #9) can be used to operate the well pump with the heat pump.

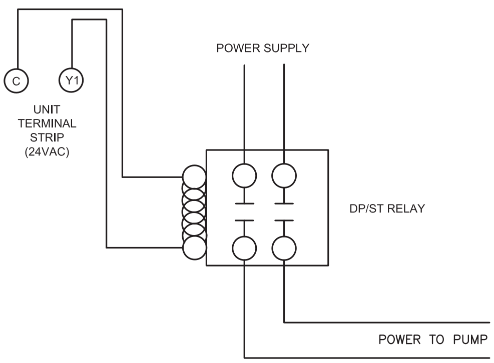


Figure #9

When two or more units are supplied from one well, the pump can be wired (Figure #10) to operate independently from either unit. An upsized VA transformer may be required in either case.

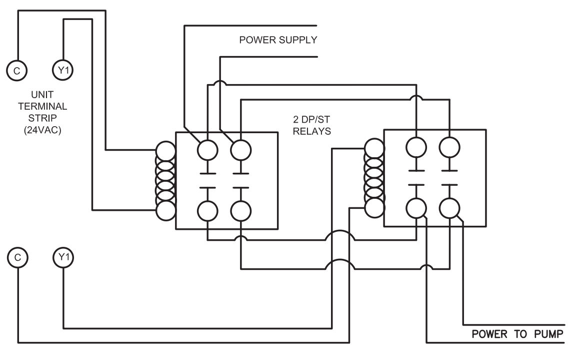


Figure #10

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.

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.)

REFRIGERANT LINES

The installation of the copper refrigerant tubing must be done with care to obtain reliable, trouble-free operation. This installation should only be performed by qualified refrigeration service and installation personnel.

Refrigerant lines generally can and should be routed and supported so as to prevent the transmission of vibrations into the building structure. Experience and good design practice dictate 75 feet as the maximum practical length for interconnecting refrigerant lines in split system heat pumps without special considerations. Beyond 75 feet, system losses become substantial and the total refrigerant charge required can compromise the reliability and design life of the equipment.

Refrigerant lines should be sized in accordance with Table 3 in the following instructions. Copper tubing should be clean and free of moisture and dirt or debris. The suction and liquid lines MUST be insulated with at least 3/8" wall, closed-cell foam rubber insulation or the equivalent.

GENERAL INFORMATION (REFRIGERANT LINES)

1. Pressure drop (friction losses) in refrigerant suction lines reduces system capacity and increases power consumption by as much as 2% or more, depending on the line length, number of bends, etc. Pressure drop in liquid lines affects system performance to a lesser degree, provided that a solid column of liquid (no flash gas) is being delivered to the refrigerant metering device, and that the liquid pressure at the refrigerant metering device is sufficient to produce the required refrigerant flow.
2. Oil is continually being circulated with the refrigerant so, oil return to the compressor is always a consideration in line sizing. Suction lines on split system heat pumps are also hot gas lines in the heating mode, but are treated as suction lines for sizing purposes. If the recommended suction lines sizes are used, there should be no problem with oil return.
3. Vertical lines should be kept to a minimum. Vertical liquid lines will have a vertical liquid lift in either heating or cooling, and the weight of the liquid head is added to the friction loss to arrive at the total line pressure drop.
4. Wherever possible, the air handler should be installed at a higher elevation than the condensing section to aid with oil return to the compressor.

LINEAR VS. EQUIVALENT LINE LENGTH

LINEAR LINE LENGTH – is the actual measured length of the line including bends. This issued to calculate the additional refrigerant charge that must be added to the system (See Table 3 and examples).

EQUIVALENT LINE LENGTH – is the combination of the actual lengths of all straight runs and the equivalent length of all bends valves and fittings in a particular line. The equivalent length of a bend, valve or fitting is equal to the length of a straight tube of the same diameter having the same pressure drop as the particular valve or fitting. The ASHRAE Fundamentals Handbook provides tables for determining the equivalent length of various bends, valves and fittings. Liquid and suction line sizes as shown in Table 3 are based on Equivalent Line Length.

CONNECTING REFRIGERANT LINES

- Use only ACR grade copper tubing and keep ends sealed until joints are made.
- For best performance, select routing of refrigerant lines for minimum distance and fewest number of bends.
- Size lines in accordance with Table 3.
- Cut crimped ends off the air handler suction and liquid lines. Connect and braze lines to the air handler.

The air handler is factory supplied with a holding charge of dry nitrogen.

Connect and braze lines to service valves on the condensing section (See figure #11 – Service Valve Drawing).

Always wrap the body of the service valve with a wet towel or apply some other form of heat sink prior to brazing and direct flame away from the valve body. Failure to do so will result in damage to the valve. Valve body temperature must remain below 250°F to protect the internal rubber "O" rings and seals.

Unit Size	Line Type	Valve Conn. Size	Allen Wrench size
CE025/035/049	Suction	3/4	5/16
CE061/071	Suction	7/8	5/16
All Valves	Liquid	3/8	3/16

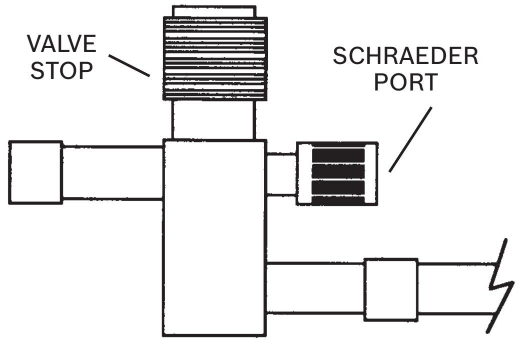


Figure #11

Pressurize the refrigerant line set and air handler to 150 lbs with dry nitrogen through the Schrader ports provided on the service valves. Check line set and unit connections for leaks.

Once system integrity is verified, evacuate line set and air handler with a good vacuum pump to 500 microns and hold for one half hour.

Pump-down must never be used with heat pumps.

CHARGING THE SYSTEM

Do not overcharge the system. Charge all systems by weight as determined from Table 3 and the supplied factory charge. Remember the condensing unit is factory charged with sufficient refrigerant to support the air handler, condensing section and 25 feet of liquid line. If the lines are less or more than 25 feet, then a charge adjustment must be calculated. Refer to examples #1 and #2 following Table 4.

High pressure refrigerant gas and liquid is present in the unit. Liquid refrigerant can cause severe burns to exposed skin areas. Wear safety glasses to protect the eyes. Liquid refrigerant in contact with the eyes could cause loss of sight.

Open both service valves in the condensing section by turning the valve stops located at the top of each valve counter-clockwise with an Allen wrench (See Figure 11). Make sure that both valves are fully open.

