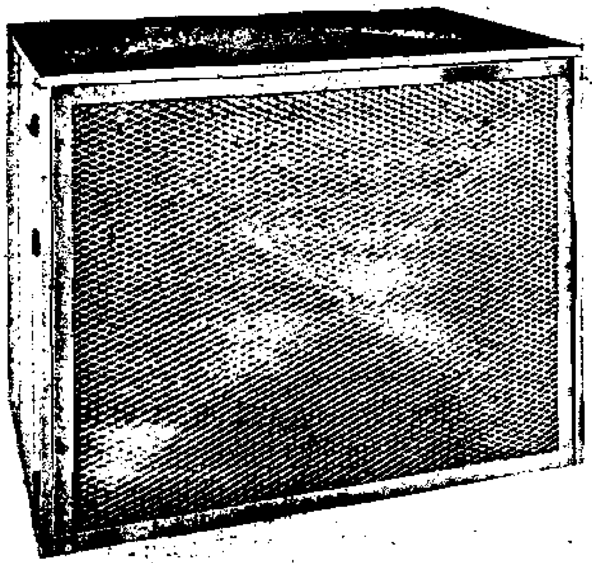
BARD REMOTE HEAT PUMPS

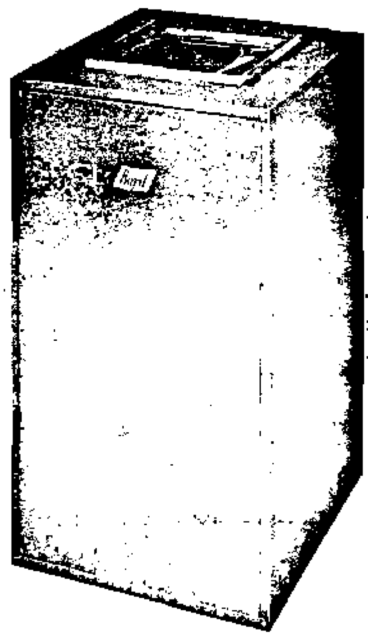


Outdoor Unit

MODEL	COOLING BTU	HEATING BTU
36HPQ w/B36HQ	34,000	35,000
48HPQ w/B48HQ1	48,000	49,000
60HPQ w/B60HQ1	57,000	58,000

Where Quality Comes First

- Time temperature defrost
- Equipped with service ports
- Fiberglas insulated air handlers
- Galvannealed steel cabinets
- Tecumseh Compressors
- Air handler vertical or horizontal



Indoor Unit

- Pre-wired, ready to install
- Large coil surfaces for added efficiency
- Convenient access panels
- Fiberglas filters
- Pre-charged with F-22
- Baked enamel finish for long life

BARD MANUFACTURING COMPANY • P. O. BOX 607 • BRYAN, OHIO 43506

Form 111569

DIMENSIONS AND SPECIFICATIONS

CAPACITY RATINGS

MODEL—OUTDOOR/INDOOR	36HPQ/B36HQ		48HPQ/B48HQ1		60HPQ/B60HQ1	
Heating and Cooling Capacity						
Cooling BTU	34,000		48,000		57,000	
Heating BTU @ 45°	35,000		49,000		58,000	
Heating BTU @ 20°	18,500		31,000		36,000	
Electrical	1-Ph.	3-Ph.	1-Ph.	3-Ph.	1-Ph.	3-Ph.
Cooling Watts	6000 W	5700 W	7000 W	6800 W	8700 W	8400 W
Heating Watts @ 45°	5200 W	5000 W	6000 W	5700 W	6800 W	6600 W
Heating Watts @ 20°	4000 W	3700 W	5000 W	4700 W	5600 W	5400 W
Maximum Electric Heat	15KW		20KW		20KW	

INDOOR UNIT (Vertical or Horizontal Installation)

MODEL	B36HQ	B48HQ1	B60HQ1
Electrical	1-Ph. 60 cy.	1-Ph. 60 cy.	1-Ph. 60 cy.
Operating Voltage	115 V	115 V	115 V
Field Wire Supply	2 #12 AWG	2 #12 AWG	2 #12 AWG
Delay Fuse Min/Max	10/15	10/15	10/15
Total Unit Amps	6.4 A	5.4 A	7.4 A
Motor & Blower	Direct 10 x 8	Belt 12 x 12	Belt 12 x 12
Blower Motor—RPM	1050/950/850	1725	1725
Blower Motor—HP/Watts	⅓/600 W	⅓/500 W	½/600 W
CFM Cooling/Filter	1300 @ .20"	1750 @ .20"	2050 @ .22"
Evaporator			
Face Area Sq. Ft./Row/Fins per in.	3.17/3/14	3.91/4/10	4.34/4/12
Filter Sizes (inches)	20 x 20 x 1	(2) 14 x 25 x 1	(2) 14 x 25 x 1
Refrigerant Control	Capillary	Capillary	Capillary
Shipping Weight Lbs.	125	185	200

OPTIONAL EQUIPMENT

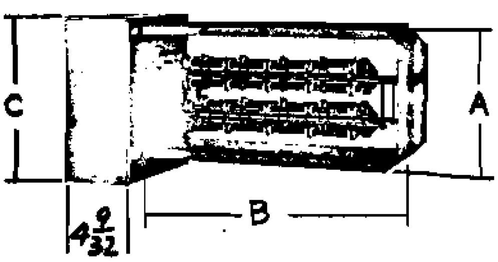
Outdoor Thermostat **Model A22** (10° to 45°)
Emergency Switch w/light **Model 12T9153**

OUTDOOR UNITS

MODEL	36HPQ	36HPQ-3	48HPQ	48HPQ-3	60HPQ	60HPQ-3
Electrical	1-Ph. 60 cy.	3-Ph. 60 cy.	1-Ph. 60 cy.	3-Ph. 60 cy.	1-Ph. 60 cy.	3-Ph. 60 cy.
Operating Voltage	197-253 V	187-264 V	197-253 V	187-264 V	207-253 V	187-264 V
Field Wire Supply	2 #10 AWG	3 #12 AWG	2 #8 AWG	3 #10 AWG	2 #6 AWG	3 #10 AWG
Delay Fuse Min/Max	35/45 A	20/35 A	50/60 A	30/40 A	55/80 A	40/50 A
Total Unit Amps	23.9 A	16.1 A	32.9 A	18.9 A	37.9 A	23.9 A
Compressor—Tecumseh	PSC		CSR		CSR	
Volts	208/230 V	208/240 V	208/230 V	208/240 V	230 V	208/240 V
Name Plate Amps	20.0	12.2	29.0	15.0	34.0	20.0
Lock Rotor Amps	92.5	72.0	125	100	135	110
Crankcase Heater	50 W*	50 W	50 W*	50 W	50 W*	50 W
Fan Motor & Condenser						
Fan Motor—HP/RPM	1/5 / 1050	1/5 / 1050	1/2 / 1075	1/2 / 1075	1/2 / 1075	1/2 / 1075
Fan Motor—AMPS/Watts	3.9 A/340 W	3.9 A/340 W	3.9 A/400 W	3.9 A/400 W	3.9 A/400 W	3.9 A/400 W
Fan—DIA/CFM	20"/1800	20"/1800	20"/2750	20"/2750	20"/2975	20"/2975
Face Area						
Sq. Ft./Row/Fins per in.	4.61/3/13	4.61/3/13	6.25/3/12	6.25/3/12	7.7/3/12	7.7/3/12
Refrigerant R-22**	107 oz.	107 oz.	144 oz.	144 oz.	160 oz.	160 oz.
Shipping Weight Lbs.	270	270	335	335	350	350

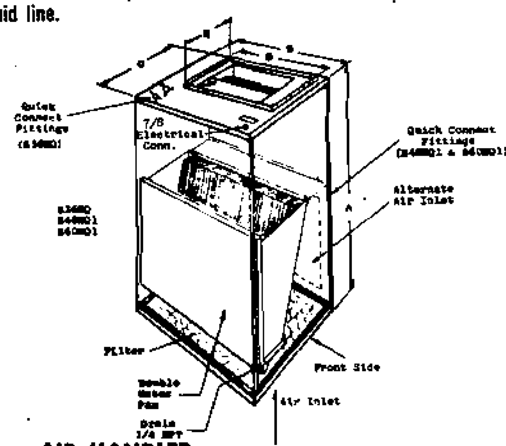
*Run Capacitor Heat Circuit.

**Refrigerant Charge Includes Indoor and Outdoor Unit.
For total R-22 charge add the weight of R-22 per ft. of liquid line.

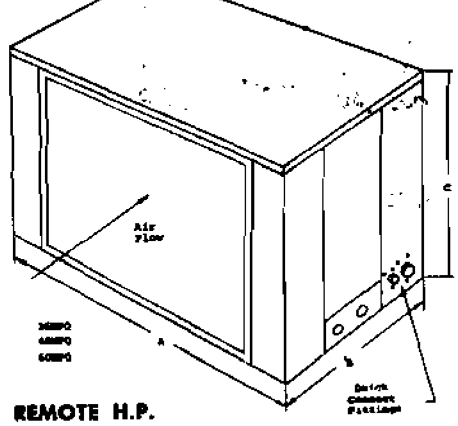


DUCT HEATER

MODEL NO.	DUCT SIZE H x W.	A "	B "	C "
MSB816-5	8" x 16"	8	15¾	10
MSB816-9.6	8" x 16"	8	15¾	10
MSB1218-14.4	12" x 18"	11	17⅝	13¼
MSB1218-19.2	12" x 18"	11	17⅝	13¼



AIR HANDLER



REMOTE H.P.

CABINET DIMENSIONS / DUCT OPENINGS

MODEL NO.	LENGTH A "	WIDTH B "	HEIGHT C "	INLET AIR	OUTLET AIR D "	OUTLET AIR E "
B36HQ	[illegible]	24	20	20 x 24	18	12
B48HQ1	43	29⅛	26	26 x 29	18	16
B60HQ1	48	29⅛	26	26 x 29	18	16
36HPQ	37⅛	24¼	24¼			
48HPQ	40¾	24¼	30½			
60HPQ	40¾	24¼	30½			

Form No. 112569

Remote Heat Pump
Installation and Service Instructions

General

These remote heat pumps are designed to operate with matching indoor blower-evaporator units.

All units are "Quick Connect" and pre-charged. When tubing other than pre-charged is used, refer to Charging Procedure in these instructions for further information and use the CTO Quick Connect Adapter.

Location

The unit must be located outside or in a well ventilated place. Under no circumstances should it be located in the space being cooled or in a confined area where the heat rejected by the unit can cause a temperature rise in the space in which the unit is located. Prevailing summer wind should blow at one end of the unit, rather than into the condenser coil, for best defrosting conditions. A screen or baffle should be installed as a shield when necessary.

Condenser inlet air should not be closer than 12 inches to any wall and maintain a 30 inch clearance on the discharge side of the condenser outlet air.

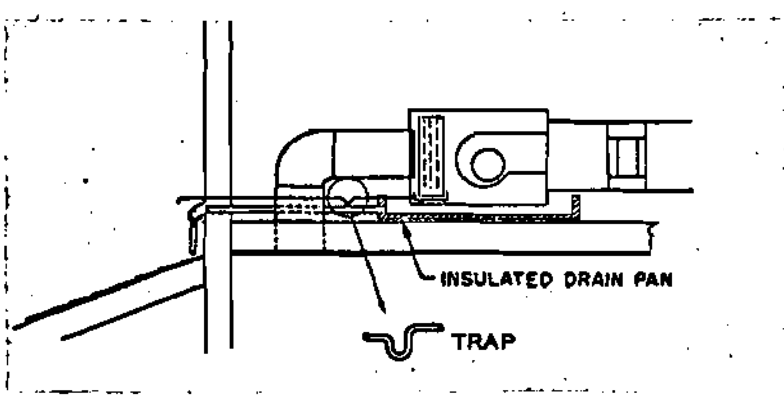
A 4" concrete slab at least 4" wider and 4" longer than the unit is recommended as a foundation for installation. The slab can be set at any distance from the house wall but not tied in or noise will transmit through into house. A raised platform or steel framework must be used in areas where prevailing water accumulation or snowfall might interfere with proper operation of the unit.

If the unit is installed on the roof, be sure the structure will support the weight of the unit. It is recommended that the unit be raised 12 inches above the roof to allow air circulation beneath the unit and prevent blocking by snow, leaves, water, and ice.

In areas where winter conditions go below 32° F. (for any length of time) the unit should be raised a minimum of 18 inches above the ground or roof.

These units are provided for free outdoor coil drainage. The mounting bases shall permit unobstructed draining and avoid ice buildup.

OIL TRAP IN SUCTION LINE



Duct Requirements

Minimum filter sizes to keep filter velocities between 400 - 500 fpm, are as follows:

Indoor Unit Model	Minimum Filter Size - For Blower Evaporators
B36HQ	(1) 20" x 20" x 1"
B48HQ	(2) 14" x 25" x 1"
B60HQ	(2) 14" x 25" x 1"

The filters should always be installed in a location that is convenient for filter removal and cleaning. This is especially important with a heat pump. On the heating cycle, as the filters get dirty, the airflow through the indoor coil is reduced, this raises the compressor head pressure. As the airflow reduces to a low level, the head pressure may reach a point high enough to trip the high pressure cutout.

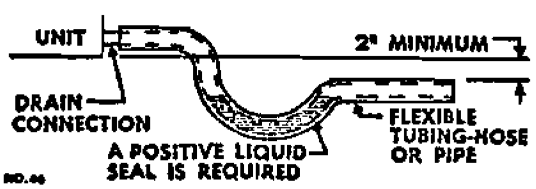
Duct work passing through unconditioned areas, such as crawl spaces and attics must be well insulated (approximately 2" insulation) and provided with a suitable vapor barrier. (The crawl space must be thoroughly ventilated and provided with a good vapor barrier as a ground cover). All outdoor duct work must be thoroughly insulated and weather-proofed. Failure to properly insulate will result in serious loss of capacity and condensate formation on the ducts. Supply and return air ducts should be designed for minimum resistance and length of runs.

For designing ductwork, it is recommended that reference be made to the appropriate National Warm Air Heating and Air Conditioning Association Manual.

Condensate Drain Line

The condensate drain connection from the indoor coil is located on the side of the unit. It is threaded to receive a 3/4" pipe. Install a trap in the drain line near the unit. This trap will prevent air from being drawn back into the unit through the drain line, and consequently will insure proper drainage of the condensate.

INSTALL CONDENSATE DRAIN TRAP SHOWN BELOW. USE DRAIN CONNECTION SIZE OR LARGER. DO NOT OPERATE UNIT WITHOUT TRAP. UNIT MUST BE LEVEL OR SLIGHTLY INCLINED TOWARD DRAIN.



QUICK - CONNECT

COUPLINGS

Coupling halves, before connection, maintain a perfect seal against refrigerant loss. The male half (right unit) is comprised of a cutting tool for piercing diaphragms, the diaphragm (which is a leakproof metal closure), a rubber washer to prevent loss of refrigerant while coupling is being connected, and a knife-edged metal seal - the permanent seal. The female half (left unit) contains a diaphragm which is a leak-proof metal closure. For attaching gauge lines or adding additional refrigerant, the female half is also equipped with a charging port on the tubing sets.

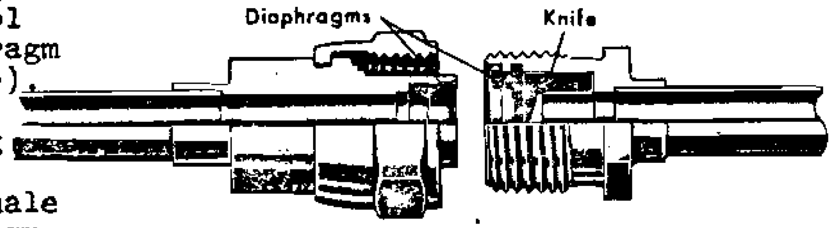


Figure 1
Coupling Halves Before Connection

During connection, the female body contacts the rubber washer in the male half, preventing loss of refrigerant or inclusion of air during the actual connection as the knife pierces the diaphragm.

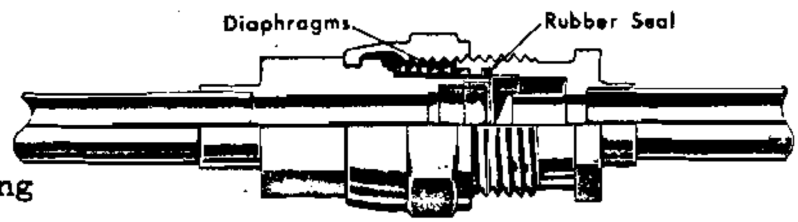


Figure 2
Coupling Halves Partially Connected

Tightening the union nut draws the coupling halves together, folding the diaphragms back, as shown, to open the fluid passage, When fully coupled, the knife-edged metal seal forms a permanent leakproof joint between the two coupling halves.

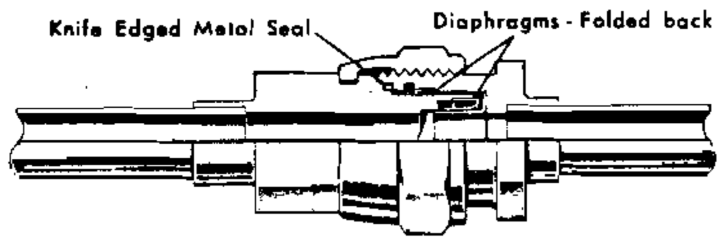


Figure 3
Coupling Halves Connected

REFRIGERANT TUBING - FIELD CHARGED

The tubing used should be refrigeration grade which is cleaned, dehydrated and sealed. The tubing should be left sealed until after it is run and ready to connect. Then the tubing should be cut and the joint immediately de.

Locations where copper tubing will be exposed to mechanical damage should be avoided.

Cut ends must be reamed, but with tubing in such a position that filings will fall out rather than into the tubing.

Two refrigerant lines must be run between the condensing unit and evaporator. Refer to LINE SIZE table for recommended tubing O.D. and length. Page 8. All refrigerant piping should conform to local regulations and in accordance with the latest ASHRAE standard.

Provide Necessary Traps In Suction Line-Refer to Diagram (Fig. 10-11-12)

When the evaporator is higher or not more than 10 feet lower than condensing unit, no oil trap is required. When the evaporator is more than 10 feet lower than the condensing unit, an oil trap is required in the suction line to insure return of oil to the compressor.

TUBING INSTALLATION - FIELD CHARGED

All field made refrigerant piping joints shall be brazed with an Oxygen-Acetylene Outfit using a brazing alloy having a working temperature of 1000° F - 1500° F.

ALLOY	SIL-FOS	EASY FLO-45
Melt Temp.	1185° F	1125° F
Flow Temp.	1300° F	1145° F
Used On	Non-Ferrous	All Except Al.
Flux	No	Handy Flux

1. Solder suction line to evaporator stub and run line to stub of Suction Service Valve at condensing unit. BEFORE UNSOLDERING SERVICE VALVE CAPS, REMOVE SERVICE PORT CAPS TO RELIEVE PRESSURE ON THIS SOLDERED END CAP. (Fig. 4)

   Finish soldering the suction line to the service valve stub. Be sure to provide necessary traps in line.

2. Connect liquid line to Liquid Line Service Valve and run line to filter-drier location near expansion valve. Leave enough separation between suction line and liquid line so that suction line can be insulated.

   HEAT PUMP FILTER-DRIER HAS BEEN INSTALLED AT FACTORY IN THE AIR HANDLER AND IS LOCATED IN THE COOLING CYCLE SO THAT THE FREON FLOW IS IN ONE DIRECTION ONLY. HEAT PUMP ONLY.

   Connect sight glass (if used) to outlet end of filter drier. Connect other end of sight glass to line leading to the expansion valve, and other end of filter drier to the liquid line coming from condensing unit. Avoid Exposing Filter Drier to Atmosphere For More Than A Few Seconds.

LEAK-TEST   UNIT SHIPPED WITH 1-lb F-22 FIELD CHARGED

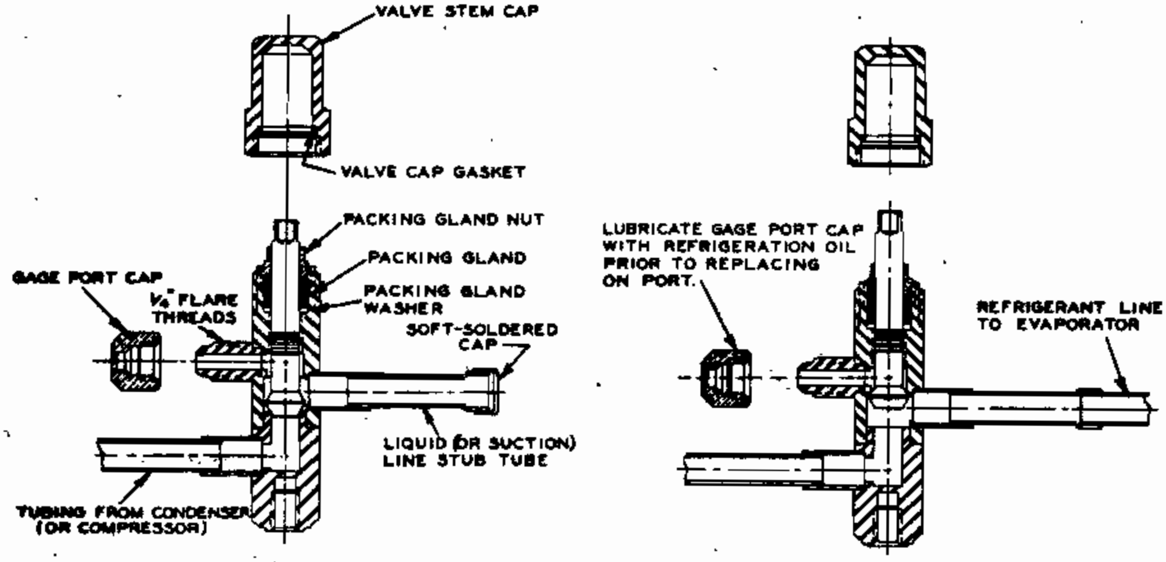
1. Check to be sure that both service valves are front seated (shipped from factory in this position) turned tightly clockwise.

2. Remove gauge port cap from suction service valve and attach Manifold Suction Gauge Hose.

3. Remove gauge port cap from Liquid Service Valve and back seat (turn counter clockwise) permitting the 1-lb. of F-22 shipped in the condenser coil to flow through the complete system until the pressure reaches 40 psig.

4. Check all soldered joints, including those on the evaporator coil with an Electronic Leak detector of Halide Torch. If a leak is found which requires soldering, pressure in the system must be bled off since it is impossible to solder with unit pressurized. Be sure all leaks are located and marked before bleeding pressure from circuit.

5. When leaks, if any, have been repaired, circuit is ready to be evacuated and charged. Relieve all pressure from the system down to 0 psig.



LIQUID (OR SUCTION) LINE SERVICE VALVE FRONT SEATED AS SHIPPED FROM FACTORY

(A)

LIQUID (OR SUCTION) LINE SERVICE VALVE BACK SEATED FOR SYSTEM OPERATION

(B)

Fig. 4

EVACUATION - FIELD CHARGED (Page 10)

1. Connect a manifold gauge set to the low and high gauge ports on the service valves and the other hose to a good vacuum pump. A pump capable of a vacuum of 1,000 microns absolute pressure is recommended but if a pump of this capacity is not available at least a 28" vacuum must be reached for 30 minutes.

2. After vacuum has been obtained and holds constant for several minutes, break vacuum by opening liquid valve permitting remainder of 1 lb. refrigerant to enter into the system. Immediately shut off valves to vacuum pump and disconnect from unit.

3. The system is now ready for the correct operating charge of refrigerant 22.

CHARGING - Field Charged

1. The correct weight of refrigerant charge is determined by adding the basic charge weight to the liquid line charge. The amount of refrigerant added for the connecting tubing depends upon the length and size of the liquid line.

2. So that you can safely charge with liquid in the suction side of the system, it is necessary to make a charging adapter from a piece of 1/8" O.D. tubing x 12" long. Refer to Schematic for details. The charging adapter allows only a specified flow rate of F-22 entering the compressor.

3. Connect refrigerant cylinder through charging manifold to both gauge ports leaving connections at gauge ports loose. Purge each hose and tighten connections. Crack both service valves. 3/4 turn CW. Fig 2 (B)

4. With manifold suction valve open and manifold discharge valve closed, open refrigerant cylinder valve and allow pressure in circuit to balance pressure of cylinder.

5. Set system control on thermostat to "Cool" and set Thermostat dial below room temperature.

6. To obtain full rated capacity charge in accordance with both of the following methods:
   (a) Refer to the basic refrigerant charge table.
   (b) Charge in accordance with the allowable Head Pressure as shown in the Head Pressure Chart.

7. Close refrigerant cylinder valve and allow unit to run for 30 minutes. Refer to Start Up Procedure and Check List.

REMOTE HEAT PUMP FREON CHARGE SPECIFICATIONS

FACTORY CHARGED TUBING

Model	Charged Tubing	Length In Feet	Liquid Line	Suction Line
36HPQ	CT-0	0	3/8"	3/4"
36HPQ	CT-15	15	1/4"	5/8"
36HPQ	CT-25	25	3/8"	3/4"
36HPQ	CT-35	35	3/8"	3/4"
36HPQ	CT-45	45	3/8"	3/4"
48 & 60HPQ	CT0-12	0	3/8"	7/8"
48 & 60HPQ	CT15-12	15	3/8"	7/8"
48 & 60HPQ	CT25-12	25	3/8"	7/8"
* 48HPQ	CT35-12	35	3/8"	7/8"
* 48HPQ	CT45-12	45	3/8"	7/8"

CTO and CTO-12 To convert quick connect units to sweat.
*Charged tubing not recommended for 60HPQ over 25 ft. Field Charge Only.

LIQUID AND SUCTION LINE

MODEL	RECOMMENDED LIQUID AND SUCTION LINE			
	0 - 15'	0 - 25'	26' - 50'	51' - 75'
36HPQ	1/4 & 5/8	3/8 & 3/4	3/8 & 3/4	3/8 & 7/8
48HPQ	3/8 & 7/8	3/8 & 7/8	3/8 & 7/8	1/2 & 1-1/8
60HPQ	3/8 & 7/8	3/8 & 7/8	3/8 & 1-1/8	1/2 & 1-1/8

BASIC UNIT CHARGE

INDOOR AND OUTDOOR UNIT MODEL	F-22	MAXIMUM CHARGE
36HPQ/B36HQ	6 lb. 11-oz.	10 lb.
48HPQ/B48HQ	9 lb. 0-oz.	12 lb.
60HPQ/B60HQ	10 lb. 0-oz.	14 lb.

LIQUID LINE CHARGE

LINE SIZE	*WT. OF F-22 PER FT.
1/4" O.D.	.4 oz.
3/8" O.D.	.6 oz.
1/2" O.D.	1.2 oz.

*Total system charge equals the Basic Unit Charge plus Wt. of F-22 per ft. of liquid line.

HEAT PUMP
START-UP PROCEDURE AND CHECK LIST

HEATING CYCLE

1. Turn system switch to "Heat" and fan switch to "System Off".

2. Wait at least three minutes before restarting unit, to give pressures a chance to level out. Turn fan switch to "Auto."

3. Slowly raise the heating temperature setting. After the first (upper) stage mercury bulb makes contact, stop moving the lever. The compressor, blower and condenser fan should now be running.

4. Turn the temperature setting a bit higher, to keep the unit running. Do not, however, turn it high enough to make the second stage mercury bulb contact (2 stage model). After giving the unit time to settle out, make sure heated air is being supplied by the unit.

5. If the outdoor ambient is above approximately 80°, the unit may trip on its high-pressure cutout. The compressor and outdoor fan should stop. NOTE: If outdoor ambient is low and the unit operates properly on the heating cycle, you may check the pressure cutout operation by blocking the return air until the unit trips. In cold climates, it may take five minutes or longer to trip.

6. Return fan switch to "Auto" position. The compressor, blower, and outdoor fan should start again, assuming that the thermostat is still calling for heat.

7. If the outdoor ambient is too high to allow a thorough heating cycle check, postpone the test until another day.

• Record here after 30 minutes' operation, the total current draw of the unit in Amps: ____________

9. Record here after 30 minutes' operation, the Hi Side Press. ___________
   Low Side Press. ______________

10. Record here after 30 minutes' operation, the following air temperatures: Indoor Return Air Temps. _________ °F. Indoor Supply Air Temp. _______ °F.
    Outdoor Air Temp. __________ °F.

11. If unit operates properly on the heating cycle, raise the heating temperature setting high enough to make the second-stage heating contact (2-stage model).

12. Supplementary resistance heat should now come on. Make sure it is operating correctly.

13. Record here the voltage measured at the unit line voltage terminals with the unit operating: ______volts. Check voltage at the disconnect switch and then the main service entrance. If the voltage is under 220 volts or above 250 volts at the service entrance (for single-phase models) or below 210 volts or over 250 volts (for three-phase model) consult your power company. While the single-phase model will operate at voltages as low as 207 volts and the three-phase model at voltages as low as 197 volts, their capacities and efficiencies are greatly reduced. Operation at single-phase voltage above 253 volts or three-phase voltages above 250 volts will result in reduced life of electrical components.

14. If checking the unit on the heating cycle in the wintertime, when the outdoor coil is cold enough to actuate the defrost timer, observe at least one defrost cycle to make sure the unit defrosts properly. See section of this manual for an explanation of the defrost control system.

AIR CONDITIONING
START-UP PROCEDURE AND CHECK LIST

COOLING CYCLE

Begin with power turned off at all disconnects.

1. Turn system switch to "Cool" and fan switch to "System Off."

2. Turn cooling temperature setting as high as it will go, heating temperature setting as low as it will go, and remove thermostat cover.

3. Inspect all registers and set them to the normal open position.

4. Turn on the unit electrical supply at the fused disconnect switch, both for the indoor unit and the outdoor unit.

5. Turn the fan switch to the "On" position. The blower should operate.

6. Turn the fan switch to the "Auto" position, the blower should now stop.

7. With a manometer (draft gauge), check the static pressure in the return duct just ahead of the return air filters; and in the supply duct just outside the unit. Add the numerical values of the two readings together to obtain the total static pressure against which the unit is operating. If the static pressure is too great, refer to CFM chart and compare measured static versus unit CFM and determine whether ductwork alterations are required. Record the final static pressure: ________________

8. Record here the voltage measured at the unit voltage terminals, with the unit operating: ______________volts.

9. Record here, after 30 minutes operation, the total current draw of the unit in Amps: _______

10. Record here after 30 minutes' operation, the following pressures: High Side Press. ______________ Low Side Press. ________________

11. Record here after 30 minutes' operation, the air temperatures: Indoor Return Air Temp. _______°F. Indoor Supply Air Temp. _______°F. Outdoor Ambient Air Temp. __________°F.

12. Turn temperature setting as high as it will go, stopping the unit.

SERVICE GUIDE

COMPLAINT ↓ / CAUSE →	Main disconnect open	Fuses blown - voltage on line side only	Low voltage - less than 200 V. at LRA	Thermostat - incorrect location	Thermostat set too high or off	Defective compressor motor - open winding	Internal or external overload open - when jumpered compressor runs	Broken valves	Defective compressor contactor	Defective transformer - fuse blown in transformer	High pressure switch open - loose wire - dirty condenser	High head pressure	Defective starting components - starts when replaced	Defective run capacitor - PSC - starts when replaced	Liquid slugging back - overcharged	Low refrigerant charge - low back pressure	Plugged capillary - low back pressure	Loose expansion valve bulb	Expansion valve stuck open	Defective expansion valve power element - low back pressure	Unit undersized	Outdoor temperature above normal	Restricted filter drier - temperature difference across the line	Restricted duct - check with static pressure gauge	Filters or evaporator dirty	Indoor blower wheel loose on shaft	Moisture or air in system - high head pressure
COMPRESSOR WILL NOT RUN - NO COOLING	●	●	●		●	●	●		●	●	●		●	●													
COMPRESSOR WILL NOT START - FAN MOTOR RUNS THEN STOPS		●	●			●							●	●													
COMPRESSOR AND FAN MOTOR RUNS - INSUFFICIENT COOLING					●			●				●				●	●	●		●	●		●	●	●	●	●
COMPRESSOR SHORT CYCLES - FAN MOTOR RUNS			●	●		●	●		●					●		●											
COMPRESSOR OPERATES CONTINOUSLY				●					●			●				●					●	●					
COMPRESSOR IS NOISY								●				●			●				●								

SERVICE GUIDE

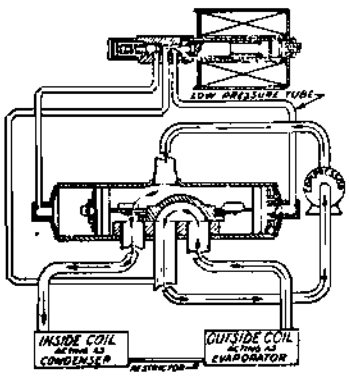
REVERSING VALVE

FOR

HEAT PUMP OPERATION

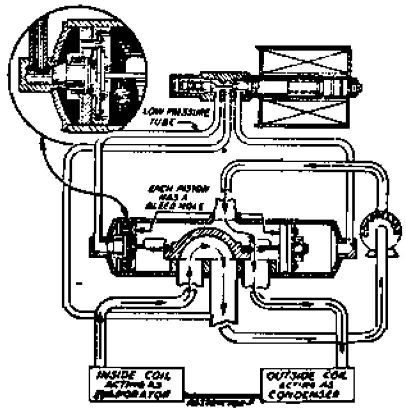
SCHEMATIC OPERATION OF THE VALVE

HEATING PHASE
Solenoid coil on Pilot Valve Energized



Path of the refrigerant gas arrowed through the Main Valve body shows the position of rest of the "sliding port" over two tube openings "E" & "C" as both coils are transferred to different operating phases.

COOLING OR DE-ICING PHASE
Solenoid coil on Pilot Valve De-Energized



VALVE OPERATION

The SOLENOID COIL on the 3-way PILOT VALVE forces the pilot valve needles to OPEN and CLOSE two port openings to start reversing operation for the 4-way MAIN VALVE.

under ONE operating condition:

1. An ENERGIZED COIL (in the heating phase) forces two opposing pilot valve needles, separated with stainless steel pins, to simultaneously CLOSE the **left "inlet" port** and to keep open the **right "inlet" port.**
   - (a) The "outlet" port is always open. It is the center pilot tube brazed into the suction line tube as a common flow path for the two outside ("inlet") ports.
   - (b) Two "inlet" tubes (brazed at all connections) are operating paths from each pilot port to the opposite end chambers of the main valve cylinder for gas to seep through small holes in each piston as gas pressure changes occur within the end chambers.
2. Gas flows out of the RIGHT end chamber, decreasing in pressure there. High pressure gas from the system is maintained within the LEFT END CHAMBER as the escape path which was first closed by the needle valve at the pilot LEFT "inlet" PORT.
   - (a) At the end of each stroke, the operating gas path is closed to the pilot valve.
3. Differences in pressures within and between the two end chambers aids the molded "sliding port" to be **moved instantly** by the pistons to the RIGHT from the pressure differential of the system.
   - (a) In reversing operation, the "sliding port" straddles one or the other of two openings, "E" and "C", as directed. The tube between "E" and "C" is always open connected to the low pressure (suction) side of the system.
4. While in and during this heating phase, both end chambers equalize in pressure until the solenoid coil is DE-ENERGIZED. This operation becomes cooling or de-icing phase when the pilot and main valves operate opposite to above in reversing.
   - (a) During the transfer period, there is sufficient bypass to prevent overloading of the compressor due to excessive head pressure.
   - (b) The valve reverses against running pressure with no mechanical or impact noises from the "sliding port" or pistons, except for an instant of hissing gas as pressures equalize in both end chambers.

OPERATION OF THE HEAT PUMP

The redirection of the refrigerant flow is accomplished with a reversing valve. (See Section covering schematic drawing of a typical reversing valve.) The valve contains a solenoid coil which, when energized, moves a pilot valve. The pilot valve then actuates the main valve, which slides to its other position and reverses the flow of refrigerant in the system.

Since the outdoor air is relatively cool when the unit is on the heating cycle, and the outdoor coil is acting as an evaporator, frost forms on the surfaces of the coil under certain weather conditions of temperature and relative humidity. Therefore, it is necessary to reverse the action of the heat pump at certain intervals, returning it to the cooling cycle to heat the outdoor coil and melt the frost accumulation. At the same time, the outdoor fan stops, to hasten the temperature rise of the outdoor coil.

DEFROST CYCLE - Below 45° Ambient

During the defrost cycle the outdoor unit will reverse back into the cooling cycle and stay in this position until the coil temperature has risen to 57° F. The time of defrost may vary from 30 seconds to 10 minutes, depending upon the amount of ice collected on the coil. During this time interval of defrost the indoor motor continues to operate, blowing cool air. To eliminate this cool condition, it is recommended that each indoor unit have an electric heat strip installed, wired in conjunction with the second stage of a two stage thermostat.

NOTE: The electric heating element will come on automatically when the heat pump is in the Defrost Cycle.

On self-contained units containing a single motor driving both the outdoor and indoor blower, the defrost relay stops the fan motor and de-energizes the electric heat strip.

DEFROST CONTROL SYSTEM

1. Operation of the Defrost Control System

A "Defrost" thermostat is located at the bottom of the outdoor coil.

The Defrost thermostat makes contact, or closes when the temperature of the outdoor coil drops to 32° F. The timer motor (located in the unit electrical box) then starts, and after the accumulative running periods reach either 30 minutes or 90 minutes (depending on the cam installed in the timer as described in Paragraph 2 below) the timer energizes the defrost relays.

The defrost relay reverses the reversing valve and stops the outdoor fan motor.

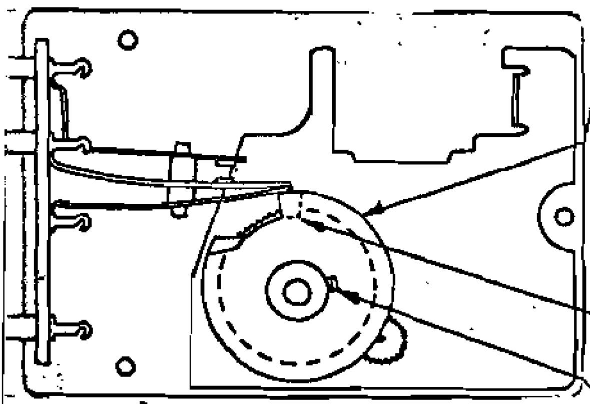
The unit remains in the defrosting cycle (cooling cycle) until the temperature of the outdoor coil reaches 57° F. At 57° F, the coil is free of frost and the Defrost thermostat opens to stop the timer and thus returns the unit to the heating cycle. The timer will not begin to run again until the outdoor coil temperature drops to 32° F. In higher outdoor temperatures, the timer motor will not be energized because the outdoor coil will not get as low as 32° F.

DEFROST CONTROL SYSTEM

2. The 30 Minute and the 90 Minute Cams

Each unit is shipped with a 30 minute cam installed in the timer. Therefore, each unit will defrost once every 30 minutes (of accumulated running time) when the outdoor coil temperature is below 32° F. If there is little or no frost present, the defrost cycle will be very short (approximately 45 seconds to 1 minute).

In mild climates where defrosting is seldom necessary, a 90 minute cycle should be adequate. Some areas may require a shorter cycle. If a 90 minute cycle is required, proceed as follows:

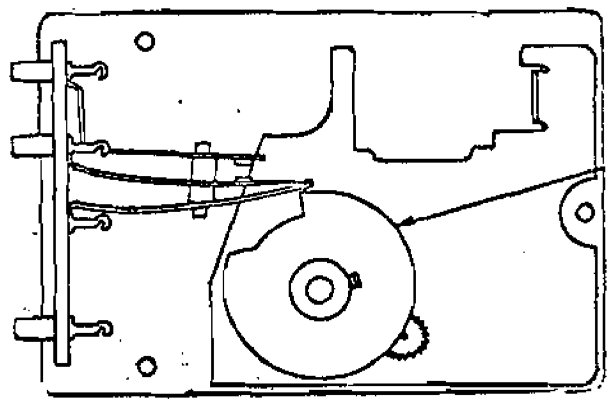


90 MINUTE CAM INSTALLED

FOR 90 MIN. DEFROST CYCLE: REMOVE 30 MIN. CAM. INSTALL CAM SHIPPED LOOSE WITH UNIT ON BOTTOM AS SHOWN. REPLACE 30 MIN. CAM ON TOP.

IMPORTANT

NOTCH ON OUTER CAM MUST TRAIL NOTCH ON INNER CAM BY 1/8" AS SHOWN FOR PROPER CIRCUIT INTERRUPTION. TIGHTEN SET SCREW WITH 1/16" ALLEN WRENCH.



30 MINUTE CAM INSTALLED

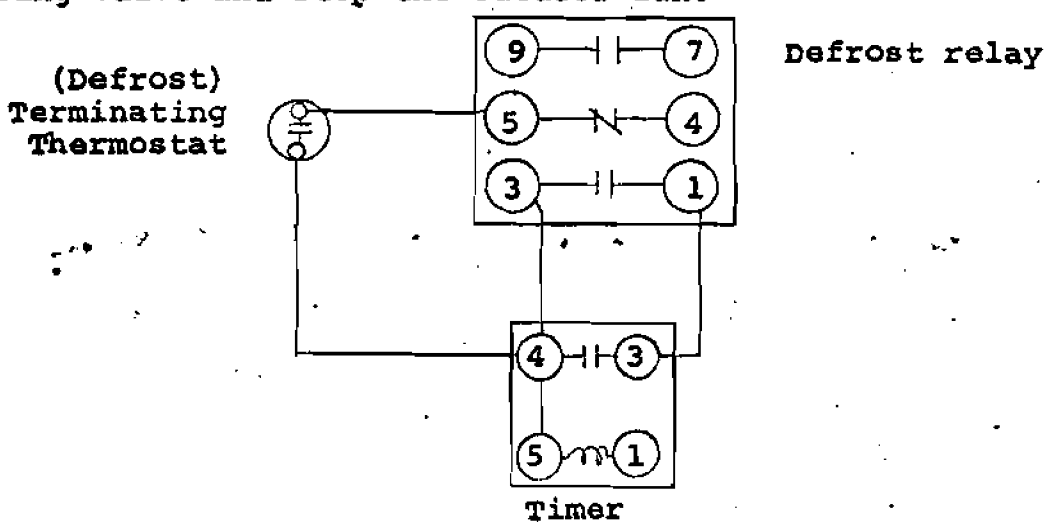
3. Timer Motor

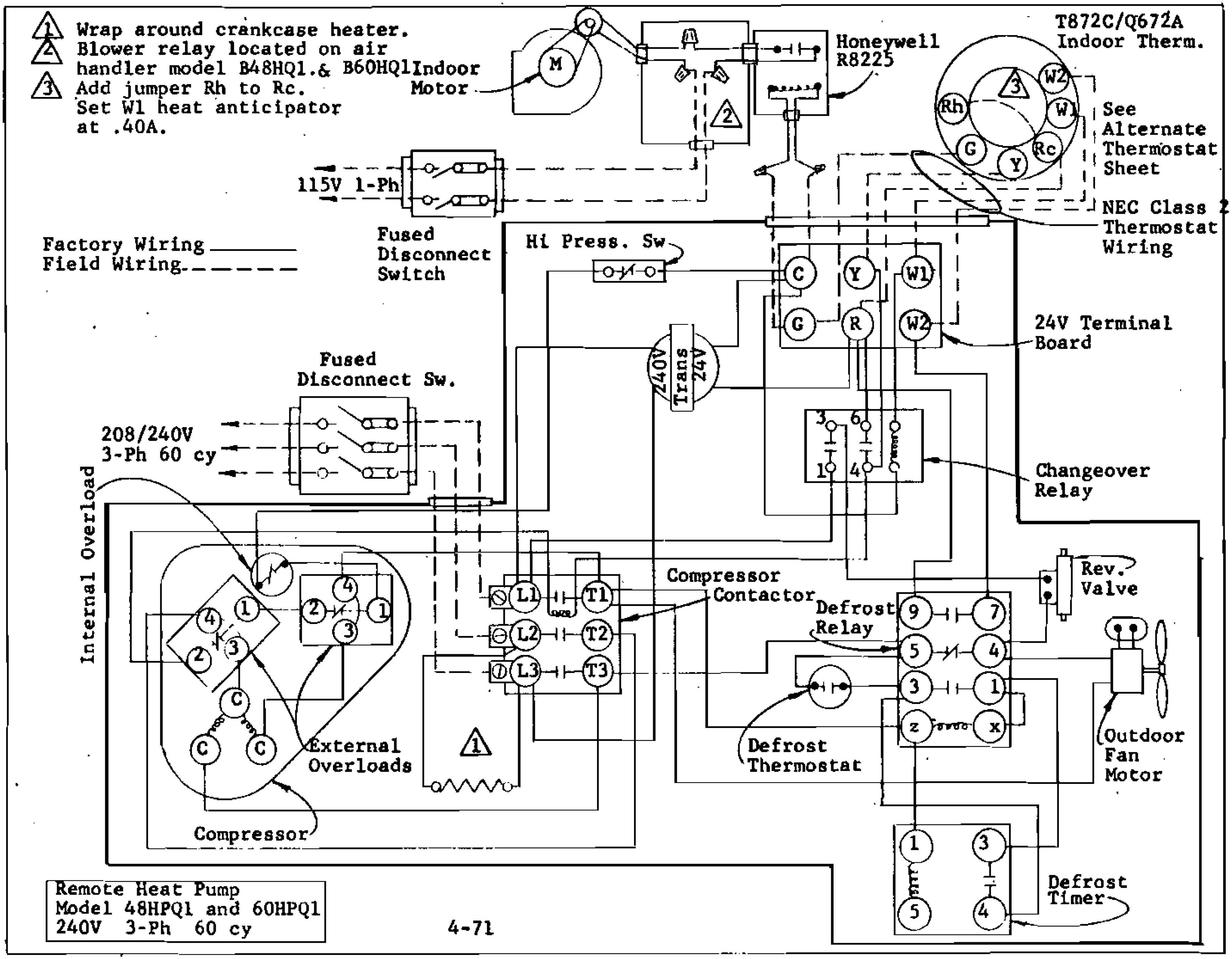
As mentioned in Paragraph 1, the timer runs only when the Defrost thermostat closes. The timer will not run at any other time. The operation of the timer may be observed visually by the moving rotor behind the window.

4. Checking Out the Defrost System

In accordance with the correct wiring diagram (located in the heat pump), proceed as follows:

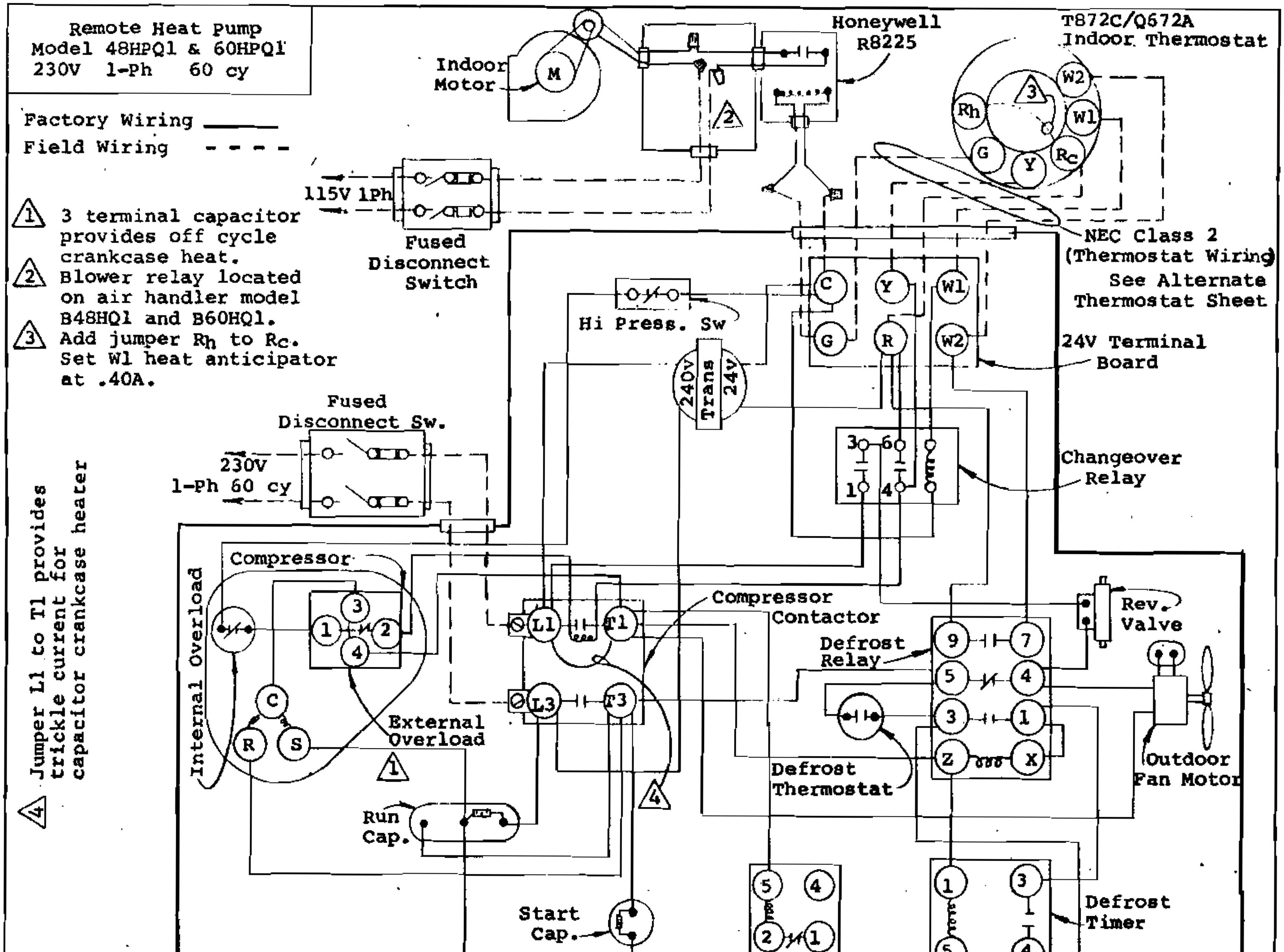
(a) To close the Defrost thermostat, jumper between terminals 5 and 3 of the defrost relay. This will start the timer motor to run. Then jumper between terminals 4 and 3 on the timer. This will close the timer contacts which, in turn, will energize the defrost relay and reversing valve and stop the outdoor fan.





Remote Heat Pump
Model 48HPQ1 and 60HPQ1
240V 3-Ph 60 cy

4-71


Remote Heat Pump
Model 48HPQ1 & 60HPQ1
230V 1-Ph 60 cy
Factory Wiring
Field Wiring
1 3 terminal capacitor provides off cycle crankcase heat.
2 Blower relay located on air handler model B48HQ1 and B60HQ1.
3 Add jumper Rh to Rc. Set W1 heat anticipator at .40A.
4 Jumper L1 to T1 provides trickle current for capacitor crankcase heater
Indoor Motor
M
Honeywell R8225
T872C/Q672A Indoor Thermostat
W2
W1
Rh
Rc
G
Y
115V 1Ph
Fused Disconnect Switch
NEC Class 2 (Thermostat Wiring)
See Alternate Thermostat Sheet
C
Y
W1
G
R
W2
24V Terminal Board
Hi Press. Sw
240v
Trans
24v
Fused Disconnect Sw.
230V 1-Ph 60 cy
Changeover Relay
Compressor
Internal Overload
External Overload
Compressor Contactor
L1
T1
L3
T3
Defrost Relay
Defrost Thermostat
Rev. Valve
Outdoor Fan Motor
Run Cap.
Start Cap.
Defrost Timer

BARD REMOTE HEAT PUMP - MODELS 48HPQ1 & B48HQ1
60HPQ2 & B60HQ2