bryant

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Payne

installation, operation, and maintenance instructions

PACKAGED HEAT PUMPS

542E

Sizes 024 thru 060

& 542D060

Cancels: New

40542DP6-A
12/15/79

NOTE: Installation must conform to the guidelines presented in these unit Installation Instructions. Read and become familiar with these instructions before starting installation.

Models 542D and 542E Packaged Heat Pumps are fully self-contained combination heating/cooling units designed for outdoor installation. Model 542E may be installed either on a rooftop or ground level slab. Model 542D is used in conjunction with an accessory roof mounting curb and incorporates a down-discharge/return-air plenum as an integral part of the unit.

These packaged heat pumps are factory-charged and sealed. Installation is easy—simply connect condensate drain, air ducts, high- and low-voltage wiring, and install a field-supplied air filter in the return-air ductwork (except for Model 542D which has factory-supplied high-capacity air filters) to obtain heating during the heating season, cooling and dehumidification during the cooling season, and filtering of the conditioned space.

All units can be connected into existing duct systems *that are properly sized and designed to handle an airflow of 400 to 450 ft³/min per each 12,000 Btuh of unit capacity.*

Accessory UL-listed, field-installed, supplemental electric heat packages are available in a variety of KW and voltage options. These electric resistance heaters mount inside the unit blower compartment.

Important-Read Before Installing

1. Check all local and other applicable codes for information concerning proximity to property lines, height above roof, obstructions, or other special installation requirements.
2. Make certain that power supply available (volts, hertz, and phase) corresponds to that specified on unit rating plate.
3. Check electrical supply provided by utility to be sure that service capacity is sufficient to handle load imposed by unit being installed.
4. Refer to the 542D or 542E dimensional drawing for locations of electrical inlets, condensate drain, duct connections, and required clearances before setting unit in place.

GENERAL

Models 542D and 542E Packaged Heat Pumps have been designed and tested in accordance with ARI Standard 240-77 and 270-75, and are UL-listed.

These instructions contain the following sections:

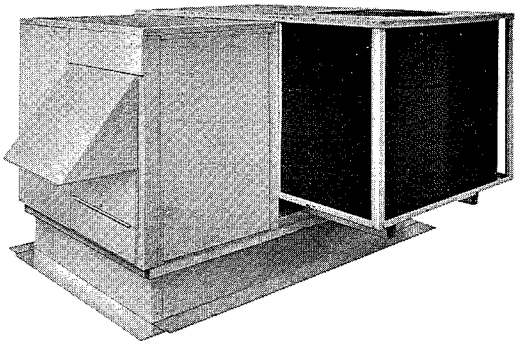

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Figure 1—Model 542E

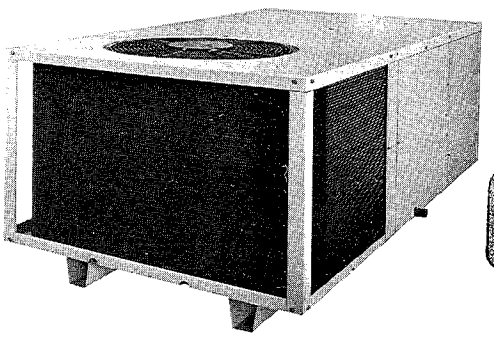

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Figure 2—Model 542D060 Mounted On Accessory Roof Mounting Curb

I. MOVING AND SETTING UNIT IN PLACE

CAUTION: Precautions must be taken to prevent damage when moving the unit. The unit must remain in an upright position during all rigging and moving operations. Be sure to protect the top and sides of the unit by using spreaders when rigging the unit to be lifted. Model 542D must be rigged for lifting as shown in Figure 7. Model 542E must be rigged for lifting as shown in Figure 8.

The unit must be installed level for proper condensate drainage. Be sure that the ground level pad, field-fabricated support, or accessory roof mounting curb is level before setting the unit in place.

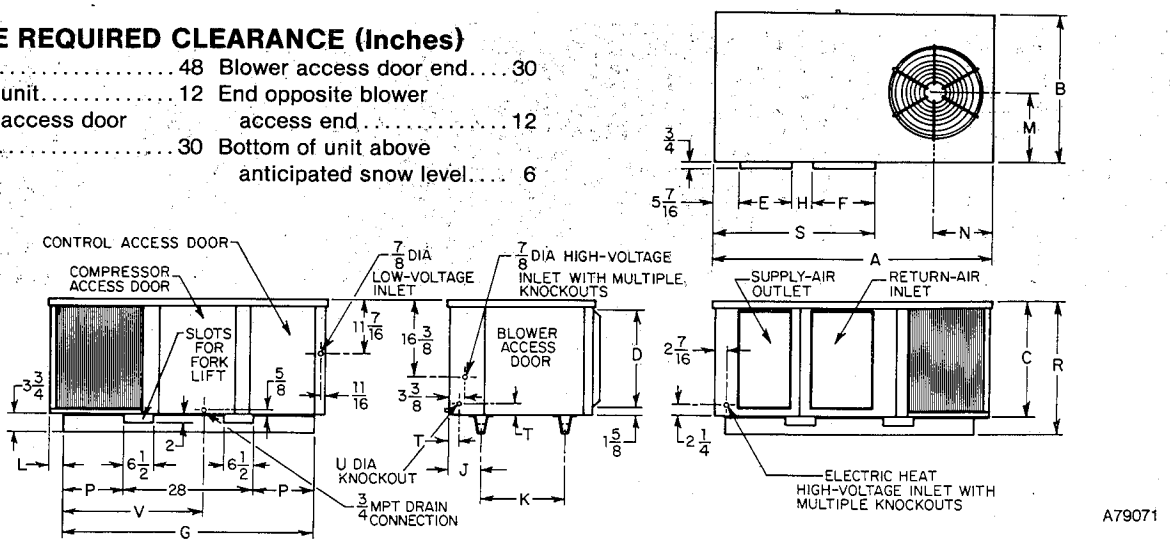
When selecting an installation site, try to locate the unit on the side opposite the prevailing wind to assure proper operation of the defrost cycle and to avoid snow drifts that could block the outdoor coil. *Be sure that the unit is installed at least 6 inches above the highest probable snow level to prevent blockage of the outdoor coil and assure proper drainage of defrosted ice.*

A. Rooftop Installation

When installing a Model 542D downflow unit or a Model 542E end-discharge unit with an accessory downflow

542E REQUIRED CLEARANCE (Inches)

Top of unit	48	Blower access door end	30
Duct side of unit	12	End opposite blower access end	12
Compressor access door side	30	Bottom of unit above anticipated snow level	6



542E DIMENSIONS (Inches)