THINGS TO REMEMBER

1) Do not oversize liquid lines unless absolutely unavoidable. If oversized lines must be used, a suction line accumulator may be required and

the addition of a crankcase heater may be necessary. Consult the Factory for recommendation.

2) If the calculated Equivalent Line Length falls between the lengths shown on Table 3, use tubing sized for the next longer length.
3) Maximum Linear (actual) liquid line length without a suction line accumulator is 60 feet. Liquid line length in excess of 100 feet is not recommended either with or without a suction line accumulator.
4) A liquid line drier-filter is required, it must be of the bidirectional type only and approved for the refrigerant type utilized.
5) Suction line size must be one of those given in Table 3.
6) Horizontal suction line runs should be pitched slightly toward the compressor to provide free drainage and aid oil return. Do not exceed the largest diameter given in the tables on horizontal runs.
7) When brazing always bleed dry nitrogen through refrigerant tubing to displace air and prevent oxidation.
8) Air handler is pre-charged in the factory with nitrogen gas. Cut air handler piping with care.

Always check refrigerant type on the unit data plate before servicing. Do not use R22 manifold gauges on R-410A units. Doing so could result in severe injury.

INSTALLATION OF PRESSURE REGULATING VALVES

Pressure regulating valves are used to increase or decrease water flow through the heat pump in response to refrigerant pressure. In some cases more water may be required in heating than in cooling, or vice versa. With the CE heat pumps these valves are not required. However, if installed, a pair of valves are required for proper operation, one valve for cooling (direct acting) and another valve for heating (indirect acting) or one dual acting valve. A refrigerant tap is provided in the refrigerant line located between the reversing valve and the water-to-refrigerant heat exchanger for proper monitoring of the refrigerant pressures.

The discharge water from the heat pump is not contaminated in any manner and can be disposed of in various ways depending on local building codes (i.e. discharge well, dry well, storm sewer, drain field, stream or pond, etc.) Most local codes forbid the use of a sanitary sewer for disposal. Consult your local building and zoning department to insure compliance in your area.

WELL WATER SYSTEMS

Copper is adequate for ground water that is not high in mineral content. Should your well driller express concern regarding the quality of the well water available or should any known hazards exist in your area, we recommend proper testing to assure the well water quality is suitable for use with water source equipment. In conditions anticipating moderate scale formation or in brackish water a cupro-nickel heat exchanger is recommended. In well water applications water pressure must always be maintained in the heat exchanger. This can be accomplished with either control valve or a bladder type expansion tank. When using a single water well to supply both domestic water and the heat pump care must be taken to insure that the well can provide sufficient flow for both. In well water applications a slow closing solenoid valve must be used to prevent water hammer.

Solenoid valves should be connected across Y1 and C1 on the interface board. Make sure that the VA draw of the valve does not exceed the contact rating of the thermostat.

COOLING TOWER/BOILER SYSTEMS

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

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

In the heating mode, heat is absorbed from the water loop. A boiler can be utilized to maintain the loop at the desired temperature.

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

Consult the specification sheets for piping sizes. Teflon tape sealer should be used when connecting to the unit to insure against leaks and possible heat exchanger fouling. Do not over tighten the connections. Flexible hoses should be used between the unit and the rigid system to avoid possible vibration. Ball valves should be installed in the supply and return lines for unit isolation and unit water flow balancing. Pressure/temperature ports are recommended in both supply and return lines for system flow balancing. Water flow can be accurately set by measuring the water-to-refrigerant heat exchangers water side pressure drop. See specification sheets for water flow vs. pressure drop information

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

EARTH COUPLED SYSTEMS

Closed loop and pond applications require specialized design knowledge. No attempt at these installations should be made unless the dealer has received specialized training. Utilizing the Bosch Ground Loop Pumping Package (GLP), makes the installation easy. Anti-freeze solutions are utilized when low evaporating conditions are expected to occur. Refer to the GLP installation manuals for more specific instructions.

SYSTEM CHECKOUT

- After completing the installation, and before energizing the unit, the following system checks should be made:
- Verify that the supply voltage to the heat pump is in accordance with the nameplate ratings.
- Make sure that all electrical connections are tight and secure.
- Check the electrical fusing and wiring for the correct size.
- Verify that the low voltage wiring between the thermostat and the unit is correct.
- Verify that the water piping is complete and correct.
- Check that the water flow is correct, and adjust if necessary.
- Check the blower for free rotation, and that it is secured to the shaft.
- Verify that vibration isolation has been provided.
- Unit is serviceable. Be certain that all access panels are secured in place.

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...

HEAT RECOVERY PACKAGE

The Heat Recovery package is a factory mounted option. It consists of a forced pumped unit that employs a circulating pump to move water through a double wall/vented heat exchanger and returns the heated water to the water tank. The water is heated by superheated refrigerant discharge gas from the compressor. This waste heat of the cooling mode captured by the heat recovery increases the capacity and efficiency of the heat pump unit. If the air temperature is uncomfortable coming from the air vents in the heating mode the heat recovery may need to be turned off. In the heating mode the heat recovery captures heat that would normally be used for space heating.

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

TYPICAL CONNECTION PIPING

WATER TANK PREPARATION:

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

HR WATER PIPING:

All hot water piping should be a minimum of 3/8" O.D. copper tube to a maximum distance of fifteen (15) feet. For distances beyond fifteen feet but not exceeding sixty (60) feet use 1/2" copper tube. Separately insulate all exposed surface of both connecting water lines with 3/8" wall closed cell insulation. Install isolation valves on supply and return to the heat recovery. (Figure #12)

WATER TANK REFILL:

1. Open the cold water supply to the tank.
2. Open a hot water faucet to vent air from the system until water flows from the faucet, then close.
3. Depress the hot water tank pressure relief valve handle to ensure there is no air remaining in the tank.
4. Carefully inspect all plumbing for water leaks. Correct as required.
5. Purge all air from HR by depressing the schrader valve on the HR Unit. Allow all air to bleed out until water appears at the valve.
6. Before restoring the power or fuel supply to the water heater, adjust the temperature setting on the tank thermostat(s) to ensure maximum utilization of the heat available from the refrigeration system and conserve the most energy. On tanks with both upper and lower elements and thermostats, the lower

