Installation & Maintenance Data

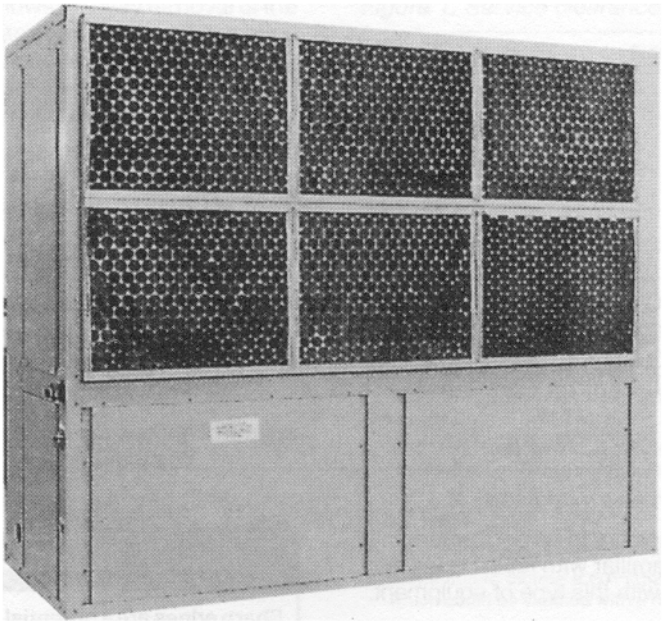
IM 439-11

Group: **WSHP**

Part Number: **106018831**

Date: **May 1999**

Large Vertical Water Source Heat Pumps
6 thru 25 Tons



Contents

Model Nomenclature

W LDD 1 070 D Z

Product Category
W = WSHP

Product Identifier
See box below

Design Series
1 = A Design
2 = B Deisgn
3 = C Design
4 = D Design
5 = E Design

Nominal Capacity
070 = 70,000
108 = 108,000
121 = 121,000
180 = 180,000
215 = 215,000
290 = 290,000
etc. . .

Coil Options
(None)

Voltage
D = 208-60-3
H = 230-60-3
K = 460-60-3
L = 575-60-3
N = 380-50-3

McQuay Product Identifiers

LDD = Std. Large Vertical/DDC Controls/Std. Range/Less Board
LDE = Std. Large Vertical/DDC Controls/Ext. Range
LDL = Std. Large Vertical/DDC Controls/Ext. Range/Less Board
LDS = Std. Large Vertical/DDC Controls/Std. Range
LME = Std. Large Verical/Mark IV/Ext. Range
LMH = High Static Large Vertical/Mark IV/Std. Range
LML = High Static Large Vertical/Mark IV/Ext. Range
LMS = Std. Large Vertical/Mark IV/Std. Range

Note: Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations, and are experienced with this type of equipment.

⚠ CAUTION

Sharp edges are a potential injury hazard. Avoid contact with them.

Transportation and Storage

Upon receipt of the equipment, check unit for visible damage. Make a notation on the shipper's delivery ticket before signing. If there is any evidence of rough handling, the cartons should be opened at once to check for concealed damage. If any damage is found, notify the carrier within 48 hours to establish your claim and request their inspection and a report. The Warranty Claims Department should then be contacted.

Do not stand or transport the machines on end. For storing, each unit must be in the "up" position.

In the event that elevator transfer makes upended positioning unavoidable, absolutely insure that the machine is in the normal upright position for at least 24 hours before operating.

Temporary storage at the jobsite must be indoors, completely sheltered from rain, snow, etc. High or low temperatures naturally associated with weather patterns will not harm the conditioners. Excessively high temperatures 140°F (60°C) may deteriorate certain plastic materials and cause permanent damage. In addition, the solid-state circuit boards may experience operational problems.

Installation

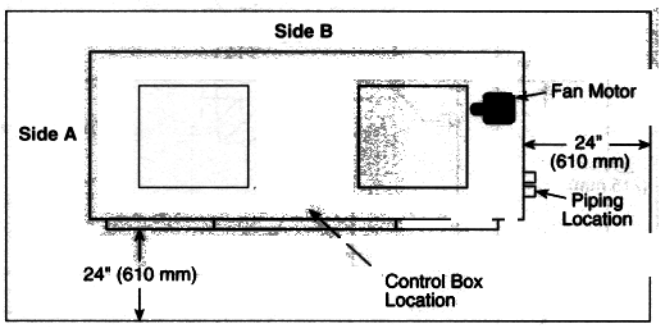
General

1. To prevent damage, this equipment should not be operated for supplementary heating and cooling during the construction period.
2. Inspect the shipping label for any specific tagging numbers indicated per request from the installing contractor. At this time the voltage, phase and capacity should be checked against the plans.
3. Check the unit size against the plans to be sure that the unit will be installed in the correct location.
4. After removing the packaging material, remove unit from the skid.
5. Before installation, check the available dimensions versus the dimensions of the unit.
6. Pay attention to the location and routing of water piping, condensate drain piping, and electrical wiring. The locations of these items are clearly marked on submittal drawings.
7. The installing contractor will find it beneficial to confer with piping, sheetmetal, ceiling and electrical foremen together before installing any conditioners.
8. We recommend that the contractor cover the conditioners with plastic film to protect the machines during finishing of the building. This is important if spraying fireproofing material on bar joists, sandblasting, spray painting and plastering operations have not been completed.

Unit Location

1. Locate the unit in an area that allows for easy removal of the filter and access panels, and has enough space for service personnel to perform maintenance or repair. Provide sufficient room to make water, electrical and duct connections *(see Figure 1 for service clearance details)*.
2. The contractor should make sure that access has been provided including clearance for 2" (51 mm) thick filter brackets, duct collars and fittings at water and electrical connections.
3. Allow adequate room around the unit for a condensate trap.
4. The unit can be installed "free standing" in an equipment room. Generally, the unit is located in a separate room with the non-ducted return air facing the return air intake. Alternatively, the unit can have a ducted return air.
5. It is recommended that the unit be located on vibration isolators to reduce any vibration *(see Figure 3)*.
6. If optional field installed controls are required (Boilerless System), space must be provided for the enclosure to mount on the side of the unit.

Figure 1. Service clearance



1. A 24" (610 mm) minimum clearance is required on the return air, control box and piping sides. However, a 36" (914 mm) clearance allows for easier serviceability.
2. A 12" (305 mm) minimum clearance is required on Side A to gain access to panel to remove locking collar for shaft removal.
3. A 6" (152 mm) minimum clearance is required to remove screws holding top panel.
4. Top clearance is required for fan shaft removal.
5. Some codes dictate a 60" (1524 mm) clearance above the control box which could be violated with a ducted return. Check your codes.

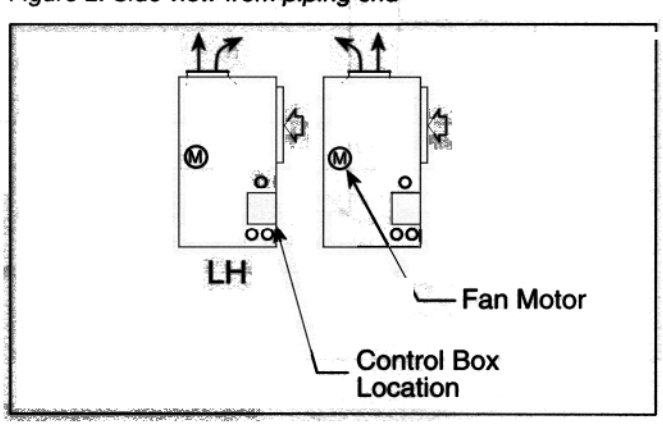
Filter Access

Each unit is shipped with a filter bracket for side filter removal.

Unit Arrangement

Two fan discharges and piping arrangements are available. With the return air side defined as the "front" of the unit, the water piping and electrical power connections may be right-hand (side) or left-hand. The main control panel is located in the center of the unit, lower section under the return air filter. Unit sides opposite the control panel and opposite the piping side may be up against walls and still allow for service and maintenance through the remaining access panels.

Figure 2. Side view from piping end



Vibration Isolation

For minimum sound and vibration transmission, it is recommended that the unit be mounted on vibration isolators.

Holes are provided in the bottom panel to facilitate connection of isolators *(see Figure 3 for hole locations)*.

Isolators supplied by the manufacturer are the type shown in Figures 4 and 5. Four white isolators are used for single compressor units and six green isolators are used for dual compressor units. The holes in the bottom of the unit allow for a ⅜" (10 mm) bolt to be secured to the isolator.

Figure 3. Isolator

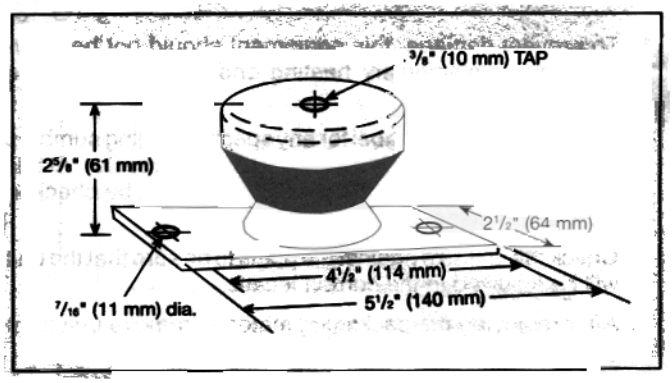
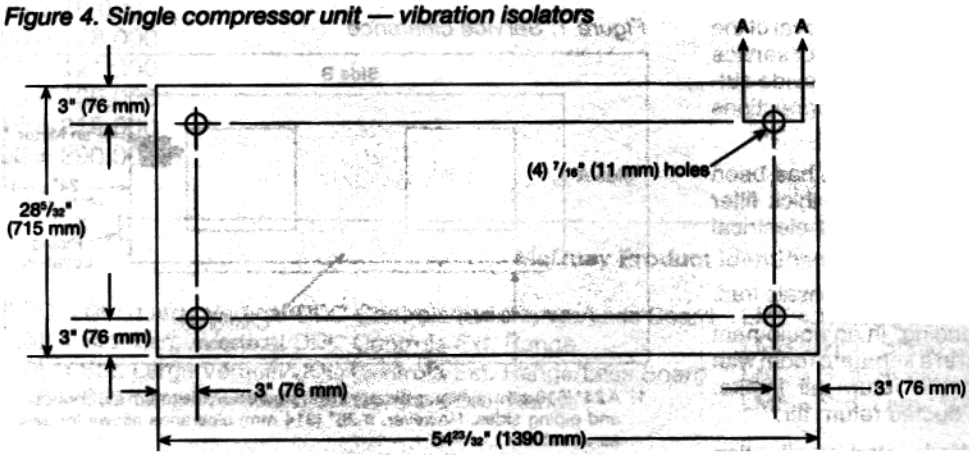
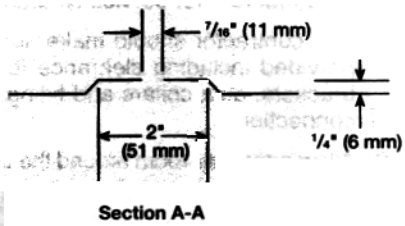


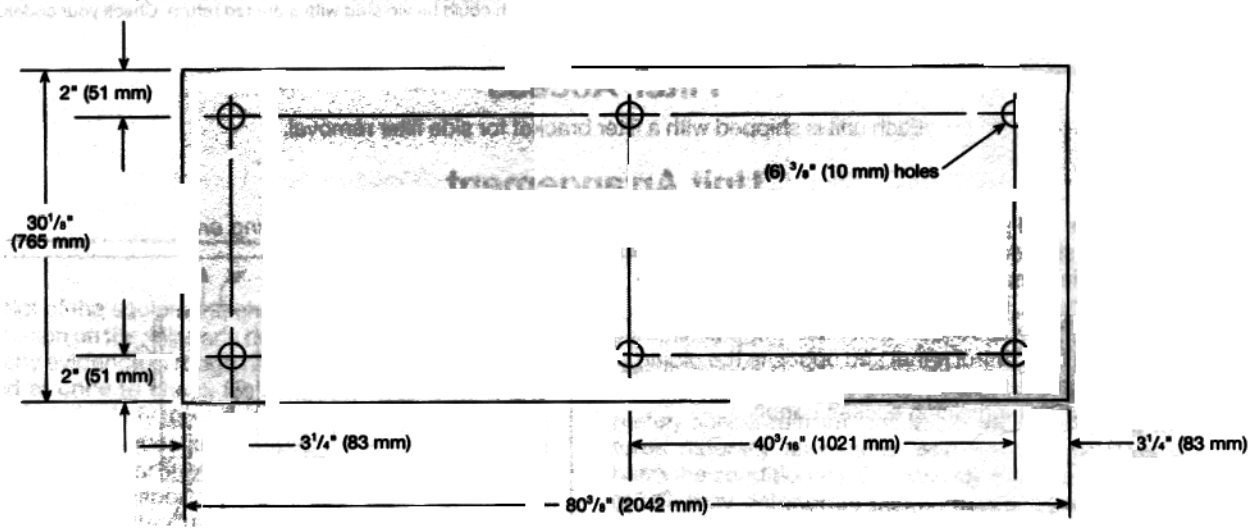
Figure 4. Single compressor unit — vibration isolators





Section A-A

Figure 5. Dual compressor unit — vibration isolators



Air Balancing

All units are supplied with a variable pitch motor sheave to aid in airflow adjustment. They are typically set at the low end of the rpm range for field adjustment to the required airflow.