Size	A	B	C	D	E	F	G	H	J
024 & 030	60-3/16	32-3/16	24-13/16	21	11-1/2	13-5/16	54	6-7/8	6-15/16
036	60-3/16	32-3/16	24-13/16	21	13-3/4	13-5/16	54	4-5/8	6-15/16
042, 048, & 060	68-3/16	40-3/16	30-13/16	21	16-3/8	17-5/16	61-3/16	5-1/8	7-1/2

Sizes	K	L	M	N	P	R	S	T	U	V
024 & 030	18-1/8	3	15-3/32	12-9/16	13	28-9/16	37-1/8	2	7/8	27-3/8
036	18-1/8	3	15-3/32	12-9/16	13	28-9/16	37-1/8	2	7/8	27-3/8
042, 048, & 060	25	3-3/8	20-3/32	15-1/8	16-19/32	34-9/16	44-1/4	2	7/8	33-11/16

Figure 3—542E Dimensional Drawing

TABLE I—RATINGS, PERFORMANCE, & RECOMMENDED FILTER SIZES

MODEL	542E						542D
SIZE	024	030	036	042	048	060	060
SERIES	A	A	A	A	A	A	A
Rated Heating Capacity @ 47°F (Btuh)*	26,000	30,000	35,000	43,000	48,000	58,000	58,000
Total Power Consumption (Watts)*	2850	3300	3850	4700	5100	6300	6300
COP*	2.7	2.7	2.7	2.7	2.8	2.7	2.7
Rated Heating Capacity @ 17°F (Btuh)*	14,000	16,000	18,000	22,000	25,000	31,500	31,500
Total Power Consumption (Watts)*	2300	2650	3000	3650	4150	5200	5200
COP*	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Rated Cooling Capacity @ 95°F (Btuh)*	25,500	30,000	35,000	43,000	47,000	58,000	58,000
Total Power Consumption (Watts)*	3350	3800	4650	5300	6100	7700	7700
EER	7.6	7.9	7.5	8.1	7.7	7.5	7.5
Rated Indoor Airflow (Ft^3/Min)*	850	1050	1300	1550	1700	2000	2000
Rated External Static Pressure (In. wc)*	0.3	0.3	0.3	0.3	0.3	0.3	0.3
ARI Sound Rating Number†	19	19	19	18	18	20	20
Recommended Minimum Filter Size (Sq In.)‡							
Standard-Type	408	504	624	744	816	960	**
Cleanable- or High-Capacity-Type	265	328	406	484	530	624	**

*Rated in accordance with ARI Standard 240-77.
†Rated in accordance with ARI Standard 270-75.
‡Recommended field-supplied filter sizes shown are based on a velocity of 300 ft/min at the rated indoor airfow.
**Two 20 x 20 x 2 high-capacity filters are furnished with Model 542D060.

plenum, the accessory roof mounting curb must be installed on and flashed into the roof before unit installation. The instructions for installing the curb are packaged with the curb.

CAUTION: Be sure that the roof will support the additional weight. Refer to Figure 5 or 6 for weight information. On a downflow installation with a Model 542D or a Model 542E with an accessory downflow plenum where the accessory roof mounting curb is not being used, the field-fabricated support must be level and must properly support the unit and downflow plenum.

When installing a Model 542E *without* an accessory downflow plenum, place the unit on a level base that provides proper support. On flat roofs, be sure that the unit is at least 4 inches above the highest expected water level on the roof to prevent flooding. Consult local codes for installation requirements.

NOTE: See Figure 10 for a typical rooftop installation.

B. Ground-Level Installation

The unit must be placed on a solid level concrete pad that is a minimum of 4 inches thick and that extends approximately 2 inches beyond the casing on all four sides of the unit. The unit does not need to be secured to the pad except when required by local codes.

NOTE: See Figure 11 for a typical ground level installation.

C. Clearances

The required minimum operating and service clearances are

542D060 REQUIRED CLEARANCES (Inches)

Top of unit	48	Blower access door end	30
Compressor access door side	30	End opposite blower access end	12
Side opposite compressor access door	12	Bottom of unit above anticipated snow level	6

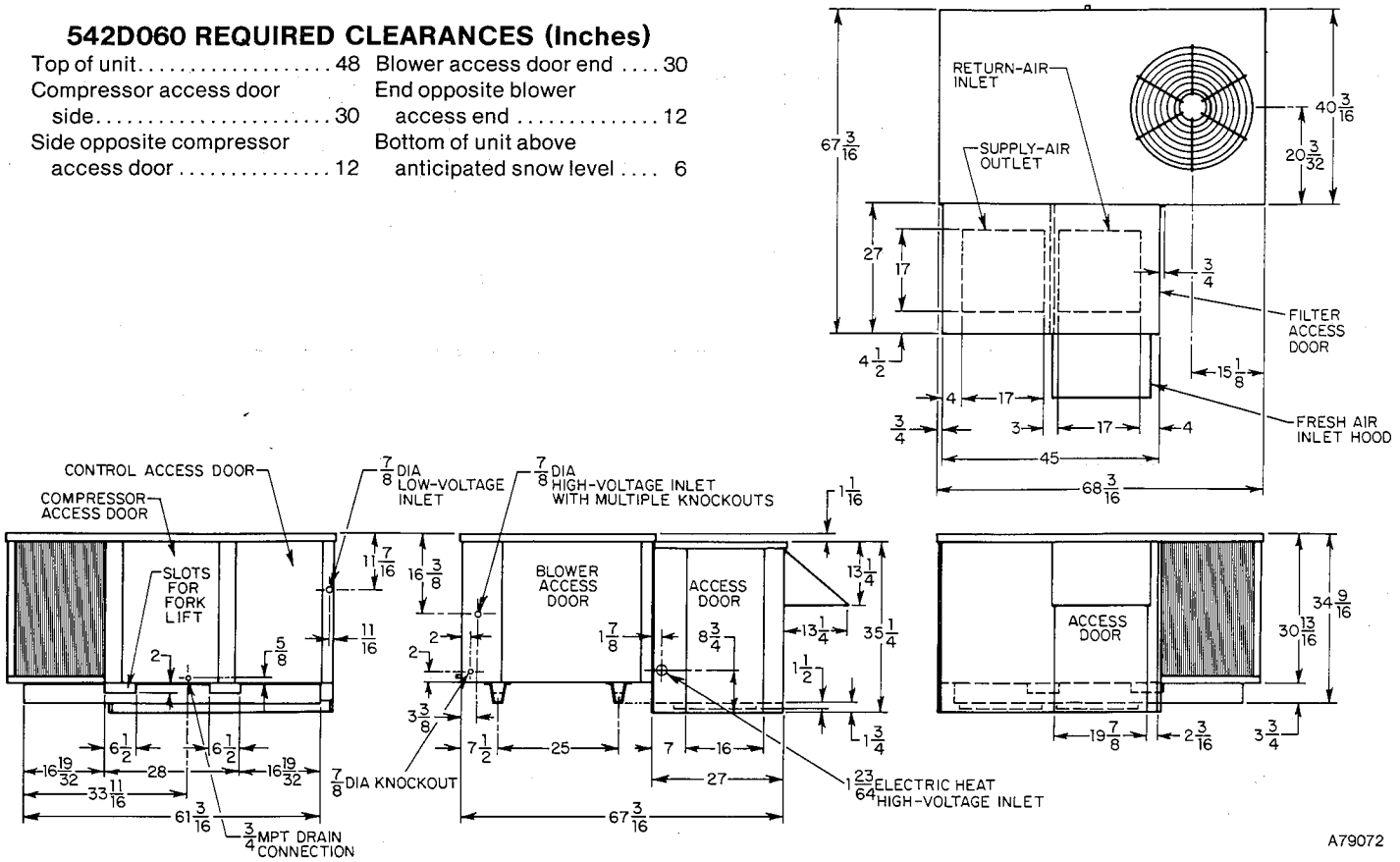
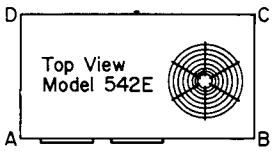