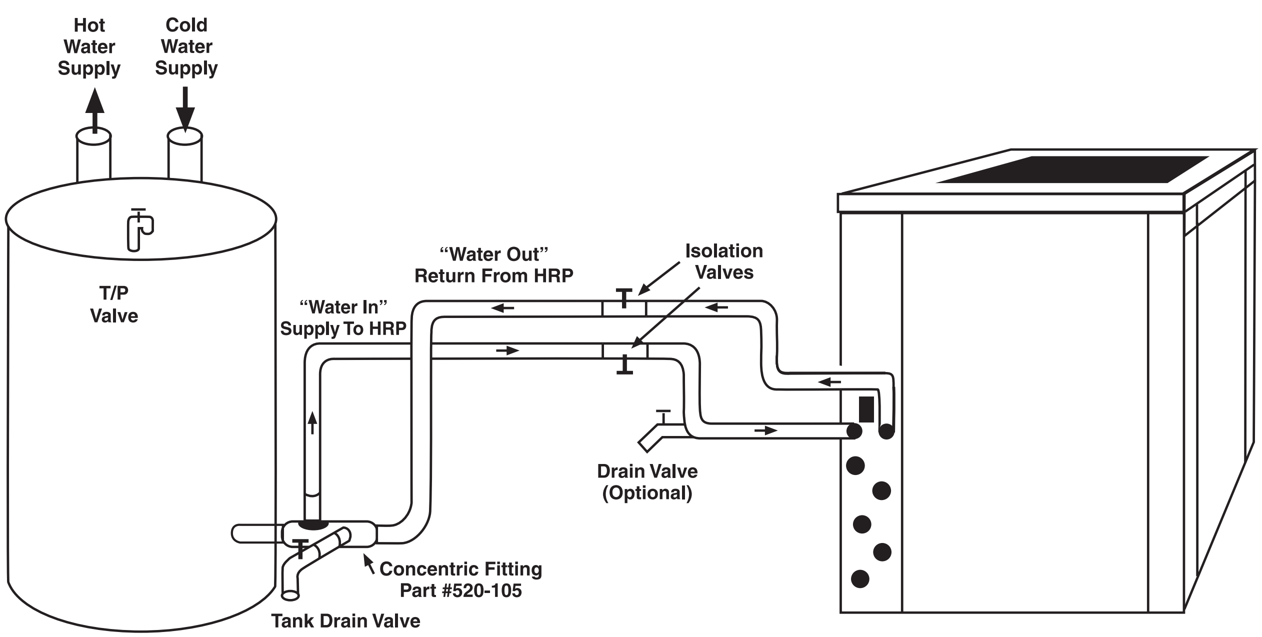


Figure #12

element should be turned down to 100° F, while the upper element should be adjusted to 120° F. Depending upon the specific needs of the customer, you may need to adjust the upper element differently. On tanks with a single thermostat lower the thermostat setting to 120° F or the "LOW" position.

7. After thermostat adjustments are completed, replace access cover and restore electrical or fuel supply to water heater.

INITIAL START-UP:

1. Make sure all valves in heat recovery water piping system are open. NEVER OPERATE HR PUMP DRY.
2. Turn on the heat pump. The HR pump should not run if the compressor is not running.
3. Turn HR switch to the "ON" position. The pump will operate if entering water temperature to HR is below 120° F.
4. The temperature difference between the water entering and leaving the heat recovery should be 5° to 15° F.

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. See Unit specifications for replacement filter sizes. Factory provided filters are all 2" MERV 11 rated pleated filters.

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

2. An annual "checkup" is recommended by a 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.

IN-WARRANTY MATERIAL RETURN

When contacting your Representative for service or replacement parts, refer to the model and serial number of the unit as stamped on the data plate attached to the unit.

Material may be returned to the factory only with permission of an authorized factory representative. A "Warranty Return Material" tag must be attached to the returned material. Assure that all of the information as called for on the tag is filled out completely and accurately to expedite handling and insure prompt issuance of credits.

Freight charges for all items returned to the factory shall be prepaid. The return of the part does not constitute an order for a replacement. Therefore, a purchase order must be entered through your nearest representative. The order shall include the part number, model number, and serial number of the unit involved. If the part is within the warranty period, and after our inspection of the returned part proves that the failure is due to faulty material or workmanship a credit or replacement part will be issued

Parts returned without a completed "Warranty Return Material" tag will not be credited.

UNIT SPECIFICATIONS

Table 2: Dimensions

CE Split Dimensions (IN)															
Model	Vertical Air Handler			Horizontal Air Handler			Condensing Section			Supply Connection		Return Connection		Replacement Filter Nominal Size
	Width	Depth	Height	Width	Depth	Height	Width	Depth	Height	Width	Height	Width	Height	
CE025	21.50	26.00	25.75	26.00	34.00	21.75	21.75	26.00	21.75					Hz: 20"x30"x2" Vrt: 24"x24"x2" (1)
CE035	21.50	26.00	25.75	26.00	34.00	21.75	21.50	26.00	21.75					Hz: 20"x30"x2" (1) Vrt: 20"x24"x2" (1)
CE049	24.00	32.75	25.75	30.00	38.50	21.75	24.00	32.75	21.75					Hz: 20"x34.5"x2" (1) Vrt: 24"x30"x2" (1)
CE061	26.00	33.25	27.75	30.00	38.50	21.75	26.00	33.25	21.75					Hz: 20"x34.5"x2" (1) Vrt: 24"x30"x2" (1)
CE071	26.00	33.25	35.75	30.00	49.00	21.75	26.00	33.25	21.75					Hz: 20"x24"x2" (1) Vrt: 16"x30"x2" (1)

Table 3: Refrigerant Charge, Line Sizing and Capacity Multiplier Chart

System Model	Factory R410A Charge (Oz)*	Refrigerant Line O.D. Size (Based on Equivalent Line Length)										Suct. Line Riser Max.
		15 FT.		25 FT.		35 FT.		45 FT.		50 FT.		
		LIQ.	SUC.	LIQ.	SUC.	LIQ.	SUC.	LIQ.	SUC.	LIQ.	SUC.	
CE025	79	5/16	5/8	5/16	3/4	5/16	3/4	5/16	3/4	3/8	3/4	5/8
CE035	83	5/16	3/4	3/8	3/4	3/8	3/4	3/8	3/4	3/8	7/8	3/4
CE049	93	3/8	3/4	3/8	7/8	3/8	7/8	3/8	7/8	3/8	7/8	7/8
CE061	99	3/8	7/8	3/8	1-1/8	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8	7/8
CE071	127	3/8	7/8	3/8	1-1/8	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8	7/8
CAPACITY MULTIPLIER				1.00		.995		0.990		0.990		

