INSTALLATION INSTRUCTIONS

SINGLE PACKAGE HEAT PUMPS

Models:

PH11242
PH11301
PH11361
PH11422
PH10481
PH12241
PH1230
PH1236
PH1242
PH12481
PH1060

Bard Manufacturing Company, Inc.
Bryan, Ohio 43506

Since 1914 . . . Moving ahead, just as planned.

Manual : 2100-354F
Supersedes: 2100-354E
File: Volume II Tab 11
Date: 12-20-06

CONTENTS

Getting Other Information and Publications

These publications can help you install the air conditioner or heat pump. You can usually find these at your local library or purchase them directly from the publisher. Be sure to consult current edition of each standard.

National Electrical Code ..... ANSI/NFPA 70

Standard for the Installation ..... ANSI/NFPA 90A of Air Conditioning and Ventilating Systems

Standard for Warm Air ..... ANSI/NFPA 90B Heating and Air Conditioning Systems

Load Calculation for ..... ACCA Manual J Residential Winter and Summer Air Conditioning

Duct Design for Residential ..... ACCA Manual D Winter and Summer Air Conditioning and Equipment Selection

FOR MORE INFORMATION, CONTACT THESE PUBLISHERS:

ACCA **Air Conditioning Contractors of America**
1712 New Hampshire Ave. N.W.
Washington, DC 20009
Telephone: (202) 483-9370
Fax: (202) 234-4721

ANSI **American National Standards Institute**
11 West Street, 13th Floor
New York, NY 10036
Telephone: (212) 642-4900
Fax: (212) 302-1286

ASHRAE **American Society of Heating Refrigerating, and Air Conditioning Engineers, Inc.**
1791 Tullie Circle, N.E.
Atlanta, GA 30329-2305
Telephone: (404) 636-8400
Fax: (404) 321-5478

NFPA **National Fire Protection Association**
Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9901
Telephone: (800) 344-3555
Fax: (617) 984-7057

GENERAL INSTRUCTIONS

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 ducts, must be properly sized for the design air flow requirement of the equipment. ACCA 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 heat pump 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.

FIELD INSTALLED HEATER PACKAGES (OPTIONAL)

These packaged heat pumps are manufactured without supplementary electric heaters. Supplementary heaters are available for simple, fast field installation.

A separate power circuit is required for the supplementary heaters.

IMPORTANT: Refer to Table 1 when designing duct work for maximum available static pressure with heater installed.

Refer to electrical data shown in Tables 3 and 4 for proper application information on all available heater combinations and what units they can be used with. It also shows the applicable circuit ampacities, fuse size, and wire size for each heater combination.

TABLE 1
RATED CFM AND EXTERNAL STATIC PRESSURE (ESP)

Model	Rated CFM	Recommended Airflow Range	Rated ESP	Maximum ESP
PH11242	800	680-880	0.20	0.50
PH12241	800	*Note 1*	0.10	0.50
PH11301	1000	775-1100	0.30	0.40
PH1230	1000	*Note 1*	0.15	0.50
PH11361	1000	775-1210	0.20	0.40
PH1236	1000	*Note 1*	0.15	0.50
PH11422	1400	1260-1540	0.20	0.35
PH1242	1400	*Note 1*	0.15	0.50
PH10481	1550	1400-1700	0.40	0.50
PH12481	1550	*Note 1*	0.20	0.50
PH1060	1700	1530-1870	0.20	0.50

NOTE: Motor will adjust to deliver rated airflow.

TABLE 2
ELECTRICAL DATA

Model	PH11242	PH11301	PH11361	PH11361-B	PH11361-C	PH11422
Electric Rating 60 Hz - Ckt A	230/208-60-1	230/208-60-1	230/208-60-1	230/208-60-3	460-60-3	230/208-60-1
Operating Votage Range	197-253	197-253	197-253	187-253	414-506	197-253
Minimum Circuit Ampacity	17	21	25	18	12	32
BCSC	11	13.5	18	11	6	18.5
Field Wire Size *	10	10	8	10	14	8
Ground Wire Size	10	10	10	10	14	10
Delay Fuse - Max. **	25	30	40	25	15	50
Total Unit Amps - 203-208	13.9/14.9	15.7/17.2	18.9/20.7	13.2/13.8	6.9	22.8/24.2
Compressor - Circuit A						
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Volts	230/208	230/208	230/208	230/208	460	230/208
Rated Load Amps	10/11	11.5/13	14.7/16.5	9.0/9.6	4.7	17.1/18.5
Lock Rotor Amps	54/54	72.5/72.5	88/88	77/77	39	104/104
Fan Motor and Condenser						
Fan Motor - HP/RPM	1/5 - 1090	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/3 - 825
Fan Motor Amps	1.2	1.6	1.6	1.6	0.8	2.5
Fan Dia/CFM	20"/1650	20"/2000	20"/2000	20"/2000	20"/2000	24"/2950
Motor and Evaporator						
Blower Motor - HP/RPM	1/3 - 1075	1/3 - 1075	1/3 - 1075	1/3 - 1075	1/3 - 1075	1/2 - 1075
Blower Motor - Amps	2.1	2.6	2.6	2.6	1.4	3.7
CFM Cooling & ESP	800 @ 0.20	1100 @ 0.30	1100 @ 0.20	1100 @ 0.20	1100 @ 0.20	1400 @ 0.20
Charge (R-22 oz.)	88	93	86	86	86	121
Shipping Weight (pounds)	365	365	365	365	365	435

* 75 degree C copper wire

** Maximum time delay fuse of HACR type circuit breaker

TABLE 2A
ELECTRICAL DATA

Model	PH10481	PH10481-B	PH10481-C	PH1060	PH1060-B	PH1060-C
Electric Rating 60 Hz - Ckt A	230/208-60-1	230/208-60-3	460-60-3	230/208-60-1	230/208-60-3	460-60-3
Operating Votage Range	197-253	187-253	414-506	197-253	187-253	414-506
Minimum Circuit Ampacity	34	25	12	43	29	14
BCSC	21.5	14.7	7.1	29	18	9
Field Wire Size *	8	8	12	8	8	12
Ground Wire Size	10	10	10	10	10	12
Delay Fuse - Max. **	50	35	15	60	45	20
Total Unit Amps - 203-208	25.2/21.2	18.3/19.7	9	30.3/32.5	21.3/22.8	11
Compressor - Circuit A						
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Volts	230/208	230/208	460	230/208	230/208	460
Rated Load Amps	19.5/21.5	12.6/14.0	6.2	24.6/26.8	15.6/17.1	8.2
Lock Rotor Amps	137/137	91/91	50	148/148	137/137	62
Fan Motor and Condenser						
Fan Motor - HP/RPM	1/3 - 850	1/3 - 850	1/3 - 850	1/3 - 850	1/3 - 850	1/3 - 850
Fan Motor Amps	2.5	2.5	1.2	2.5	2.5	1.2
Fan Dia/CFM	24"/3000	24"/3000	24"/3000	24"/3000	24"/3000	24"/3000
Motor and Evaporator						
Blower Motor - HP/RPM	1/2 - 1075	1/2 - 1075	1/2 - 1075	1/2 - 1075	1/2 - 1075	1/2 - 1075
Blower Motor - Amps	3.7	3.7	1.8	3.7	3.7	1.8
CFM Cooling & ESP	1550 @ 0.40	1550 @ 0.40	1550 @ 0.40	1700 @ 0.20	1700 @ 0.20	1700 @ 0.20
Charge (R-22 oz.)	125	125	125	167	167	167
Shipping Weight (pounds)	450	450	450	450	450	450

* 75 degree C copper wire

** Maximum time delay fuse of HACR type circuit breaker

TABLE 2B
ELECTRICAL DATA

Model	PH12241	PH1230	PH1236	PH1236-B	PH1242	PH12481	PH12481-B
Electric Rating 60 Hz - Ckt A	230/208-60-1	230/208-60-1	230/208-60-1	230/208-60-3	230/208-60-1	230/208-60-1	230/208-60-3
Operating Votage Range	197-253	197-253	197-253	187-253	197-253	197-253	187-253
Minimum Circuit Ampacity	17	21	26	19	30	33	25.4
BCSC	10.5	13.5	16.5	10.9	18	20.5	14.7
Field Wire Size *	12	10	10	12	10	8	8
Ground Wire Size	10	10	10	10	10	10	10
Delay Fuse - Max. **	25	30	40	25	45	50	35
Total Unit Amps - 203-208	12.9/13.9	15.6/17.1	19.4/21.2	14.7/15.6	23.5/24.5	25.5/27.5	19.0/20.3
Compressor - Circuit A							
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Volts	230/208	230/208	230/208	230/208	230/208	230/208	230/208
Rated Load Amps	9.5/10.5	11.5/13.0	14.7/16.5	10/10.9	16.7/17.7	18.5/20.5	12.0/13.3
Lock Rotor Amps	54/54	72.5/72.5	88/88	77/77	104/104	137/137	91/91
Fan Motor and Condenser							
Fan Motor - HP/RPM	1/5 -1090	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/3 - 825	1/3 - 825	1/3 - 825
Fan Motor Amps	1.2	1.4	1.4	1.4	2.5	2.5	2.5
Fan Dia/CFM	20"/1650	20"/2000	20"/2000	20"/2000	24"/3000	24"/3000	24"/3000
Motor and Evaporator							
Blower Motor - HP/RPM	1/3 Variable	1/2 Variable	1/2 Variable	1/2 Variable	3/4 Variable	3/4 Variable	3/4 Variable
Blower Motor - Amps	2.1	2.7	3.3	3.3	4.3	4.5	4.5
CFM Cooling & ESP	800 @ 0.10	1000 @ 0.15	1000 @ 0.15	1000 @ 0.15	1400 @ 0.20	1550 @ 0.20	1550 @ 0.20
Charge (R-22 oz.)	91	99	121	121	133	123	123
Shipping Weight (pounds)	320	335	345	345	420	440	440

* 75 degree C copper wire

** Maximum time delay fuse of HACR type circuit breaker

TABLE 3
OPTIONAL FIELD INSTALLED HEATER PACKAGES
ONLY TO BE USED WITH THE HEAT PUMP MODELS INDICATED

Heater Package Model	Volts and Phase	PH11242	PH12241	PH11301	PH1230	PH11361	PH11361-B	PH11361-C	PH1236	PH1236-B	
EH3PB-A05	240/208-1	S	NA	S	NA	S	A	A	NA	NA	
EH3PB-A08	240/208-1	S	NA	S	NA	S	A	A	NA	NA	
EH3PB-A10	240/208-1	NA	NA	S ①	S	S ①	A ①	A ①	S	NA	
EH3PB-A15	240/208-1	NA	NA	S	NA	S	A	A	NA	NA	This column has been left blank intentionally
EH3PC-A05	240/208-1	NA	S	NA	S	NA	NA	NA	S	NA	
EH3PC-A10	240/208-1	NA	S	NA	NA	NA	NA	NA	NA	NA	
EH3PC-A15	240/208-1	NA	NA	NA	S ②	NA	NA	NA	S ②	NA	
EH3PB-B09	240/208-3	NA	NA	A ①	NA	A ①	S ①	A ①	NA	S	
EH3PB-B15	240/208-3	NA	NA	A	NA	A	S	A	NA	S ③	
EH3PB-C09	480-3	NA	NA	A ①	NA	A ①	A ①	S ①	NA	NA	
EH3PB-C15	480-3	NA	NA	A	NA	A	A	S	NA	NA	

Heater Package Model	Volts and Phase	PH11422	PH1242	PH10481	PH10481-B	PH10481-C	PH12481	PH12481-B	PH1060	PH1060-B	PH1060-C
EH5PB-A05	240/208-1	S	S	S	A	A	S	NA	S	A	A
EH5PB-A10	240/208-1	S ①	S	S ①	A ①	A ①	S	NA	S ①	A ①	A ①
EH5PB-A15	240/208-1	S	S ②	S	A	A	S ②	NA	S	A	A
EH5PB-A20	240/208-1	NA	NA	S	A	A	NA	NA	S	A	A
EH5PB-B09	240/208-3	NA	NA	A ①	S ①	A ①	NA	S	A ①	S ①	A ①
EH5PB-B15	240/208-3	NA	NA	A	S	A	NA	S ③	A	S	A
EH5PB-B18	240/208-3	NA	NA	A	S	A	NA	NA	A	S	A
EH5PC-C09	480-3	NA	NA	A ①	A ①	S ①	NA	NA	A ①	A ①	S ①
EH5PC-C18	480-3	NA	NA	A	A	S	NA	NA	A	A	S

S=Standard application – heater voltage and phase same as basic unit.
A=Alternate application – heater voltage and phase different from basic unit.
NA=Not approved.