Figure 4—542D060 Dimensional Drawing



542E Size	Shipping Wt (lbs)	Operating Wt (lbs)	Corner Wt (lbs)			
			A	B	C	D
024	320	310	78	75	77	80
030	334	324	81	78	81	84
036	348	338	85	82	84	87
042	453	443	111	107	110	115
048	465	455	114	110	113	118
060	490	480	120	116	120	124

Figure 5—542E Corner Weights

shown in Figure 3 for Model 542E and Figure 4 for Model 542D.

CAUTION: Any air restriction at the outdoor air inlet (the entire surface of the outdoor coil) can be detrimental to compressor life.

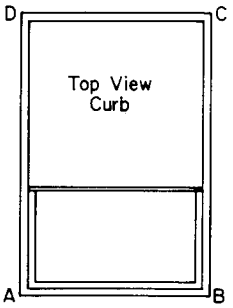
The fan discharge is through the top of the unit. Do not locate the unit under a complete overhead obstruction. Minimum clearance under a partial overhang (such as a normal house roof overhang) is 48 inches.

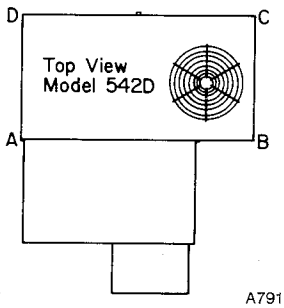
Be sure that the unit is located so that water, ice, or snow from an overhang or roof will not fall directly on the top of the unit and damage it. Be sure that grass, shrubs, or other plants do not interfere with the airflow into or out of the unit.

II. CONDENSATE AND DEFROST DISPOSAL

NOTE: Condensate and defrost water disposal methods must comply with local codes, restrictions, and practices.

Models 542D and 542E are designed to dispose of cooling cycle condensate water through a 3/4-inch MPT plastic





UNIT—MODEL 542D060				
Shipping Wt (lbs)	703			
Operating Wt (lbs)	556			
Unit Corner Wts (lbs)	A	B	C	D
	144	138	134	140
ROOF MOUNTING CURB P/N 304851-302				
Shipping Wt (lbs)	120			
Operating Wt (lbs)	113			
Curb Corner Wt (lbs)	A	B	C	D
	27.5	27.5	29	29
UNIT & CURB				
Combined Operating Wt (lbs)	669			
Curb Corner Wts with Unit on Curb	A	B	C	D
	154	164	181	170

Figure 6—542D060 Corner Weights

drain fitting. To prevent damage during the shipping and moving of the unit, this fitting is shipped inside the unit compressor compartment (secured with tape). Locate this fitting and insert the nonthreaded end into the drain hose located in the compressor compartment. See Figure 12.

It is recommended that a 3-inch trap be installed in the drain line to avoid improper drainage and to prevent leakage of indoor air to the outdoors. See Figure 9. Make sure that the outlet of the trap is at least 2 inches lower than the unit drain pan connection to prevent the pan from overflowing.

TABLE II—ELECTRICAL DATA—MODEL 542E—SIZES 024 THRU 042

MODEL	542E					
SIZE	024	030	036		042	
SERIES	A	A	A		A	
Unit Volts-Phase (60Hz)	208-230—1	208-230—1	208-230—1	208/230—3	230—1	208/230—3
Operating Voltage Range	197—253	197—253	197—253	187—253	207—253	187—253
Total Unit Amps	16.7	22.7	23.9	14.8	28.7	21.0
Max Branch Circuit Fuse Size (Amps)	30	45	45	25	50	40
Unit Ampacity for Wire Sizing	20.2	27.5	29.2	17.8	34.9	25.2
Minimum Wire Size (AWG)*	10	10	10	12	8	10
Maximum Wire Length (Ft)*	115	85	80	95	112	107

TABLE III—ELECTRICAL DATA—MODELS 542E048, 542D060, & 542E060

MODEL	542E			542E	542D & 542E	
SIZE	048			060	060	
SERIES	A			A	A	
Unit Volts—Phase (60Hz)	230—1	208/230—3	460—3	230—1	208/230—3	460—3
Operating Voltage Range	207—253	187—253	414—506	207—253	187—253	414—506
Total Unit Amps	31.9	22.4	10.9	40.9	26.1	13.7
Max Branch Circuit Fuse Size (Amps)	60	45	20	60	50	25
Unit Ampacity for Wire Sizing	38.9	27.1	13.2	49.8	31.3	16.4
Minimum Wire Size (AWG)*	8	10	14	6	8	12
Maximum Wire Length (Ft)*	101	100	181	123	137	229

*Only use copper wire for field connections to unit. Wire size is based on 60 or 75°C copper conductor at 86°F (30°C) ambient temperature and ampacity shown in table. If other than 60 or 75°C copper conductor is used, if ambient temperature is above 86°F, or if voltage drop of wire exceeds 2% of unit rated voltage, determine wire size from ampacity shown and the National Electrical Code. Wire lengths shown are measured one way along the wire path between unit and service panel for minimum voltage drop.