Table 3 continued: Refrigerant Charge, Line Sizing and Capacity Multiplier Chart

System Model	Factory R410A Charge (Oz)*	Refrigerant Line O.D. Size (Based on Equivalent Line Length)										Suct. Line Riser Max.
		60 FT.		70 FT.		80 FT.		120 FT.		150 FT.		
		LIQ.	SUC.	LIQ.	SUC.	LIQ.	SUC.	LIQ.	SUC.	LIQ.	SUC.	
CE025	79	3/8	7/8	3/8	7/8	3/8	7/8	3/8	7/8	3/8	7/8	5/8
CE035	83	3/8	7/8	3/8	7/8	3/8	7/8	1/2	7/8	1/2	7/8	3/4
CE049	93	1/2	7/8	1/2	7/8	1/2	7/8	1/2	7/8	1/2	7/8	7/8
CE061	99	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8	7/8
CE071	127	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8	1/2	1-1/8	7/8
CAPACITY MULTIPLIER		0.985		0.980		0.975		0.970		0.960		

* Factory charge is based on 25 feet of equivalent length

Table 4: Liquid Line Charge Per Linear Foot

	Liquid Line Size, O.D.				
	1/4	5/16	3/8	1/2	5/8
R410A oz per foot	.25	.44	.60	1.15	1.95

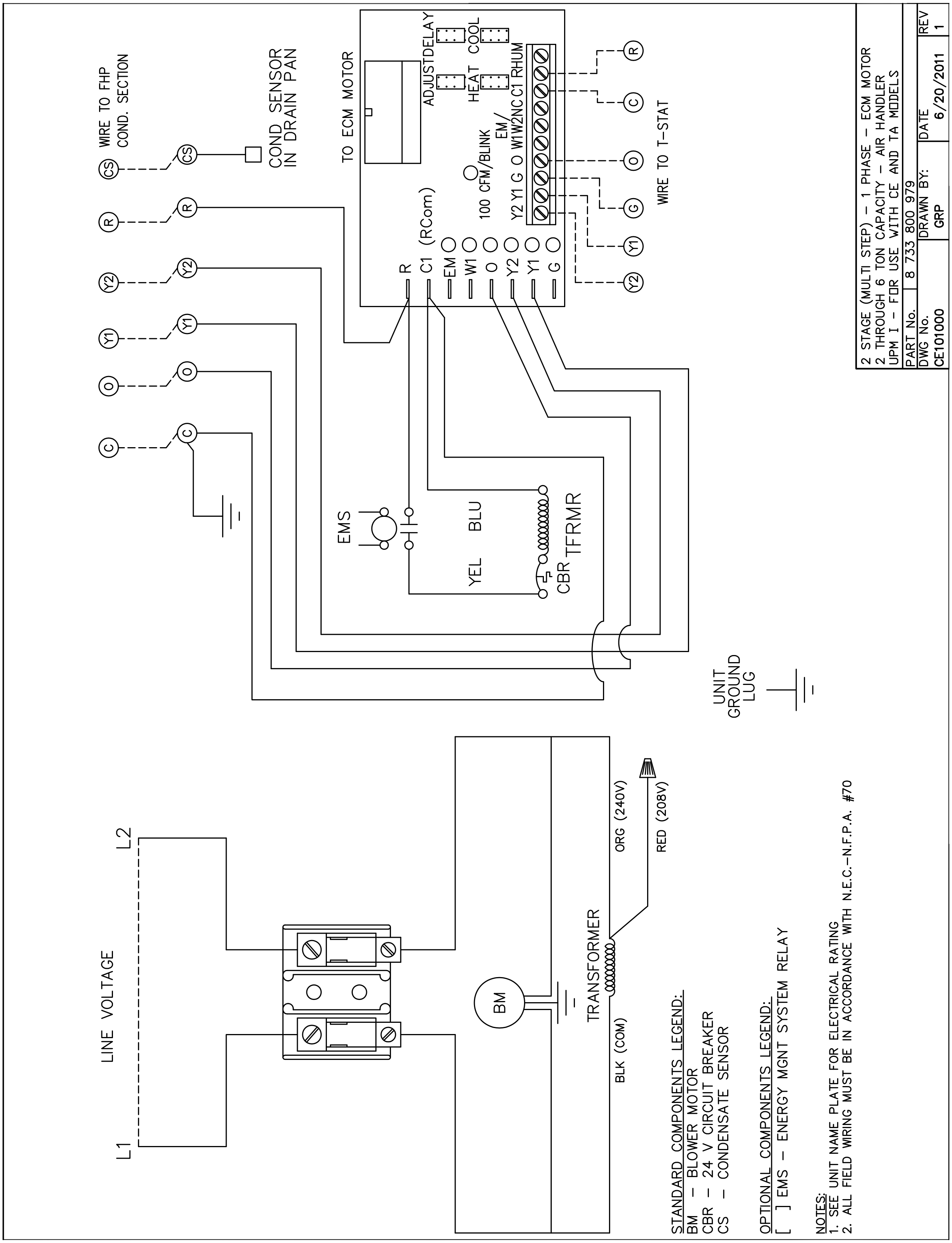
Example 1:

Model CE035 with 45 ft of equivalent length of 3/8" O.D. Liquid Line. Total System Charge = Factory Charge + (45 ft - 25 ft) x .60 oz/ft Total System Charge = 93 oz + (20 ft x .60 oz/ft) = 105 oz Additional 12 oz of R410A refrigerant required