① Max. KW that can operate with Heat Pump on.
② Max. KW that can operate with Heat Pump on is 10 KW. 15 KW will operate during emergency heat.
③ Max. KW that can operate with Heat Pump on is 9KW. 15 KW will operate during emergency heat

TABLE 4
OPTIONAL FIELD INSTALLED ELECTRIC HEATER TABLE

Heater Pkg. Model No.	Unit Volts & Phases	Heater KW & Capacity @ 240 Volts		Heater KW & Capacity @ 208 Volts		240/208V Heater Amps	Heater Internal Fuse	Circuit B				
		KW	BTUH	KW	BTUH			No. Field Circuits	Min. Circuit Ampacity	① Max. Over Current Protection	② Field Power Wiring	③ Ground Wire Size
EH3PB-A05	240/208-1	5	17,100	3.75	12,800	20.8/18.1		1	26/23	30/25	10/10	10
EH3PB-A08	240/208-1	8	27,300	6.00	20,500	33.3/28.8		1	42/36	45/40	10/10	10
EH3PB-A10	240/208-1	10	34,100	7.50	26,000	41.6/36.2		1	53/46	60/50	6/8	10
EH3PB-A15	240/208-1	15	51,200	11.25	38,400	62.5/54.1	30/60	1	79/68	80/70	4/4	8
EH3PC-A08	240/208-1	5	17,100	3.75	12,800	20.8/18.1		1	26/23	30/25	10/10	10
EH3PC-A10	240/208-1	10	34,100	7.50	26,000	41.6/36.2		1	53/48	60/50	6/8	10
EH3PC-A15	240/208-1	15	51,200	11.25	38,400	62.5/54.1	30/60	1	79/68	80/70	4/4	8
EH5PB-A05	240/208-1	5	17,100	3.75	12,800	20.8/18.1		1	26/23	30/25	10/10	10
EH5PB-A10	240/208-1	10	34,100	7.50	26,000	41.6/36.2		1	53/46	60/50	6/8	10
EH5PB-A15	240/208-1	15	51,200	11.25	38,400	62.5/54.1	30/60	1	79/68	80/70	4/4	8
EH5PB-A20	240/208-1	20	68,200	15.00	51,200	83.2/72.1	60/60	1	104/91	110/100	2/3	6
EH3PB-B09	240/208-3	9	30,700	6.75	23,000	21.7/18.7		1	28/24	30/25	10/10	10
EH3PB-B15	240/208-3	15	51,200	11.25	38,400	36.2/31.2		1	46/39	50/40	8/8	10
EH5PB-B09	240/208-3	9	30,700	3.75	23,000	21.7/18.7		1	28/24	30/25	10/10	10
EH5PB-B15	240/208-3	15	51,200	11.25	38,400	36.2/31.2		1	46/39	50/40	8/8	10
EH5PB-B18	240/208-3	18	61,400	13.50	46,100	43.4/37.5		1	55/47	60/50	6/8	10
EH3PB-C09	480-3	9	30,700	8.26	28,200	10.8		1	15	15	14	14
EH3PB-C15	480-3	15	51,200	13.77	47,000	18.0		1	23	25	10	10
EH5PB-C09	480-3	9	30,700	8.26	28,200	10.8		1	15	15	14	14
EH5PB-C15	480-3	15	51,200	13.77	47,000	18.0		1	23	25	10	10
EH5PB-C18	480-3	18	61,400	16.53	56,400	21.7		1	28	30	10	10

① Time delay fuses of HACR type circuit breakers must be used for 60 and smaller sizes. Standard fuses or circuit breakers are suitable for sizes 70 and larger. 480V circuit breakers are not HACR type.

② Based on wire suitable for 75 degree C. Other wiring materials must be rated for marked Minimum Circuit Ampacity or greater.

③ Based upon Table 250-95 of N.E.C. 1993. See electric data for basic heat pump for Circuit A wiring specification requirements.

NOTE: While this electrical data is presented as a guide, it is important to electrically connect properly sized fuses and conductor wires in accordance with the national Electrical Code and all existing local codes.

FIGURE 1
UNIT DIMENSIONAL DRAWING

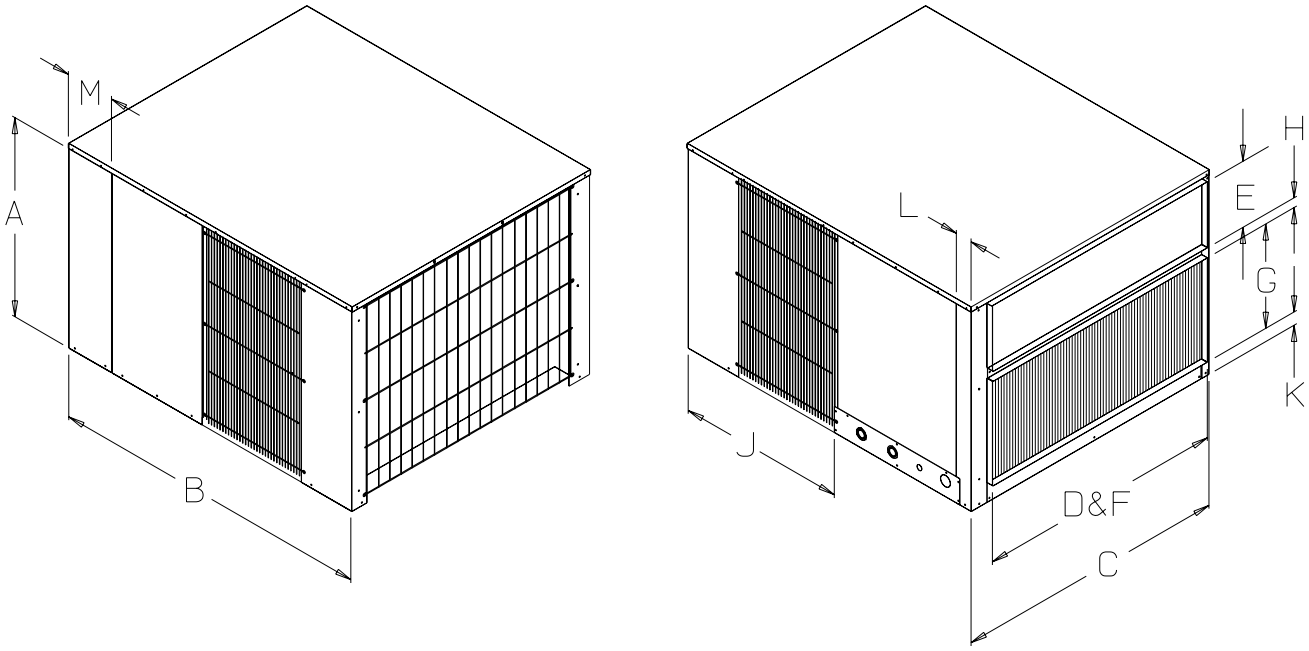


TABLE 5
DIMENSIONS OF UNIT

Model No.	Nominal Cabinet Dimensions (Inches)							Duct Opening (Inches)				
								Discharge		Return Air		
	A	B	C	J	K	L	M	D	E	F	G	H
PH1124 PH1224 PH1130 PH1230 PH1136 PH1236	24-1/4	48-3/16	38-1/8	26-1/8	2-1/8	9/16	9/16	33	6	33	14	7/8
PH1142 PH1242 PH1148 PH1248 PH1060	31-1/4	50	42	26	3	2-3/4	7-9/16	38	10	38	16	1-3/8

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 lease ¼ 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 runoff water from higher ground will not collect around unit. See Figure 2.

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 3.

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 be necessary on ground level installations, also. See Figure 4.

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 inches 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 5.

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. 2-inch thick insulation with suitable vapor barrier is recommended for both outdoor and attic runs.

   In roof top installation, 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. See Figures 6 and 7, and Tables 6 and 7.

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 a 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. **THROUGH THE WALL** – This type installation requires a suitable framework to be fabricated capable of withstanding the unit weight. Normally the unit will be insulated so as to minimize supply and return duct work.

FIGURE 2
SLAB MOUNTING AT GROUND LEVEL
(Above 32°F Outside Temperature)