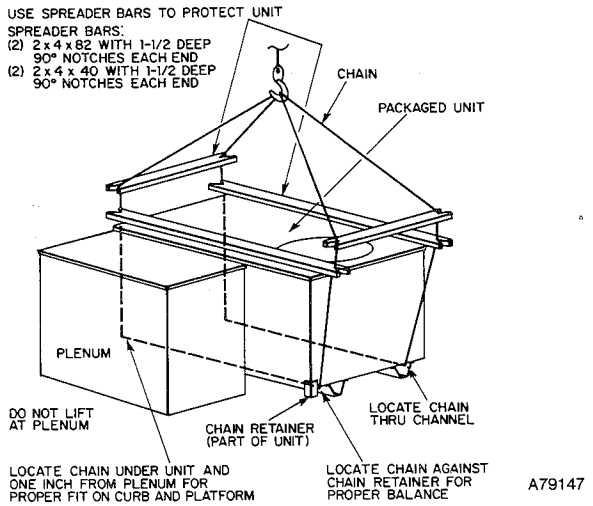


Figure 7—542D060 Suggested Rigging

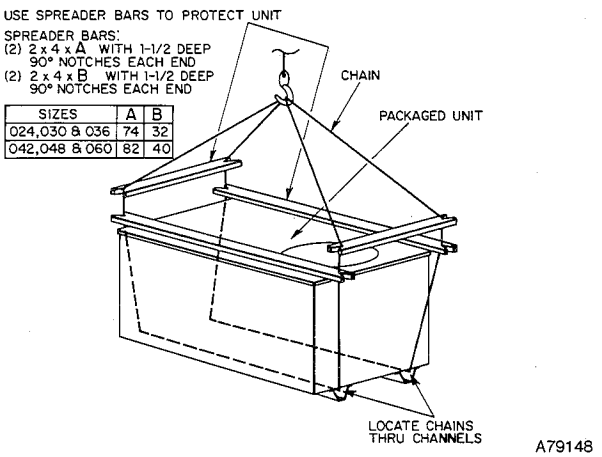


Figure 8—542E Suggested Rigging

Prime the trap with water and check the condensate line for leaks.

CAUTION: Do not undersize the condensate drain line.

During the heating defrost cycle, defrost water from the melting ice on the outdoor coil flows through the slots in the heat pump base directly below the outdoor coil. If a field-supplied drain pan is to be used to catch the defrost water, this pan should be at least 2 inches high and extend at least 2 inches beyond the width and length of the unit.

If the installation requires draining the condensate and/or defrost away from the unit, connect a minimum of 7/8-inch OD copper tubing, 3/4-inch galvanized pipe, or 7/8-inch plastic pipe. The drainage lines should pitch downward at a slope of at least 1 inch in every 10 feet of horizontal run.

Both condensate and defrost water can be drained directly onto the roof in rooftop installations where permitted or onto a gravel apron in ground-level installations. When a gravel apron is being used, it should extend at least 24 inches around the mounting pad to ensure proper drainage.

III. DUCT CONNECTIONS

Flanges are provided on the 542E supply- and return-air openings on the side of the unit. See Figure 3 for connection sizes and locations. See Figures 10 and 11 for illustrations of typical installations.

Flanges are provided on the 542D supply- and return-air openings on the bottom of the unit. See Figure 4 for connection sizes and locations.

NOTE: The minimum installation requirements of the duct system must be in accordance with the standards of the National Fire Protection Association for installation of air conditioning and ventilating systems of other than residence type, NFPA No. 90; or residence type, NFPA No. 90B; and/or local codes and ordinances.

CAUTION: When the duct system fastening holes are being drilled into the 542E side instead of the unit duct flanges provided, use care to avoid puncturing the coil tubes.

The following criteria must be followed when selecting, sizing, and installing ductwork:

1. When electric heater is installed, a minimum clearance of one inch to combustible materials must be maintained for the first 36 inches of duct.
2. It is recommended that flexible connectors be used be-

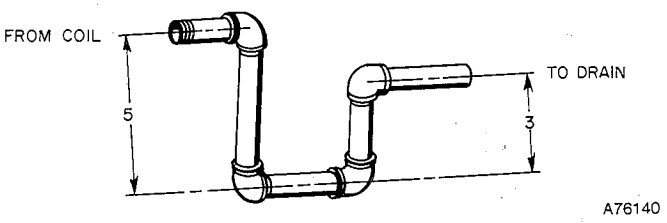


Figure 9—Condensate Drain Trap

tween the ductwork and unit to prevent transmission of vibration. The duct system can be screwed or bolted to the unit duct flanges. Suitable gaskets should be used to insure an airtight seal. When a supplemental electric resistance heater is being used, use fireproof material for the connector between the ductwork and unit supply-air duct flange. If flexible duct (which is not heat resistant) is being used, use a sheet metal duct sleeve inside the flexible duct for at least the first 36 inches of duct.

3. An external field-supplied air filter must be installed in the 542E return-air ductwork. Recommended filter sizes are shown in Table I. Filters should be installed where they are easily accessible for service.

NOTE: Model 542D has factory-supplied high-capacity air filters. High-capacity air filters are also factory-supplied when the accessory plenum, horizontal economizer, or high-capacity filter rack is being used with Model 542E.

4. Avoid abrupt duct size increases of decreases.
5. Size all ductwork for required heat pump airflow.
6. Adequately insulate and weatherproof all ductwork located outdoors. Ducts passing thru an unconditioned space must be insulated and covered with a vapor barrier in accordance with the latest issue of SMACNA and NESCA minimum installation standards for heating and air conditioning systems.
7. Secure all ducts to the building structure.
8. All openings in the building structure must be properly flashed, weatherproofed, and vibration-isolated in accordance with local codes and good building practices.

IV. ELECTRICAL CONNECTIONS

WARNING: The unit cabinet must have an uninterrupted or unbroken electrical ground to minimize personal injury if an electrical fault should occur. This may consist of electrical wire connected to the unit ground lug in the control compartment, or conduit approved for electrical ground when installed in accordance with the National Electrical Code and local electrical codes. A failure to follow this warning can result in the installer being liable for the personal injury of others.

CAUTION: A failure to follow these precautions could result in damage to the unit being installed:

1. All electrical connections must be made in accordance with the National Electrical Code and local electrical codes governing such wiring.
2. Copper conductor is the only type of wire that is to be connected between the field-supplied electrical disconnect switch and the unit. DO NOT USE ALUMINUM WIRE.
3. High-voltage power to the unit must be within the operating voltage range indicated on the unit rating plate. On 3-phase units, phases must be balanced within 2%. Consult the local power company for correction of improper voltage and/or phase balance.
4. When the low-voltage control wires are run in the same conduit as the high-voltage wires, the low-voltage wires must be insulated for the highest voltage contained within the conduit.

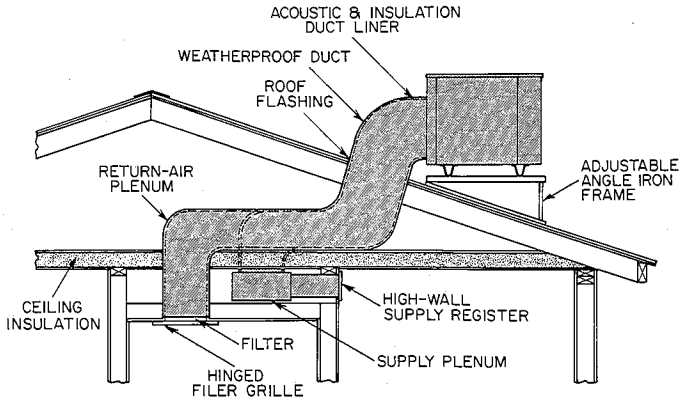


Figure 10—542E Typical Rooftop Installation on Pitched Roof

5. When drilling thru any panel to mount electrical hardware, conduit, etc; ensure that the drill does not damage internal components.
6. If aluminum conductors are used between the electrical service panel (power source) and the field-supplied electrical disconnect switch, the wire gauge selected must have a current capacity that is not less than the copper wire specified and must not create a voltage drop in excess of 2% of the unit rated voltage.