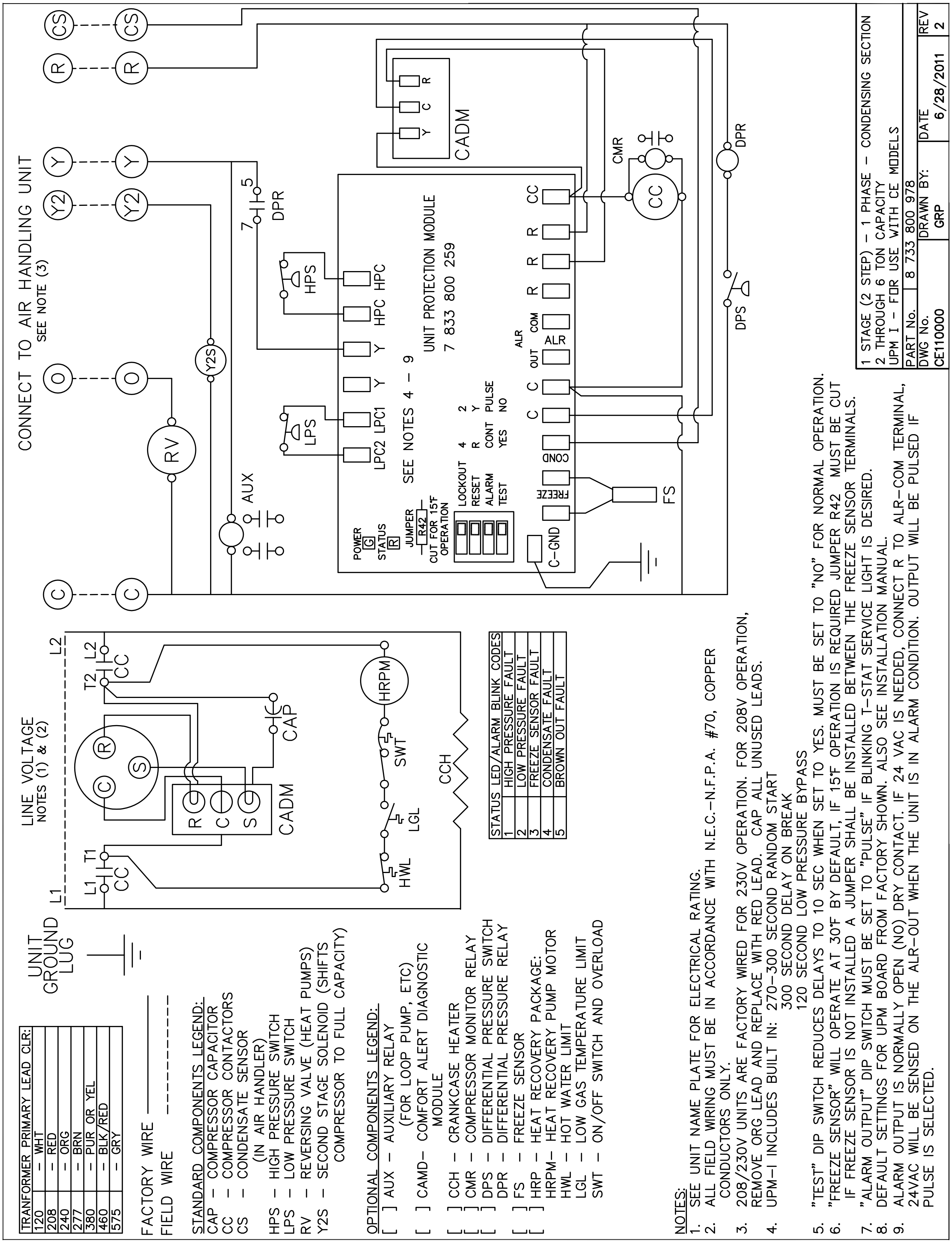
Example 2:

Model CE061 with 10 feet of equivalent length of 3/8" O.D. Liquid Line. Total System Charge = Factory Charge - (25 ft - 10 ft) x .60 oz/ft Total System Charge = 150 oz - (15 ft x .60 oz/ft) = 141 oz Reclaim of 9 oz of R410A refrigerant required.

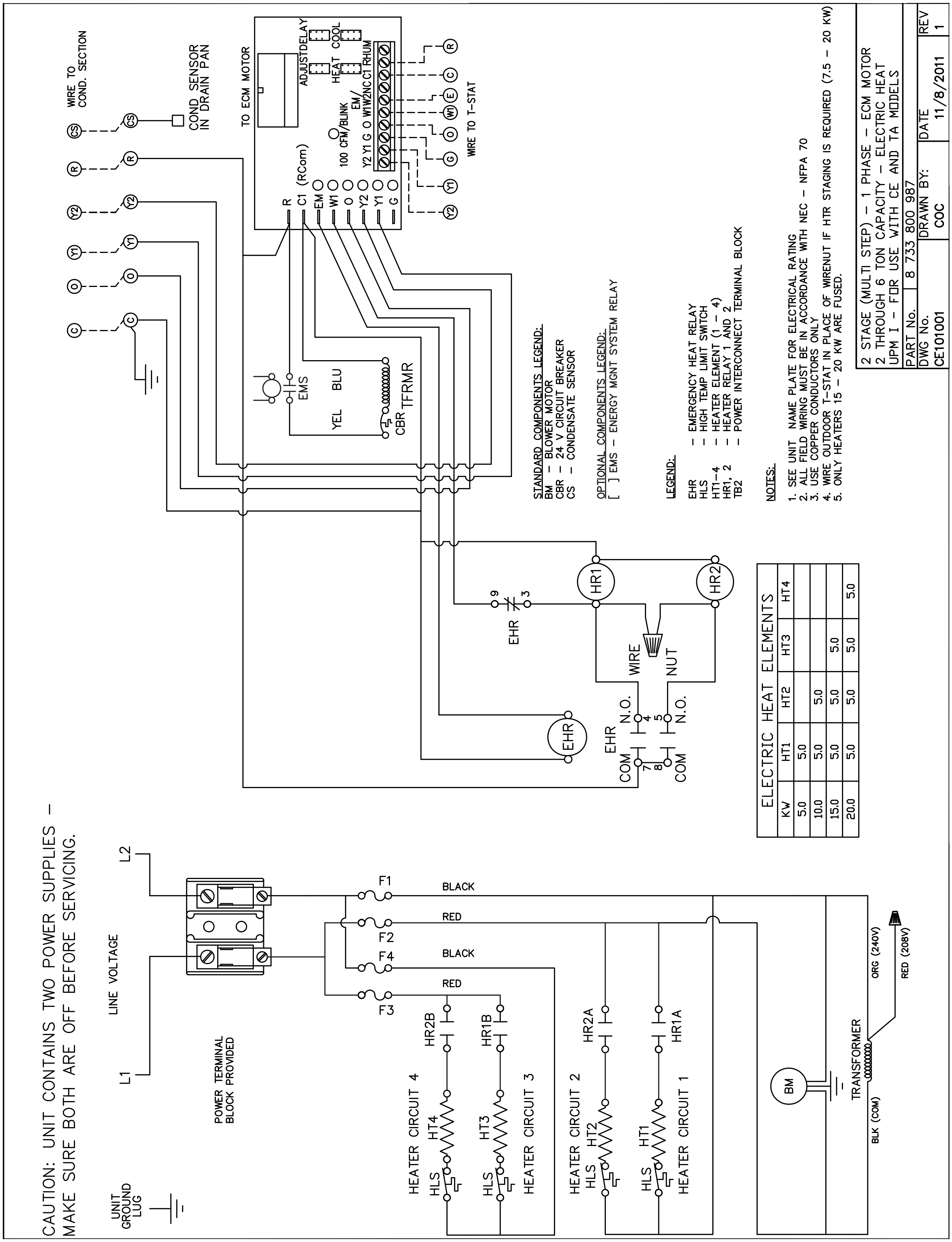
Figure 13: TYPICAL WIRING DIAGRAMS
Two Stage Two Step – Single Phase ECM Motor



Single Stage Two Step - Single Phase



Two Stage Multi Step - Single Phase - ECM Motor - Electric Heat



OPERATING PRESSURES & TEMPERATURES
Environmentally Safe R-410A Refrigerant

Table 5: Operating Data

			COOLING				HEATING			
Model	Entering Water Temp. °F	Water Flow GPM	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
CE025 Part Load	30°	4					75-91	264-322	5-6	15-17
		8					79-96	270-331	3-4	16-18
	40°	4					88-107	277-339	6-7	17-20
		8	115-140	175-214	8-9	19-23	92-112	284-348	4-5	18-21
	50°	4	129-157	218-267	14-17	18-20	98-122	291-356	7-8	20-23
		8	124-151	204-250	8-9	19-22	110-130	298-364	5-6	21-24
	60°	4	134-163	249-305	13-16	17-20	112-136	304-372	8-10	22-26
		8	128-156	233-287	8-9	18-21	117-143	312-381	6-7	23-28
	70°	4	138-168	281-341	13-16	17-19	124-152	318-389	9-11	24-29
		8	133-161	263-323	7-9	18-21	131-159	325-398	6-8	26-31
	80°	4	143-174	317-388	13-16	16-19	136-166	331-405	11-13	27-32
		8	137-167	297-366	7-9	17-20	143-174	339-415	7-9	28-33
	90°	4	147-179	357-437	13-16	16-18	149-181	345-422	12-14	29-35
		8	141-172	335-411	7-9	17-20	156-190	352-432	8-10	31-37
	100°	4	151-185	402-492	13-15	15-18				
		8	146-177	378-459	7-9	16-19				
CE025 Full Load	30°	4					76-92	242-297	3-4	13-14
		8					80-97	249-304	2-3	13-15
	40°	4	125-151	180-221	14-18	19-22	89-108	255-312	4-5	15-17
		8	120-146	169-207	8-10	20-23	93-113	261-320	3-3	16-18
	50°	4	134-163	211-258	14-18	18-21	106-118	267-327	5-6	17-19
		8	129-157	198-242	8-10	19-23	110-126	274-335	3-4	18-21
	60°	4	139-169	241-295	14-17	18-21	113-138	280-342	6-7	19-22
		8	134-163	227-278	8-10	19-22	119-145	287-351	4-5	20-23
	70°	4	144-175	272-333	14-17	17-20	126-155	292-358	7-8	21-24
		8	138-168	255-313	8-10	18-21	133-162	300-367	5-6	22-26
	80°	4	148-181	307-375	14-17	17-19	138-168	305-373	8-9	23-27
		8	143-174	288-353	8-10	18-21	145-177	312-382	5-6	24-29
	90°	4	153-186	346-423	14-17	16-19	151-184	317-388	8-10	25-29
		8	147-179	325-398	8-9	17-20	158-193	325-398	6-7	26-31
	100°	4	158-191	389-477	13-16	16-18				
		8	152-185	366-448	8-9	17-20				
CE035 Part Load	30°	4.5					73-89	266-325	5-6	15-18
		9.0					77-94	272-333	3-4	16-19
	40°	4.5	117-143	189-231	14-17	18-22	86-105	279-341	6-7	17-21
		9.0	112-137	178-217	8-9	19-24	90-110	286-350	4-5	18-22
	50°	4.5	126-154	221-270	14-17	18-21	105-125	293-358	7-8	20-24
		9.0	121-148	207-253	8-9	19-23	109-130	300-366	5-6	21-25
	60°	4.5	131-160	252-308	13-16	17-21	110-134	306-374	8-10	22-27
		9.0	125-153	237-290	8-9	18-22	115-141	314-383	6-7	23-29
	70°	4.5	135-165	284-347	13-16	17-20	122-150	320-391	9-11	24-30
		9.0	130-158	266-326	7-9	18-22	129-157	327-400	6-8	26-32
	80°	4.5	140-171	320-391	13-16	16-20	134-164	333-407	11-13	27-33
		9.0	134-164	300-367	7-9	17-21	141-172	341-417	7-9	28-35
	90°	4.5	144-176	360-440	13-16	16-19	147-179	347-424	12-14	29-36
		9.0	138-169	338-414	7-9	17-21	154-188	355-434	8-10	31-38
	100°	4.5	149-182	405-495	13-15	15-19				
		9.0	143-174	381-465	7-9	16-20				

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

OPERATING PRESSURES & TEMPERATURES
Environmentally Safe R-410A Refrigerant

Table 5 continued: Operating Data

			COOLING				HEATING			
Model	Entering Water Temp. °F	Water Flow GPM	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
CE035 Full Load	30°	4.5					74-90	244-299	3-4	13-15
		9.0					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
		9.0	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	95-105	269-329	5-6	17-20
		9.0	126-154	201-245	8-10	19-24	100-125	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
		9.0	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
		9.0	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
		9.0	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
		9.0	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				
		9.0	149-182	369-451	8-9	17-21				
CE049 Part Load	30°	6.0					64-78	248-303	5-6	15-18
		12.0					67-82	254-311	3-4	16-19
	40°	6.0	109-134	183-224	18-22	19-23	75-91	261-319	6-8	17-21
		12.0	105-128	172-210	10-12	20-25	79-96	267-327	4-5	18-23
	50°	6.0	118-144	214-261	18-22	19-23	78-90	273-334	8-10	20-24
		12.0	113-138	201-245	10-12	20-24	82-95	280-342	5-7	21-26
	60°	6.0	122-149	244-298	17-21	18-22	96-117	286-349	9-11	22-27
		12.0	117-143	230-281	10-12	19-24	101-123	293-358	6-8	24-29
	70°	6.0	126-154	275-336	17-21	18-22	107-131	299-365	11-13	25-30
		12.0	121-148	258-316	10-12	19-23	113-138	306-374	7-9	26-32
	80°	6.0	130-159	310-378	17-21	17-21	117-143	311-380	12-15	27-33
		12.0	132-153	291-356	10-12	18-22	123-151	319-390	8-10	29-35
	90°	6.0	134-164	349-426	17-20	17-20	128-157	324-396	13-16	29-36
		12.0	129-158	328-401	9-12	18-22	135-165	332-406	9-11	31-38
	100°	6.0	139-170	392-480	16-20	16-20				
		12.0	133-163	369-451	9-11	17-21				
CE049 Full Load	30°	6.0					71-87	277-339	6-7	15-19
		12.0					75-92	284-347	4-5	16-20
	40°	6.0	118-144	194-237	21-25	19-23	84-102	291-356	7-9	18-22
		12.0	113-138	182-223	12-14	20-24	88-108	299-365	5-6	19-23
	50°	6.0	127-155	226-276	21-25	18-22	92-110	305-373	9-11	20-25
		12.0	122-149	213-260	12-14	19-24	98-120	313-383	6-7	21-26
	60°	6.0	131-160	259-316	21-25	18-22	108-132	320-391	10-13	23-28
		12.0	126-154	243-297	12-14	19-23	113-138	328-400	7-9	24-29
	70°	6.0	136-166	291-355	20-25	17-21	120-147	334-408	12-15	25-31
		12.0	130-159	273-334	12-14	18-22	126-154	342-418	8-10	27-32
	80°	6.0	140-171	328-401	20-24	17-20	131-161	348-425	14-17	27-34
		12.0	135-165	308-377	11-14	18-22	138-169	356-436	9-11	29-36
	90°	6.0	145-177	369-451	20-24	16-20	144-176	362-442	15-18	30-37
		12.0	139-170	347-424	11-14	17-21	151-185	371-453	10-12	32-39
	100°	6.0	149-183	415-508	19-24	16-19				
		12.0	143-175	391-477	11-14	17-21				

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

OPERATING PRESSURES & TEMPERATURES
Environmentally Safe R-410A Refrigerant

Table 5 continued: Operating Data

			COOLING				HEATING			
Model	Entering Water Temp. °F	Water Flow GPM	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
CE061 Part Load	30°	7.0					68-84	256-313	5-7	19-23
		14.0					73-89	261-319	4-5	20-25
	40°	7.0	113-138	172-210	18-22	19-23	81-99	277-339	7-8	22-26
		14.0	110-134	161-196	12-14	20-24	86-105	283-346	5-6	23-28
	50°	7.0	116-142	206-252	17-21	19-23	93-114	299-365	8-9	24-29
		14.0	112-137	193-236	12-14	19-24	99-121	305-373	6-7	25-31
	60°	7.0	118-145	241-294	17-21	18-23	106-129	321-392	9-11	26-32
		14.0	115-140	225-275	11-14	19-23	113-138	327-400	7-8	28-34
	70°	7.0	121-148	275-336	17-21	18-22	118-145	342-418	10-12	29-35
		14.0	117-143	257-314	11-14	19-23	126-154	349-427	8-9	30-37
	80°	7.0	123-151	309-378	16-20	18-22	131-160	364-444	11-14	31-38
		14.0	120-146	289-353	11-13	19-23	139-170	371-454	8-10	33-40
	90°	7.0	126-154	344-420	16-20	18-22	143-175	385-471	12-15	33-41
		14.0	122-149	321-392	11-13	18-22	152-186	393-480	9-11	35-43
	100°	7.0	128-157	378-462	16-19	17-21				
		14.0	125-152	353-432	11-13	18-22				
CE061 Full Load	30°	7.0					68-84	256-313	5-7	19-23
		14.0					73-89	261-319	4-5	20-25
	40°	7.0	117-143	182-222	15-19	21-26	81-99	277-339	7-8	22-26
		14.0	114-139	170-208	11-14	22-27	86-105	283-346	5-6	23-28
	50°	7.0	120-147	215-263	15-18	20-25	93-114	299-365	8-9	24-29
		14.0	117-143	201-246	11-14	21-26	99-121	305-373	6-7	25-31
	60°	7.0	123-150	248-304	14-17	20-24	106-129	321-392	9-11	26-32
		14.0	119-146	232-284	11-13	21-25	113-138	327-400	7-8	28-34
	70°	7.0	126-154	282-344	14-17	19-24	118-145	342-418	10-12	29-35
		14.0	122-149	263-322	10-13	20-25	126-154	349-427	8-9	30-37
	80°	7.0	129-157	315-385	13-16	19-23	131-160	364-444	11-14	31-38
		14.0	125-153	294-360	10-12	19-24	139-170	371-454	8-10	33-40
	90°	7.0	132-161	348-426	13-16	18-22	143-175	385-471	12-15	33-41
		14.0	128-156	326-398	10-12	19-23	152-186	393-480	9-11	35-43
	100°	7.0	134-164	382-466	12-15	17-21				
		14.0	131-160	357-436	9-11	18-22				
CE071 Part Load	30°	9.0					71-87	259-316	5-7	19-23
		18.0					76-92	264-322	4-5	20-25
	40°	9.0	116-141	175-213	18-22	19-23	84-102	280-342	7-8	22-26
		18.0	113-137	164-199	12-14	20-24	89-108	286-349	5-6	23-28
	50°	9.0	119-145	209-255	17-21	19-23	96-117	302-368	8-9	24-29
		18.0	115-140	196-239	12-14	19-24	102-124	308-376	6-7	25-31
	60°	9.0	121-148	244-297	17-21	18-23	109-132	324-395	9-11	26-32
		18.0	118-143	228-278	11-14	19-23	116-141	330-403	7-8	28-34
	70°	9.0	124-151	278-339	17-21	18-22	121-148	345-421	10-12	29-35
		18.0	120-146	260-317	11-14	19-23	129-157	352-430	8-9	30-37
	80°	9.0	126-154	312-381	16-20	18-22	134-163	367-447	11-14	31-38
		18.0	123-149	292-356	11-13	19-23	142-173	374-457	8-10	33-40
	90°	9.0	129-157	347-423	16-20	18-22	146-178	388-474	12-15	33-41
		18.0	125-152	324-395	11-13	18-22	155-189	396-483	9-11	35-43
	100°	9.0	131-160	381-465	16-19	17-21				
		18.0	128-155	356-435	11-13	18-22				

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

OPERATING PRESSURES & TEMPERATURES
Environmentally Safe R-410A Refrigerant

Table 5 continued: Operating Data

			COOLING				HEATING			
Model	Entering Water Temp. °F	Water Flow GPM	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
CE071 Full Load	30°	9.0					71-87	259-316	5-7	19-23
		18.0					76-92	264-322	4-5	20-25
	40°	9.0	120-146	185-225	15-19	21-26	84-102	280-342	7-8	22-26
		18.0	117-142	173-211	11-14	22-27	89-108	286-349	5-6	23-28
	50°	9.0	123-150	218-266	15-18	20-25	96-117	302-368	8-9	24-29
		18.0	120-146	204-249	11-14	21-26	102-124	308-376	6-7	25-31
	60°	9.0	126-153	251-307	14-17	20-24	109-132	324-395	9-11	26-32
		18.0	122-149	235-287	11-13	21-25	116-141	330-403	7-8	28-34
	70°	9.0	129-157	285-347	14-17	19-24	121-148	345-421	10-12	29-35
		18.0	125-152	266-325	10-13	20-25	129-157	352-430	8-9	30-37
	80°	9.0	132-160	318-388	13-16	19-23	134-163	367-447	11-14	31-38
		18.0	128-156	297-363	10-12	19-24	142-173	374-457	8-10	33-40
	90°	9.0	135-164	351-429	13-16	18-22	146-178	388-474	12-15	33-41
		18.0	131-159	329-401	10-12	19-23	155-189	396-483	9-11	35-43
	100°	9.0	137-167	385-469	12-15	17-21				
		18.0	134-163	360-439	9-11	18-22				

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

UNIT CHECK-OUT SHEET

BOSCH

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) ______________

Minimum Circuit Ampacity (Amps) ______________

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)	______________	______________
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	______________	______________
Compressor Volts / Amps	______ / ______	______ / ______
Blower Motor Volts / Amps	______ / ______	______ / ______

Auxiliary Heat

Unit Make ______________________

Model Number ______________________ Serial Number______________

Max Fuse Size (Amps) ______________________

Volts / Amps__________ /__________

Entering Air Temperature ______________________

Leaving Air Temperature ______________________

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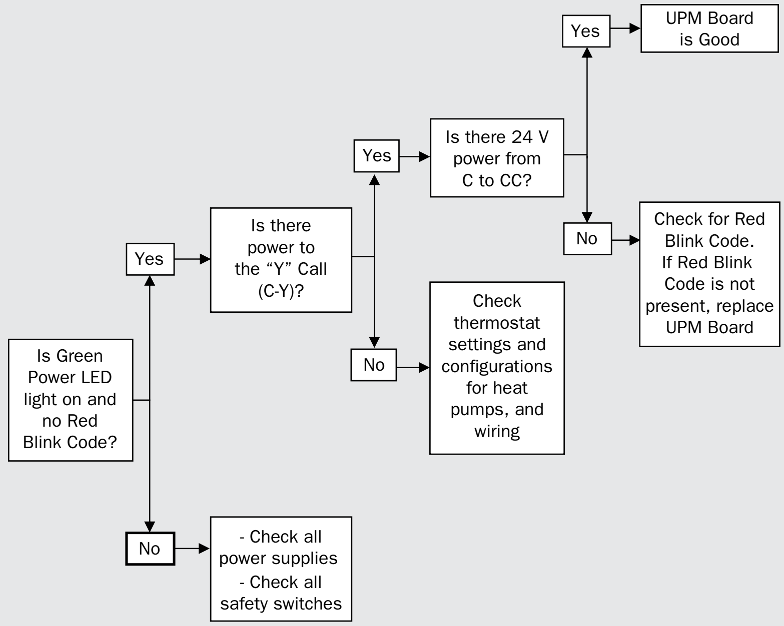
TROUBLESHOOTING

Problem	Possible Cause	Checks and Corrections
Entire unit does not run	Power Supply Off	Apply power, close disconnect
	Blown Fuse	Replace fuse or reset circuit breaker. Check for correct fuses
	Voltage Supply Low	If voltage is below minimum voltage specified on unit data plate, contact local power company.
	Thermostat	Set the fan to “ON”, the fan should run. Set thermostat to “COOL” and lowest temperature setting, the unit should run in the cooling mode (reversing valve energized). Set unit to “HEAT” and the highest temperature setting, the unit should run in the heating mode. If neither the blower or compressor run in all three cases, the thermostat could be miswired or faulty.To ensure miswired or faulty thermostat verify 24 volts is available on the condensing section low voltage terminal strip between “R” and “C”, “Y” and “C”, and “O” and “C”. If the blower does not operate, verify 24 volts between terminals “G” and “C” in the air handler. Replace the thermostat if defective.
Blower operates but compressor does not	Thermostat	Check setting, calibration, and wiring
	Wiring	Check for loose or broken wires at compressor, capacitor, or contactor.
	Safety Controls	Check UPM board red default L.E.D. for Blink Code
	Compressor overload open	If the compressor is cool and the overload will not reset, replace compressor.
	Compressor motor grounded	Internal winding grounded to the compressor shell. Replace compressor. If compressor burnout, install suction filter dryer.
	Compressor windings Open	After compressor has cooled, check continuity of the compressor windings. If the windings are open, replace the compressor
Unit off on high pressure control	Discharge pressure too high	In “COOLING” mode: Lack of or inadequate water flow. Entering water temperature is too warm. Scaled or plugged condenser. In “HEATING” mode: Lack of or inadequate air flow. Blower inoperative, clogged filter or restrictions in duct work
	Refrigerant charge	The unit is overcharged with refrigerant. Reclaim refrigerant, evacuate and recharge with factor recommended charge.
	High pressure	Check for defective or improperly calibrated high pressure switch.
Unit off on low pressure control	Suction pressure too low	In “COOLING” mode: Lack of or inadequate air flow. Entering air temperature is too cold. Blower inoperative, clogged filter or restrictions in duct work In “HEATING” mode: Lack of or inadequate water flow. Entering water temperature is too cold. Scaled or plugged condenser.
	Refrigerant charge	The unit is low on refrigerant. Check for refrigerant leak, repair, evacuate and recharge with factory recommended charge.
	Low pressure switch	Check for defective or improperly calibrated low pressure switch.
Unit short cycles	Unit oversized	Recalculate heating and or cooling loads.
	Thermostat	Thermostat installed near a supply air grill; relocate thermostat. Readjust heat anticipator.
	Wiring and controls	Check for defective or improperly calibrated low pressure switch.

Insufficient cooling or heating	Unit undersized	Recalculate heating and or cooling loads. If excessive, possibly adding insulation and shading will rectify the problem
	Loss of conditioned air by leakage	Check for leaks in duct work or introduction of ambient air through doors or windows
	Airflow	Lack of adequate air flow or improper distribution of air. Replace dirty filter
	Refrigerant charge	Low on refrigerant charge causing inefficient operation
	Compressor	Check for defective compressor. If discharge is too low and suction pressure is too high, compressor is not pumping properly. Replace compressor.
	Reversing Valve	Defective reversing valve creating bypass of refrigerant from discharge of suction side of compressor. Replace reversing valve
	Operating pressures	Compare unit operation pressures to the pressure/temperature chart for the unit.
	TXV	Check TXV for possible restriction or defect. Replace if necessary.
	Moisture, noncondensables	The refrigerant system may be contaminated with moisture or noncondensables. Reclaim refrigerant, replace filter dryer, evacuate the refrigerant system, and recharge with factory recommended charge.
	Service valve not fully open	Ensure that both service valves on the condensing section are both fully opened.
UPM board trouble shooting	Compressor will not run, no fault blink code	

BOSCH

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