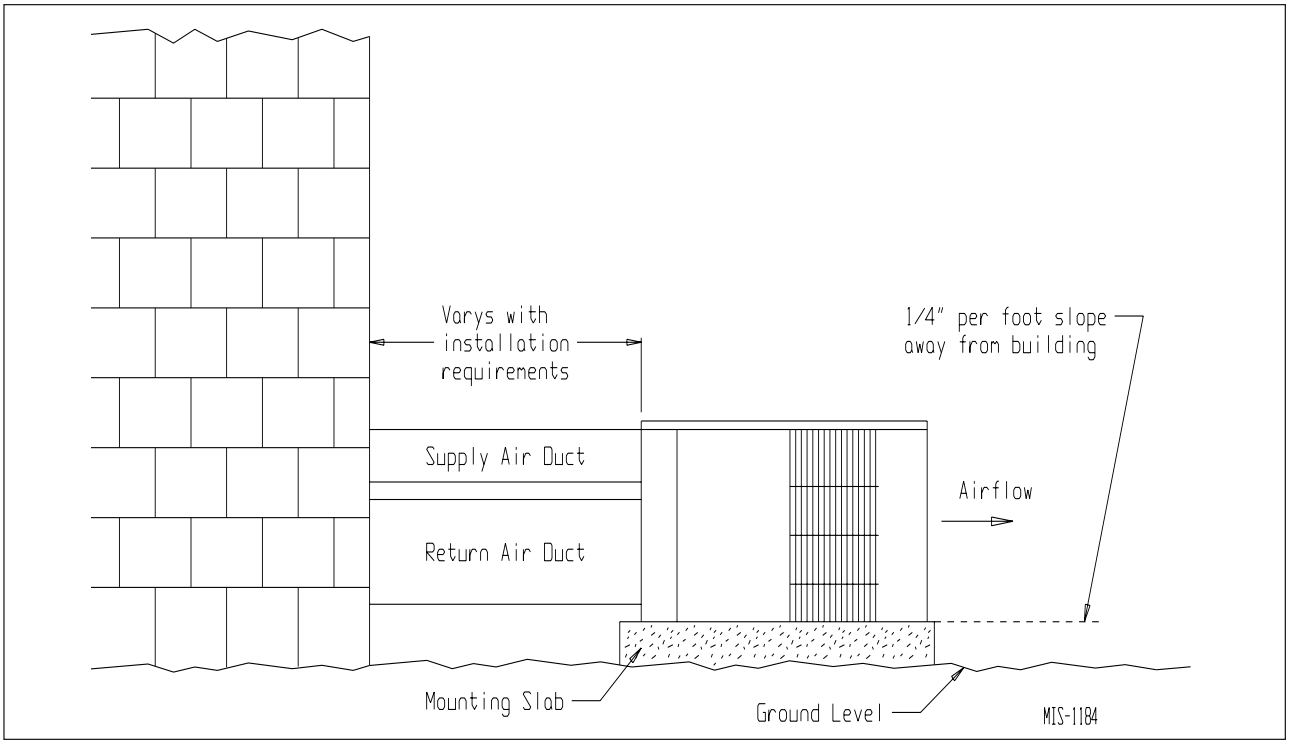


FIGURE 3
AIRFLOW AND SERVICE ACCESS CLEARANCES

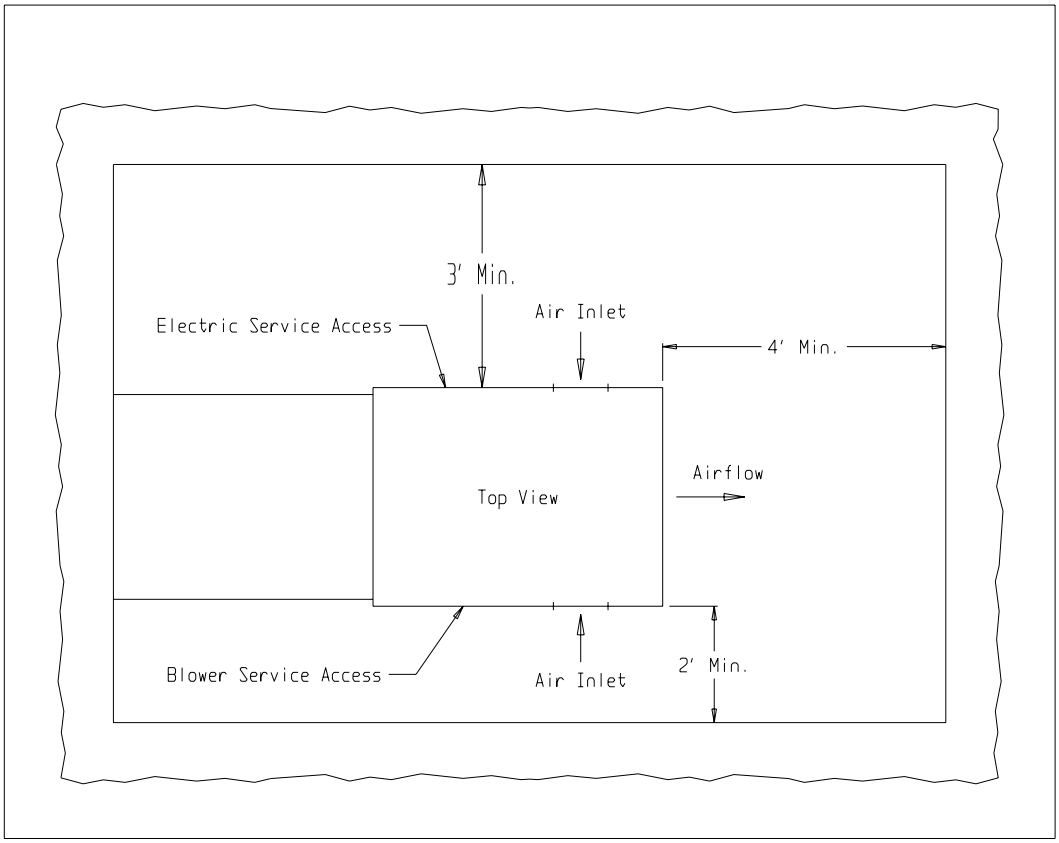


FIGURE 4
ROOF TOP APPLICATION
(May also be required for ground level installations)

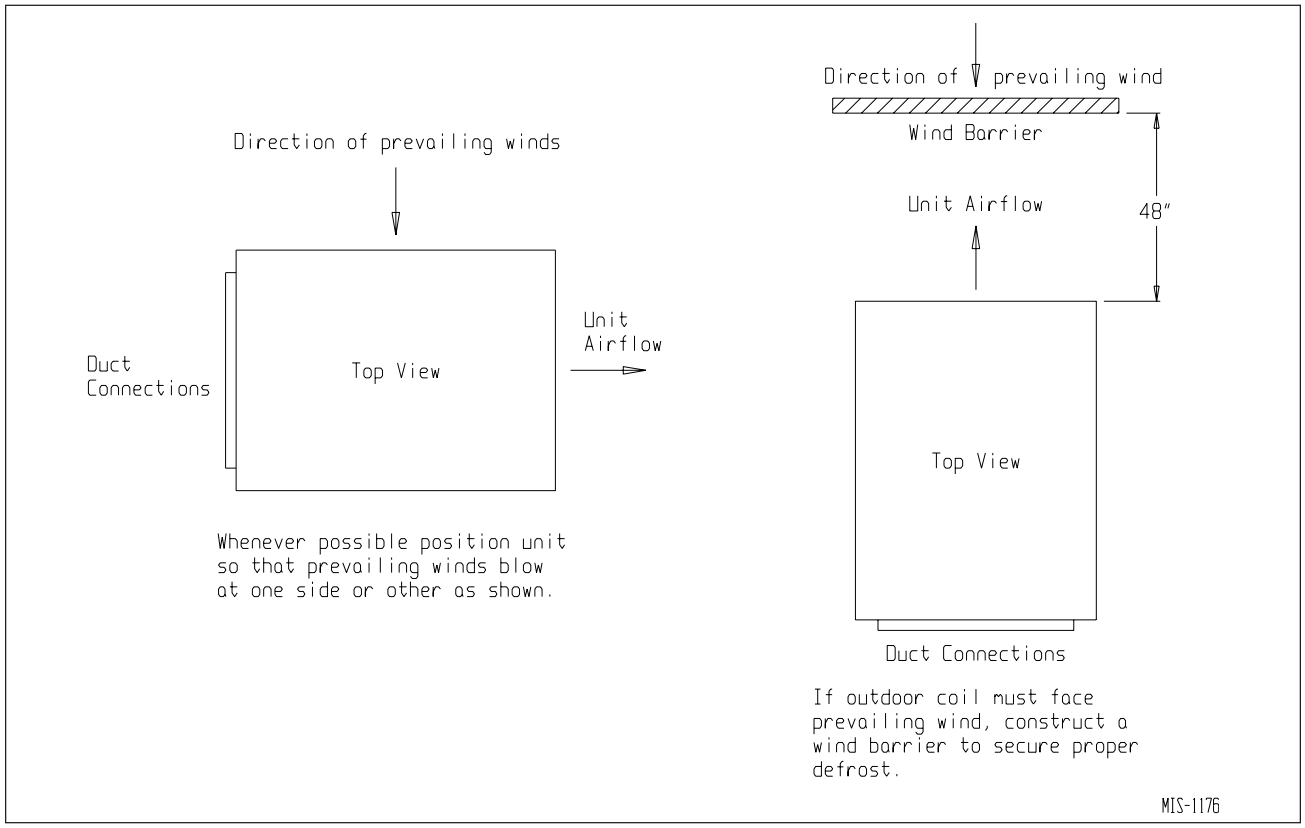


FIGURE 5
ELEVATED MOUNTING PLATFORMS

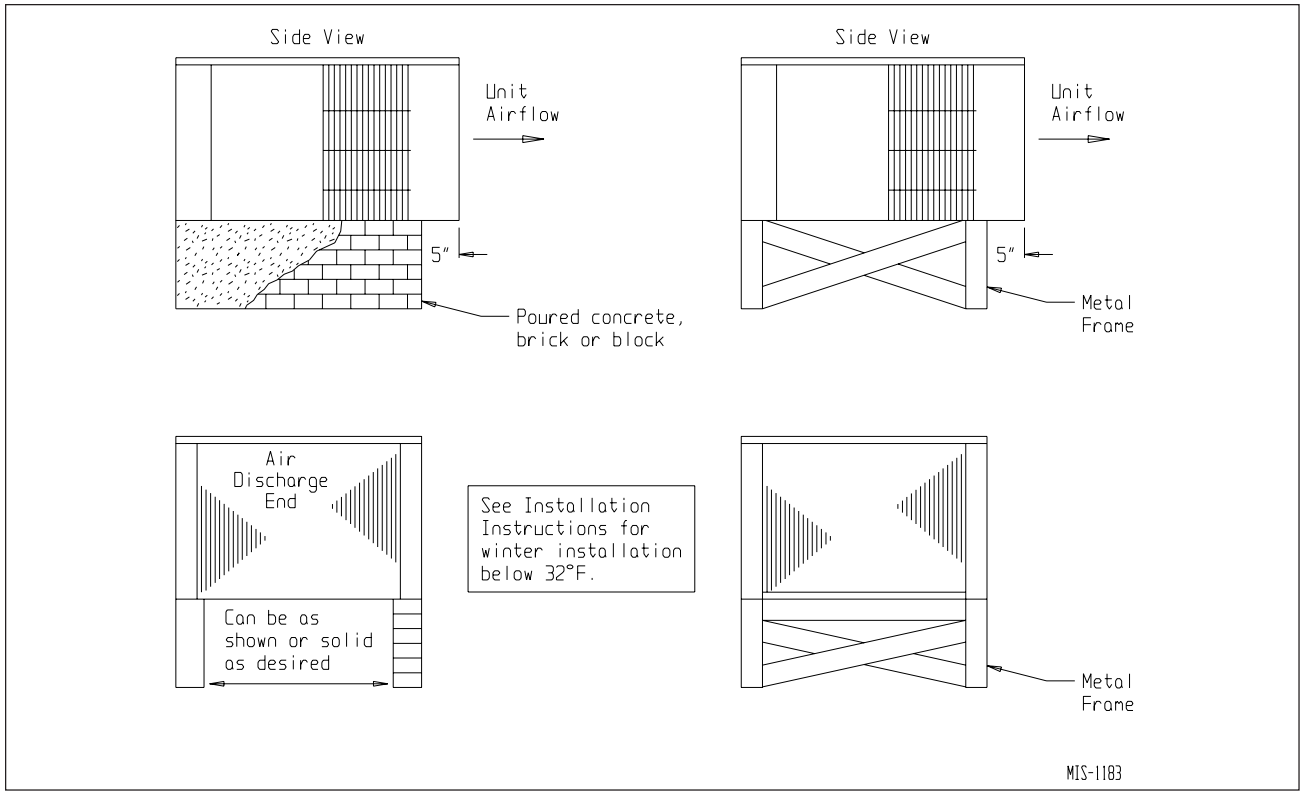


FIGURE 6
PREFABRICATED ROOF CURB SPECIFICATIONS
HEAVY GAUGE GALVANIZED WITH WOOD NAILING STRIP, WELDED/LEAKPROOF
ONE PIECE CONSTRUCTION – READY TO INSTALL