A. High-Voltage Connections

A separate electrical line with a field-supplied, waterproof, fused disconnect, switch mounted at, or within sight of, the unit must be used for this installation. Refer to the unit rating plate for maximum fuse size and minimum amps (ampacity) for wire sizing. Tables II and III show recommended wire sizes and lengths based on rating plate data.

NOTE: The field-supplied fused disconnect may be mounted over the unit high-voltage inlet hole directly on the control corner panel adjacent to the blower access panel. See Figure 3 or 4. Be sure that the disconnect box does not interfere with the removal of the blower access panel. When mounting the disconnect box, align the knockout in the box with the unit high-voltage inlet hole. Route the wiring from the disconnect box thru the aligned holes. This connection must be watertight to prevent water from entering the control box.

Proceed as follows to complete the high-voltage connections to the unit:

1. Run high-voltage power leads from fused disconnect thru high-voltage inlet hole in control corner panel. See Figure 3 or 4.
2. Connect ground lead to chassis ground connection, and connect high-voltage power leads to unit high-voltage pitgail leads. Single-phase units have two black pigtail leads. Three-phase units have two black and one red pigtail lead. See Figure 12, Figure 13, and unit wiring label. Use a suitable wire splice connector or wirenut to make each high-voltage connection. Tape each completed connection.

B. Low-Voltage Connections

Recommended heat pump room thermostats for heat pump operation with or without supplemental electric heaters are P/N 34427DP115 (subbase included) for automatic system changeover and P/N34427DP118 (subbase included) for manual system changeover. These thermostats have an emergency heat (EM. HT.) switch and red indicator light.

Heat pump room thermostat P/N 34427DP87 (subbase included) can be used for heat pump operation without supplemental electric heaters. This thermostat provides for manual system changeover and does not have an emergency heat switch.

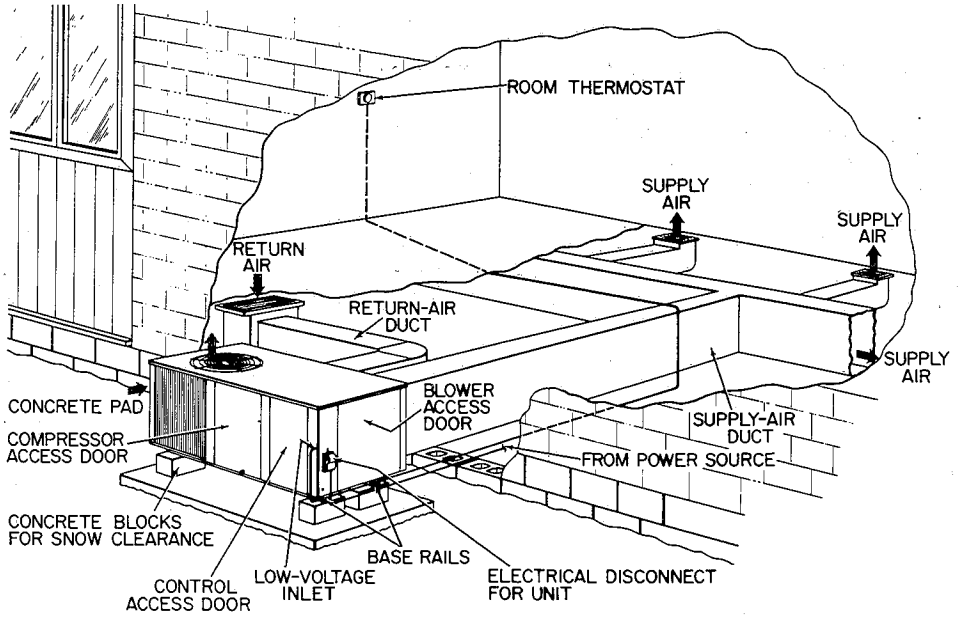


Figure 11—542E Typical Ground Level Installation Into Crawl Space

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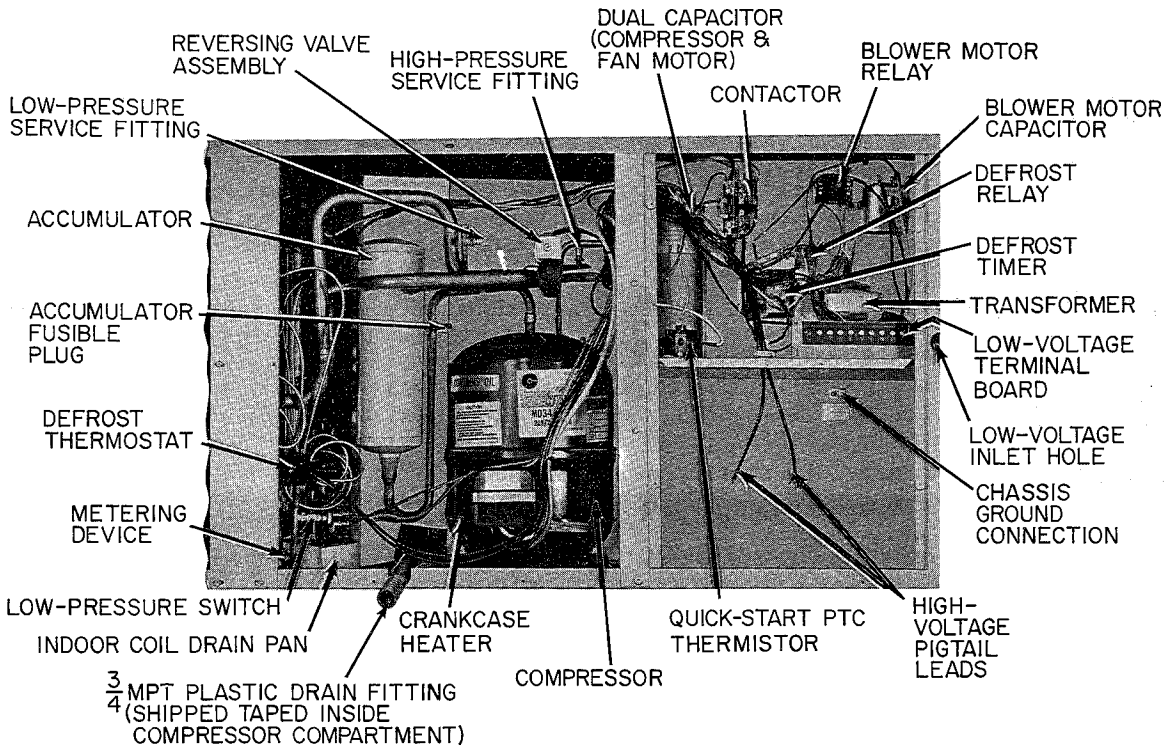