When the final adjustments are complete, the current draw of the motors should be checked and compared to the full load current rating of the motors. The amperage must not exceed the service factor stamped on the motor nameplate.

Upon completion of the air balance, it is a common industry recommendation that the variable pitched motor sheave be replaced with a properly sized fixed sheave. A matching fixed sheave will provide longer belt and bearing life and vibration free operation. Initially, it is best to have a variable pitched motor sheave for the purpose of air balancing, but once the balance has been achieved, fixed sheaves maintain balancing and alignment more effectively.

Adjustment (See Figure 6)

1. All sheaves should be mounted on the motor or driving shaft with the setscrew "A" toward the motor.
2. Be sure both driving and driven sheaves are in alignment and that shafts are parallel.
3. Fit internal key "D" between sheave and shaft, and lock setscrew "A" securely in place.

Adjusting:

1. Loosen setscrews "B" and "C" in moving parts of sheave and pull out external key "E". (This key projects a small amount to provide a grip for removing.)
2. Adjust sheave pitch diameter for desired speed by opening moving parts by half or full turns from closed position. *Do not open more than five full turns.*
3. Replace external key "E" and securely tighten setscrews "B" over key and setscrews "C" into keyway in fixed half of the sheave.
4. Put on belts and adjust belt tension to 4 lbs. ± 0.7 lbs. (18 ± 3N) for a ½" to ¾" (13 mm to 19 mm) belt deflection height.
5. To determine the deflection distance from normal position, use a straightedge or stretch a cord from sheave to sheave to use as a reference line. On multiple-belt drives an adjacent undeflected belt can be used as a reference.
6. Future adjustments should be made by loosening the belt tension and increasing or decreasing the pitch diameter of the sheave by half or full turns as required. Readjust belt tension before starting drive.
7. Be sure that all keys are in place and that all setscrews are tight before starting drive. Check setscrews and belt tension after 24 hours service.
8. When new V-belts are installed on a drive, the initial tension will drop rapidly during the first few hours. Check tension frequently during the first 24 hours of operation. Subsequent retensioning should fall between the minimum and maximum force.

Figure 6.

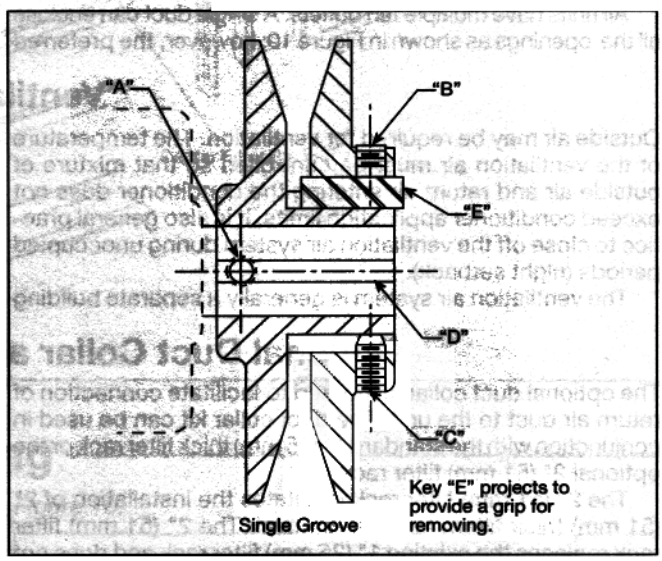
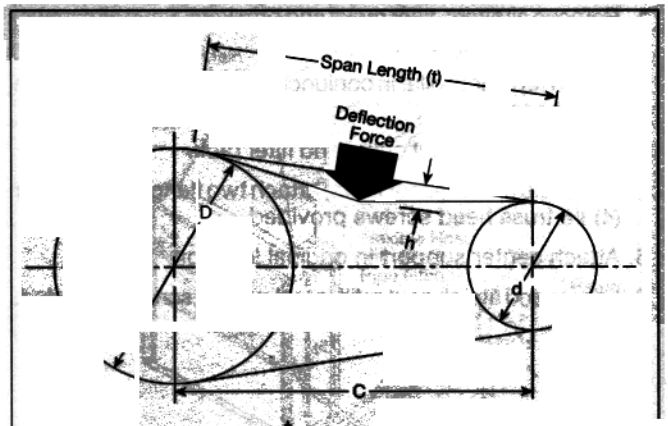


Figure 7. Drive belt adjustment



$$h = \frac{t}{64}$$

$$t = \sqrt{C^2 - \left(\frac{D-d}{2}\right)}$$

Where:
t = Span length, inches (mm)
C = Center distance, inches (mm)
D = Larger sheave diameter, inches (mm)
d = Smaller sheave diameter, inches (mm)
h = Deflection height, inches (mm)

Note: The ratio of deflection to belt span is 1:64.

Ductwork and Attenuation

Discharge ductwork is normally used with these conditioners. Return air ductwork may also be required but will require field installation of a return air duct collar.

All ductwork should conform to industry standards of good practice as described in ASHRAE Systems Guide.

The discharge duct system will normally consist of a flexible connector at the unit, a transition piece to the final duct size, a short run of duct, an elbow without vanes and a trunk duct tee'd into branch ducts with discharge diffusers as shown in Figure 10. Transition piece must not have angles totalling more than 30 degrees or severe loss of air performance can result.

All units have multiple fan outlets. A single duct can enclose all the openings as shown in Figure 10; however, the preferred method for minimum static pressure loss would be individual ducts at each outlet connected to a larger duct downstream.

For minimum noise transmission, the metal duct material should be internally lined with acoustic fibrous insulation.

The ductwork should be laid out so that there is no line of sight between the conditioner discharge and the distribution diffusers.

Return air ducts can be brought in adjacent to the return air of the conditioner. Typically, the equipment room becomes the common return air plenum.

Do not insert sheetmetal screws directly into the unit cabinet for connection of supply or return air ductwork, especially return air ductwork which can hit the drain pan or the air coil.

Ventilation Air

Outside air may be required for ventilation. The temperature of the ventilation air must be controlled so that mixture of outside air and return air entering the conditioner does not exceed conditioner application limits. It is also general practice to close off the ventilation air system during unoccupied periods (night setback).

The ventilation air system is generally a separate building subsystem with distribution ductwork. Simple introduction of the outside air into each return air plenum chamber reasonably close to the conditioner air inlet is not only adequate, but recommended. Do not duct outside air directly to the conditioner inlet. Provide sufficient distance for thorough mixing of outside and return air *(see Operating Limits on page 9).*

Optional Duct Collar and 2" (51 mm) Filter Rack

The optional duct collar kit is used to facilitate connection of return air duct to the unit. The duct collar kit can be used in conjunction with the standard 1" (25 mm) thick filter rack or the optional 2" (51 mm) filter rack.

The 2" (51 mm) filter rack facilitates the installation of 2" (51 mm) thick filters for side removal. The 2" (51 mm) filter rack replaces the existing 1" (25 mm) filter rack and does not require the use of the optional return air duct collar.

The kits are installed as follows:

1. Remove all filters, filter racks and brackets. Save all screws. Discard bracket end.
2. Attach top duct collar in conjunction with top filter rack with truss head screws.
3. Attach bottom duct collar and filter rack.
4. On single compressor units, attach two flanges using four (4) #8 truss head screws provided.
5. Attach center support in original location.
6. Locate and attach center filter racks using screws provided.
7. Attach duct collar sides using eight (8) #10 sheetmetal screws provided.
8. Attach one door end to either side of unit with #10 sheetmetal screws.
9. Slide filters into position.
10. Attach other door end side cover.

Figure 8. Assembly detail

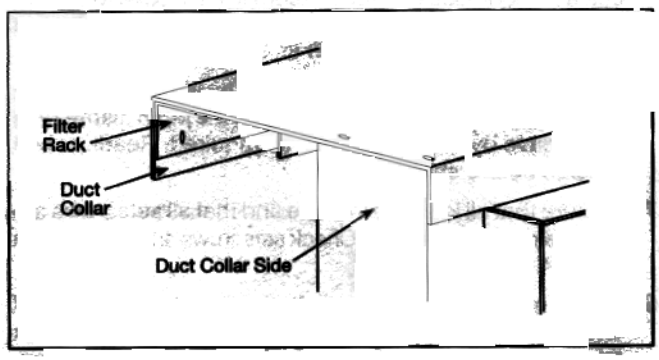
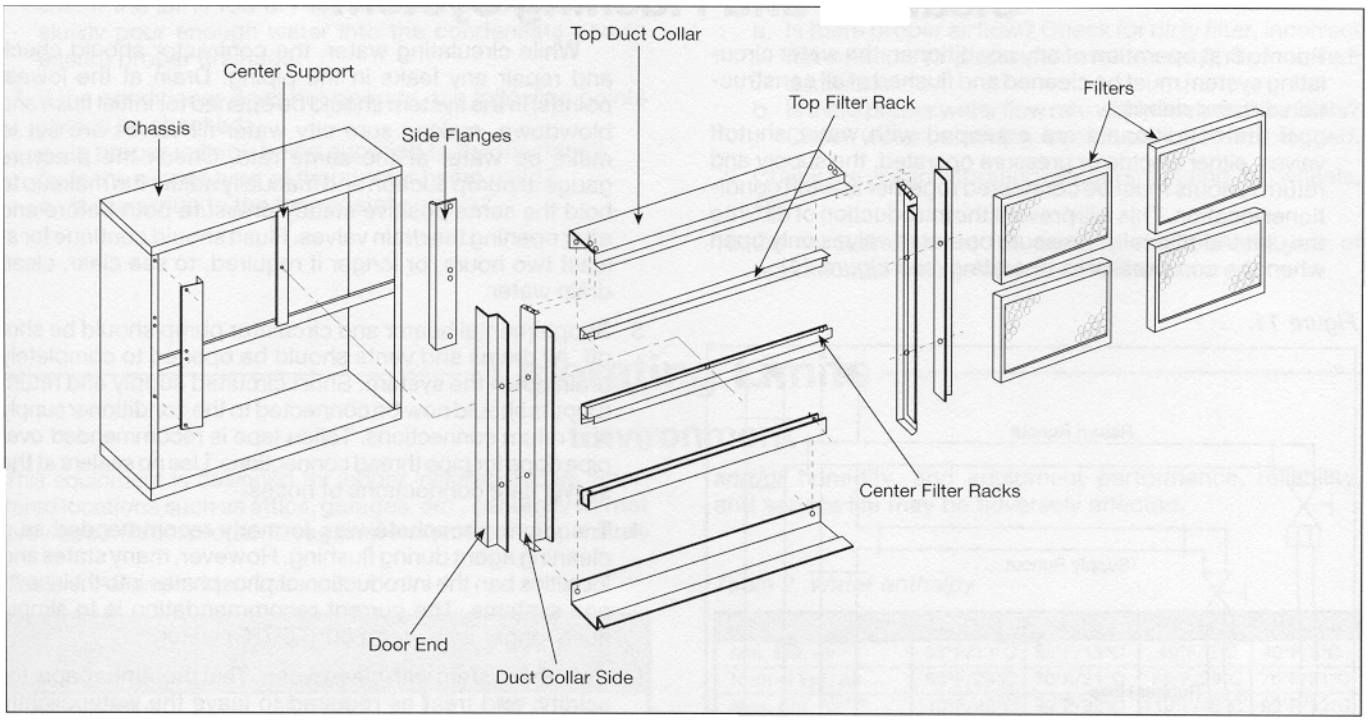


Figure 9.



Piping

1. All units are recommended to be connected to supply and return piping in a two-pipe reverse return configuration. A reverse return system is inherently self-balancing and requires only trim balancing where multiple quantities of units with different flow and pressure drop characteristics are connected to the same loop. A simple way to check for proper water balance is to take a differential temperature reading across the water connections. To insure proper water flow, the differential should be 10°F to 14°F (5°C to 8°C) in the cooling mode of operation.

   A direct return system may also be made to work acceptably, but proper water flow balancing is more difficult to achieve and maintain, and may require flow control devices.

2. The piping can be steel, copper or PVC.

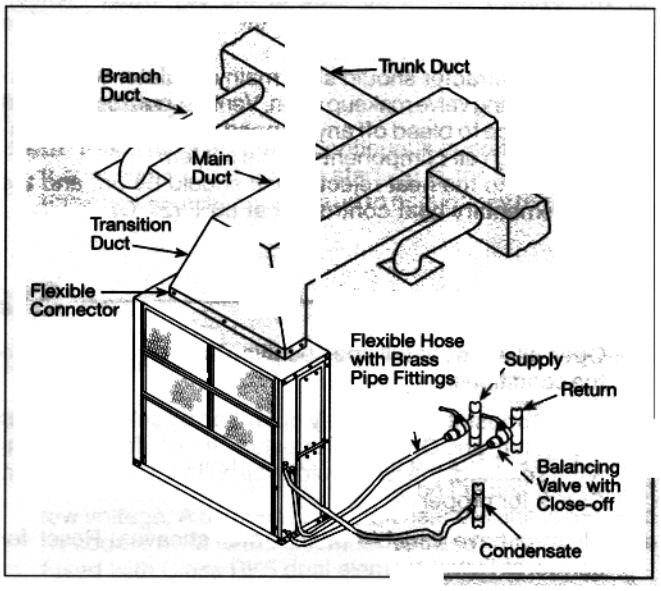
3. Supply and return runouts are usually connected to the unit by short lengths of high pressure flexible hose which are sound attenuators for both unit operating noise and hydraulic pumping noise. One end of the hose should have a swivel fitting to facilitate removal for service. Hard piping can also be brought directly to the unit although it is not recommended since no vibration or noise attenuation can be accomplished. The hard piping must have unions to facilitate unit removal *(see Figure 10 for typical piping setup)*.

4. Supply and return shutoff valves are required at each conditioner. The return valve is used for balancing and should have a "memory stop" so that it can always be closed off but can only be reopened to the proper position for the flow required.

5. No unit should be connected to the supply and return piping until the water system has been cleaned and flushed completely. After the cleaning and flushing has taken place, the initial connection should have all valves wide open in preparation for water system balancing.

6. Condensate piping can be steel, copper or PVC. Each unit is supplied with a FPT threaded fitting.

Figure 10.



7. The condensate disposal piping must have a trap and the piping must be pitched away from the unit not less than ¼" per foot (21 mm per meter). Generally, the condensate trap is made of copper. A complete copper or PVC condensate system can also be used. Union fittings in the copper lines should be applied to facilitate removal.

8. No point in the drain system may be above the drain connection of any unit.

9. Automatic flow controlled devices must not be installed prior to system cleaning and flushing.

10. A high point of the piping system must be vented.

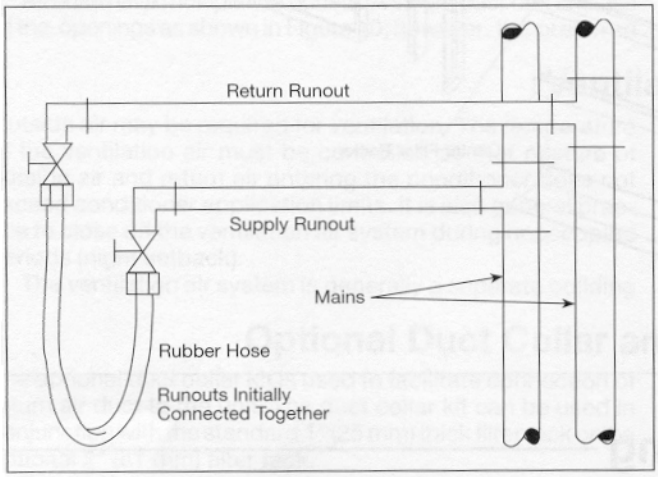
11. Check local code for the need of dielectric fittings.

Cleaning and Flushing System

1. Prior to first operation of any conditioner, the water circulating system must be cleaned and flushed of all construction dirt and debris.

   If the conditioners are equipped with water shutoff valves, either electric or pressure operated, the supply and return runouts must be connected together at each conditioner location. This will prevent the introduction of dirt into the unit. Additionally, pressure operated valves only open when the compressor is operating *(see Figure 11)*.

Figure 11.



2. The system should be filled at the city water makeup connection with all air vents open. After filling, vents should be closed.

   The contractor should start main circulator with pressure reducing valve makeup open. Vents should be checked in sequence to bleed off any trapped air to assure circulation through all components of the system.

   Power to the heat rejector unit should be off, and the supplementary heat control set at 80°F (27°C).

   While circulating water, the contractor should check and repair any leaks in the piping. Drain at the lowest point(s) in the system should be opened for initial flush and blowdown, making sure city water fill valves are set to make up water at the same rate. Check the pressure gauge at pump suction and manually adjust the makeup to hold the same positive steady pressure both before and after opening the drain valves. Flush should continue for at least two hours, or longer if required, to see clear, clean drain water.

3. Supplemental heater and circulator pump should be shut off. All drains and vents should be opened to completely drain down the system. Short circuited supply and return runouts should now be connected to the conditioner supply and return connections. Teflon tape is recommended over pipe dope for pipe thread connections. Use no sealers at the swivel flare connections of hoses.

4. Trisodium phosphate was formerly recommended as a cleaning agent during flushing. However, many states and localities ban the introduction of phosphates into their sewage systems. The current recommendation is to simply flush longer with warm 80°F (27°C) water.

5. Refill the system with clean water. Test the litmus paper for acidity, and treat as required to leave the water slightly alkaline (pH 7.5 to 8.5). The specified percentage of antifreeze may also be added at this time. Use commercial grade anti-freeze designed for HVAC systems only. Do not use automotive grade anti-freeze.

6. Set the system control and alarm panel heat add setpoint to 70°F (21°C) and the heat rejection setpoint to 85°F (29°C). Supply power to all motors and start the circulating pumps. After full flow has been established through all components including the heat rejector (regardless of season) and air vented and loop temperatures stabilized, each of the conditioners will be ready for check, test and start-up and for air and water balancing.

Start-up

1. Open all valves to full open position and turn on power to the conditioner.

2. Set thermostat for ***Fan Only*** operation by selecting ***Off*** at the system and ***On*** at the fan switch. If ***Auto*** fan operation were selected, the fan would cycle with the compressor. Check for proper air delivery.

3. All units have variable pitch motor sheaves. Reset for correct airflow.

4. Set thermostat to ***Cool***. If the thermostat is an automatic changeover type, simply set the cooling temperature to the coolest position. On manual changeover types additionally select ***Cool*** at the system switch.

   Again, many conditioners have time delays which protect the compressor against short cycling. After a few minutes of operation, check the discharge grilles for cool air delivery. Measure the temperature difference between entering and leaving water. It should be approximately 1½ times greater than the heating mode temperature difference. For example, if the cooling temperature difference is 15°F (8°C), the heating temperature difference should have been 10°F (5°C).

   Without automatic flow control valves, a cooling temperature difference of 10°F to 14°F (5°C to 8°C) is about right. Adjust the combination shutoff/balancing valve in the return line to a water flow rate which will result in the 10°F to 14°F (5°C to 8°C) degree difference in cooling.

5. Set thermostat to ***Heat***. If thermostat is the automatic changeover type, set system switch to the ***Auto*** position and depress the heat setting to the warmest selection. Some conditioners have built-in time delays which prevent the compressor from immediately starting. With most control schemes, the fan will start immediately. After a few minutes of compressor operation, check for warm air delivery at discharge grille. If this is a "cold building" start-up, leave unit running until return air to the unit is at least 65°F (18°C).

   Measure the temperature difference between entering and leaving air and entering and leaving water. With entering water of 60°F to 80°F (16°C to 27°C), leaving water should be 6°F to 12°F (3.3°C to 6.6°C) cooler, and the air temperature rise through the machine should not exceed 35°F (19°C). If the air temperature exceeds 35°F (19°C), the airflow rate is probably inadequate.

   If the water temperature difference is less than 6°F (3.3°C) degrees, the water flow rate is excessive. If the water temperature difference exceeds 12°F (6.6°C), then the water flow rate is inadequate.

6. Check the elevation and cleanliness of the condensate line. If the air is too dry for sufficient dehumidification, slowly pour enough water into the condensate pan to ensure proper drainage.
7. If the conditioner does not operate, the following points should be checked:
   a. Is proper voltage being supplied to the machine?
   b. Is the proper type of thermostat being used?
   c. Is the wiring to the thermostat correct?
8. If the conditioner operates but stops after a brief period, check for:
   a. Is there proper airflow? Check for dirty filter, incorrect fan rotation (3-phase fan motors only), or incorrect ductwork.
   b. Is there proper water flow rate within temperature limits? Check water balancing; backflush unit if dirt-clogged.
9. Check the unit for vibrating refrigerant piping, fan wheels, etc.
10. Do not lubricate the fan motor during the first year of operation as it is prelubricated at the factory.

Operating Limits

Environment

This equipment is designed for indoor installation *only*. Sheltered locations such as attics, garages, etc., generally will not provide sufficient protection against extremes in temperature *and/or* humidity, and equipment performance, reliability, and service life may be adversely affected.

Table 1. Air and water limits

	All UNITS	
	Cooling	Heating
Min. Ambient Air	40°F/5°C	40°F/5°C
Normal Ambient Air	80°F/27°C	70°F/21°C
Max. Ambient Air	100°F/38°C	85°F/29°C
Min. Ent. Air①②	50°F/10°C	40°F/5°C
Normal Ent. Air, db/wb	80/67°F 27/19°C	70°F 21°C
Max. Ent. Air, db/wb①②	100/83°F 38/28°C	80°F 27°C

Table 2. Water enthalpy

	Cooling	Heating	Cooling	Heating
Min. Ent. Air①②	55°F/13°C	55°F/13°C	40°F/5°C	40°F/5°C
Normal Ent. Air	85°F/29°C	70°F/21°C	85°F/29°C	70°F/21°C
Max. Ent. Air①②	110°F/43°C	90°F/32°C	110°F/43°C	90°F/32°C

① At ARI flow rate.
② Maximum and minimum values may not be combined. If one value is at maximum or minimum, the other two conditions may not exceed the normal condition for standard units. Extended range units may combine any two maximum or minimum conditions, but not more than two, with all other conditions being normal conditions.

Additional Information

. **All units**
Unit will start and operate in an ambient of 40°F (5°C), with entering air at 40°F (5°C), with entering water at 40°F (5°C), with both air and water at flow rates used in the ARI Standard 320-86 rating test, for initial start-up in winter.

Note: This is not a normal or continuous operating condition. It is assumed that such a start-up is for the purpose of bringing the building space up to occupancy temperature.

Electrical Data

General

1. Be sure the available power is the same voltage and phase as that shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electrical Code, whichever is applicable.
2. Apply correct line voltage to the unit. Each unit is supplied with a 3-lug terminal block in the main control for three-phase main power. Multiple knockouts on the sides of the unit facilitate conduit connections on the unit for line and low voltage. A disconnect switch near the unit is required by code. Power to the unit must be sized correctly and be fused with Class RK5 dual element fuses.

Minimum and Maximum Voltage

Nameplate 208/60/3: Min. 187 volts, Max. 229 volts
Nameplate 230/60/3: Min. 207 volts, Max. 253 volts
Nameplate 460/60/3: Min. 414 volts, Max. 506 volts
Nameplate 575/60/3: Min. 515 volts, Max. 632 volts
Nameplate 380/50/3: Min. 360 volts, Max. 418 volts

Note: Three-phase system unbalance should not exceed 2%.

Typical Wiring Diagrams

Figure 12. Typical Mark IV/AC unit — single compressor

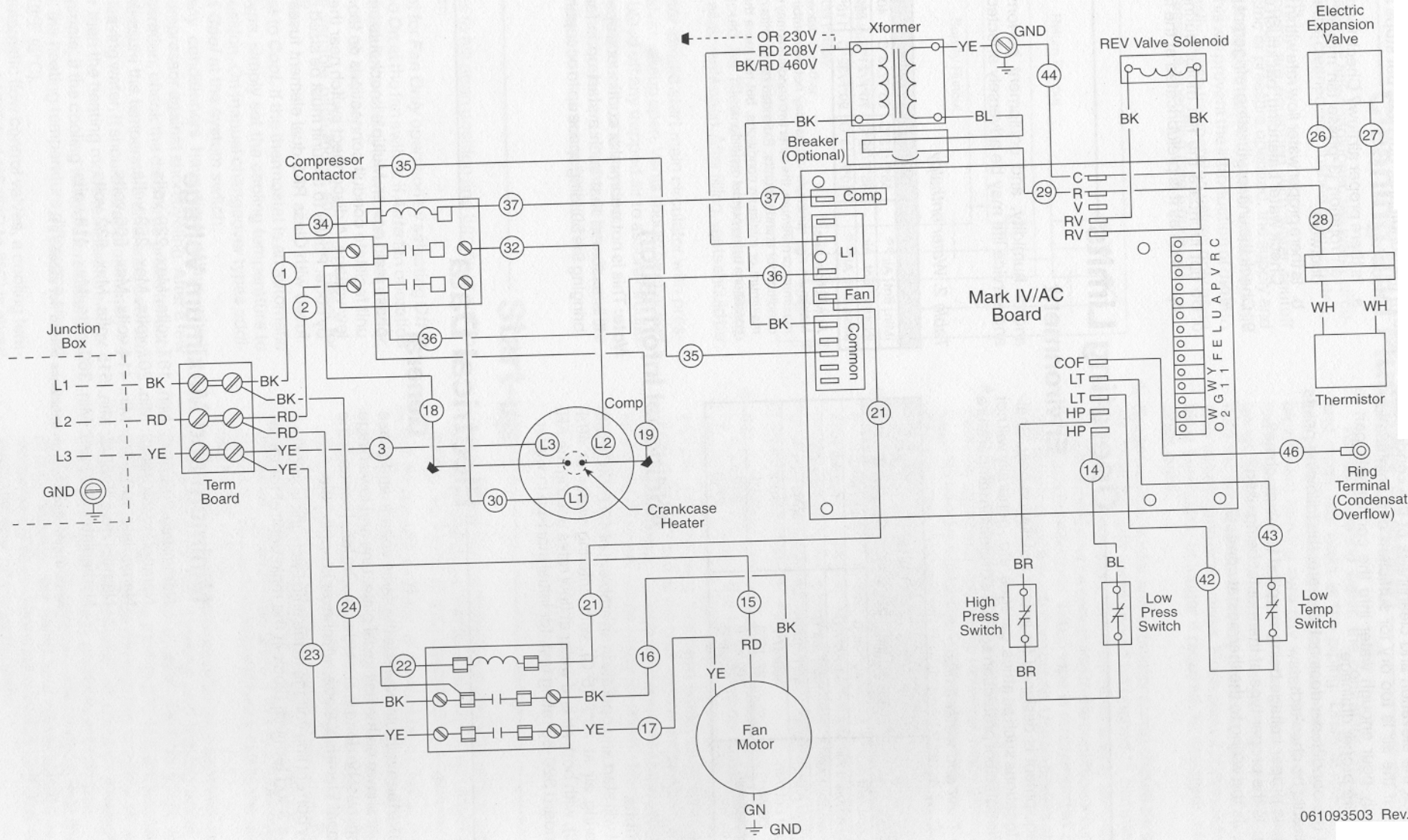


Figure 13. Typical Mark IV/AC unit dual compressor

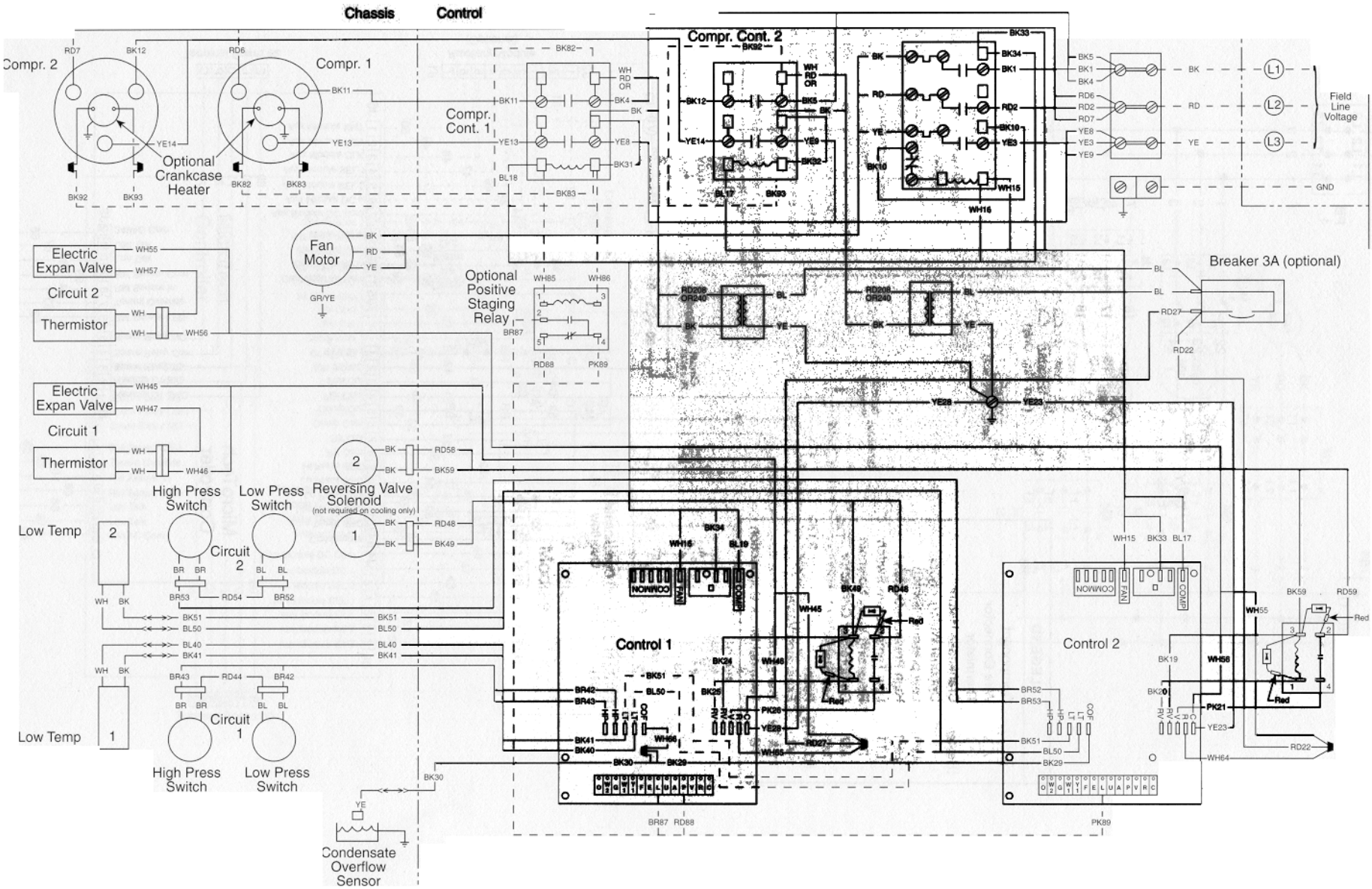


Figure 14. Typical MicroTech unit single compressor

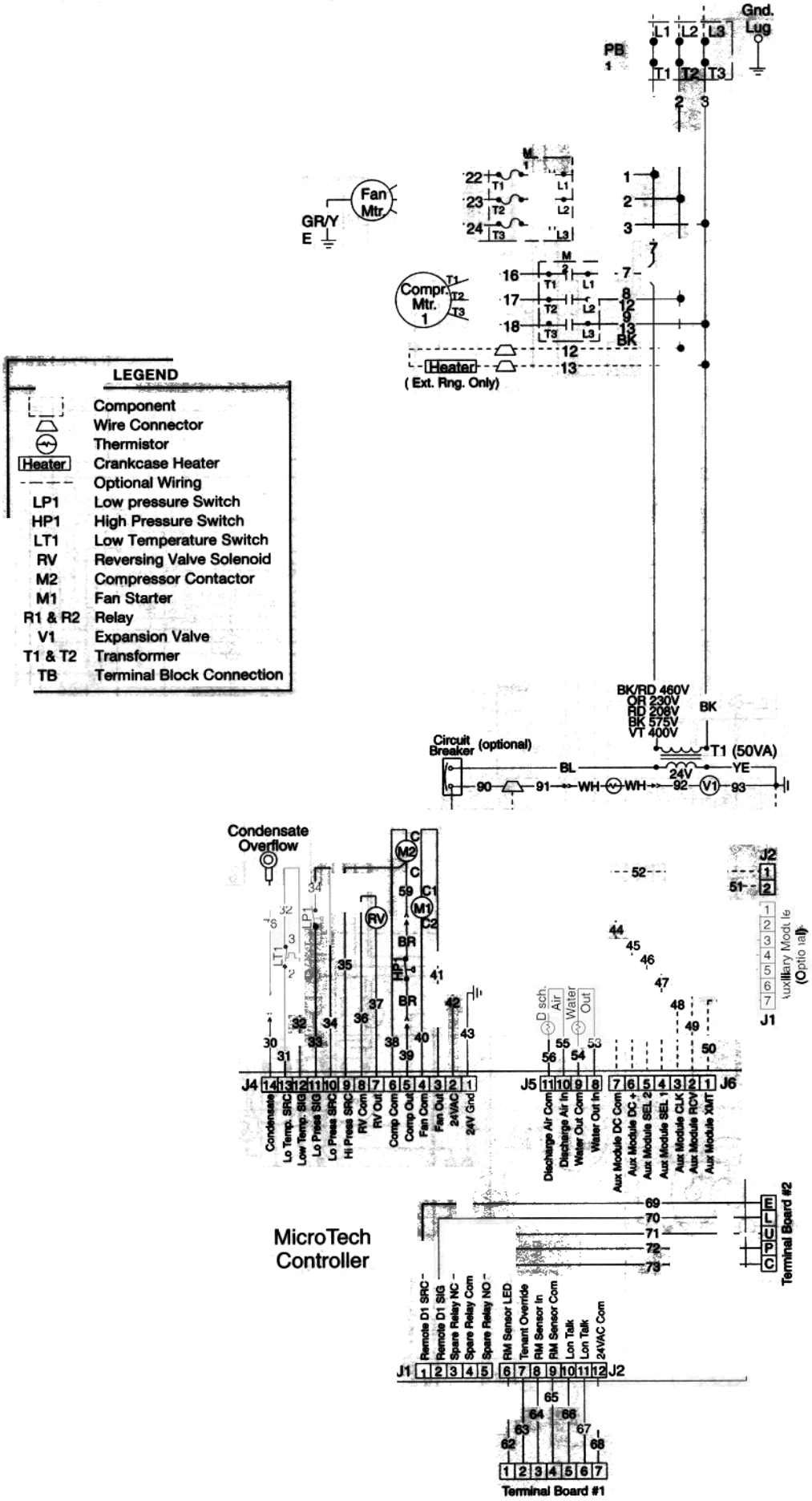
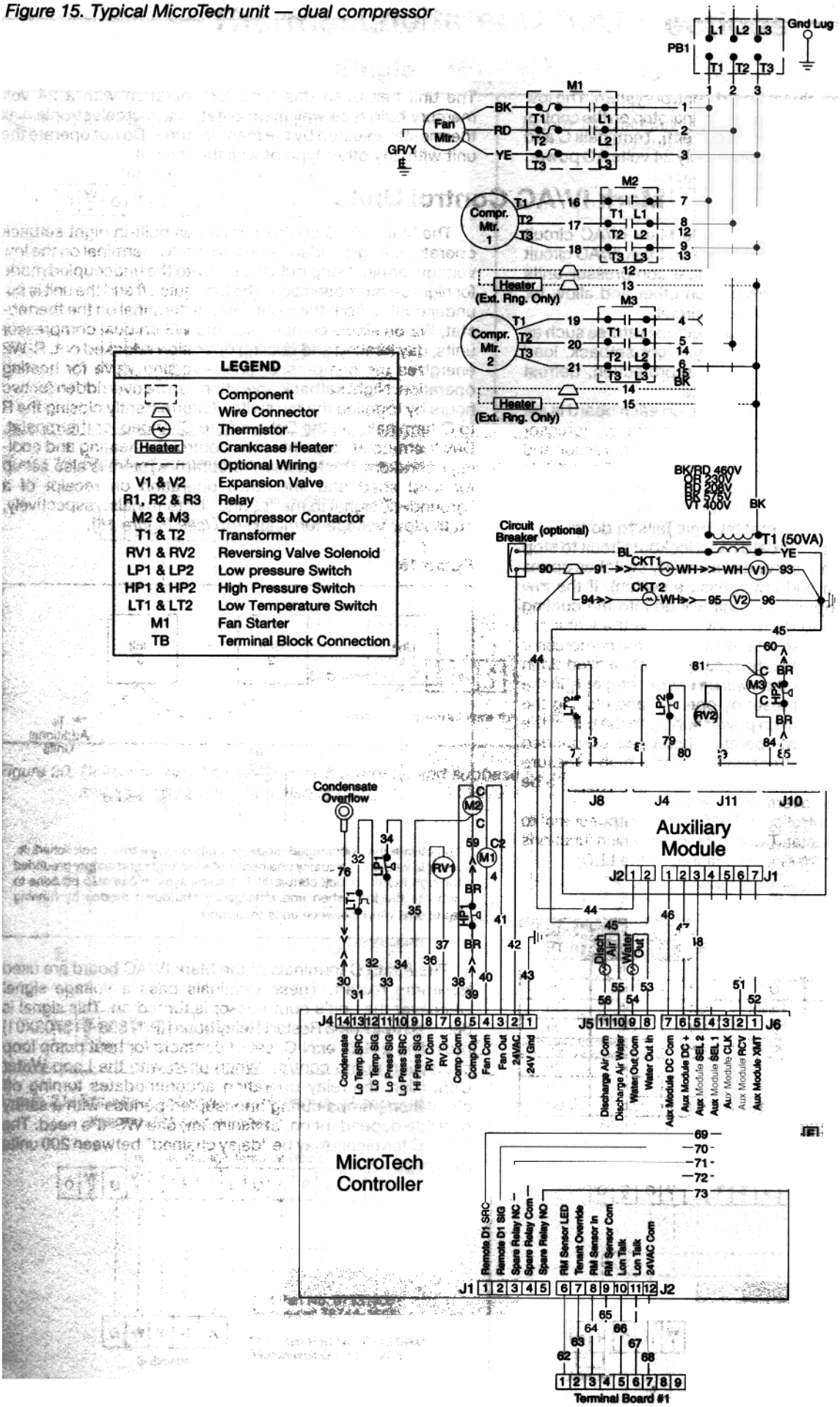


Figure 15. Typical MicroTech unit — dual compressor



Unit Operation

General

Each unit has a printed circuit board control system. The low voltage output from the low voltage terminal strip on the control board is always 24 volts DC (direct current). Terminals C and R on the low voltage terminal strip supply 24 volts AC power.

The unit has been designed for operation with a 24 volt mercury bulb type wall thermostat or a microelectronic wall thermostat selected by the manufacturer. Do not operate the unit with any other type of wall thermostat.

Mark IV/AC Control Units

Single compressor units have a single Mark IV/AC circuit board and dual compressor units have two Mark IV/AC circuit boards. The refrigerant circuits on dual compressor units operate totally independent from each other and allow for total independent operation of each circuit.

The Mark IV/AC circuit board has built-in features such as random start, compressor time delay, night setback, load shed, shutdown, condensate overflow protection, defrost cycle, brownout, and LED/fault outputs.

The 24 volt low voltage terminal strip on each board is set up so R-G energizes the fan, R-Y1 energizes the compressor for cooling operation, R-W1 energizes the compressor and reversing valve for heating operation. The reversing valve is set up to be energized in the heating mode. The circuit board has a fan interlock circuit to energize the fan whenever the compressor is on if the thermostat logic fails to do so.

The Mark IV/AC control board has a lockout circuit to stop compressor operation if any one of its safety switches opens (high pressure switch and low pressure switch). If the low temperature switch opens, the unit will go into the cooling mode for 60 seconds to defrost any slush in the water-to-refrigerant heat exchanger. After 60 seconds the compressor is locked out. If the condensate sensor detects a filled drain pan, the compressor operation will be suspended only in the cooling mode. The unit is reset by opening and closing the disconnect switch on the main power supply to the unit in the event the unit compressor operation has been suspended due to low temperature (freezestat) switch, high pressure switch or low pressure switch. The unit does not have to be reset on a condensate overflow detection.

The Mark IV/AC control circuit has a fault output signal to an LED on a wall thermostat. Table 3 shows for which functions the fault output is "on" (sending a signal to the LED).

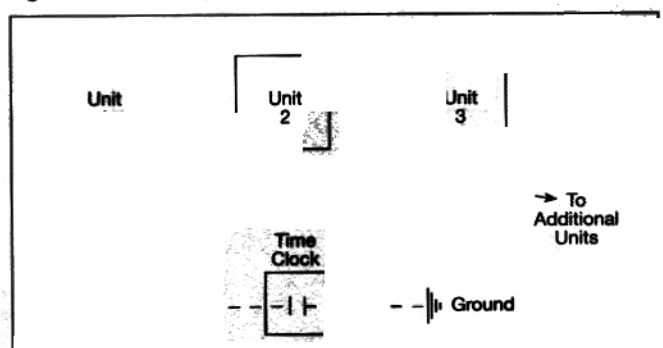
Table 3.

INDICATION	LEDs			FAULT OUTPUT
	Yellow	Green	Red	
Normal Mode	Off	On	Off	Off
High Pressure Fault	Off	Off	Flash	On
Low Temperature Fault*	Flash	Off	Off	On
Condensate Overflow	On	Off	Off	On
Brown-out	Off	Flash	Off	On
Load Shed	Off	Off	On	Off
Unoccupied Mode	On	On	Off	Off
Emergency Shutdown	Off	Flash	Off	On

*In heating mode

The Mark IV/AC control circuit has built-in night setback operation. A "grounded" signal to the "U" terminal on the low voltage terminal strip puts the unit into the unoccupied mode for night setback operation. The fan shuts off and the unit is put under control from the night setback terminal on the thermostat, W2 on single compressor and W3 on dual compressor units; day heating and cooling operation is locked out. R-W2 energizes the compressor and reversing valve for heating operation. Night setback operation can be overridden for two hours by toggling the fan switch (intermittently closing the R to O terminals) on the Deluxe Auto Changeover thermostat. Day thermostat setpoints then control the heating and cooling operation. The Mark IV/AC control system is also set up for load shed and shutdown operation on receipt of a "grounded" signal to the "L" and "E" terminals, respectively, on the low voltage terminal strip *(see Figure 16)*.

Figure 16.



To activate the unoccupied mode for units on the same clock schedule, a single wire can be "daisy chained" between units and simply grounded through the timeclock contacts. The same system can also be done to activate the load shed and emergency shutdown modes by running additional wires between units to ground.

The P and C terminals of the Mark IV/AC board are used for pump restart. These terminals pass a voltage signal whenever the unit's compressor is turned on. This signal is detected by a Pump Restart Relay board (P/N 898-613703X01) providing a N.O. or N.C. set of contacts for heat pump loop circulation pump control. When used with the Loop Water Controller, the relay operation accommodates turning off circulation pumps during unoccupied periods with a safety override dependent on, at minimum, one WSHPs need. The P and C terminals may be "daisy chained" between 200 units *(see page 17)*.

Thermostat/Subbase Connections

Single Compressor Units

Figure 17. Manual changeover thermostat

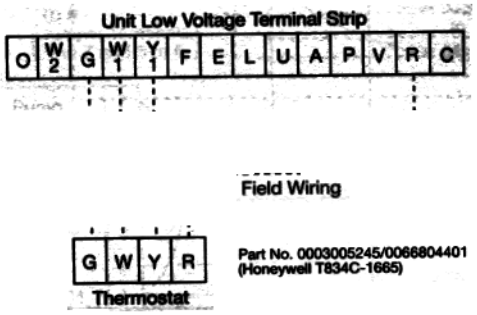


Figure 18. Standard automatic changeover thermostat and subbase

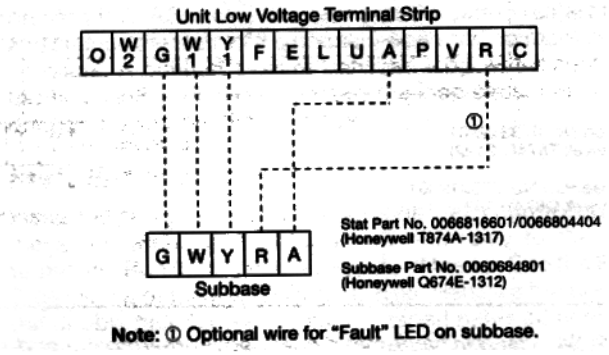


Figure 19. Standard automatic changeover thermostat and subbase for control of 2 units

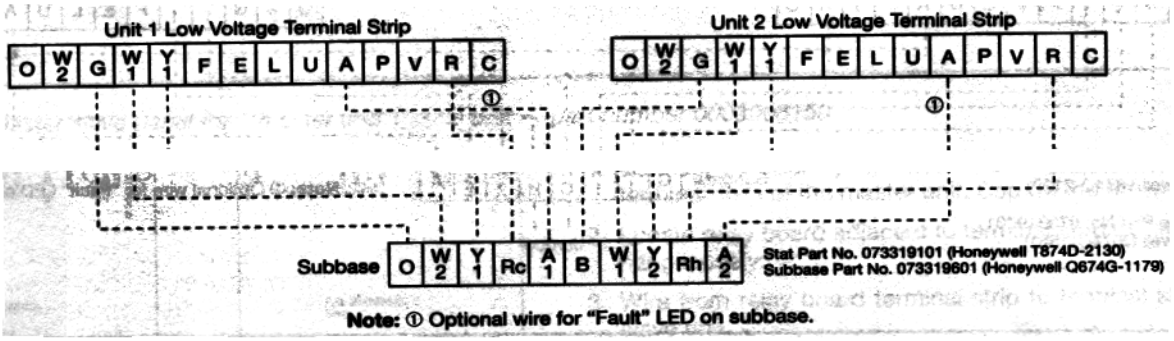


Figure 20. Deluxe automatic changeover thermostat and subbase for night setback and override operation, shutdown and load shed operation also shown

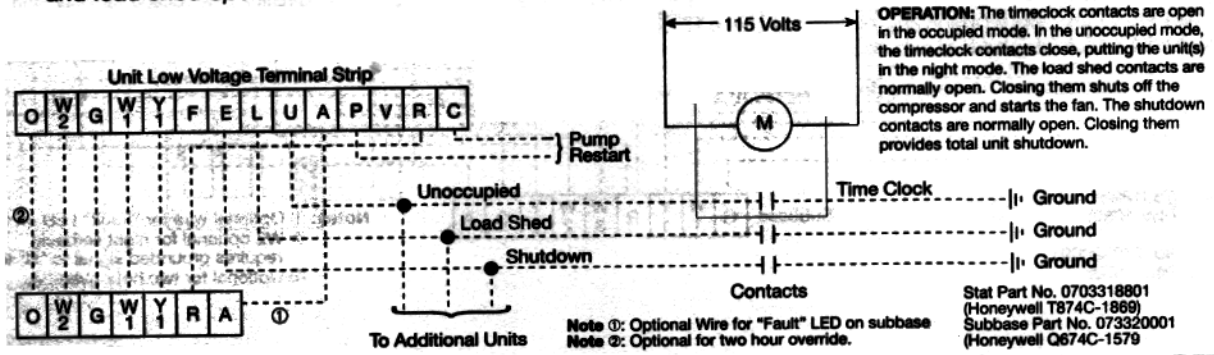


Figure 21. Standard automatic and manual changeover thermostat and subbase

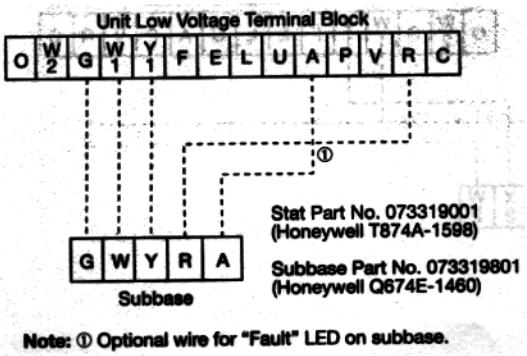


Figure 22. Programmable electronic thermostat for Mark IV/AC control unit

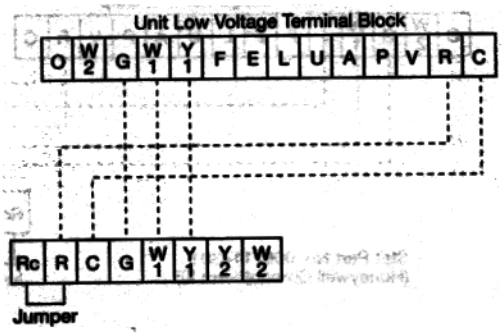
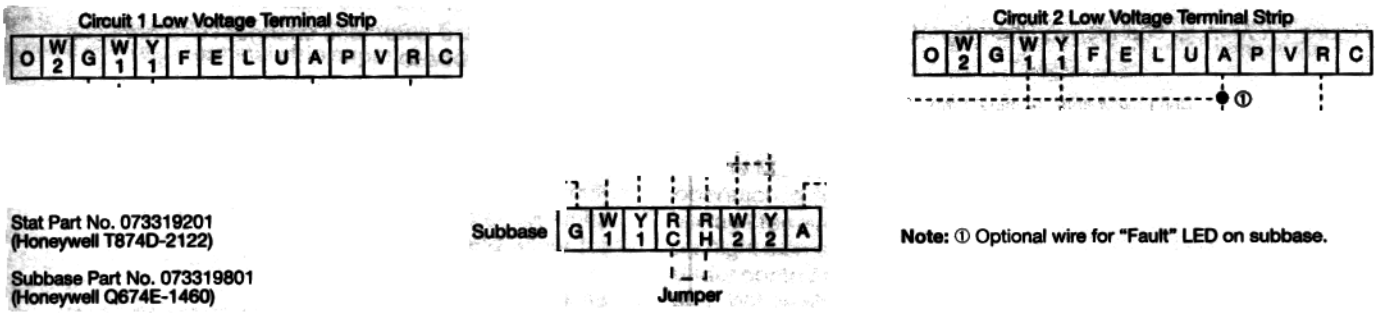


Figure 23. Standard manual and automatic changeover thermostat and subbase

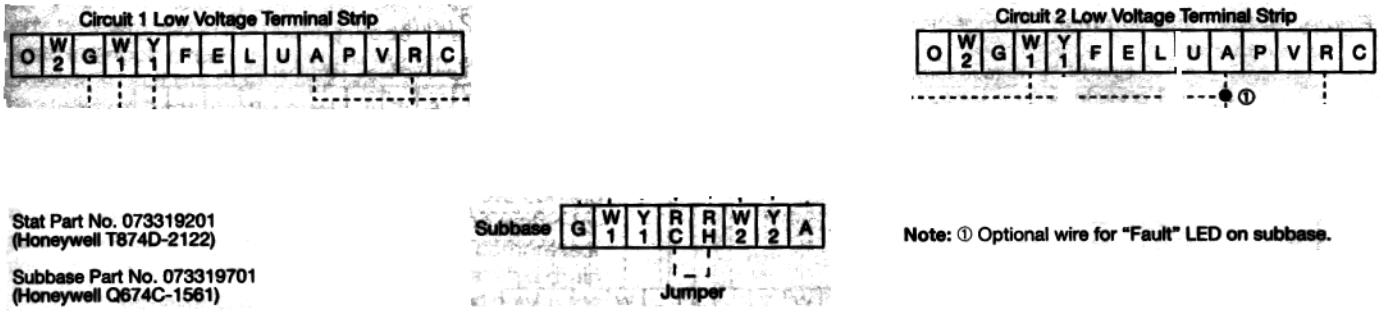


Stat Part No. 073319201
(Honeywell T874D-2122)

Subbase Part No. 073319801
(Honeywell Q674E-1460)

Note: ① Optional wire for "Fault" LED on subbase.

Figure 24. Standard automatic changeover thermostat and subbase

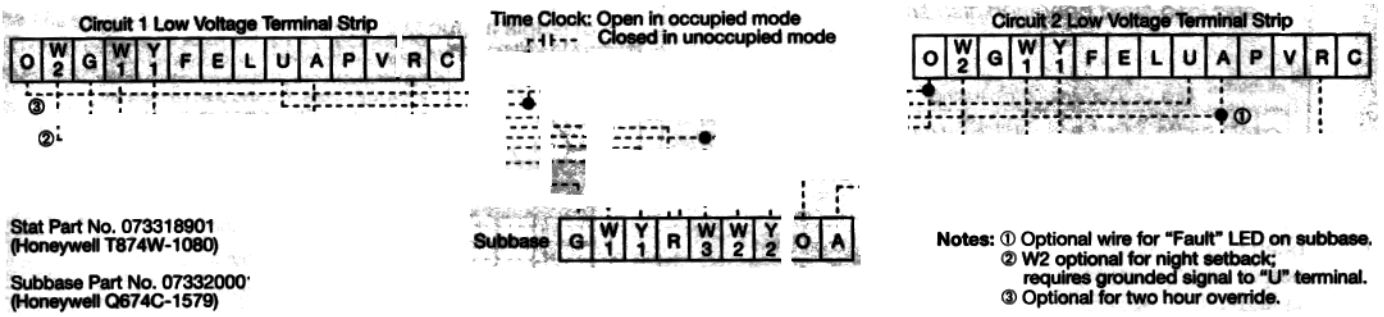


Stat Part No. 073319201
(Honeywell T874D-2122)

Subbase Part No. 073319701
(Honeywell Q674C-1561)

Note: ① Optional wire for "Fault" LED on subbase.

Figure 25. Deluxe automatic changeover thermostat and subbase for night setback and override operation

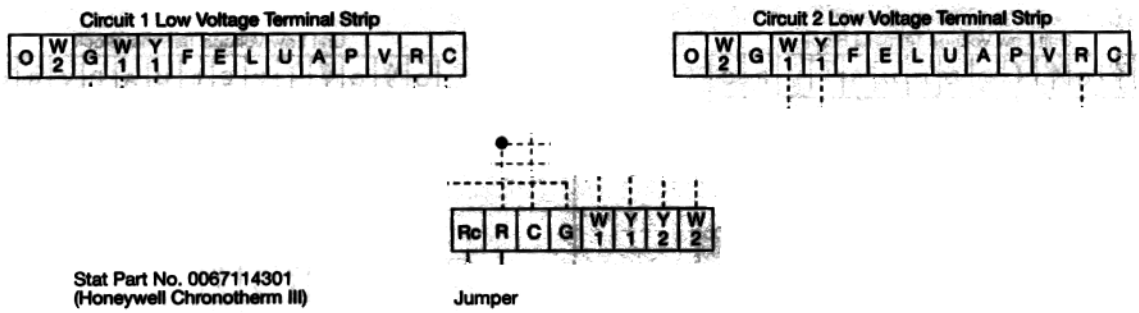


Stat Part No. 073318901
(Honeywell T874W-1080)

Subbase Part No. 07332000
(Honeywell Q674C-1579)

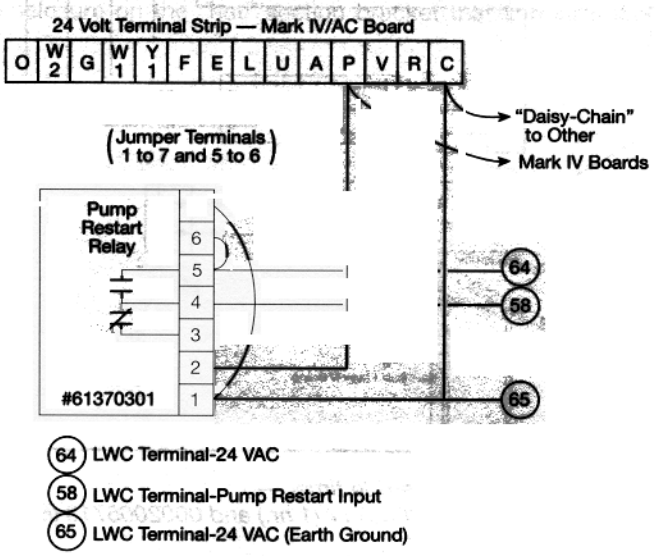
Notes: ① Optional wire for "Fault" LED on subbase.
② W2 optional for night setback; requires grounded signal to "U" terminal.
③ Optional for two hour override.

Figure 26. Programmable thermostat and subbase



Stat Part No. 0067114301
(Honeywell Chronotherm III)

Figure 27. Pump restart relay kit — part number 0061419001 (for installation in the loop water controller)



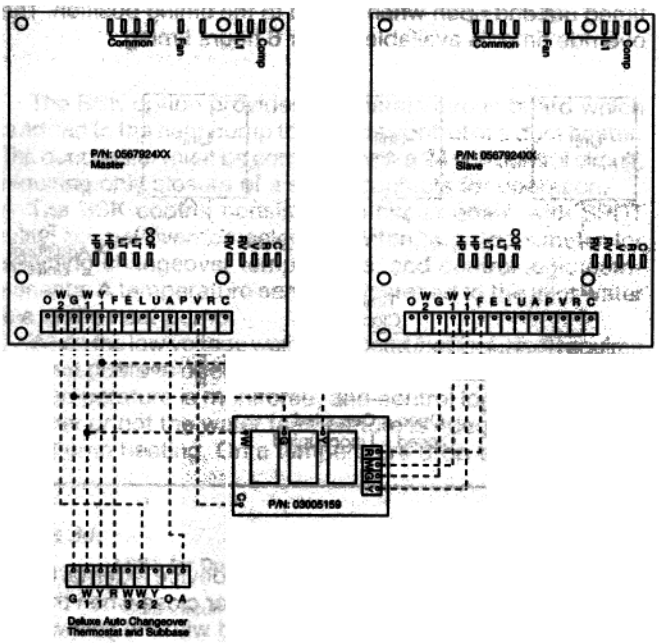
Operation:

The pump restart relay is designed to work with the Mark IV/AC board's P and C terminals for sensing compressor operation. Any Mark IV/AC board can energize the pump restart relay and change the state of the normally open and normally closed contacts. A contact closure between loop water controller terminals (58) and (64) will restart the loop circulating pump during unoccupied time periods.

Installation:

Install the pump restart relay in the loop water controller. First make the wiring connections from the relay to the LWC terminals. Run the wires out the side of the LWC to the P and C terminals of the Mark IV/AC boards. Remove the cover of the double face tape and affix the taped panel adjacent the pushbutton circuit breaker (CB1) and terminal block (TB3).

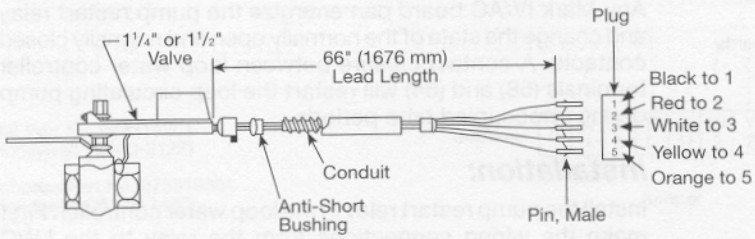
Figure 28. Master slave panel for 1 master and 1 slave unit part number 0003005159



1. Connect the four flying leads of the relay board to the terminal strip of the master unit. Cap off the brown wire.
2. Locate relay board adjacent to terminal strip by letting it hang loosely.
3. Wire from relay board terminal strip to terminal strip of slave unit.
4. Wire wall thermostat to the terminal strip of master unit. This relay board permits control of two units from a single thermostat.
5. The two control circuits are now electrically parallel and both units will operate as one in response to the wall thermostat.
6. Cut fixed cool anticipator on thermostat.

Figure 29. Motorized valve and relay — part number 0061201202

Valve opens when compressor is on and closed when compressor is off. If Mark IV/AC night setback emergency shutdown or load shed logic is being utilized, the valve will cycle open and closed in response to a call for heating and cooling at day thermostat setpoints. Connect circuit #1 on dual compressor units.



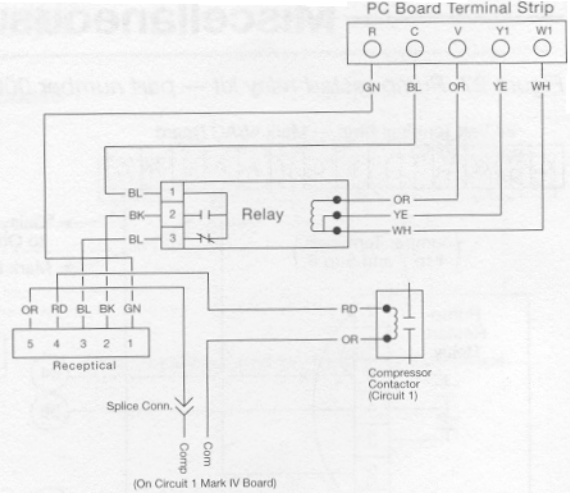


Figure 30. Typical motorized valve installation

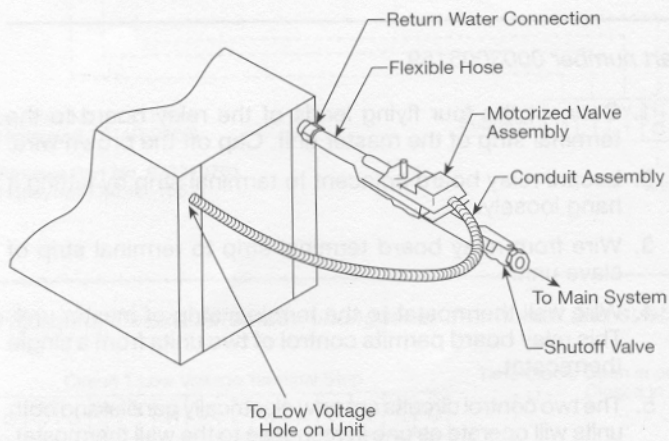


Figure 31. Manual override timer — part number 0002005717 (1 hr.) and 0002005718 (6 hr.)

One wire is daisy chained to each heat pump "U" terminal to activate night setback operation. An override timer wired in the night setback circuit, per the diagram below, takes the unit out of night setback operation by opening the night setback circuit. The manual timer contacts are closed when timed out and open when turned to the timing position. The override timer is available in 1 or 6 hours timing.

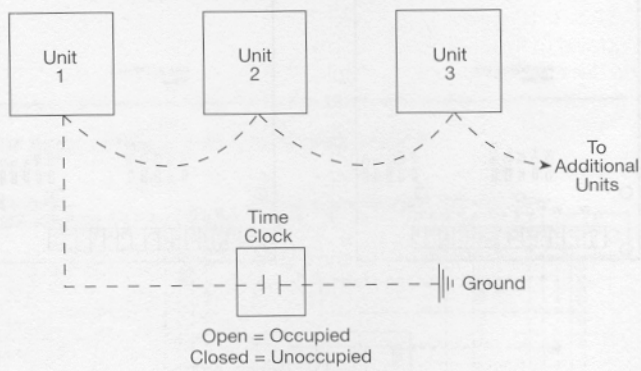
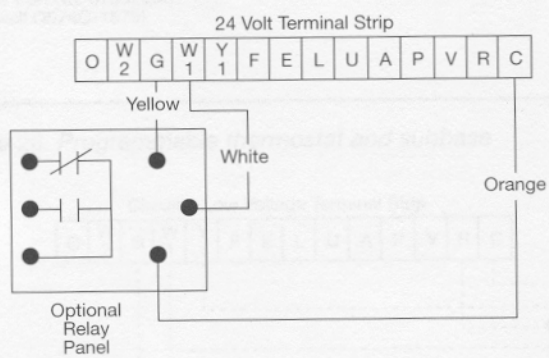


Figure 32. Auxiliary relay — part number 03005073

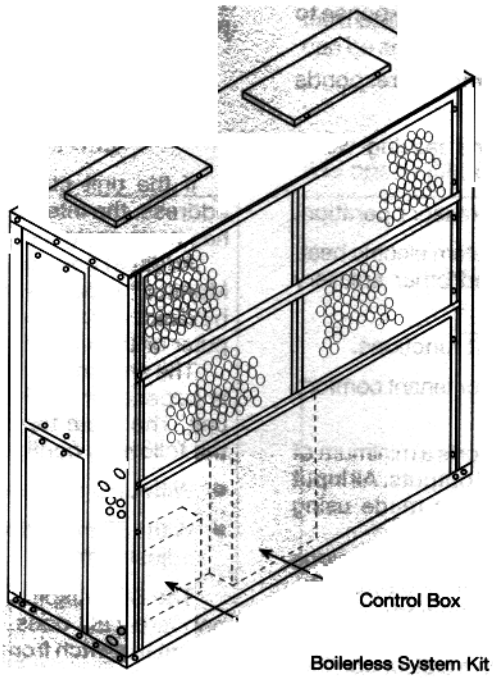


Auxiliary relay is to control an auxiliary device external to the unit. As illustrated, contacts will open or close when the fan is on. The relay can also be connected with the yellow wire to the Y1 terminal to open or close when compressor cycles.

If Mark IV/AC night setback emergency shutdown or load shed logic is utilized, relay will respond to thermostat.

Figure 33. Boilerless system part number 0061251501

The field installed kit is supplied with a sheetmetal enclosure, wire harness and printed circuit board. Attach the sheetmetal enclosure on the "hat" section bracket that supports the coaxial heat exchanger in the location shown in the diagram below. Route the wire harness through the knockouts on the control box, and connect per the wiring diagram below.



Boilerless System Kit

The BSK option provides a separate circuit board which is added to the heat pump to provide control of a duct heater. The duct heater must be complete with a 24 volt control circuit, requiring only closure of a set of contacts for operation.

The BSK control consists of a circuit board with SPDT relay, *normal/override* selector switch, a potentiometer for selecting changeover temperature, and control logic components. A temperature sensor is fastened to the inlet water line of the heat pump.

When the low voltage wall thermostat *(not included)* requires the heat pump to operate in the heating mode, the inlet water line temperature is monitored, and control logic determines whether or not the water temperature is adequate to permit heat pump heating. On a temperature drop to the selected control point, the duct heater will be substituted for the compressor. The heater and the compressor never operate simultaneously.

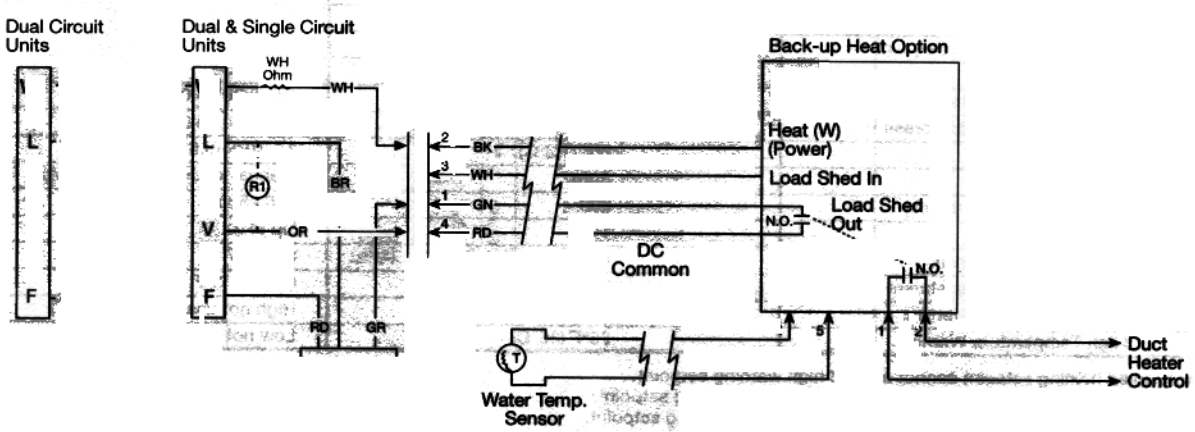
When the thermistor temperature is less than the potentiometer setpoint, the relay will be cycled by the heat demand of thermostat. Additionally, control logic will suspend compressor operation.

Fan operation may be either continuous or cycled with heating operation, as selected by the fan switch of the thermostat.

On a space temperature rise, when the thermostat calls for cooling operation, the BSK permits compressor operation, regardless of inlet water temperature or selector switch position.

Figure 34.

BSK for Dual Circuit Heatpump



Keystone RL-2010-1726-97-DI
or Equivalent

The MicroTech WSHP unit controller is a preprogrammed, pretested microprocessor which:

- Controls unit heating and cooling functions in response to a wall mounted comfort sensor.
- Monitors safety controls in each heat pump and responds accordingly.
- Monitors discharge air temperature and leaving water temperature at each heat pump.
- Provides fan, reversing valve, and compressor operation.
- Provides control outputs for boilerless system electric heat, motorized valves, fresh air damper, and other auxiliary equipment.
- Provides operation status of all vital unit functions.
- Provides optional night setback override for tenant comfort.

The MicroTech WSHP unit controller supports a minimum of 6 analog inputs, 4 digital inputs and 5 digital outputs. All input and output connections to the controller are made using Insulation Displacement Connectors (IDC).

The controller can operate a unit as either a stand-alone device (for start-up, etc.) using factory programmed setpoints, or preferably, as part of the MicroTech Network System through a MicroTech gateway panel. On a call for constant fan operation, the fan relay is energized. On a call for cooling, the fan is energized *(if not already on)* and after a time delay the compressor contactor is energized. On a call for heating, the fan is energized *(if not already on)* along with the reversing valve and after a time delay the compressor contactor is energized.

Standard lockout circuitry causes compressor lockout if any one of its safety switches opens. In addition, when a low temperature fault occurs the unit will run in the cooling mode for 60 seconds to defrost the water to refrigerant heat exchanger coil. If the condensate sensor detects a filled drain pan, the compressor operation will be suspended only in the cooling mode. The unit can be reset by either disconnecting power at the disconnect feeding power to the unit or by use of the Monitor™* program through the MicroTech Network System. The unit does not have to be reset on a condensate overflow detection.

A single onboard LED gives indication of the unit status in relation to the following:

LED on	—	Occupied
LED mostly off	—	Unoccupied
LED mostly on	—	Unoccupied override
LED flashing	—	Fault

If the unit controller has not been assigned a logical address, the intensity of the LED is low. If a logical address has been assigned, the LED intensity is high.

Additional status and details are available by use of the Monitor™ program and the MicroTech Network system either by direct connection using a portable IBM® compatible computer or through the system computer.

The amount of user control without the use of the network is dependent on the type of comfort sensor used with the unit. The room temperature sensor is currently available in the following configurations:

- With LED indication and tenant override.
- With LED indication, tenant override and setpoint differential adjustment.

The LED display indicates the same conditions that the onboard LED does. The tenant override switch allows the tenant to switch from an unoccupied to an occupied comfort setpoint for a preprogrammed period of time. The tenant setpoint differential adjustment allows heating and cooling setpoint differentials to be modified by the tenant.

* The Monitor™ program is sold as part of the MicroTech Network System.

NOTICE

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device must not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Table 4.

DESCRIPTION	FACTORY PROGRAMMED SETPOINT	ADJUSTABILITY RANGE
Occupied Heating Setpoint	70°F (21°C)	35° - 120°F (1.7° - 49°C) ①④
Occupied Cooling Setpoint	74°F (23°C)	35° - 120°F (1.7° - 49°C) √ ④
Fan – Occupied	On	On, Cycle, Heat, Cycle/Cool On
Unoccupied Heating Setpoint	60°F (16°C)	35° - 120°F (1.7° - 49°C) ①
Unoccupied Cooling Setpoint	85°F (29°C)	35° - 120°F (1.7° - 49°C) ③
Fan – Unoccupied	Cycle	On, Cycle
Tenant Override – 1st press	1:00	Off, 0:30 - 8:00
Tenant Override – 2nd press	Off	Off, 0:30 - 8:00
Differential	2°F (1.2°C)	1° - 10°F (0.6° - 5.6°C) ⑤
Auto/Manual	Auto	Manual (occupied, unoccupied, fan only, off)
Next Filter Change (hours)	600	100 - 5000
Clock Schedule	1	Up to 32
Load Shed Start Level	Off	Off, 1 - 7
Tenant Setpoint Adjustment	Off (0°F, 0°C)	Off, On (3°F, 1.7°C)
Low Temperature Warning	55°F (13°C)	High not used – 35°F (1.7°C)
High Temperature Warning	95°F (35°C)	Low not used – 120°F (49°C)

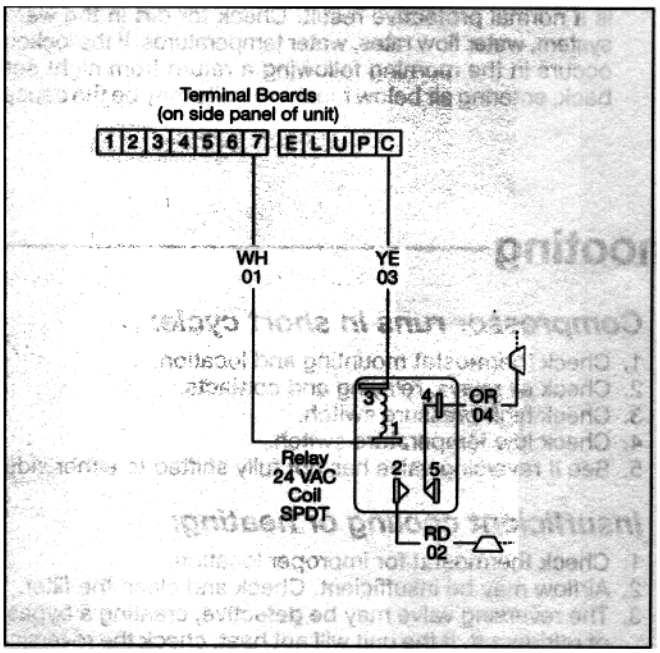
① Unoccupied heating setpoint cannot exceed high warning setpoint.
② Occupied heating setpoint cannot exceed unoccupied heating setpoint.
③ Unoccupied cooling setpoint cannot be lower than low warning setpoint.
√ Occupied cooling setpoint cannot be lower than unoccupied cooling setpoint.
⑤ Occupied heating and occupied cooling setpoints must differ by at least the differential.

Field Installed Options on MicroTech Units

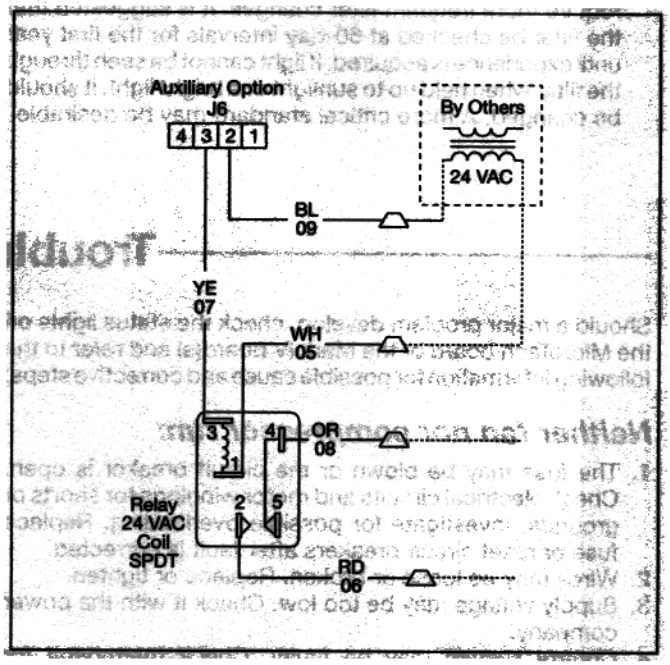
Standard options	Code
1. Timed Output Relay	MTR
2. Fresh Air Damper	MFD
3. Motorized Valve Relay	MTV

If only one option is required in a unit, it will be supplied by the WSHP Base Controller. This can be any one of the three standard options. If more than one is desired, the second and third options will be supplied by the auxiliary module; these can be any combination of the standard options listed on left.

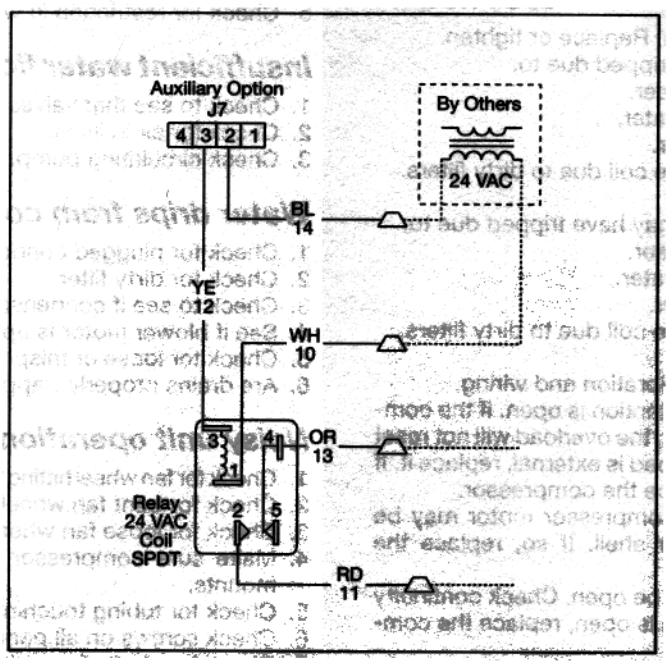
1st option (field installed)



2nd option (field installed)



3rd option (field installed)



Maintenance

1. Normal maintenance on all conditioners is generally limited to filter changes and fan motor lubrication. Lubrication of the fan motor should be performed in accordance with the instruction label on the conditioner. Be sure to use non-detergent electric motor oil.
2. Filter changes are required at regular intervals. The time period between changes will depend upon the project requirements. Some applications such as motels produce a lot of lint from carpeting and linen changes, and will require more frequent filter changes. It is suggested that the filter be checked at 60-day intervals for the first year until experience is acquired. If light cannot be seen through the filter when held up to sunlight or a bright light, it should be changed. A more critical standard may be desirable.
3. The condensate drain pan should be checked annually and cleaned and flushed as required.
4. Recording of performance measurements of volts, amps, and water temperature differences *(both heating and cooling)* is recommended. A comparison of logged data with start-up and other annual data is useful as an indicator of general equipment condition.
5. Periodic lockouts almost always are caused by air or water problems. The lockout *(shutdown)* of the conditioner is a normal protective result. Check for dirt in the water system, water flow rates, water temperatures. If the lockout occurs in the morning following a return from night setback, entering air below machine limits may be the cause.

Troubleshooting

Should a major problem develop, check the status lights on the MicroTech board or the Mark IV board(s) and refer to the following information for possible cause and corrective steps:

Neither fan nor compressor run:

1. The fuse may be blown or the circuit breaker is open. Check electrical circuits and motor windings for shorts or grounds. Investigate for possible overloading. Replace fuse or reset circuit breakers after fault is corrected.
2. Wires may be loose or broken. Replace or tighten.
3. Supply voltage may be too low. Check it with the power company.
4. Control system may be faulty. Check thermostat for correct wiring and check 24 volt transformer for burnout.

Fan operates but compressor does not:

1. Wires may be loose or broken. Replace or tighten.
2. The high pressure may have tripped due to:
   a. Fouled or plugged condenser.
   b. Lack of or no condenser water.
   c. Too warm condenser water.
   d. Not enough airflow over the coil due to dirty filters.
   e. Coil or fan motor failure.
3. The low temperature switch may have tripped due to:
   a. Fouled or plugged condenser.
   b. Lack of or no condenser water.
   c. Too cold compressor water.
   d. Not enough airflow over the coil due to dirty filters.
   e. Coil or fan motor failure.
4. Check thermostat setting, calibration and wiring.
5. The compressor overload protection is open. If the compressor dome is extremely hot, the overload will not reset until cooled down. If the overload is external, replace it. If the overload is internal, replace the compressor.
6. The internal winding of the compressor motor may be grounded to the compressor shell. If so, replace the compressor.
7. The compressor winding may be open. Check continuity with ohmmeter. If the winding is open, replace the compressor.

Compressor attempts to start but doesn't:

Check for defective compressor by making resistance check on winding.

Compressor runs in short cycle:

1. Check thermostat mounting and location.
2. Check all relays, relaying and contacts.
3. Check high pressure switch.
4. Check low temperature switch.
5. See if reversing valve has not fully shifted to either side.

Insufficient cooling or heating:

1. Check thermostat for improper location.
2. Airflow may be insufficient. Check and clean the filter.
3. The reversing valve may be defective, creating a bypass of refrigerant. If the unit will not heat, check the reversing valve coil.
4. Check expansion valve(s) for possible restriction of refrigerant flow.
5. Check for restriction in water flow.

Insufficient water flow through condenser:

1. Check to see that valves are open all the way.
2. Check for air in lines.
3. Check circulating pump.

Water drips from conditioner:

1. Check for plugged condensate drain.
2. Check for dirty filter.
3. Check to see if condensate drain runs uphill.
4. See if blower motor is up to speed.
5. Check for loose or mispositioned blower.
6. Are drains properly trapped?

Noisy unit operation:

1. Check for fan wheel hitting the housing. Adjust for clearance.
2. Check for bent fan wheel. Replace if damaged.
3. Check for loose fan wheel on shaft. Tighten.
4. Make sure compressor is floating free on its isolator mounts.
5. Check for tubing touching compressor or other surface.
6. Check screws on all panels. Tighten.
7. Check for chattering or humming in the contactor relays due to low voltage or a defective holding coil. Replace component.
8. Check water balance to unit for proper water flow rate.