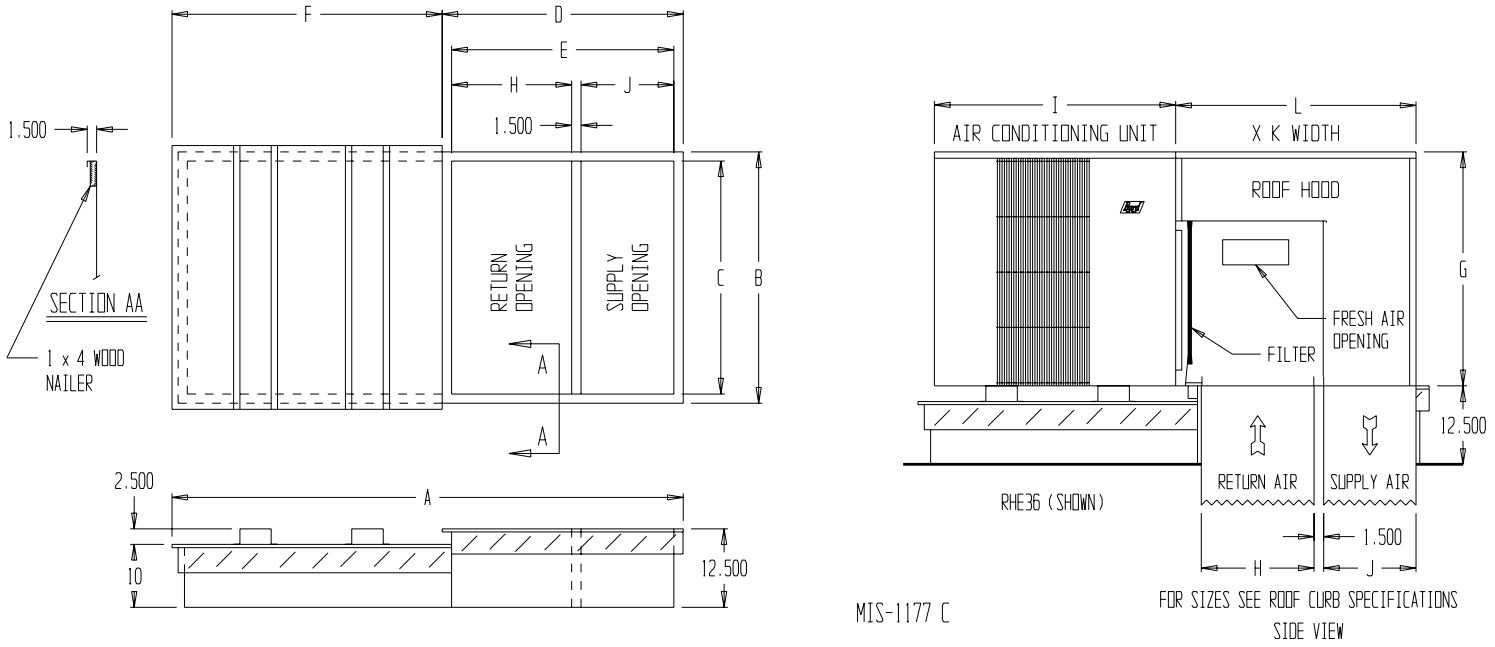
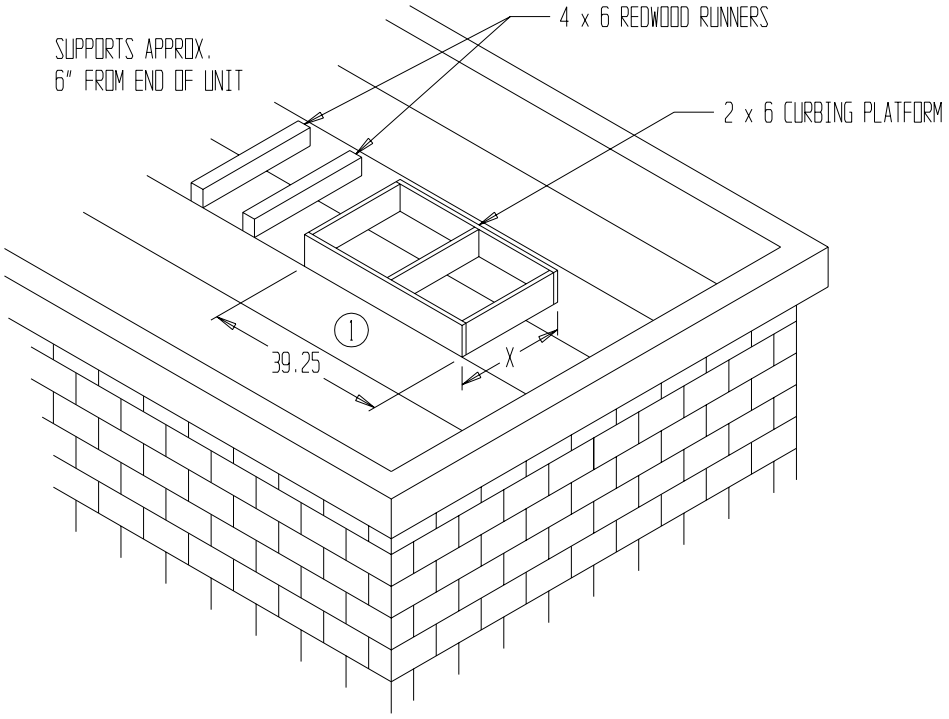


TABLE 6
ROOF CURB DIMENSIONS

Unit Model	Roof Hood Model	Roof Curb Model	Roof Curb Details											
			A	B	C	D	E	F	G	H	I	J	K	L
PH1124* PH1224* PH1130* PH1230* PH1136* PH1236*	RHE-36	9042-003	80.375	40.25	37.25	38.375	35.375	42	24.25	19.125	48.188	14.75	38.125	38.25
PH1142* PH1242* PH1048* PH1248* PH1060*	RHE-60	9042-004	82.375	44.125	41.125	38.375	35.375	44	31.25	19.125	50	14.75	42	38.25

* Revision Level

FIGURE 7
FIELD FABRICATED CURBING



(1) A SEPARATE METAL FLASHING SHOULD BE INSTALLED AROUND WOOD CURBING. CAULK & SEAL ALL JOINTS & WEATHERPROOF.

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TABLE 7
DIMENSION "X" FOR FIELD FABRICATED CURBING

Unit Model	Roof Hood Model	Dimension X
PH1124 PH1224 PH1130 PH1230 PH1136 PH1236	RHE-36	41
PH1142 PH1242 PH1048 PH1248 PH1060	RHE60	44-7/8

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 airflow over the outdoor coil will be maintained.

If this unit is operated in cooling below a 65° outdoor ambient temperature, the installation of low ambient controls (CMA-6) to unit is required.

CONDENSATE DRAIN TRAP

It is very important to provide a trap in the condensate drain line to allow a positive liquid seal in the line and assure correct drainage from the coil condensate pan.

Install condensate drain trap shown in Figure 8. Use drain connection size or larger. Do not operate unit without trap. Unit must be level or slightly inclined toward drain.

With a trap installed on a unit located in an unconditioned area, water in the trap may freeze. It is recommended that the trap material be of a type that will allow for expansion of water when it freezes.

AIR FILTERS

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

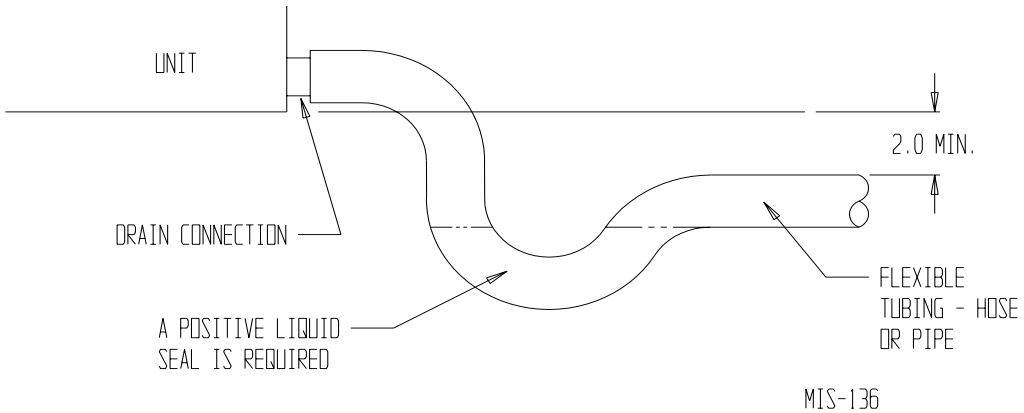
Prior thought should be given to return air location and placement of the air filter(s). The air filter(s) must be of adequate size and readily accessible to the operator of the equipment. Filters must be adequate in size and properly maintained for proper operation. If this is not done, excessive energy 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. Table 8 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.

TABLE 8
FILTERS REQUIRED AND SIZE

Model No.	Minimum Filter Area	Recommended Size
PH1124 PH1224 PH1130 PH1230 PH1136 PH1236	462 Square Inches (3.21 Square Feet)	15 x 30-5/8 x 1
PH1142 PH1242 PH1048 PH1248 PH1060	608 Square Inches (4.62 Square Feet)	(2) 16 x 20 x 1

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.

FIGURE 8
CONDENSATE DRAIN TRAP



WIRING – MAIN POWER

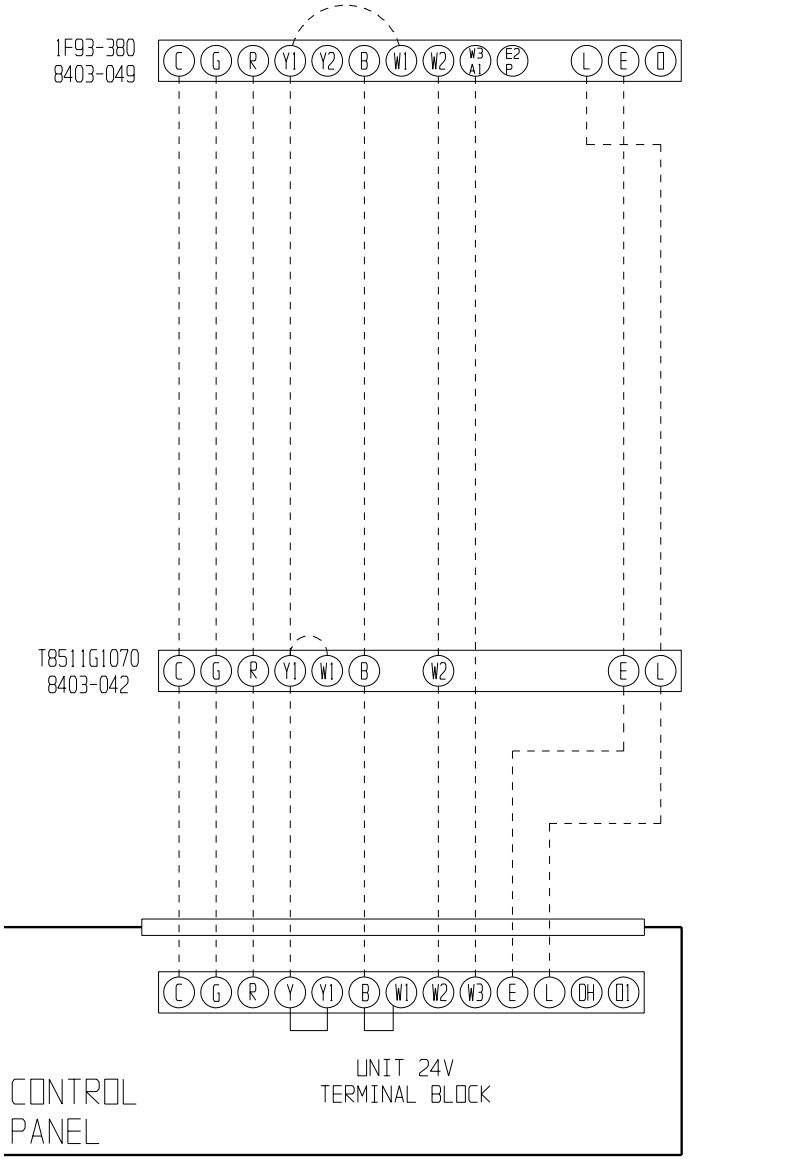
Refer to the unit rating plate for wire sizing information and maximum fuse size. Each outdoor unit is marked with a "Minimum Circuit Ampacity". This means that the field wiring used must be sized to carry that amount of current. If field installed heaters are added to the basic unit, a second separate power supply circuit will be required. The heater rating plate located adjacent to the basic unit rating plate will show the appropriate circuit ampacity fuse size, etc. (Also see "Electrical Data" on pages 3, 4 and 5.) *All models are suitable for connection with copper wire only.* 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 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 LOW VOLTAGE CONTROL CIRCUIT

Nine (9) wires should be run from thermostat subbase to the 24V terminal board in the unit. A nine conductor, 18 gauge copper, color-coded thermostat cable is recommended. The connection points are shown in Figure 9.

FIGURE 9
LOW VOLTAGE WIRING



THERMOSTATS

See specific wiring information for the different models, heater KWs, and voltages.

TABLE 9
HEAT PUMP THERMOSTATS

Thermostat	Predominant Features
8403-049 (1F93-380)	2 stage Cool; 2 stage Heat Programmable Electronic Auto or Manual changeover
8403-058 (TH5220D1151)	2 stage Cool; 2 stage Heat Electronic Non-Programmable Auto or Manual changeover

IMPORTANT NOTE: Only the thermostats shown above are recommended for use with this equipment.

TABLE 10
THERMOSTAT WIRE SIZE

Transformer VA	FLA	Wire Gauge	Maximum Length In Feet
55	2.3	20	45
		18	60
		16	100
		14	160
		12	250

THERMOSTAT INDICATOR LAMPS

The red lamp marked “EM. HT.” comes on and stays on whenever the system switch is placed in 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.

TRANSFORMER TAPS

230/208V, 1 phase and 3 phase equipment employ dual primary voltage transformers. All equipment leaves the factory wired on 240V tap. For 208V operation, reconnect from 240V to 208V tap. The acceptable operating voltage range for the 240 and 208V taps are:

TAP	RANGE
240	253 – 216
208	220 – 187

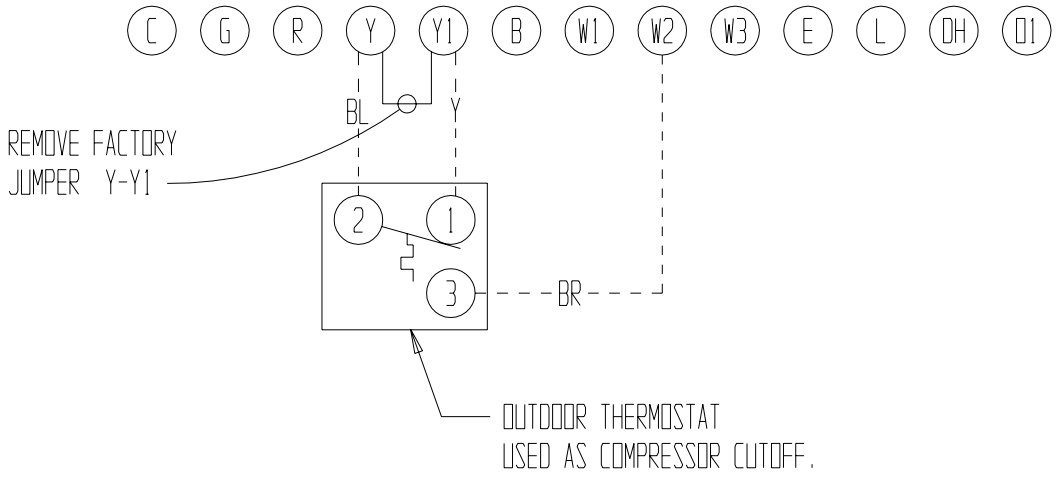
NOTE: The voltage should be measured at the field power connection point in the unit and while the unit is operating at full load (maximum amperage operating condition).

COMPRESSOR CUTOFF THERMOSTAT and OUTDOOR THERMOSTAT WIRING

Heat pump compressor operation at outdoor temperatures below 0°F are neither desirable not 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 cutoffs 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. Refer to Installation Instructions of CMH-14 Outdoor Thermostat Kit for more information.

FIGURE 10
UNIT 24V TERMINAL BOARD (5 THROUGH 10 KW)



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COMPRESSOR CUTOFF THERMOSTAT WIRING (5 through 10 KW) (FIGURE 10)

TABLE 11
5 through 10 KW

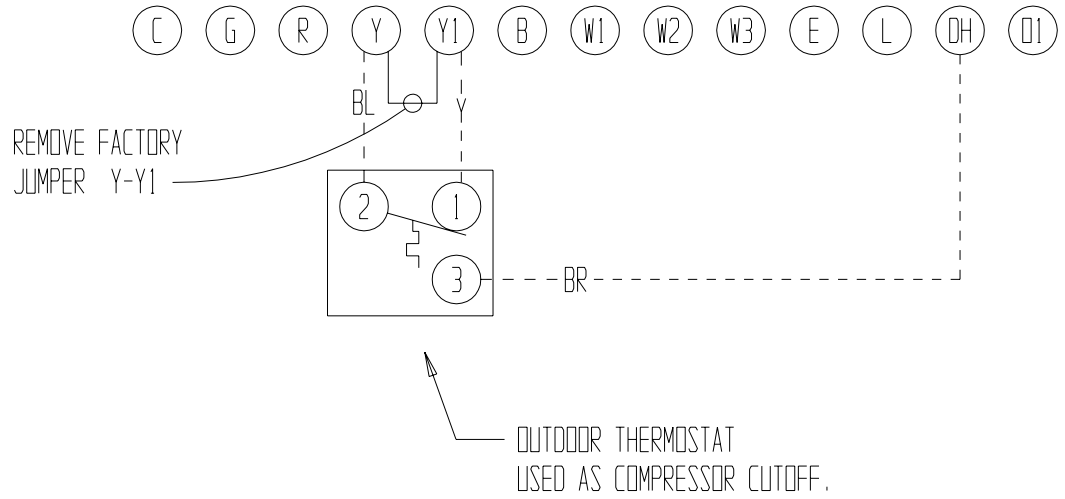
Model	KW	Volts	Phase
PH11242	0,5,8	230	1
PH12241	0,5,10	230	1
PH11301	0,5,8	230	1
PH1230	0,5,10	230	1
PH11361	0,5,8	230	1
PH1236	0,5,10	230	1
PH11422	0,5,10	230	1
PH1242	0,5,10	230	1
PH10481	0,5,10	230	1
Ph10481-B, -C	0,9	230 / 460	3
PH12481	0,5,10	230	1
PH12481-B	0,9	230	3
PH1060	0,5,10	230	1
PH1060-B, -C	0,9	230 / 460	3

COMPRESSOR CUTOFF THERMOSTAT WIRING (15 through 20 KW) (FIGURE 11)

TABLE 12
15 through 20 KW

Model	KW	Volts	Phase
PH11242	15	230	1
PH12241	15	230	1
PH11301	15	230	1
PH1230	15	230	1
PH11361	15	230	1
PH1236	15	230	1
PH11422	15,20	230	1
PH1242	15	230	1
PH10481	15,20	230	1
PH10481-B, -C	15,18	230 / 460	3
PH12481	15	230	1
PH12481-B	15	230	1
PH1060	15,20	230	1
PH1060-B, -C	15,18	230 / 460	3

FIGURE 11
UNIT 24V TERMINAL BOARD (15 through 20 KW)



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THREE PHASE SCROLL COMPRESSOR START UP INFORMATION

Scroll compressors, like several other types of compressors, will only compress in one rotational direction. Direction of rotation is not an issue with single phase compressors since they will always start and run in the proper direction.

However, three phase compressors will rotate in either direction depending upon phasing of the power. Since there is a 50-50 chance of connecting power in such a way as to cause rotation in the reverse direction, verification of proper rotation must be made. Verification of proper rotation direction is made by observing that suction pressure drops and discharge pressure rises when the compressor is energized. Reverse rotation also results in an elevated sound level over that with correct rotation, as well as, substantially reduced current draw compared to tabulated values.

Verification of proper rotation must be made at the time the equipment is put into service. If improper rotation is corrected at this time there will be no negative impact on the durability of the compressor. However, reverse operation for over one hour may have a negative impact on the bearing due to oil pump out.

NOTE: If compressor is allowed to run in reverse rotation for several minutes the compressor's internal protector will trip.

All three phase ZR*3 compressors are wired identically internally. As a result, once the correct phasing is determined for a specific system or installation, connecting properly phased power leads to the same Fusite terminals should maintain proper rotation direction.

The direction of rotation of the motor may be changed by reversing any two line connections to the unit.

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 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 temperature and time on the solid state heat pump control. See Figure 12.

When the outdoor temperature is in the lower 40°F temperature range or colder, the outdoor coil temperature is 32°F or below. This coil temperature is sensed by the coil sensor mounted near the bottom of the outdoor coil. Once coil temperature reaches 30°F or below, the coil sends a signal to the control logic of the heat pump control and the defrost timer will start.

After 30 minutes at 30°F or below, the heat pump control will place the system in the defrost mode.

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 the coil sensor will send a signal to the heat pump control which will return the system to heating operations automatically.

If some abnormal or temporary condition such as a high wind causes the heat pump to have a prolonged defrost cycle, the heat pump control will restore the system to heating operation automatically after 10 minutes.

There are three settings on the heat pump control – 30, 60 and 90 minutes. Models are shipped wired on the 60-minute setting for greatest operating economy. If special circumstances require a change to another time, remove wire connected to terminal 60 and reconnect to desired terminal. Refer to Figure 12. The manufacturer's recommendation is for 60-minute defrost cycles.

There is a cycle speed up jumper on the control. This can be used to reduce the time between defrost cycle operation without waiting for time to elapse.

Use a small screwdriver or other metallic object, or another 1/4 inch QC to short between the *SPEEDUP* terminals to accelerate the HPC timer and initiate defrost.

Be careful not to touch any other terminals with instrument used to short the *SPEEDUP* terminals. It may take up to 10 seconds with the *SPEEDUP* terminals shorted for the speedup to be completed and the defrost cycle to start.

As soon as the defrost cycle kicks in remove the shorting instrument from the *SPEEDUP* terminals. Otherwise the timing will remain accelerated and run through the 1-minute maximum defrost length sequence in a matter of seconds and will automatically terminate the defrost sequence.

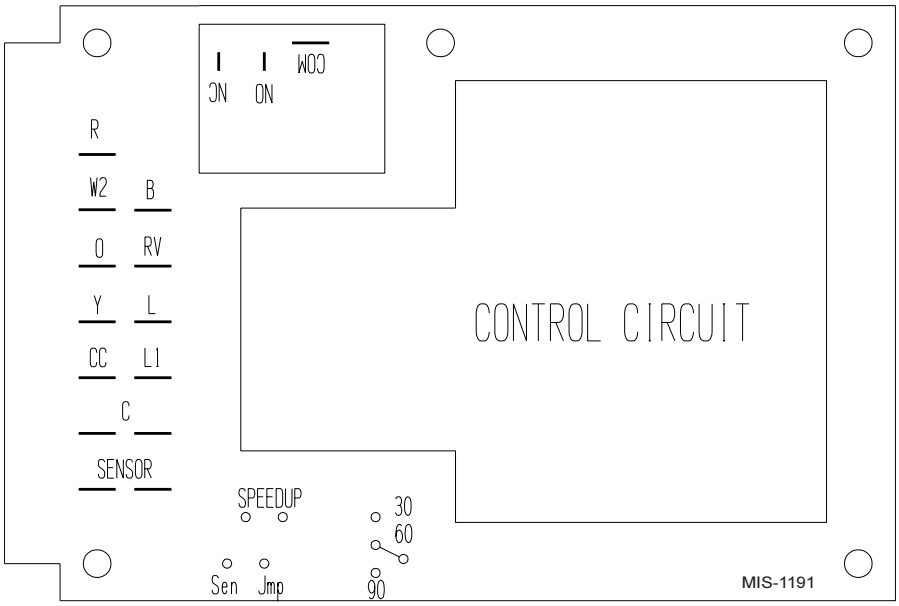
There is an initiate defrost jumper (sen jump) on the control that can be used at any outdoor ambient during the heating cycle to simulate a 0° coil temperature. This can be used to check defrost operation of the unit without waiting for the outdoor ambient to fall into the defrost region.

By placing a jumper across the SEN JMP terminals (a 1/4 inch QC terminal works best) the defrost sensor mounted on the outdoor coils is shunted out and will activate the timing circuit. This permits the defrost cycle to be checked out in warmer weather conditions without the outdoor temperature having to fall into the defrost region.

In order to terminate the defrost test in the *SEN JMP* jumper must be removed. If left in place too long the compressor could stop due to the high pressure control opening because of the high pressure condition created by operating in the cooling mode with outdoor fan off. Pressure will rise fairly fast as there is likely no actual frost on the outdoor coil in this artificial test condition.

There is also a 5-minute compressor time delay function built into the HPC. This is to protect the compressor from instances it is helpful to the service technician to override or speed up this timing period, and shorting out the speedup terminals for a few seconds can do this.

FIGURE 12
HEAT PUMP CONTROL BOARD



SOLID STATE HEAT PUMP CONTROL TROUBLESHOOTING PROCEDURE

1. Turn on AC power supply to unit.
2. Turn thermostat blower switch to fan on. The indoor blower should start. (If it doesn't, troubleshoot indoor unit and correct problem.)
3. Turn thermostat blower switch to Auto position. Indoor blower should stop.
4. Set system switch to heat or cool. Adjust thermostat to call for heat or cool. The indoor blower, compressor, and outdoor fan should start.

NOTE: If there is no power to 24 volt transformer, the compressor and outdoor fan motor will not start for 5 minutes. This is because of the compressor short cycle protection.

TROUBLESHOOTING

Symptom	Possible Causes	What to Check	How to Check or Repair
Compressor will not start in heating or cooling	Control Circuit Wiring	Check for 24V from R to C on the heat pump control	If 24V is not present at R, check wiring from board to transformer and check transformer input and output voltage. If transformer has no 24V output, determine cause and replace transformer.
	Control Circuit Wiring	Check for 24V from Y to C on low voltage terminal strip	If 24V is not present, check thermostat and thermostat wiring, outdoor thermostat (if equipped) phase monitor (if equipped). If 24V is present, continue to next step.
	Control Circuit Wiring	Check for 24V from C to CC on heat pump control	If 24V is present, check &/or replace compressor contactor. If 24V is not present, jump the speed up terminal for 10 seconds. If compressor does not start check for 24V from C to L1 on the heat pump control.
	Compressor lock out	Compressor lock out	If 24V is not present at L1 of the heat pump contro,l check the high-pressure switch and low-pressure bypass relay (if equipped) and all associated wiring and terminals. The safety circuit is a closed circuit. If the high pressure switch or low pressure bypass relay are open, the control will lock out the compressor. Replace defective component. Cycle power off and on to reset lock out. Jump speed up terminals for 10 seconds to override 5-minute time delay.
	Heat pump control defective	Defective heat pump control	If 24V is present from C to Y, and C to L1 on the heat pump control, the time delay has been overridden or expired and no 24V is present at CC replace the heat pump control.
Fan outdoor motor does not run (cooling or heating except during defrost)	Motor defective	Check for open or shorted motor winding.	Replace motor.
	Motor capacitor defective	Check capacitor rating. Check for open or shorted capacitor.	Replace capacitor.
	Heat pump control defective	Check across fan relay on heat pump control. (Com-NC)	Replace heat pump control.
Reversing valve does not energize (heating only)	Reversing volve solenoid coil defective	Check for open or shorted coil.	Replace solenoid coil.
	Heat pump control defective	Check for 24V between RV-C and B-C.	1. Check control circuit wiring. 2. Replace heat pump control
Unit will not go into defrost (heating only)	Temperature sensor or heat pump control defective	Disconnect temperature sensor from board and jumper across speed up terminals and sen jump terminals. This should cause the unit to go through a defrost cycle within one minute.	1. If unit goes through defrost cycle, replace temperature sensor. 2. If unit does not go through defrost cycle, replace heat pump control.
Unit will not come out of defrost (heating only)	Temperature sensor or heat pump control defective.	Jumper across speed up terminals. This should cause the unit to come out of defrost within one minute.	1. If unit comes out of defrost cycle, replace temperature sensor. 2. If unit does not come out of defrost cycle, replace heat pump control.

CHECKING TEMPERATURE SENSOR CHECK OUT

1. Disconnect temperature sensor from board and from outdoor coil.
2. Use an ohmmeter and measure the resistance of the sensor. Also use ohmmeter to check for short or open.
3. Check resistance reading to chart of resistance; use sensor ambient temperature. (Tolerance of part is ± 10%.)
4. If sensor resistance reads very low, then sensor is shorted and will not allow proper operation of the heat pump control.
5. If sensor is out of tolerance, shorted, open, or reads very low ohms then it should be replaced.

TEMPERATURE F VS RESISTANCE R OF TEMPERATURE SENSOR

F	R	F	R	F	R	F	R
-25.0	196871	13.0	56985	53.0	19374	89.0	7507
-24.0	190099	14.0	55284	52.0	18867	90.0	7334
-23.0	183585	15.0	53640	53.0	18375	91.0	7165
-22.0	177318	16.0	52051	54.0	17989	92.0	7000
-21.0	171289	17.0	50514	55.0	17434	93.0	6840
-20.0	165487	18.0	49028	56.0	16984	94.0	6683
-19.0	159904	19.0	47590	57.0	16547	95.0	6531
-18.0	154529	20.0	46200	58.0	16122	96.0	6383
-17.0	149355	21.0	44855	59.0	15710	97.0	6239
-16.0	144374	22.0	43554	60.0	15310	98.0	6098
-15.0	139576	23.0	42295	61.0	14921	99.0	5961
-14.0	134956	24.0	41077	62.0	14544	100.0	5827
-13.0	130506	25.0	39898	63.0	14177	101.0	5697
-12.0	126219	26.0	38757	64.0	13820	102.0	5570
-11.0	122089	27.0	37652	65.0	13474	103.0	5446
-10.0	118108	28.0	36583	66.0	13137	104.0	5326
-9.0	114272	29.0	35548	67.0	12810	105.0	5208
-8.0	110575	30.0	34545	68.0	12492	106.0	5094
-7.0	107010	31.0	33574	69.0	12183	107.0	4982
-6.0	103574	32.0	32634	70.0	11883	108.0	4873
-5.0	100260	33.0	31723	71.0	11591	109.0	4767
-4.0	97064	34.0	30840	72.0	11307	110.0	4663
-3.0	93981	35.0	29986	73.0	11031	111.0	4562
-2.0	91008	36.0	29157	74.0	10762	112.0	4464
-1.0	88139	37.0	28355	75.0	10501	113.0	4367
0.0	85371	38.0	27577	76.0	10247	114.0	4274
1.0	82699	39.0	26823	77.0	10000	115.0	4182
2.0	80121	40.0	26092	78.0	9760	116.0	4093
3.0	77632	41.0	25383	79.0	9526	117.0	4006
4.0	75230	42.0	24696	80.0	9299	118.0	3921
5.0	72910	43.0	24030	81.0	9077	119.0	3838
6.0	70670	44.0	23384	82.0	8862	120.0	3757
7.0	68507	45.0	22758	83.0	8653	121.0	3678
8.0	66418	46.0	22150	84.0	8449	122.0	3601
9.0	64399	47.0	21561	85.0	8250	123.0	3526
10.0	62449	48.0	20989	86.0	8057	124.0	3452
11.0	60565	49.0	20435	87.0	7869		
12.0	58745	50.0	19896	88.0	7686		

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 airflow 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.

PRESSURE SERVICE PORTS

High and low pressure service ports are installed on all units so that the system operating pressures can be observed. Pressure tables can be found in Tables 16 through 23 in this manual covering all models on both cooling and heating cycles. It is imperative to match the correct pressure table to the unit by model number.

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 Table 13.

TABLE 13
REFRIGERANT CHARGE

Model	Rated Airflow	95° OD Temperature	82° OD Temperature
PH11242	800	56 - 57	65 - 67
PH12241	800	64 - 66	67 - 69
PH1130	1000	56 -58	58 - 60
PH1230	1000	56 - 58	58 - 60
PH1136	1100	50 - 52	52 - 54
PH1236	1100	50 - 52	52 - 54
PH1142	1400	54 - 56	57 - 59
PH1242	1400	54 - 56	57 - 59
PH1048	1550	55 - 57	58 - 60
PH1248	1550	55 - 57	57 - 59
PH1060	1700	52 - 54	57 - 59

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

FAN BLADE SETTINGS

Shown in Figure 13 are the correct fan blade setting dimensions for proper air delivery across the outdoor coil.

Any service work requiring removal or adjustment in the fan and/or motor area will require that the dimensions in Table 14 be checked and blade adjusted in or out on the motor shaft accordingly.

FIGURE 13
FAN BLADE SETTING

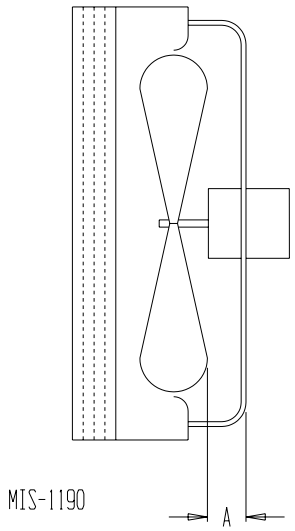


TABLE 14
FAN BLADE SETTING DIMENSIONS

Model	Dimension "A"
PH1124 PH1224	1.00"
PH1130 PH1230 PH1136 PH1236	.75"
PH11422 PH1242 PH1048 PH1248 PH1060	1.75"

SUCTION AND DISCHARGE TUBE BRAZING

Compliant Scroll compressors have copper plated steel suction and discharge tubes. These tubes are far more rugged and less prone to leaks than copper tubes used on other compressors. Due to different thermal properties of steel and copper, brazing procedures may have to be changed from those commonly used.

- To disconnect: heat joint Areas 2 and 3 slowly and uniformly until braze material softens and the tube can be pulled out of suction fitting. (See Figure 14.)
- To connect:
  - Recommended brazing materials: silfos with minimum 5% silver or silver braze material with flux.
  - Reinsert tube into fitting.
  - Heat tube uniformly in Area 1 moving slowly to Area 2. When joint reaches brazing temperature, apply brazing material. (See Figure 14.)
  - Heat joint uniformly around the circumference to flow braze material completely around the joint.
  - Slowly move torch into Area 3 to draw braze material into joint. (See Figure 14.)
  - ***Do not*** overheat joint.