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Figure 12—Partial Side View With Compressor & Control Access Panels Removed (Model 542E036, 208V-230V—1)

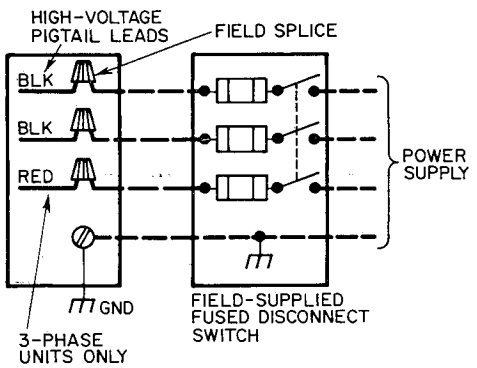

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Figure 13—Field High-Voltage Connections

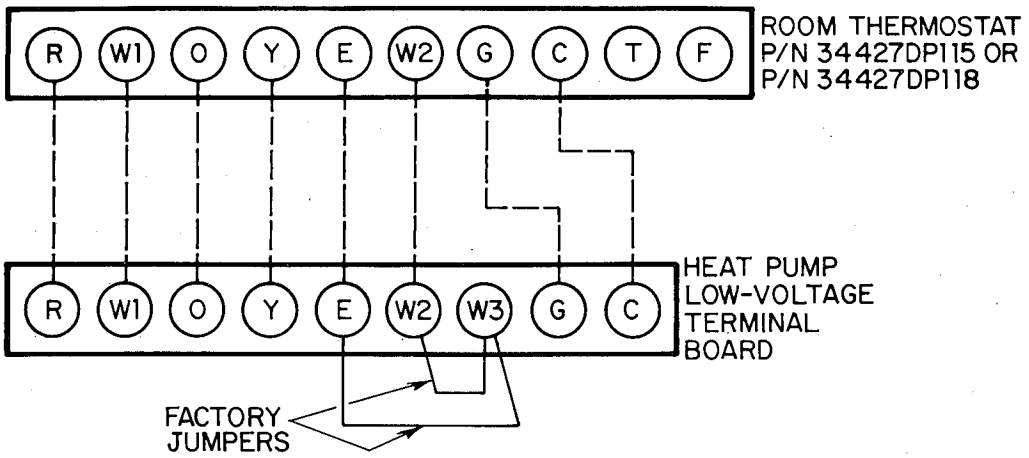

Figure 14—Field Low-Voltage Connections Using Room Thermostat P/N 34427DP115 or P/N 34427DP118

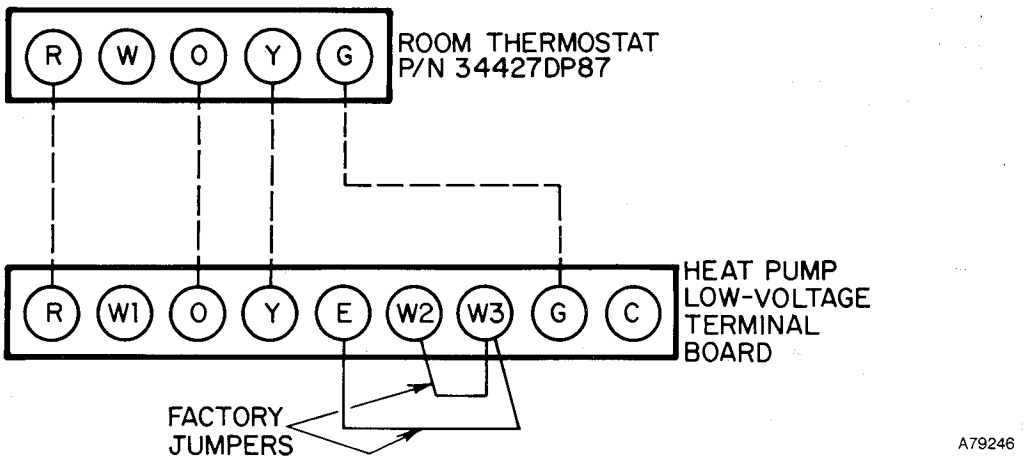

Figure 15—Field Low-Voltage Connections Using Room Thermostat P/N 34427DP87

Mount the room thermostat on an inside wall in the space to be conditioned. The thermostat should be approximately 4 or 5 feet above the floor and located where it will not be subjected to either a cooling or heating source, or direct exposure to sunlight.

Use No. 18 AWG "color-coded" insulated wires to make the low-voltage connections between the thermostat and the unit. If the thermostat is located more than 100 feet from the unit as measured along the low-voltage wires, use No. 16 AWG wire.

A grommeted low-voltage inlet hole has been provided in the control panel adjacent to the control access panel. See Figure 3 or 4. Run the low-voltage thermostat leads thru the inlet hole and to the low-voltage terminal board. See Figure 12. Complete the low-voltage thermostat connections as shown in Figure 14 or 15, depending on which recommended room thermostat is being used.

C. Heat Anticipator Settings

The recommended room thermostats have a fixed heat anticipator for heat pump heating. When using an accessory electric heater to provide supplemental heat and emergency heat capability for the system, see the Installation Instructions packaged with the heater for setting the adjustable second-stage heat anticipator.

V. PREPARING UNIT FOR STARTUP

WARNING/DANGER: A failure to follow these instructions could result in serious personal injury:

1. Follow recognized safety practices and wear protective goggles when checking or servicing the refrigerant system.
2. Do not operate the compressor or provide any electric power to this unit unless compressor terminal cover is in place and secured.
3. Do not remove the compressor terminal cover until all electrical sources have been disconnected.
4. If a refrigerant leak is suspected around the compressor terminals, relieve all pressure from the system before touching or disturbing anything inside the terminal box.
5. System contains oil and refrigerant under pressure. Do not use a torch to remove any component. To remove a component, wear protective goggles and proceed as follows:
   a. Shut off electrical power to unit.
   b. Relieve all pressure from system.
   c. Cut component connecting tubing with tubing cutter and remove component from unit.
   d. When necessary, unsweat remaining tubing stubs carefully. Oil may ignite when exposed to torch flame.

Proceed as follows to prepare the unit for initial startup:

1. Read and follow instructions on all WARNING, CAUTION, and INFORMATION labels attached to the unit; for example, blower rotation labels etc.
2. Visually inspect for oil at all refrigerant tubing connections and on unit base. Detecting oil generally indicates a refrigerant leak. Leak-test all refrigerant tubing connections, using electronic leak detector, halide torch, or liquid-soap solution. If refrigerant leak is detected, see Section VI, "Refrigerant Leaks," in these instructions.

3. Make certain all field and factory wiring connections have been completed and are tight.
4. Inspect all supply ducts and grilles to be sure they are open.
5. Check for correct position of outdoor fan blade in fan orifice. Blades should clear fan motor by no more than 1/4 inch.
6. Check to be sure air filters are in proper place.
7. Fill condensate drain pan with water to assure proper drainage.
8. Make certain all tools and miscellaneous loose parts have been removed.
9. If coil fins have been damaged during shipping and handling, carefully straighten fins with a fin comb.
10. Replace all access panels. Unit is now ready for initial startup.

VI. REFRIGERANT LEAKS

In rare instances when the factory refrigerant charge has been lost because of a shipping damage leak, or when a refrigerant leak has been found, proceed as follows:

1. Locate leak and ensure that refrigerant system prressure has been relieved.
2. Repair leak following accepted practices.
3. Add a small charge of R-22 refrigerant to system and leak-test unit.
4. If additional leaks are not found, evacuate refrigerant system.
5. Charge unit with R-22 refrigerant to exact amount shown on unit rating plate, using volumetric charging cylinder or accurate scale.

NOTE: It is recommended that a filter-drier be installed whenever the system has been open for repair. If a filter-drier has been installed, be sure to add enough extra R-22 to compensate for the internal volume of the filter-drier.

VII. STARTUP AND ADJUSTMENTS

CAUTION: Do not jumper any safety devices when operating the unit. Do not operate the compressor until electric power has been applied to the heat pump for a minimum of 4 hours to ensure that the off-cycle crankcase heater has sufficiently warmed the compressor oil to free most of the accumulated refrigerant.

A. Checking Unit Operation

The heat pump should be started and checked for proper operation as follows:

1. Set room thermostat SYSTEM switch to OFF position. Observe that indoor blower motor starts when FAN switch is placed in ON position and shuts down when FAN switch is placed in AUTO position.
2. Place SYSTEM switch in COOL position and FAN switch in AUTO position. Set thermostat temperature setting to "call" for cooling. Compressor, outdoor fan, and indoor blower motors should start. Observe that unit shuts down when thermostat temperature setting is satisfied. Wait 5 minutes for pressues to equalize.
3. Place SYSTEM switch in HEAT position and leave FAN switch in AUTO position. Increase room thermostat temperature setting gradually unitl thermostat "calls" for heat. Compressor, outdoor fan, and indoor blower motor should start. If supplemental electric heater is being used in the system, increase room thermostat temperature setting an additional 6 degrees. The supplemental electric heater should energize. Set thermostat setting below room temperature and observe that heater deenergizes and that heat pump shuts down.
4. If supplemental electric heater is being used in the system, leave FAN switch in AUTO position, SYSTEM switch in HEAT position, and move emergency heat switch from NORM. position to EM. HT. position. Set room thermostat temperature setting above room temperature. Observe that all supplemental electric heat is energized, that indoor blower motor starts, and that emergency heat indicator bulb lights. When thermostat temperature setting is satisfied, observe that heater deenergizes and that blower motor stops; however, indicator light should remain on as long as emergency heat switch is in EM. HT. position.
5. If autochangeover thermostat P/N 34427DP115 is being used, place both SYSTEM and FAN switches in AUTO position. Observe that heat pump operates in heating mode when thermostat temperature selector is set above room temperature, and operates in cooling mode when selector is set below room temperature.

B. Checking and Adjusting Refrigerant Charge

The refrigerant system has been fully charged with R-22 refrigerant, tested, and factory-sealed. The factory charge is the correct charge for optimum performance for most installations; however, this charge may require a slight adjustment for some installations to assure full rated performance.

An operating pressure/temperature tag (also see Tables IV and V) is fastened inside the unit compressor compartment. This tag is provided so that the refrigerant charge can be evaluated by checking operating pressures and temperatures. This method of checking is sufficiently accurate to determine the adequacy of the refrigerant charge in the system when the conditions and system components are normal; however, it does not solve or fix system abnormalities. The evaluation indicates whether the refrigerant charge needs a slight increase or decrease to establish the correct operating pressures for the system at the time of checking.

The level of refrigerant operating charge determines how efficiently and economically the unit will operate. An overcharged or undercharged unit will lead to insufficient heating and cooling mode capacity, high operating costs, and the possibility of premature compressor failure.

When checking the refrigerant using the temperature/pressure evaluation method, adhere to the following criteria:

1. Check refrigerant charge in cooling mode when outdoor temperature is above 65°F.
2. Check refrigerant charge in heating mode when outdoor temperature is below 65°F.
3. For best results, do not operate unit continuously for more than 10 minutes if for any reason charge must be checked in opposite mode above or below 65°F.

Proceed as follows to evaluate the system performance and refrigerant charge level:

1. Remove caps from low- and high-pressure service fittings. See Figure 12.
2. Attach low- and high-side pressure gauge hoses to low- and high-pressure service fittings, respectively. *Hoses must have valve core depressors.* Gauges should be calibrated for accuracy.
3. Set room thermostat below room temperature to start cooling operation or above room temperature to start heating operation, depending on outdoor temperature. Allow unit to operate until conditions stabilize and pressures level out.
4. Determine and record these conditions:
   a. Low- and high-side pressure.
   b. Dry-bulb temperature of inlet air at outdoor coil.
   c. Temperature of inlet air at return-air grille—wet bulb if operating in cooling mode or dry bulb if operating in heating mode.

TABLE IV—HEATING PERFORMANCE PRESSURES

Air Temp at Indoor Coil Inlet (°F DB)	Pressure Designation (Psig)	542E024 Air Temperature at Outdoor Coil (F° DB)								542E030 Air Temperature at Outdoor Coil (°F DB)								542E036 Air Temperature at Outdoor Coil (°F DB)							
		60	50	40	30	20	10	0	−10	60	50	40	30	20	10	0	−10	60	50	40	30	20	10	0	−10
65	High Side	250	229	209	190	172	155	140	127	238	218	201	184	169	155	144	134	232	214	198	183	170	158	149	142
	Low Side	69	59	49	41	33	25	18	14	71	60	50	41	32	24	18	13	64	52	46	38	31	25	18	13
70	High Side	268	243	220	199	180	162	147	134	251	231	211	195	179	165	153	142	247	230	213	198	184	171	161	152
	Low Side	70	60	50	42	34	26	19	15	72	61	51	42	33	25	19	14	65	53	47	39	31	25	19	13
75	High Side	280	256	233	211	190	172	155	140	266	246	226	207	190	176	162	151	261	243	225	209	195	182	171	162
	Low Side	71	61	51	43	35	27	20	16	73	62	52	43	34	26	20	15	66	54	48	40	32	26	19	14

Air Temp at Indoor Coil Inlet (°F DB)	Pressure Designation (Psig)	542E042 Air Temperature at Outdoor Coil (°F DB)								542E048 Air Temperature at Outdoor Coil (°F DB)								542D060 & 542E060 Air Temperature at Outdoor Coil (°F DB)							
		60	50	40	30	20	10	0	−10	60	50	40	30	20	10	0	−10	60	50	40	30	20	10	0	−10
65	High Side	254	234	216	193	171	159	148	136	262	237	214	193	174	158	144	134	268	238	210	186	166	151	142	136
	Low Side	71	62	50	42	32	24	18	14	64	56	48	40	33	26	19	13	66	56	47	39	32	24	19	13
70	High Side	268	250	230	205	183	169	156	144	278	251	226	204	184	166	154	146	284	252	224	198	178	164	154	146
	Low Side	72	63	51	43	33	25	18	14	65	57	49	41	34	27	20	13	67	57	48	40	32	25	19	13
75	High Side	283	266	243	218	194	180	166	153	290	266	242	220	201	184	169	158	298	268	238	212	190	174	162	156
	Low Side	73	64	52	44	34	26	19	14	66	58	50	42	35	28	21	14	68	58	49	41	33	25	20	14

TABLE V—COOLING PERFORMANCE PRESSURES

Air Temp at Indoor Coil Inlet (°F WB)	Pressure Designation (Psig)	542E024 Air Temp at Outdoor Coil (°F DB)										542E030 Air Temp at Outdoor Coil (°F DB)										542E036 Air Temp at Outdoor Coil (°F DB)									
		65	70	75	80	85	90	95	100	105	110	65	70	75	80	85	90	95	100	105	110	65	70	75	80	85	90	95	100	105	110
55	High Side	157	174	190	207	224	240	258	276	293	313	150	166	181	196	212	226	246	264	282	302	182	196	211	227	242	259	276	294	312	332
	Low Side	58	59	60	61	62	63	64	66	67	68	60	62	63	65	67	69	71	73	75	77	67	69	70	72	74	75	76	78	79	81
60	High Side	162	179	195	212	228	244	261	279	296	315	153	169	185	200	216	230	250	268	286	306	185	199	215	231	246	263	280	298	316	336
	Low Side	64	65	66	67	68	69	70	71	73	74	63	65	66	68	70	72	75	77	79	81	69	71	72	74	76	77	79	80	82	83
65	High Side	168	185	200	216	232	247	264	282	298	317	157	173	188	204	220	235	255	273	291	311	188	203	219	235	251	268	285	303	321	341
	Low Side	70	71	72	73	75	76	77	78	79	80	67	69	70	72	74	76	79	81	83	85	71	73	74	76	78	80	81	83	85	86
70	High Side	173	191	206	223	239	253	270	288	304	324	160	177	192	208	224	240	259	277	295	315	192	207	223	239	255	273	290	308	326	346
	Low Side	77	78	79	80	81	82	83	84	86	87	70	72	74	76	78	80	83	85	87	89	74	76	77	79	81	83	84	86	88	89
75	High Side	175	192	209	227	242	260	278	294	315	336	164	180	196	212	228	244	264	282	300	320	196	212	228	244	260	278	296	314	332	352
	Low Side	84	85	86	87	88	90	91	93	94	95	74	76	78	80	82	84	87	89	91	93	79	81	83	84	86	88	89	91	93	95

Air Temp at Indoor Coil Inlet (°F WB)	Pressure Designation (Psig)	542E042 Air Temp at Outdoor Coil (°F DB)										542E048 Air Temp at Outdoor Coil (°F DB)										542D060 & 542E060 Air Temp at Outdoor Coil (°F DB)									
		65	70	75	80	85	90	95	100	105	110	65	70	75	80	85	90	95	100	105	110	65	70	75	80	85	90	95	100	105	110
55	High Side	165	179	192	206	222	237	254	270	289	308	178	192	207	224	238	255	272	291	308	330	176	189	202	217	233	249	266	283	300	320
	Low Side	60	62	63	65	67	68	70	72	74	75	61	62	63	65	66	68	70	72	74	76	59	61	62	63	65	67	68	70	72	74
60	High Side	169	183	196	210	226	241	258	275	293	312	183	197	212	229	243	260	277	296	314	335	180	193	207	222	237	254	270	287	305	324
	Low Side	64	66	67	69	70	72	74	75	77	79	65	66	67	69	70	72	74	76	78	80	63	65	66	67	68	70	71	73	75	77
65	High Side	173	187	201	215	231	246	263	280	298	317	188	203	218	235	249	266	283	302	320	340	185	198	212	227	242	259	275	292	310	329
	Low Side	68	69	71	73	74	76	78	79	81	83	69	70	71	73	74	76	78	80	82	84	67	69	70	71	72	74	75	76	78	80
70	High Side	177	191	205	220	235	251	268	285	303	322	193	208	223	240	254	271	288	307	326	345	191	205	219	234	250	266	283	301	319	338
	Low Side	72	73	75	77	78	80	82	83	85	87	73	74	75	77	78	80	82	84	86	88	71	73	74	75	77	79	80	81	83	85
75	High Side	181	196	210	225	240	256	273	290	308	327	198	214	229	246	260	277	294	312	332	350	198	212	227	242	258	274	292	310	328	346
	Low Side	76	77	79	81	82	84	86	87	89	91	77	78	80	81	83	84	86	88	90	92	76	77	79	80	82	84	85	87	89	91

5. Evaluate system performance and refrigerant charge level by comparing recorded readings with unit operating pressure/temperature tag.
6. When necessary, make slight adjustment to refrigerant charge. If a substantial adjustment is indicated, determine abnormal condition in system that is causing inaccurate readings, such as insufficient airflow across either or both coils.

CAUTION: If it is determined that the problem is an overcharged or undercharged unit when operating in the heating mode, the refrigerant system should be evacuated and recharged by adding the exact amount of R-22 refrigerant as shown on the unit rating plate. A volumetric charging cylinder or accurate scale should be used. When operating in the cooling mode, the operating pressure/temperature tag may be used to adjust the charge.

C. Indoor Airflow & Airflow Adjustments

Model 542D and 542E units are equipped with direct-drive blower motors. All motors have a high- and low-speed connection except for 460-V motors which have only a high-speed connection.

The system airflow for all units (except 460-V) can be changed, when necessary, by changing the blower motor speed connection from the factory setting to the unused speed connection. The factory setting is indicated on the unit wiring label.

CAUTION: The recommended airflow is 400 to 450 ft^3/min per each 12,000 Btuh of unit capacity. Inadequate airflow can cause unsatisfactory operation and performance. Certain unit/heater combinations can only be used with high speed blower operation. See electric heater information label.

Table VI shows the air delivery performance of all units at various external static pressures. