

# INSTALLATION INSTRUCTIONS



## SINGLE PACKAGE HEAT PUMPS

## MODELS

PH 31 - 1

PH 36 - 2

**BARD MANUFACTURING CO. • BRYAN, OHIO 43506**

*Dependable quality home equipment... since 1914*

# SP-1000

MODEL	PH24-1	PH31-1	PH36-2	PH36-2(3)	PH36-2(3)	PH42	PH42(3)	PH42(3)	PH48-2	PH48-2(3)	PH48-2(3)	PH60-2	PH60-2(3)	PH60-2(3)
Cooling Capacity, BTU	22,600	29,000	34,800	35,600	35,600	41,000	41,000	41,000	46,000	46,000	46,000	53,000	53,000	53,000
Hi-Temp. Heating BTU @ 47°	23,800	30,200	36,400	37,200	37,200	44,500	44,500	44,500	49,500	49,500	49,500	55,000	55,000	55,000
Electrical—Less Kw (V - PH @ 60Hz)	230/208-1	230/208-1	230/208-1	230/208-3	460-3	230/208-1	230/208-3	460-3	230/208-1	230/208-3	460-3	230/208-1	230/208-3	460-3
Operating Voltage Range	197-253	197-253	197-253	187-253	414-506	197-253	187-253	414-506	197-253	187-253	414-506	197-253	187-253	414-506
Minimum Circuit Ampacity	19	26	29	24	15	35	26	15	37	28	15	42	32	15
Field Wire Supply**	12	10	10	10	14	8	10	12	8	10	12	6	8	12
Max. Fuse or Circuit Breaker <sup>2</sup>	25	35	45	35	15	50	35	20	60	40	15	60	50	20
Total Unit Amps	15.5	21.4	24.4	20.4	9.7	28.0	21.0	14.0	30	23	13	34.5	26.5	15.5
<b>Compressor — Circuit A</b>														
Volts	230/208	230/208	230/208	230/208	460	230/208	230/208	460	230/208	230/200	460	230/208	230/200	460
Rated Load Amps	11.5	17	20	16	7	22	15	8	24	17	7	27	19	8
Lock Rotor Amps	81	68	91	74	41	95.4	82	41	130	93	47	148	137	54
<b>Fan Motor and Condenser</b>														
Fan Motor — HP/RPM	1/2/1075	1/5/1075	1/5/1075	1/5/1075	1/3/1075	1/3/825	1/3/825	1/3/825	1/3/825	1/3/825	1/3/825	1/2/1075	1/2/1075	1/2/1075
Fan Motor—Amps	4.0	1.6	1.6	1.6	1.4	2.8	2.8	2.8	2.8	2.8	2.8	4.3	4.3	4.3
Fan—DIA/CFM	18"/1600	20"/2360	20"/2360	20"/2360	20"/2360	24"/3220	24"/3220	24"/3220	24"/3220	24"/3220	24"/3220	24"/3950	24"/3950	24"/3950
Face Area Sq. Ft./Row/Fins per in.	3.75/3/14			5.04/3/14							7.73/12			
<b>Motor and Evaporator</b>														
Blower Motor — HP/RPM	Com. w/fan	1/3/1075	1/3/1075	1/3/1075	1/3/1075	1/2/1075	1/2/1075	1/2/1075	1/2/1075	1/2/1075	1/2/1075	1/2/1075	1/2/1075	1/2/1075
Blower Motor — AMPS		2.8	2.8	2.8	1.3	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
CFM Cooling w/Filter (Rated)	825 @ .13	1075 @ .5		1275 @ .23		1500 @ .3					1700 @ .2			
Face Area Sq. Ft./Row/Fins per in.	2.34/3/12			3.21/3/13							4.62/4/14			
Refrigerant 22 - oz.	71	89	91	91	91	147	147	147	138	138	138	152	152	152
Shipping Weight - Lbs.	295	365	365	365	365	435	435	435	475	475	475	480	480	480

\*For additional heating capacity add the KW from Table No. 1. Also see electrical data table.  
 \*\*60°C Copper Wire Size, basic unit only. See electrical data for models with electric heat.

Maximum time delay fuse or HACR type circuit breaker.

MODEL	Rated Volts & PH	Operating Voltage Range	Heater KW @ 240V	Max. Unit Amps	No. Field Power Circuits	Internal Fuses		Req'd. Maximum External Fuses or Ckt. Breaker <sup>2</sup>		Minimum Circuit Ampacity		Field Power Wiring**		Ground Wire Size**
						Ckt. A	Ckt. B	Ckt. A	Ckt. B	Ckt. A	Ckt. B	Ckt. A	Ckt. B	
PH24-1	230/208	197-253	5	36.3	1			50		45		6		10
	1		10	57.1	2			50	30	45	26	6	10	10/10
PH31-1	230/208	197-253	5	41.2	1			60		52		6		10
	1		10	62.0	2			60	30	52	26	6	10	10/10
			15	82.9	2	60	60	60	60	52	52	6	6	10/10
PH36-2	230/208	197-253	5	45.2	1			60		55		6		10
	1		10	66.0	2			60	30	55	26	6	10	10/10
			15	86.9	2	60	60	60	60	55	52	6	6	10/10
PH36-2(3)	230/208	187-253	9	41.1	1			60		51		6		10
	3		15	55.6	2			35	45	24	45	10	6	10/10
PH36-2(3)	460	414-506	9	20.5	1			30		26		10		10
	3		15	27.7	1			35		35		8		10
PH42	230/208	197-253	5	48.8	2			50	30	35	26	8	10	10/10
	1		10	69.6	2			50	60	35	52	8	6	10/10
			15	90.5	2	60	60/30	50	80	35	78	8	3	10/6
PH42(3)	230/208	187-253	9	42.7	1			60		53		6		10
	3		12	57.2	2			40	45	26	45	10	6	10/10
PH42(3)	460	414-506	9	24.8	1			40		27		10		10
	3		15	32	1			40		36		8		10
PH48-2	230/208	197-253	5	50.8	2			60	30	37	26	8	10	10/10
	1		10	71.6	2			60	60	37	52	8	6	10/10
			15	92.5	2	60	60/30	60	80	37	78	8	3	10/6
			20	113.2	2	60	60/60	60	110	37	104	8	1	10/6
PH48-2(3)	230/208	187-253	9	44.7	1			40	30	28	27	10	10	10
	3		15	59.2	2			40	45	28	45	10	6	10/10
			18	66.4	2			40	60	28	54	10	6	10/10
PH48-2(3)	460	414-506	9	23.8	1			30		26		10		10
	3		15	31	1			35		35		8		10
			18	34.7	1			40		39		8		10
PH60-2	230/208	197-253	5	53.8	2			60	30	42	26	6	10	10/10
	1		10	74.6	2			60	60	42	52	6	6	10/10
			15	95.5	2	60	60/30	60	80	42	78	6	3	10/6
			20	116.2	2	60	60/60	60	110	42	104	6	1	10/6
PH60-2(3)	230/208	187-253	9	44.7	1			50	30	32	27	8	10	10
	3		15	59.2	2			50	45	32	45	8	6	10/10
			18	66.4	2			50	60	32	54	8	6	10/10
PH60-2(3)	460	414-506	9	24.8	1			35		28		10		10
	3		15	32.0	1			40		37		8		10
			18	35.7	1			45		41		6		10

\*Maximum time delay fuse or HACR type circuit breaker. \*\*Based on 60°C Copper wire.

240V		
MODEL	BTUH	AMP
5KW	17,056	20.8
9KW - 3 ph	30,600	21.7
10KW	34,130	41.7
15KW	51,195	62.5
15KW - 3 ph	51,195	36.2
18KW - 3 ph	61,200	43.4
20KW	68,260	83.3

**IMPORTANT:** The AMP values listed in this Table No. 1 are for electric heating elements only. Circuit B — Some units permit the electric heating element to be wired on the compressor Circuit A.

E.S.P. in H <sub>2</sub> O	PH24-1	PH31-1	PH36-2	PH42	PH48-2	PH60-2
.0	990	1420	1810	1870		
.10	889	1370	1750	1830		
.20	823	1320	1680	1780		
.30	747	1270	1610	1720		
.40	671	1200	1505	1640		
.50	608	1130	1400	1565		

## INDOOR THERMOSTAT OPTIONS ALL MODELS

These Bard Systems feature the option of either using a thermostat with a non-cycling reversing valve or automatic changeover.

### Non-Cycling Reversing Valve

Thermostat — Part No. 8403-017 (Honeywell T874R1129)

Subbase — Part No. 8404-009

(Honeywell Q674L1181)

### Automatic Changeover

Thermostat — Part No. 8403-018

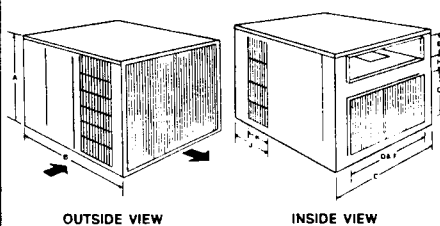
(Honeywell T874N1024)

Subbase — Part No. 8404-010

(Honeywell Q674F1261)

OUTDOOR TEMPERATURE °F									
MODEL	80°	85°	90°	95°	100°	105°	110°	115°	
PH24-1	Total BTUH	24,600	24,400	23,850	22,600	21,200	19,800	18,500	17,300
	Sensible BTUH	17,200	17,400	17,300	16,800	16,200	15,600	15,000	14,250
	Latent BTUH	7,400	7,000	6,550	5,800	5,000	4,200	3,500	3,050
PH31-1	Total BTUH	31,400	31,200	30,400	29,000	27,100	25,200	23,350	21,500
	Sensible BTUH	21,800	21,800	21,750	21,500	20,700	19,800	19,000	18,150
	Latent BTUH	9,600	9,400	8,650	7,500	6,400	5,400	4,350	3,350
PH36-2	Total BTUH	37,400	36,900	35,950	34,800	33,100	31,400	29,800	28,200
	Sensible BTUH	25,700	25,550	25,400	25,200	24,550	23,900	23,200	22,500
	Latent BTUH	11,700	11,350	10,550	9,600	8,550	7,500	6,600	5,700
PH42	Total BTUH	44,800	44,200	43,000	41,000	39,200	37,250	35,400	33,500
	Sensible BTUH	32,400	32,150	32,000	31,450	30,750	29,850	29,000	28,100
	Latent BTUH	12,400	12,050	11,000	9,550	8,450	7,400	6,400	5,400
PH48-2	Total BTUH	50,600	49,700	48,200	46,000	43,500	40,800	38,200	35,650
	Sensible BTUH	36,150	35,350	35,450	35,000	34,000	33,000	32,000	30,900
	Latent BTUH	14,450	13,350	12,750	11,000	9,500	7,800	6,200	4,750
PH60-2	Total BTUH	59,000	57,900	55,900	53,000	50,100	47,000	43,900	40,700
	Sensible BTUH	40,050	39,900	39,250	38,250	37,000	35,500	34,000	32,600
	Latent BTUH	18,950	18,000	16,650	14,750	13,100	11,500	9,900	8,100

\*At 80° DB/67° WB Return Air Temperature at Rated Indoor CFM



OUTSIDE VIEW

INSIDE VIEW

## NOMINAL CABINET DIMENSIONS (INCHES)

MODEL
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# HEATING APPLICATION DATA

## OUTDOOR TEMPERATURE °F\*

MODEL		0°	5°	10°	15°	17°	20°	25°	30°	35°	40°	45°	47°	50°	55°	60°	65°
PH24-1	Btuh	7,500	9,000	10,500	11,800	12,500	13,400	14,800	16,300	17,800	20,100	22,500	23,800	24,800	26,500	28,800	30,000
	Watts	2,180	2,220	2,270	2,320	2,340	2,370	2,410	2,470	2,540	2,620	2,710	2,750	2,800	2,910	3,025	3,140
	COP	1.01	1.19	1.36	1.49	1.57	1.66	1.80	1.93	2.05	2.25	2.43	2.50	2.60	2.67	2.79	2.80
PH31-1	Btuh	9,300	11,000	12,700	14,400	15,200	16,200	18,000	19,700	21,500	25,200	28,700	30,200	31,600	33,800	36,200	38,600
	Watts	2,460	2,540	2,620	2,690	2,730	2,760	2,830	2,880	2,910	3,140	3,280	3,350	3,460	3,640	3,820	4,010
	COP	1.11	1.27	1.42	1.57	1.63	1.72	1.86	2.00	2.16	2.35	2.56	2.60	2.68	2.72	2.78	2.82
PH36-2	Btuh	10,600	14,000	15,500	18,000	19,000	20,500	22,700	25,300	27,650	31,250	34,950	36,400	38,000	40,600	43,500	46,000
	Watts	2,850	2,965	3,070	3,170	3,210	3,275	3,385	3,500	3,625	3,780	3,970	4,060	4,180	4,390	4,595	4,800
	COP	1.09	1.38	1.48	1.66	1.73	1.83	1.96	2.12	2.23	2.42	2.58	2.60	2.66	2.71	2.77	2.81
PH42	Btuh	14,500	17,200	19,750	22,400	23,550	25,000	27,700	30,500	33,300	37,800	42,600	44,500	46,500	49,800	53,000	56,200
	Watts	3,450	3,565	3,680	3,795	3,825	3,910	4,030	4,140	4,300	4,370	4,480	4,500	4,600	4,710	4,820	4,930
	COP	1.23	1.41	1.57	1.73	1.80	1.87	2.01	2.16	2.27	2.53	2.79	2.90	2.96	3.09	3.22	3.34
PH48-2	Btuh	15,500	18,500	21,500	24,500	25,580	27,500	30,500	33,500	36,450	41,800	47,200	49,500	51,500	55,000	58,800	62,500
	Watts	3,735	3,860	3,985	4,110	4,150	4,235	4,365	4,490	4,650	4,470	4,870	4,900	4,990	5,120	5,245	5,370
	COP	1.22	1.40	1.58	1.75	1.81	1.90	2.05	2.19	2.30	2.58	2.84	2.95	3.02	3.15	3.28	3.41
PH60-2	Btuh	16,400	20,100	23,800	27,500	29,200	31,300	35,000	38,700	42,400	47,700	52,800	55,000	57,500	61,500	65,600	69,500
	Watts	4,300	4,450	4,610	4,770	4,840	4,925	5,080	5,240	5,400	5,555	5,715	5,775	5,870	6,030	6,190	6,350
	COP	1.12	1.32	1.51	1.69	1.77	1.86	2.02	2.16	2.30	2.52	2.71	2.80	2.87	2.99	3.11	3.21

\*70°F DB Indoor Return Air at Rated CFM.

## IMPORTANT

The equipment covered in this manual is to be installed by trained, experienced service and installation technicians. Any heat pump is more critical of proper operating, charge and an adequate duct system than a straight air conditioning unit. All duct work, supply and return, must be properly sized for the design air flow requirement of the equipment. NESCA is an excellent guide to proper sizing. All duct work or portions thereof not in the conditioned space should be properly insulated in order to both conserve energy and prevent condensation or moisture damage.

## SHIPPING DAMAGE

Upon receipt of equipment, the carton should be checked for external signs of shipping damage. If damage is found, the receiving party must contact the last carrier immediately, preferably in writing, requesting inspection by the carrier's agent.

## GENERAL

The refrigerant system is completely assembled and charged. All internal wiring is complete.

The unit is designed for use with or without duct work. Flanges are provided for attaching the supply and return ducts.

These instructions explain the recommended method to install the air cooled self-contained unit and the electrical wiring connections to the unit.

These instructions and any instructions packaged with any separate equipment required to make up the entire air conditioning system should be carefully read before beginning the installation. Note particularly "Starting Procedure" and any tags and/or labels attached to the equipment.

While these instructions are intended as a general recommended guide, they do not supersede any national and/or local codes in any way. Authorities having jurisdiction should be consulted before the installation is made.

## LOCATION

**General** - The unit must be located outside, or in a well ventilated area. It must not be in the space being heated or cooled. A sound absorbing material should be considered if the unit is to be installed in such a position or location that might cause transmission of sound or vibration to the living area or adjacent buildings.

**Slab Mounting** - In areas where winter temperatures DO NOT go below 32°F for periods over twelve hours, the unit may be slab mounted at grade level. When installing unit at grade level, install on a concrete slab at least four inches above finished grade level. Slab should have a slope tolerance away from the building structure of at least 1/4 inch per foot, while being level from side to side. This will prevent ice buildup under the unit during defrost cycles. Place slab in a location where run-off water from higher ground will not collect around unit. See Figure 1.

A minimum of 18 inches should be provided between the coil inlet and any building surfaces. Provide at least four feet between coil outlet and any building wall, fences or other vertical structures. Provide a minimum of three feet clearance on the service access side of the unit. See Figure 2.

**Roof Mounting** - When a unit is installed in areas where low ambient temperatures or strong winter winds exist, it should be placed so prevailing winter winds are not in direct line with the heat pump coil. If this is not possible, a wind barrier should be constructed. Place barrier 24 inches from the coil inlet side of the unit and in the direction of prevailing winds. Size barrier at least the same height and width as the unit. This may also be necessary on ground level installations. See Figure 3.

**Winter Installation Below 32°F** - In areas where winter conditions go below 32°F for extended periods, the unit must be elevated above the mounting surface to prevent snowfall or defrost ice accumulation from interfering with the operation of the unit. A minimum of twelve inch elevation is recommended, while greater elevation may be required for areas of high snow accumulation. Poured concrete, steel framework, brick, cement block, etc., can be utilized to construct a suitable raised mounting platform. See Figure 4.

## TYPICAL INSTALLATIONS

1. **Roof-Mounted** - The unit is mounted on a sturdy base on the roof of the building. Return air to the unit is brought through a single return grille (grilles with built-in filters are best, since they enable easy access for filter changing). Return air ducts are attached to the lower section of the front panel. Supply air is brought from the unit to attic duct work or to a furred down hall. Supply air duct is attached to the top of the front panel. **CAUTION:** All outdoor duct work must be thoroughly insulated and weatherproofed. All attic duct work must be thoroughly insulated. Two inch thick insulation with suitable vapor barrier is recommended for both outdoor and attic runs. In rooftop installations, as in all installations, the heat pump must be level from side to side. However, the unit should have a pitch along the length to assure complete external drainage of precipitation and of defrost condensate.
2. **Crawl Space** - Duct work installed in crawl space must be well insulated and provided with a vapor barrier. In addition, the crawl space must be thoroughly ventilated and provided with a good vapor barrier as a ground cover. It is most desirable to install the unit outdoors, rather than inside the crawl space, so that it will be readily accessible for service. In addition, it is necessary to dispose of the condensate from the outdoor coil on the heating cycle, and this is virtually impossible with the unit installed inside the crawl space.
3. **Slab Mounted at Ground Level** - This type installation is ideal for homes with slab floor construction, where a roof-mounted unit is not desired. The supply and return duct work can be run through a furred closet space.
4. **Thru-The-Wall** - This type installation requires a suitable framework to be fabricated capable of withstanding the unit weight. Normally the unit will be installed so as to minimize supply and return duct work.
5. **Other Installations** - Many other installations are possible with the packaged heat pump. No matter what the installation, always consider the following facts:
  - a. Insure that the discharge air is not obstructed in any way so as to cause operation difficulties.
  - b. The indoor coil drain pan is equipped with a coupling that must be piped through a condensate drain trap to a suitable drain.
  - c. Always mount the unit in such a position that it may be easily reached for servicing and maintenance.
  - d. Insure that the unit is clear so that proper air flow over the outdoor coil will be maintained.

**IMPORTANT:** Model PH24-1 has a single fan motor driving both the indoor blower and outdoor fan. This type of unit is particularly sensitive to natural air currents during defrost and some type of wind barrier is recommended. See Figure 3.

RATED CFM AND EXTERNAL STATIC PRESSURE (ESP) WET COIL (COOLING)			
MODEL	RATED CFM	RATED ESP	RECOMMENDED AIR FLOW RANGE
PH24-1	825	.13	725 - 975 CFM
PH31-1	1075	.50	975 - 1185 CFM
PH36-2	1275	.23	1150 - 1400 CFM
PH42	1500	.30	1350 - 1650 CFM
PH48-2	1700	.20	1520 - 1765 CFM
PH60-2	1700	.20	1520 - 1765 CFM

## AIR FILTERS

Air filters for the return air side of the system are not provided as part of the basic piece of equipment because of the various types of application for these models, and must be field supplied and installed as part of the final installation.

Prior thought should be given to return air location and placement of the air filter(s). The air filter(s) must be of adequate size and readily accessible to the operator of the equipment. Filters must be adequate in size and properly maintained for proper operation. If this is not done, excessive energy use, poor performance, and multiple service problems will result. IT IS IMPOSSIBLE TO OVERSIZE AIR FILTERS. Generous sizing will result in cleaner air and coils, as well as lower operating costs and extend the time between required changes. The following table shows minimum filter areas and recommended filter sizes. Actual filter sizes can vary with the installation due to single or multiple returns utilizing a filter/grille arrangement or being placed immediately ahead of the indoor coil face in the return air duct.

MODEL	MINIMUM FILTER AREAS	RECOMMENDED SIZE
PH24-1	336 sq.in. (2.34 sq.ft)	12x30-5/8x1
PH31-1, PH36-2	462 sq.in. (3.21 sq.ft)	15x30-5/8x1
PH42, PH48-2, PH60-2	608 sq.in. (4.62 sq.ft)	(2)16x20x1

**NOTE:** If Roof Hood Accessory is to be used, information on air filters may be found under that heading in this manual. Air filters are supplied as part of that package.

## WIRING - MAIN POWER

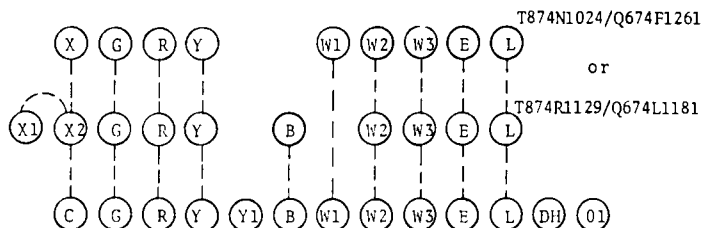
Refer to the unit rating plate for wire sizing information and maximum fuse size. Each outdoor unit is marked with a "Minimum Circuit Ampacity." This means that the field wiring used must be sized to carry that amount of current. Depending on the installed Kw of electric heat, there may be two field power circuits required. If this is the case, the unit serial plate will so indicate. Some models are suitable only for connection with copper wire, while others can be wired with either copper or aluminum wire. Each unit and/or wiring diagram will be marked "Use Copper Conductors Only" or "Use Copper or Aluminum Conductors." These instructions MUST BE adhered to. Refer to the National Electrical Code for complete current carrying capacity data on the various insulation grades of wiring material.

The electrical specifications on page 2 lists fuse and wire sizes (60°F copper) for all models, including the most commonly used heater sizes. Also shown are the number of field power circuits required for the various models with heaters.

The unit rating plate lists a "Maximum Time Delay Fuse" or "HACR" Type Circuit Breaker that is to be used with the equipment. The correct size must be used for proper circuit protection and also to assure that there will be no nuisance tripping due to the momentary high starting current of the compressor.

## WIRING - 24V CONTROL CIRCUIT

Nine (9) wires should be run from thermostat subbase to the 24V terminal board in the unit. A nine conductor, 19 gauge copper, color-coded thermostat cable is recommended. The connection points are shown on most of the wiring diagrams and are also shown below.



Unit 24V terminal Board

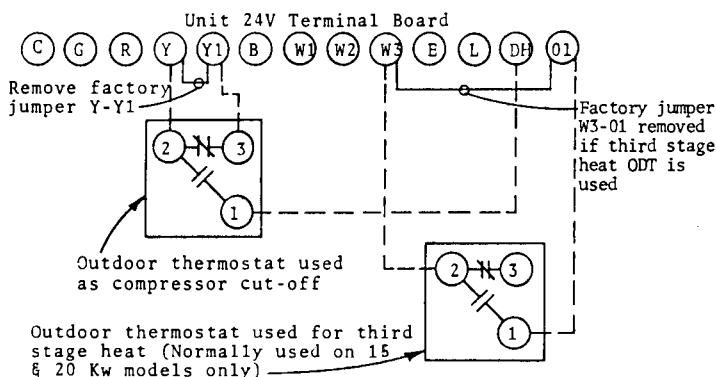
**IMPORTANT NOTE:** Only the thermostat and subbase combinations as shown above will work with this equipment. The stat and subbase MUST be matched, and correct operation can be assured only by proper selection and application of these parts.

## COMPRESSOR CUT-OFF THERMOSTAT AND OUTDOOR THERMOSTATS



Heat pump compressor operation at outdoor temperatures below 0°F are neither desirable nor advantageous in terms of efficiency. Since most equipment at time of manufacture is not designated for any specific destination of the country, and most of the equipment is installed in areas not approaching the lower outdoor temperature range, the compressor cut-offs are not factory installed.


Outdoor thermostats are available to hold off various banks of electric heat until needed as determined by outdoor temperature. The set point of either type of thermostat is variable with geographic region and sizing of the heating equipment to the structure. Utilization of the Heating Application Data and the heat loss calculation of the building are useful in determining the correct set points.


### COMPRESSOR CUT-OFF & OUTDOOR THERMOSTAT WIRING



### WALL THERMOSTAT AND SUBBASE COMBINATIONS

Group	Thermostat	Subbase	Predominant Feature
A	8403-017 (T874R1129)	8404-009 (Q674L1181)	Heat or Cool  No Auto
B	8403-018 (T874N1024)	8404-010 (Q674F1261)	Automatic Heat-Cool  Changeover Position

 No automatic changeover position—must manually place in heat or cool. Reversing valve remains energized at all times system switch is in heat position (except during defrost cycle). No pressure equalization noise when thermostat is satisfied on either heating or cooling.

 Allows thermostat to control both heating and cooling operation when set in "AUTO" position. Reversing valve de-energizes at end of each "ON" heating cycle.

**IMPORTANT NOTE:** Both thermostat and sub-base combinations shown above incorporate the following features: Man-Auto fan switch, Off-Heat-Cool-Em. Heat Switch, and two (2) indicator lamps—one for Emergency Heat and one for compressor malfunction.

### THERMOSTAT INDICATOR LAMPS

The red lamp marked "EM.HT." comes on and stays on whenever the system switch is placed in the Em. Ht. position. The green lamp marked "check" will come on if there is any problem that prevents the compressor from running when it is supposed to be.

### EMERGENCY HEAT POSITION

The operator of the equipment must manually place the system switch in this position. This is done when there is a known problem with the outdoor section, or when the green "check" lamp comes on indicating a problem.

## COMPRESSOR MALFUNCTION RELAY (Single Phase Models Only)

Actuation of the green "check" lamp is accomplished by a voltage type relay which is factory installed. Any condition such as loss of charge, defective capacitor, defective contactor, etc., that will prevent compressor from operating will cause green lamp to activate. This is a signal to the operator of the equipment to place system in emergency heat position.

### PRESSURE SERVICE PORTS

High and low pressure service ports are installed on all units so that the system operating pressures can be observed. Pressure curves can be found later in the manual covering all models on both cooling and heating cycles. It is imperative to match the correct pressure curve to the unit by model number.

### SEQUENCE OF OPERATION

**Cooling** - Circuit R-Y makes at thermostat pulling in compressor contactor starting the compressor and outdoor motor. The G (indoor motor) circuit is automatically completed on any call for cooling operation, or can be energized by manual fan switch on subbase for constant air circulation.

**Heating** - A 24V solenoid coil on reversing valve controls heating cycle operation. Two thermostat options, one allowing "Auto" changeover from cycle to cycle and the other constantly energizing solenoid coil during heating season and thus eliminating pressure equalization noise except during defrost, are to be used. On "Auto" option, a circuit is completed from R-W1 and R-Y on each heating "on" cycle, energizing reversing valve solenoid and pulling in compressor contactor starting compressor and outdoor motor. R-G also make starting indoor blower motor. Heat pump heating cycle now in operation. The second option has no "Auto" changeover position, but instead energizes the reversing valve solenoid constantly whenever the system switch on subbase is placed in "Heat" position, the "B" terminal being constantly energized from R. A thermostat demand for heat completes R-Y circuit, pulling in compressor contactor starting compressor and outdoor motor. R-G also make starting indoor blower motor.

### DEFROST CYCLE

The defrost cycle is controlled by time and temperature. The 240 volt timer motor runs all the time the compressor is in operation. When the outdoor temperature is in the lower 40°F temperature range or colder, the outdoor coil temperature is 32°F or below. This temperature is sensed by the defrost thermostat mounted near the bottom of the outdoor coil on a return bend. The defrost thermostat closes at approximately 32°F. Every 60 (or 30) minutes that the compressor is running, contacts 3-4 close for 7 minutes, with contacts 3-4 closed for the first 40 seconds of that 7 minutes. If the defrost thermostat is closed, the defrost relay energizes and places the system in defrost mode. An interlocking circuit is created with timer contact 3-5 and defrost relay contact 7-9 in series.

During the defrost mode, the refrigerant cycle switches back to the cooling cycle, the outdoor motor stops, electric heaters are energized, and hot gas passing through the outdoor coil melts any accumulated frost. When the temperature rises to approximately 57°F (Model PH24-1 is 42°F), the defrost thermostat opens, de-energizing the defrost relay and returning the system to heating operation.

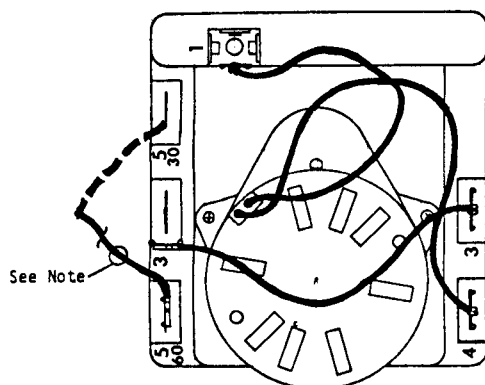
If some abnormal or temporary condition such as a high wind causes the heat pump to have a prolonged defrost cycle, contacts 3-5 of the defrost timer will open after 7 minutes and restore the system to heating operations automatically.

There are two time settings on the defrost timer—30 minutes and 60 minutes. Most models are shipped wired on the 60 minute setting for greatest operating economy. If special circumstances require a change to the shorter time, remove wire connected to terminal 5/60 and reconnect to terminal 5/30.

NOTE: Model PH24-1 has single motor which stops during defrost cycle. There is also an interlock relay which prevents any electric heat from being on during the defrost period when there is no air flow across the indoor coil.

There is a manual advance knob located on the timer. This can be used to advance timer to contact closure point if it is desired to check out defrost cycle operation, without waiting for time to elapse.

DEFROST TIMER WIRING



NOTE: All models except PH24-1 are connected to 5 60 terminal (60 minute). Ph24-1 is connected to 5 30 terminal (30 minutes) as shown by dotted line. Any model can be changed from 60 minutes to 30 minutes by unplugging from 5 60 terminal and reconnecting to 5 30 terminal.

#### SERVICE HINTS

1. Caution homeowner to maintain clean air filters at all times. Also, not to needlessly close off supply and return air registers. This reduces air flow through the system, which shortens equipment service life as well as increasing operating costs.
2. Switching to heating cycle at 75°F or higher outside temperature may cause a nuisance trip of the manual reset high pressure switch.
3. The heat pump wall thermostats perform multiple functions. Be sure that all function switches are correctly set for the desired operating mode before trying to diagnose any reported service problems.
4. Check all power fuses or circuit breakers to be sure that they are the correct rating.
5. Periodic cleaning of the outdoor coil to permit full and unrestricted airflow circulation is essential.

#### IMPORTANT INSTALLER NOTES:

1. For improved start-up performance wash the indoor coil with a dishwasher detergent.

#### CRANKCASE HEATERS

All units are provided with some form of compressor crankcase heat. Some single phase units utilize the compressor motor start winding in series with a portion of the run capacitor to generate heat within the compressor shell to prevent liquid refrigerant migration.

Some three phase units utilize a wraparound type of crankcase heater that warms the compressor oil from the outside.

Some single and three phase models have an insertion well-type heater located in the lower section of the compressor housing. This is a self-regulating type heater that draws only enough power to maintain the compressor at a safe temperature.

Some form of crankcase heat is essential to prevent liquid refrigerant from migrating to the compressor, causing oil pump out on compressor start-up and possible valve failure due to compressing a liquid.

Refer to unit wiring diagram to find exact type of crankcase heater used.

The following decal is affixed to all outdoor units detailing start-up procedure. This is very important. Please read carefully.

#### IMPORTANT

THESE PROCEDURES MUST BE FOLLOWED AT INITIAL START-UP AND AT ANY TIME POWER HAS BEEN REMOVED FOR 12 HOURS OR LONGER.

TO PREVENT COMPRESSOR DAMAGE WHICH MAY RESULT FROM THE PRESENCE OF LIQUID REFRIGERANT IN THE COMPRESSOR CRANKCASE

1. MAKE CERTAIN THE ROOM THERMOSTAT IS IN THE OFF POSITION (THE COMPRESSOR IS NOT TO OPERATE).
2. APPLY POWER BY CLOSING THE SYSTEM DISCONNECT SWITCH. THIS ENERGIZES THE COMPRESSOR HEATER WHICH EVAPORATES THE LIQUID REFRIGERANT IN THE CRANKCASE.
3. ALLOW 4 HOURS OR 60 MINUTES PER POUND OF REFRIGERANT IN THE SYSTEM AS NOTED ON THE UNIT RATING PLATE, WHICHEVER IS GREATER.
4. AFTER PROPERLY ELAPSED TIME THE THERMOSTAT MAY BE SET TO OPERATE THE COMPRESSOR.
5. EXCEPT AS REQUIRED FOR SAFETY WHILE SERVICING — DO NOT OPEN SYSTEM DISCONNECT SWITCH.

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#### REFRIGERANT CHARGE

The correct system R-22 charge is shown on the unit rating plate. Optimum unit performance will occur with a refrigerant charge resulting in a suction line temperature (6" from compressor) as shown in the following table:

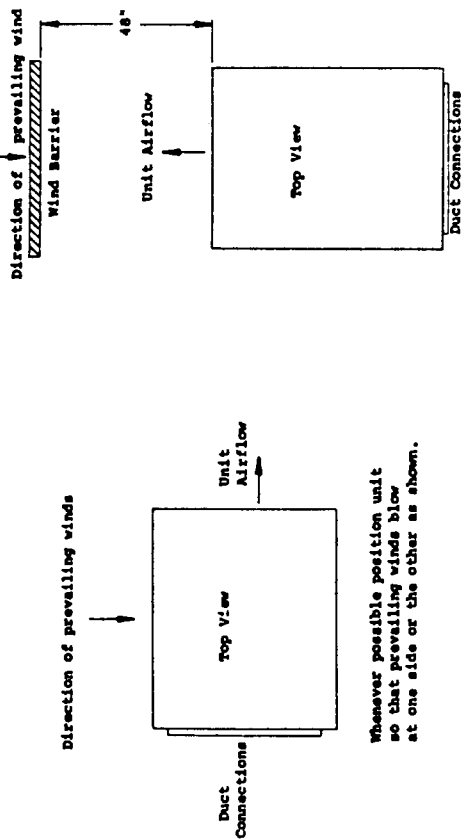
Model	Rated Airflow	95°F OD Temp	82°F OD Temp.
PH24-1	825	60 - 62	68 - 70
PH31-1	1075	55 - 57	65 - 67
PH36-2	1275	53 - 55	66 - 68
PH42	1500	60 - 62	67 - 69
PH48-2	1700	54 - 56	56 - 58
PH60-2	1700	54 - 56	59 - 61

The above suction line temperatures are based upon 80°F dry bulb/67°F wet bulb (50% R.H.) temperature and rated airflow across the evaporator during cooling cycle.

Figure 3

# ROOFTOP APPLICATION

(May also be required for ground level installations)



Whenever possible position unit so that prevailing winds blow at one side or the other as shown.

If outdoor coil must face prevailing wind, construct a wind barrier to assure proper defrost.

Figure 1

# SLAB MOUNTING AT GROUND LEVEL (Above 32°F Outside Temperature)

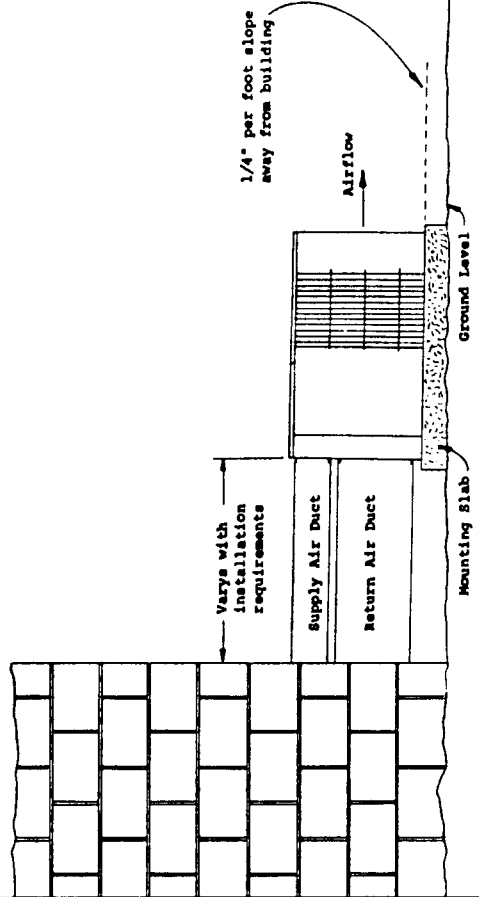


Figure 4

# ELEVATED MOUNTING PLATFORMS

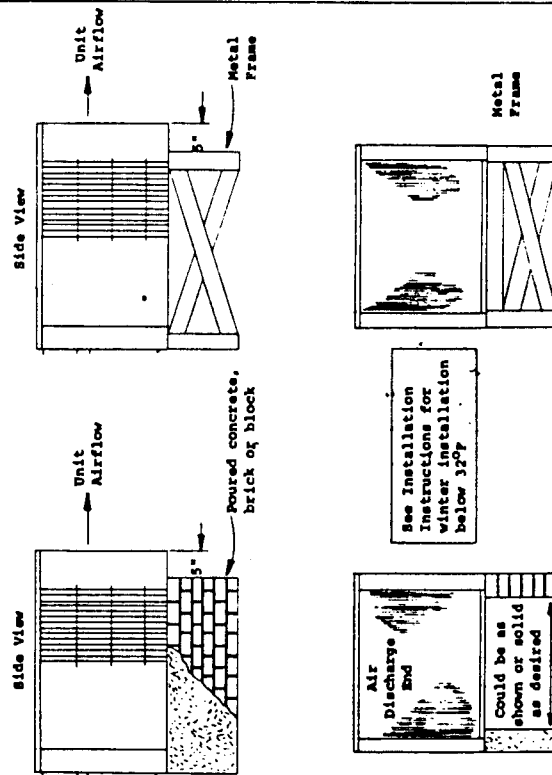
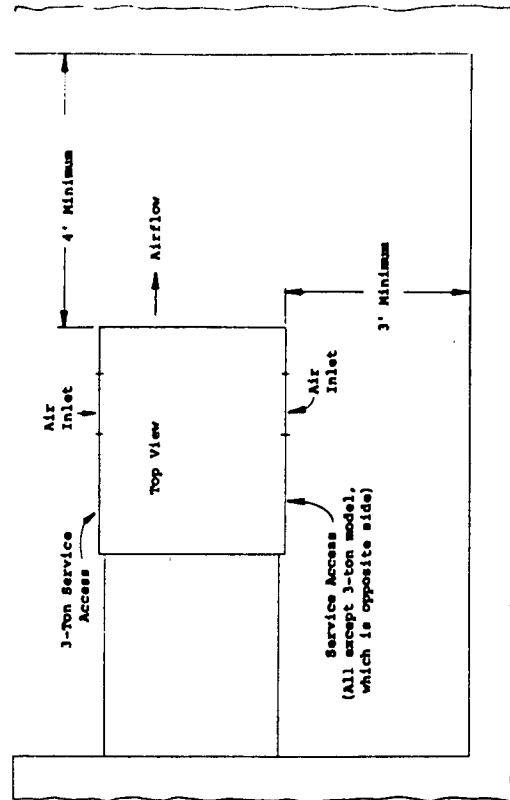


Figure 2

# AIRFLOW AND SERVICE ACCESS CLEARANCES



# ROOF HOOD ACCESSORY FOR SINGLE PACKAGE HEAT PUMPS AND AIR CONDITIONERS

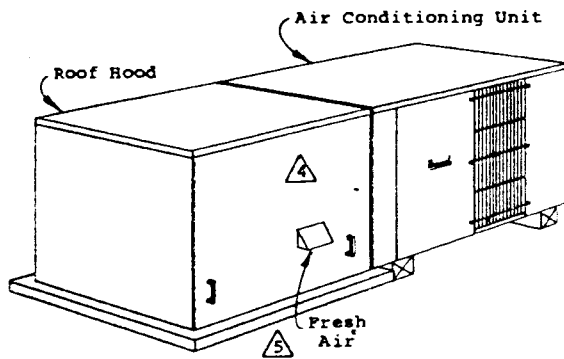


FIG. 1 - TYPICAL ROOFTOP INSTALLATION

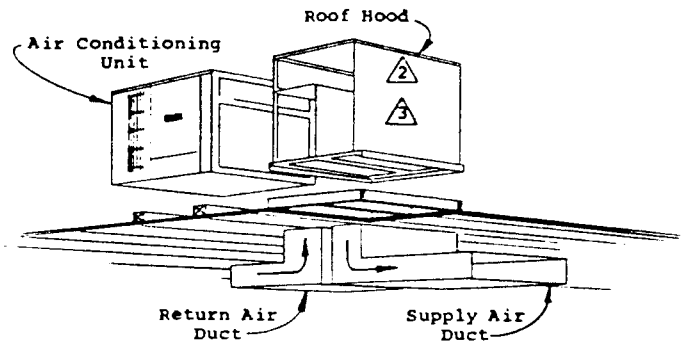


FIG. 2 - TYPICAL DUCT INSTALLATION

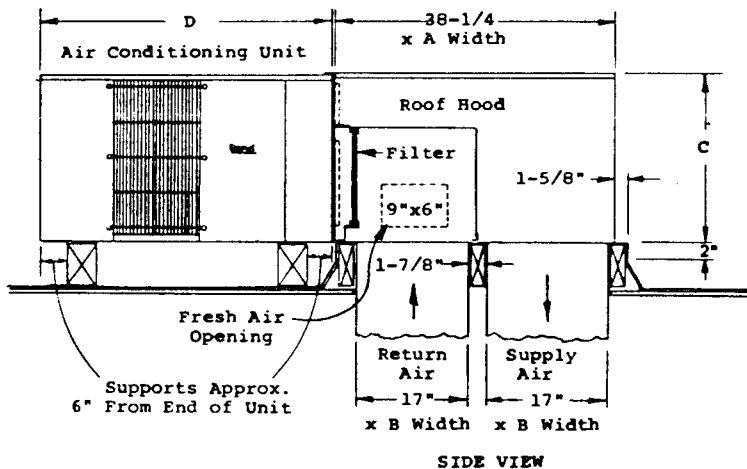


FIG. 3 - UNIT AND ROOF HOOD DETAILS

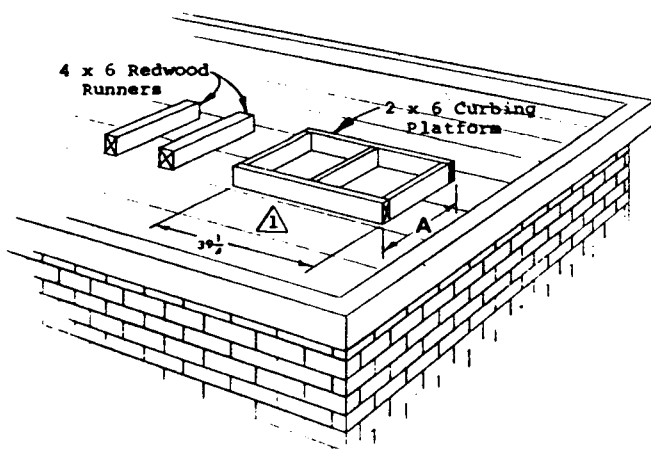


FIG. 4 - CURBING DETAILS (FIELD FABRICATED)

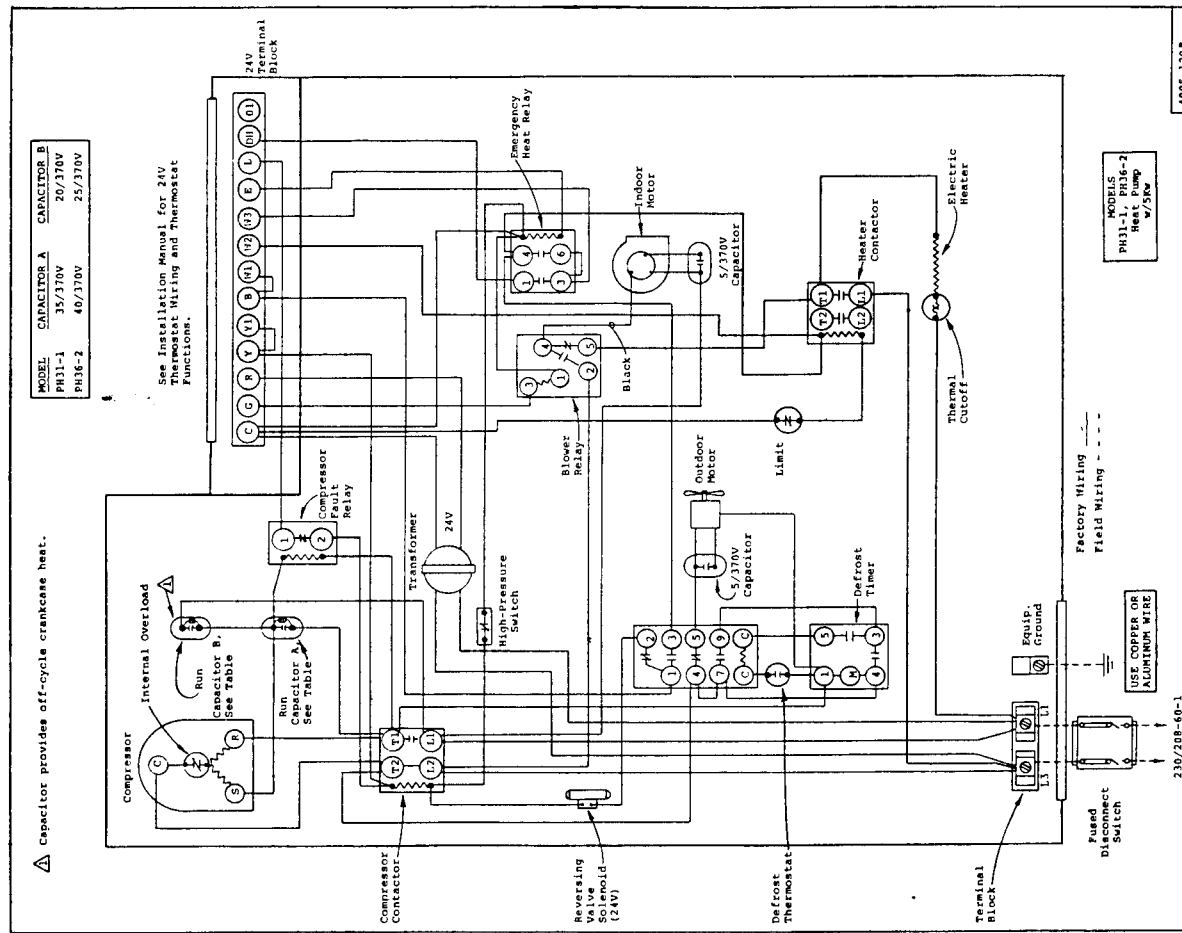
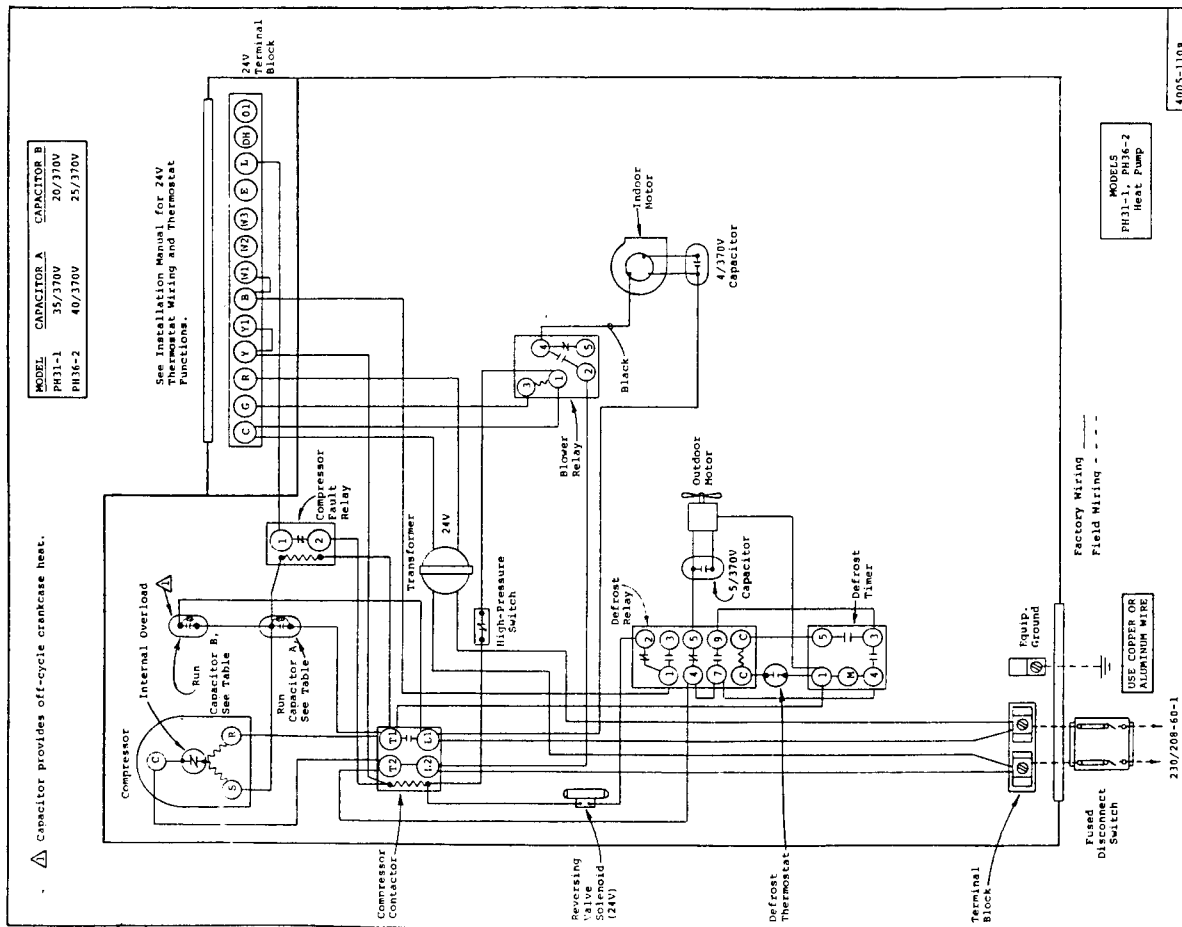
UNIT DIMENSIONS					
MODEL	A	B	C	D	1" Filter
P24A2	32	31-1/2	23-1/8	40	15 x 30-5/8
PH24-1	32	31-1/2	23-1/8	40	15 x 30-5/8
P31A	38-1/8	37-1/2	24	42-3/16	(1) 16x16 &
PH31-1	38-1/8	37-1/2	24	42-3/16	(1) 16x20
P36A4	38-1/8	37-1/2	24	42-3/16	
PH36-2	38-1/8	37-1/2	24	42-3/16	
PH42	42	41-1/2	31-1/8	50	(2) 16 x 20
P48A4	42	41-1/2	31-1/8	50	(2) 16 x 20
PH48-2	42	41-1/2	31-1/8	50	(2) 16 x 20
P60A4	42	41-1/2	31-1/8	50	(2) 16 x 20
PH60-2	42	41-1/2	31-1/8	50	(2) 16 x 20

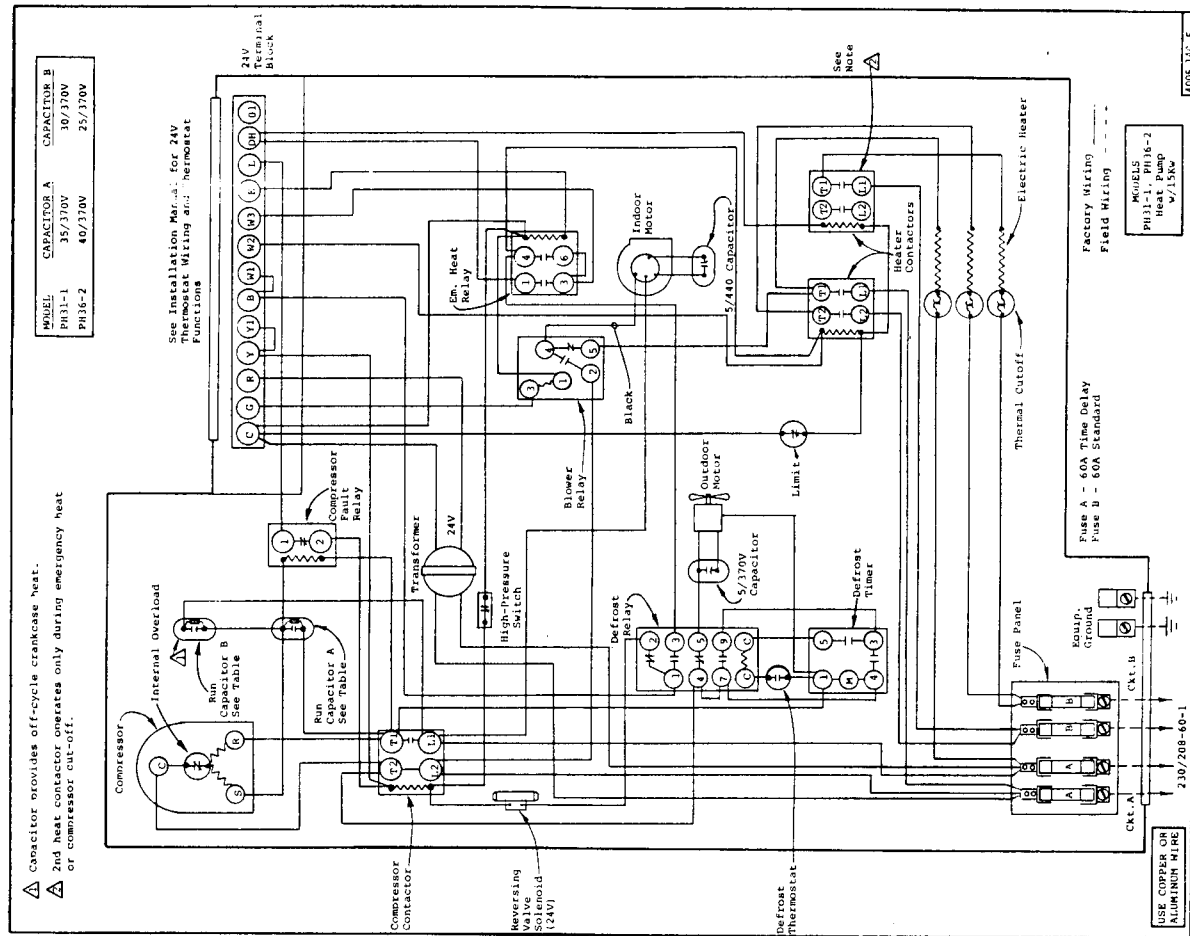
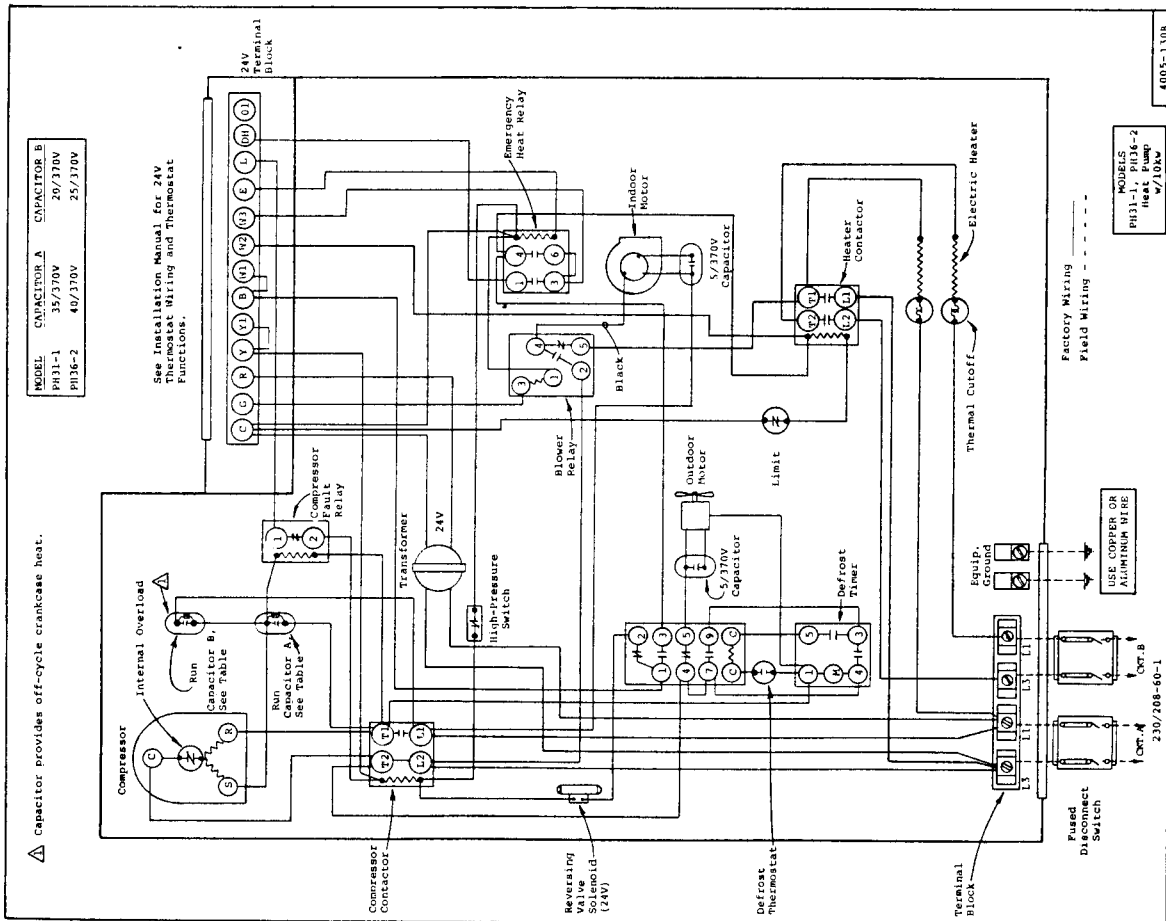
- 1 A separate metal flashing should be installed around wood curbing. Caulk and seal all joints and weatherproof.
- 2 Galvannealed cabinets painted to match basic unit design - heavy 1/2" insulation - built-in filter included.
- 3 Roof hood to be assembled in field. (See FIG. 5 on back side)
- 4 Remove this side to gain access to air filter. (Opposite side on PH48 & PH60 Roof Hood)
- 5 Provides 15% fresh air. (Opposite side on PH24, PH30, PH31, & PH36 Roof Hood)

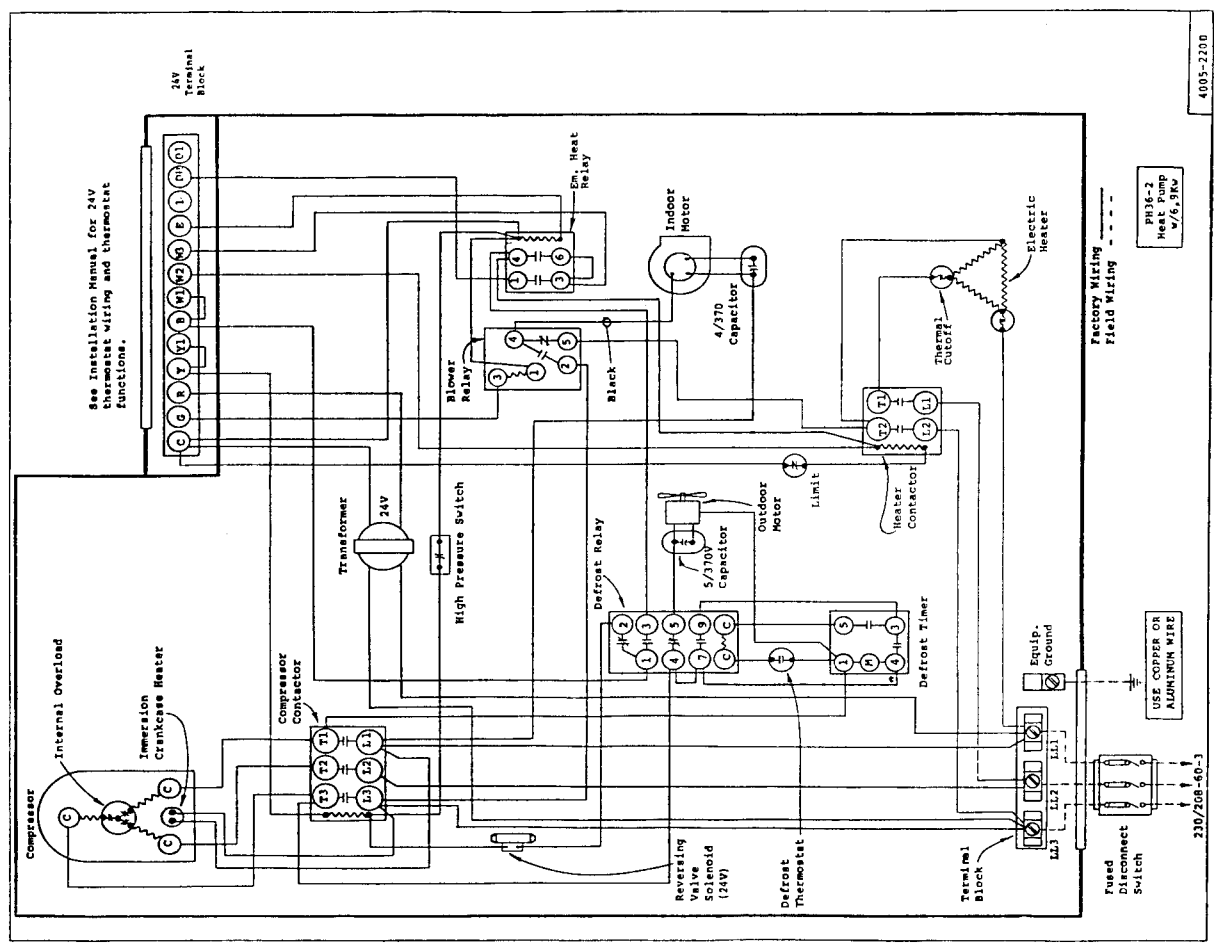
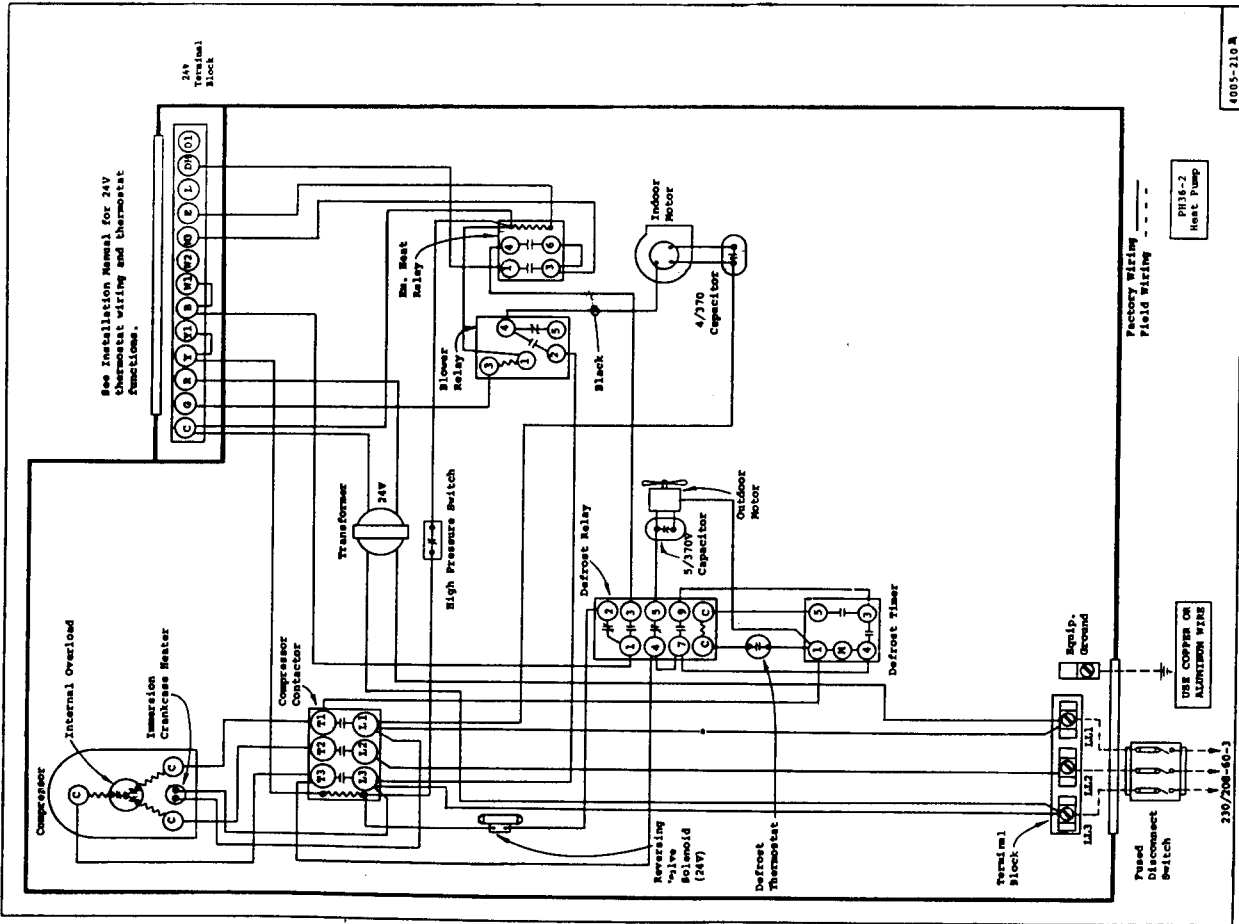
MODEL	A
F24A2	34-7/8
PH24-1	34-7/8
P31A	41
PH31-1	41
P36A4	41
PH36-2	41
PH42	44-7/8
P48A4	44-7/8
PH48-2	44-7/8
P60A4	44-7/8
PH60-2	44-7/8



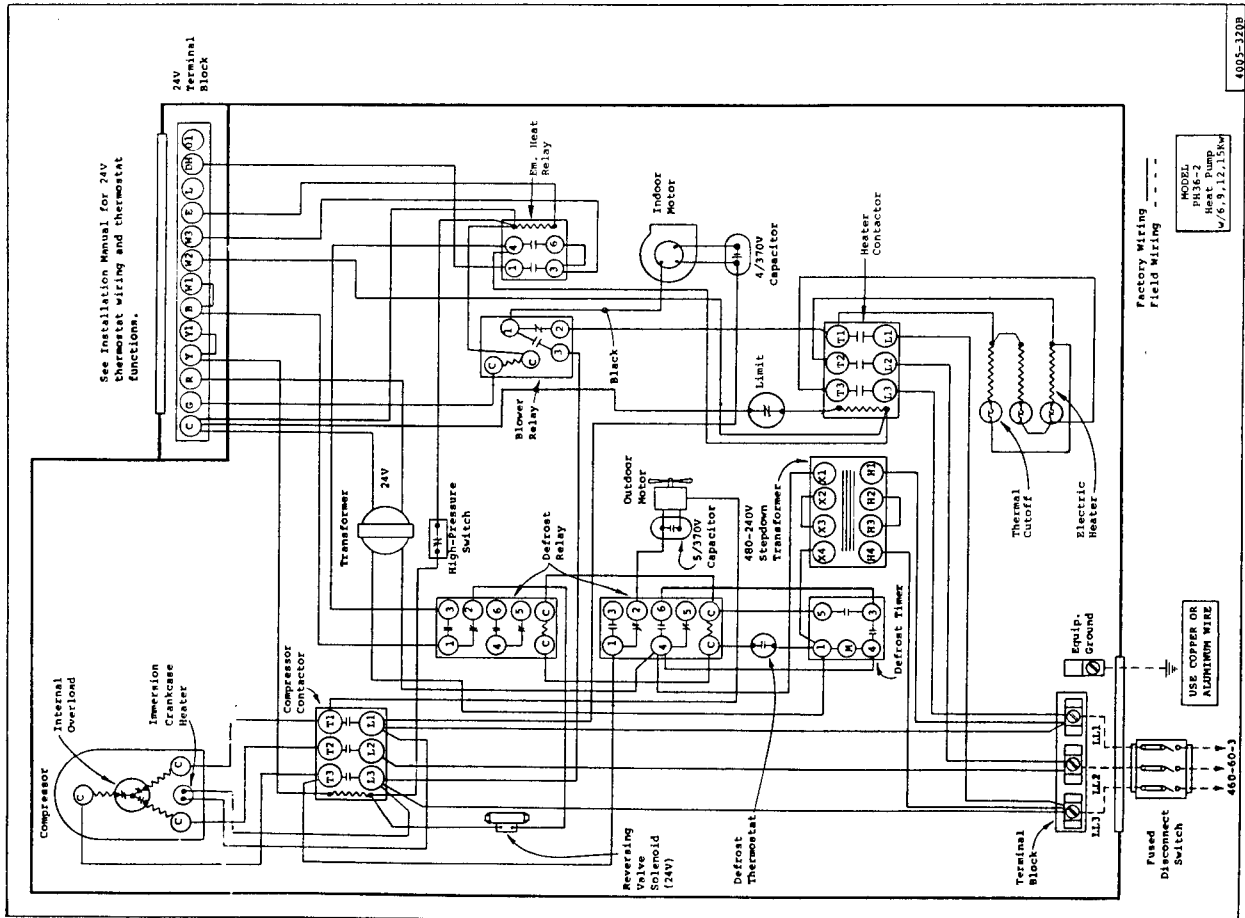












4005-3308

PARTS LIST  
SINGLE PACKAGE HEAT PUMPS

Effective 8-12-81  
Supersedes 5-3-81

PART NO.	DESCRIPTION	PH31-1	PH36-2 3-Ph	PH36-2 460V 3-Ph
5202-003	Accumulator			
5202-004	Accumulator			
5152-013	Blower Housing 10-8	x	x	x
8552-032	Blower Wheel DD10-8A	x	x	x
8552-033	Capacitor - Comp. 35/370V	x	x	x
8552-033	Capacitor - Comp. 20/370V	x		
8552-002	Capacitor - Fan & Blower 5/370V	x	x	x
8552-035	Capacitor - Comp. 40/370V	x	x	
8552-027	Capacitor - Comp. 25/370V	x	x	
5811-014	Capillary Tube - Cool	(2)		
5811-020	Capillary Tube - Heat	x	(2)	(2)
5811-033	Capillary Tube - Cool		x	x
5811-019	Capillary Tube - Heat	x	x	x
5651-006	Check Valve	x	x	x
5051-003	Condenser Coil	x	x	x
8000-042	Compressor H2EA293AB	x		
8000-051	Compressor H2EA363AB		x	
8000-059	Compressor CRJ1-0300-1F5-270			
8401-007	Compressor CRJ1-0300-TFD-270			
8401-006	Compressor - Compressor 1P25A	x	x	x
8401-002	Contact - Heater 2P20	x	x	x
8401-010	Contact - Compressor		x	x
8408-004	Contact - Heater 2P30		x	x
8408-002	Defrost Mounting Plate	x	x	x
5060-023	Defrost Thermostat	x	x	x
5151-004	Evaporator Coil	x	x	x
5151-025	Fan Blade TP2026 CW	x	x	x
8614-013	Fan Blade L10H08-2027 CW	x	x	x
8614-022	Fuse Block 15Kw	x	x	
8614-007	Fuse 60A (Heater)	x	x	
8604-042	Heat Strip 5Kw	x	x	
8604-044	Heat Strip 10Kw	x	x	
8604-047	Heat Strip 15Kw	x	x	
8604-048	Heat Strip 9Kw	x	x	
8604-046	Heat Strip 12Kw		x	
8604-050	Heat Strip 9Kw		x	
8604-051	Heat Strip 12Kw		x	
8604-052	Heat Strip 15Kw		x	
8604-010	Hi Pressure Switch	x	x	x
8402-012	Limit Switch 130°	x	x	x
8105-020	Motor - Blower 1/3 hp ccw	x	x	
8103-009	Motor - Fan 1/5 hp	x	x	
8105-016	Motor - Fan 1/3 hp	x	x	(2)

\*\*

\*Please order by model number.

\*\*Denotes change.

PARTS LIST  
SINGLE PACKAGE HEAT PUMPS

Effective 1/29/81  
Supersedes 1/1/80

PART NO.	DESCRIPTION	PH31-1	PH36-2 3-Ph	PH36-2 460V 3-Ph
8200-003	Motor Mount - Blower			
8200-001	Motor Mount - Fan	x	x	x
5451-011	Motor Mounting Parts	x	x	x
8201-009	Relay - Blower	x	x	x
8201-032	Relay - Blower	x	x	x
8201-023	Relay - Defrost	x	x	x
8201-033	Relay - Defrost	x	x	x
5650-005	Reversing Valve	x		
5650-006	Reversing Valve	x	x	x
5650-008	Solenoid Coil	x	x	x
5210-004	Strainer	x	x	x
5210-002	Strainer	x	x	x
8607-010	Terminal Board 24V	x	x	x
8607-001	Terminal Block 230V	x	x	x
8607-003	Terminal Block 230V	x	x	x
8607-002	Terminal Block 230V	x	x	x
8402-026	Thermal Cut-off	x	x	x
8612-011	Timer	x	x	x
8407-015	Transformer	x	x	x
8407-028	Transformer - Stepdown	x	x	x
8201-031	Relay - Compressor Fault	x	x	x
8201-013	Relay - Emergency Heat	x	x	x
7051-001	Condenser Grille	x	x	x
7051-015	Wire Grille - Inlet	(2)	(2)	(2)

\*

Minimum Net Billing \$15.00. Supersedes all previous lists.  
Subject to change without notice. F.O.B. Bryan, Ohio

\*Denotes change