FIGURE 14
BRAZING DIAGRAM

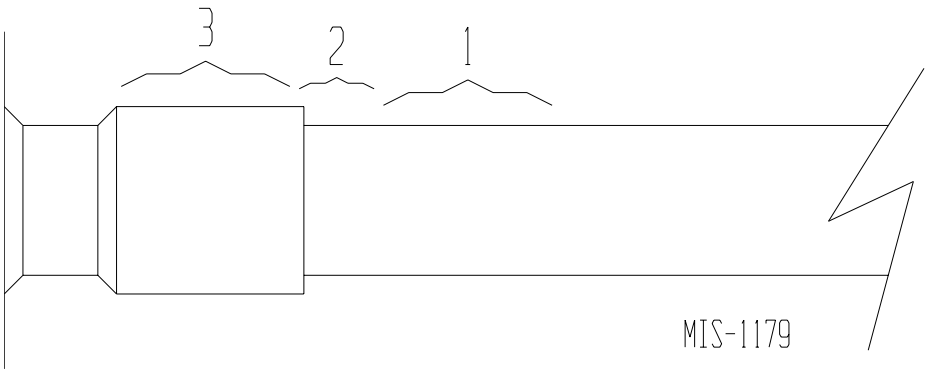


TABLE 15
INDOOR BLOWER PERFORMANCE

/ /ESP in H_20	PH1124 Dry/Wet Coil	PH1130 Dry/Wet Coil	PH1136 Dry/Wet Coil	PH1142 Dry/Wet Coil	PH1048 Dry/Wet Coil	PH1060 Dry/Wet Coil
0.0	915 / 900	1320 / 1250	1320 / 1250	1650 / 1625	1950 / 1920	1850 / 1850
0.1	860 / 835	1280 / 1175	1280 / 1175	1500 / 1525	1860 / 1830	1800 / 1780
0.2	815 / 800	1230 / 1100	1230 / 1100	1435 / 1400	1780 / 1750	1725 / 1700
0.3	785 / 750	1180 / 1000	1180 / 1000	1340 / 1310	1680 / 1660	1660 / 1625
0.4	750 / 710	1130 / 950	1130 / 950	1230 / 1210	1580 / 1550	1580 / 1540
0.5	740 / 700	1070 / 890	1070 / 890	1120 / 1000	1500 / 1480	NA

TROUBLESHOOTING GE ECM™ MOTORS

CAUTION:

Disconnect power from unit before removing or replacing connectors, or servicing motor. To avoid electric shock from the motor's capacitors, disconnect power and wait at least 5 minutes before opening motor.

Symptom	Cause/Procedure
Motor rocks slightly when starting	• This is normal start-up for ECM
Motor won't start • No movement	• Check blower turns by hand • Check power at motor • Check low voltage (24 Vac R to C) at motor • Check low voltage connections (G, Y, W, R, C) at motor • Check for unseated pins in connectors on motor harness • Test with a temporary jumper between R - G • Check motor for tight shaft • Perform motor/control replacement check • **Perform Moisture Check**
• Motor rocks, but won't start	• Check for loose or compliant motor mount • Make sure blower wheel is tight on shaft • Perform motor/control replacement check
Motor oscillates up load **& down while being tested off of blower**	• It is normal for motor to oscillate with no on shaft
Motor starts, but runs erratically	
• Varies up and down or intermittent	• Check line voltage for variation or "sag" • Check low voltage connections (G, Y, W, R, C) at motor, unseated pins in motor harness connectors • Check "Bk" for erratic CFM command (in variable-speed applications) • Check out system controls, Thermostat • **Perform Moisture Check**
• "Hunts" or "puffs" at high CFM (speed)	• Does removing panel or filter reduce "puffing"? - Reduce restriction - Reduce max airflow
• Stays at low CFM despite system call for cool or heat CFM	• Check low voltage (Thermostat) wires and connections • Verify fan is not in delay mode; wait until delay complete • "R" missing/not connected at motor • Perform motor/control replacement check
• Stays at high CFM	• "R" missing/not connected at motor • Is fan in delay mode? - wait until delay time complete • Perform motor/control replacement check
• Blower won't shut off	• Current leakage from controls into G, Y or W? Check for Triac switched thermostat or solid-state relay
Excessive noise	• Determine if it's air noise, cabinet, duct or motor noise; interview customer, if necessary
• Air noise	• High static creating high blower speed? - Is airflow set properly? - Does removing filter cause blower to slow down? Check filter - Use low-pressure drop filter - Check/correct duct restrictions
• Noisy blower or cabinet	• Check for loose blower housing, panels, etc. • High static creating high blower speed? - Check for air whistling through seams in ducts, cabinets or panels - Check for cabinet/duct deformation
• "Hunts" or "puffs" at high CFM (speed)	• Does removing panel or filter reduce "puffing"? - Reduce restriction - Reduce max. airflow
Evidence of Moisture	
• Motor failure or malfunction has occurred and moisture is present	• Replace motor and **Perform Moisture Check**
• Evidence of moisture present inside air mover	• **Perform Moisture Check**

Do	Don't
• Check out motor, controls, wiring and connections thoroughly before replacing motor	• Automatically assume the motor is bad.
• Orient connectors down so water can't get in - Install "drip loops"	• Locate connectors above 7 and 4 o'clock positions
• Use authorized motor and model #'s for replacement	• Replace one motor or control model # with another (unless an authorized replacement)
• Keep static pressure to a minimum: - Recommend high efficiency, low static filters - Recommend keeping filters clean. - Design ductwork for min. static, max. comfort - Look for and recommend ductwork improvement, where necessary	• Use high pressure drop filters some have ½" H20 drop! • Use restricted returns
• Size the equipment wisely	• Oversize system, then compensate with low airflow
• Check orientation before inserting motor connectors	• Plug in power connector backwards • Force plugs

Moisture Check

- Connectors are oriented "down" (or as recommended by equipment manufacturer)
- Arrange harness with "drip loop" under motor
- Is condensate drain plugged?
- Check for low airflow (too much latent capacity)
- Check for undercharged condition
- Check and plug leaks in return ducts, cabinet

Comfort Check

- Check proper airflow settings
- Low static pressure for lowest noise
- Set low continuous-fan CFM
- Use humidistat and 2-speed cooling units
- Use zoning controls designed for ECM that regulate CFM
- Thermostat in bad location?

Replacing ECM Control Module

To replace the control module for the GE variable-speed indoor blower motor you need to take the following steps:

1. You MUST have the correct replacement module. The controls are factory programmed for specific operating modes. Even though they look alike, different modules may have completely different functionality.

USING THE WRONG CONTROL MODULE VOIDS ALL PRODUCT WARRANTIES AND MAY PRODUCE UNEXPECTED RESULTS.

2. Begin by removing AC power from the furnace or air handler being serviced. **DO NOT WORK ON THE MOTOR WITH AC POWER APPLIED.** To avoid electric shock from the motor's capacitors, disconnect power and wait at least 5 minutes before opening motor.

3. It is usually not necessary to remove the motor from the blower assembly. However, it is recommended that the whole blower assembly, with the motor, be removed from the furnace/air handler. (Follow the manufacturer's procedures). Unplug the two cable connectors to the motor. There are latches on each connector. **DO NOT PULL ON THE WIRES.** The plugs remove easily when properly released.

4. Locate the two standard ¼" hex head bolts at the rear of the control housing (at the back end of the control opposite the shaft end). *Refer to Figure 15.* Remove these two bolts from the motor and control assembly while holding the motor in a way that will prevent the motor or control from falling when the bolts are removed. If an ECM2.0 control is being replaced (recognized by an aluminum casting rather that a deep-drawn black steel can housing the electronics), remove only the hex-head bolts. **DO NOT REMOVE THE TORX-HEAD SCREWS.**

5. The control module is now free of mechanical attachment to the motor endshield but is still connected by a plug and three wires inside the control. Carefully rotate the control to gain access to the plug at the control end of the wires. With thumb and forefinger, reach the latch holding the plug to the control and release it by squeezing the latch tab and the opposite side of the connector plug and gently pulling the plug out of the connector socket in the control. **DO NOT PULL ON THE WIRES. GRIP THE PLUG ONLY.**

6. The control module is now completely detached from the motor. Verify with a standard ohmmeter that the resistance from each motor lead (in the motor plug just removed) to the motor shell is >100K ohms. *Refer to Figure 16.* (Measure to unpainted motor end plate.) If any motor lead fails this test, do not proceed to install the control module. **THE MOTOR IS DEFECTIVE AND MUST BE REPLACED.** Installing the new control module will cause it to fail also.

7. Verify that the replacement control is correct for your application. Refer to the manufacturer's authorized replacement list. **USING THE WRONG CONTROL WILL RESULT IN IMPROPER OR NO BLOWER OPERATION.** Orient the control module so that the 3-wire motor plug can be inserted into the socket in the control. Carefully insert the plug and press it into the socket until it latches. **A SLIGHT CLICK WILL BE HEARD WHEN PROPERLY INSERTED.** Finish installing the replacement control per one of the three following paragraphs, 8a, 8b or 8c.

8a. **IF REPLACING AN ECM 2.0 CONTROL** (control in cast aluminum can with air vents on the back of the can) **WITH AN ECM 2.3 CONTROL** (control containing black potting for water protection in black deep-drawn steel case with no vents in the bottom of the can), locate the two through-bolts and plastic tab that are packed with the replacement control. Insert the plastic tab into the slot at the perimeter of the open end of the can so that the pin is located on the inside of the perimeter of the can. Rotate the can so that the tab inserts into the tab locater hole in the endshield of the motor. Using the two through-bolts provided with the replacement control, reattach the can to the motor.

THE TWO THROUGH-BOLTS PROVIDED WITH THE REPLACEMENT ECM 2.3 CONTROL ARE SHORTER THAN THE BOLTS ORIGINALLY REMOVED FROM THE ECM 2.0 CONTROL AND MUST BE USED IF SECURE ATTACHMENT OF THE CONTROL TO THE MOTOR IS TO BE ACHIEVED. ***DO NOT OVERTIGHTEN THE BOLTS.***

8b. **IF REPLACING AN ECM 2.3 CONTROL WITH AN ECM 2.3 CONTROL**, the plastic tab and shorter through-bolts are not needed. The control can be oriented in two positions 180° apart. **MAKE SURE THE ORIENTATION YOU SELECT FOR REPLACING THE CONTROL ASSURES THE CONTROL'S CABLE CONNECTORS WILL BE LOCATED DOWNWARD IN THE APPLICATION SO THAT WATER CANNOT RUN DOWN THE CABLES AND INTO THE CONTROL.** Simply orient the new control to the motor's endshield, insert bolts, and tighten. ***DO NOT OVERTIGHTEN THE BOLTS.***

8c. **IF REPLACING AN ECM 2.0 CONTROL WITH AN ECM 2.0 CONTROL** *(It is recommended that ECM 2.3 controls be used for all replacements),* the new control must be attached to the motor using through bolts identical to those removed with the original control. ***DO NOT OVERTIGHTEN THE BOLTS.***

9. Reinstall the blower/motor assembly into the HVAC equipment. Follow the manufacturer's suggested procedures.

10. Plug the 16-pin control plug into the motor. The plug is keyed. Make sure the connector is properly seated and latched.

11. Plug the 5-pin power connector into the motor. Even though the plug is keyed, **OBSERVE THE PROPER ORIENTATION. DO NOT FORCE THE CONNECTOR.** It plugs in very easily when properly oriented. **REVERSING THIS PLUG WILL CAUSE IMMEDIATE FAILURE OF THE CONTROL MODULE.**

12. Final installation check. Make sure the motor is installed as follows:
   a. Unit is as far INTO the blower housing as possible.
   b. Belly bands are not on the control module or covering vent holes.
   c. Motor connectors should be oriented between the 4 o'clock and 8 o'clock positions when the blower is positioned in its final location and orientation.
   d. Add a drip loop to the cables so that water cannot enter the motor by draining down the cables. *Refer to Figure 17.*

The installation is now complete. Reapply the AC power to the HVAC equipment and verify that the new motor control module is working properly. Follow the manufacturer's procedures for disposition of the old control module.

Figure 15
Control Disassembly

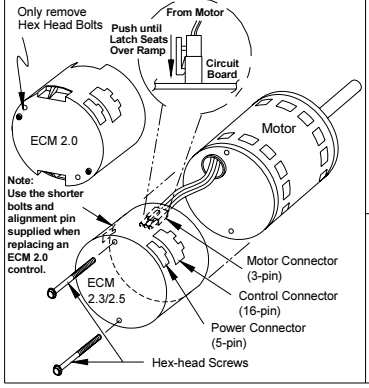


Figure 16
Winding Test

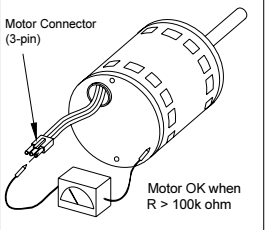
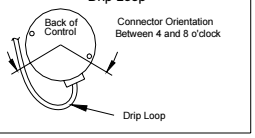


Figure 17
Drip Loop



PRESSURE TABLES

TABLE 16

COOLING

Air Temperature Entering Outdoor Coil Degrees F

Model	Return Air Temperature	Pressure	75	80	85	90	95	100	105	110	115
PH1124	75 deg. DB 62 deg. WB	Low Side High Side	73 191	75 209	76 227	77 245	78 263	79 281	80 299	81 317	83 355
	80 deg. DB 67 deg. WB	Low Side High Side	79 196	81 215	82 233	83 252	84 270	85 288	86 307	87 325	89 344
	85 deg. DB 72 deg. WB	Low Side High Side	85 203	87 222	88 242	89 261	90 280	91 299	92 318	93 338	95 357
PH1130	75 deg. DB 62 deg. WB	Low Side High Side	73 208	74 226	76 245	77 264	79 283	81 302	82 321	84 340	85 358
	80 deg. DB 67 deg. WB	Low Side High Side	77 231	79 232	81 252	83 271	85 290	87 309	89 328	91 348	93 367
	85 deg. DB 72 deg. WB	Low Side High Side	83 220	85 240	87 260	89 280	91 300	93 320	95 340	97 360	99 380
PH1136	75 deg. DB 62 deg. WB	Low Side High Side	70 209	72 227	73 245	74 262	75 280	76 298	77 315	78 333	80 351
	80 deg. DB 67 deg. WB	Low Side High Side	75 215	77 233	78 251	79 270	80 287	81 305	82 323	83 341	85 359
	85 deg. DB 72 deg. WB	Low Side High Side	80 222	81 240	83 259	84 278	86 297	88 316	89 335	91 354	92 372

TABLE 17

HEATING

Air Temperature Entering Outdoor Coil Degrees F

Model	Return Air Temp.	Pressure	0	5	10	15	17	20	25	30	35	40	45	47	50	55	60
PH1124	70 deg	Low Side High Side	12 293	16 193	21 200	26 207	28 210	31 214	36 221	41 229	45 236	50 243	55 250	57 253	60 257	65 264	70 272
PH1130	70 deg	Low Side High Side	31 179	28 177	27 176	27 177	27 178	28 180	30 184	34 189	39 196	45 205	53 215	56 219	61 226	71 239	83 254
PH1136	70 deg	Low Side High Side	41 215	33 199	28 188	25 180	24 178	24 176	24 176	27 179	32 186	39 197	48 211	52 218	59 229	72 251	87 277

Low side pressure ± 2 PSIG
High side pressure ± 5 PSIG

Tables are based upon rated CFM (airflow across the evaporator coil and should be found under section titled “Refrigerant Charge” elsewhere in manual. If there is any doubt as to correct operating charge being in the system, the charge should be removed, system evacuated, and recharged to serial plate instructions.

PRESSURE TABLES

TABLE 18

COOLING

Air Temperature Entering Outdoor Coil Degrees F

Model	Return Air Temperature	Pressure	75	80	85	90	95	100	105	110	115
PH1142	75 deg. DB 62 deg. WB	Low Side High Side	74 192	75 210	77 227	78 244	79 261	80 279	81 296	82 314	83 332
	80 deg. DB 67 deg. WB	Low Side High Side	79 197	80 215	82 233	83 250	84 268	85 286	87 304	88 322	89 340
	85 deg. DB 72 deg. WB	Low Side High Side	85 204	86 223	88 241	89 259	90 277	91 296	94 315	95 333	96 352
PH1048	75 deg. DB 62 deg. WB	Low Side High Side	71 211	73 226	75 243	76 258	77 276	78 293	79 310	80 329	81 347
	80 deg. DB 67 deg. WB	Low Side High Side	76 216	78 232	80 249	81 265	83 283	84 300	85 318	86 337	87 356
	85 deg. DB 72 deg. WB	Low Side High Side	81 224	83 240	86 258	87 274	89 292	90 311	91 329	92 349	94 368
PH1060	75 deg. DB 62 deg. WB	Low Side High Side	65 199	66 216	68 235	69 254	70 272	71 291	72 309	73 328	74 345
	80 deg. DB 67 deg. WB	Low Side High Side	70 204	71 222	72 241	73 260	75 279	76 298	77 317	78 336	79 354
	85 deg. DB 72 deg. WB	Low Side High Side	75 211	76 230	77 249	78 269	80 289	82 308	83 328	84 348	85 366

TABLE 19

HEATING

Air Temperature Entering Outdoor Coil Degrees F

Model	Return Air Temp.	Pressure	0	5	10	15	17	20	25	30	35	40	45	47	50	55	60
PH1142	70 deg	Low Side High Side	17 156	19 161	21 165	26 169	29 171	33 173	38 177	45 181	49 186	52 193	55 199	56 203	58 207	61 214	64 221
PH1048	70 deg	Low Side High Side	25 160	27 164	29 168	31 172	32 174	34 176	36 180	38 184	40 188	47 194	54 201	56 204	60 208	67 214	73 221
PH1060	70 deg	Low Side High Side	17 156	19 164	21 172	24 180	26 183	29 187	33 195	37 203	41 211	46 219	50 226	52 230	55 234	59 243	64 250

Low side pressure ± 2 PSIG
High side pressure ± 5 PSIG

Tables are based upon rated CFM (airflow across the evaporator coil and should be found under section titled “Refrigerant Charge” elsewhere in manual. If there is any doubt as to correct operating charge being in the system, the charge should be removed, system evacuated, and recharged to serial plate instructions.

PRESSURE TABLES

TABLE 20

COOLING

Air Temperature Entering Outdoor Coil Degrees F

Model	Return Air Temperature	Pressure	75	80	85	90	95	100	105	110	115
PH1224	75 deg. DB 62 deg. WB	Low Side High Side	73 191	75 205	76 219	78 234	79 251	80 267	81 285	82 303	83 323
	80 deg. DB 67 deg. WB	Low Side High Side	78 196	80 210	81 225	83 240	84 257	88 274	87 292	88 311	89 331
	85 deg. DB 72 deg. WB	Low Side High Side	81 203	83 217	84 233	86 248	87 266	89 284	90 302	91 322	92 343
PH1230	75 deg. DB 62 deg. WB	Low Side High Side	73 208	75 222	76 237	78 254	79 270	79 288	81 307	82 326	84 346
	80 deg. DB 67 deg. WB	Low Side High Side	78 213	80 228	81 243	83 260	84 277	85 295	87 315	88 334	90 355
	85 deg. DB 72 deg. WB	Low Side High Side	81 220	83 236	84 252	86 269	87 287	88 305	90 326	91 346	93 367
PH1236	75 deg. DB 62 deg. WB	Low Side High Side	72 211	74 225	75 242	77 258	78 276	79 294	80 314	81 333	82 355
	80 deg. DB 67 deg. WB	Low Side High Side	77 216	79 231	80 248	82 265	83 283	84 302	86 322	87 342	88 364
	85 deg. DB 72 deg. WB	Low Side High Side	80 224	82 239	83 257	85 274	86 293	87 313	89 333	90 354	91 377

TABLE 21

HEATING

Air Temperature Entering Outdoor Coil Degrees F

Model	Return Air Temp.	Pressure	0	5	10	15	17	20	25	30	35	40	45	47	50	55
PH1224	70 deg	Low Side High Side	22 174	24 182	27 190	30 198	31 201	33 205	37 213	41 221	45 229	50 237	56 245	58 248	62 253	68 261
PH1230	70 deg	Low Side High Side	21 167	23 170	25 174	28 178	29 179	31 182	34 187	38 192	43 197	48 203	53 210	55 213	59 217	65 224
PH1236	70 deg	Low Side High Side	24 194	25 195	26 197	28 201	28 202	30 205	33 211	37 218	42 226	47 235	53 246	56 250	60 257	68 270

Low side pressure ± 2 PSIG
High side pressure ± 5 PSIG

Tables are based upon rated CFM (airflow across the evaporator coil and should be found under section titled "Refrigerant Charge" elsewhere in manual. If there is any doubt as to correct operating charge being in the system, the charge should be removed, system evacuated, and recharged to serial plate instructions.

PRESSURE TABLES

TABLE 22

COOLING

Air Temperature Entering Outdoor Coil Degrees F

Model	Return Air Temperature	Pressure	75	80	85	90	95	100	105	110	115
PH1242	75 deg. DB 62 deg. WB	Low Side High Side	74 196	76 211	77 225	78 241	79 257	79 274	81 291	81 308	82 326
	80 deg. DB 67 deg. WB	Low Side High Side	79 201	81 216	82 231	83 247	84 264	85 281	87 298	87 316	88 334
	85 deg. DB 72 deg. WB	Low Side High Side	82 208	84 224	85 239	86 256	87 273	88 291	90 308	90 327	91 346
PH1248	75 deg. DB 62 deg. WB	Low Side High Side	72 203	74 251	76 230	77 245	79 261	80 280	81 298	83 319	84 340
	80 deg. DB 67 deg. WB	Low Side High Side	77 208	79 221	81 236	82 251	84 268	86 287	87 306	89 327	90 349
	85 deg. DB 72 deg. WB	Low Side High Side	80 215	82 229	84 244	85 260	87 277	89 297	90 317	92 338	93 361

TABLE 23

HEATING

Air Temperature Entering Outdoor Coil Degrees F

Model	Return Air Temp.	Pressure	0	5	10	15	17	20	25	30	35	40	45	47	50	55	60
PH1242	70 deg	Low Side High Side	26 160	26 164	28 168	30 173	31 174	32 177	36 182	40 187	44 192	49 198	55 204	58 206	62 210	69 216	77 223
PH1248	70 deg	Low Side High Side	26 165	26 166	27 168	28 170	29 171	30 173	33 177	37 182	41 187	46 194	52 201	54 204	58 209	65 217	73 227

Low side pressure ± 2 PSIG
High side pressure ± 5 PSIG

Tables are based upon rated CFM (airflow across the evaporator coil and should be found under section titled "Refrigerant Charge" elsewhere in manual. If there is any doubt as to correct operating charge being in the system, the charge should be removed, system evacuated, and recharged to serial plate instructions.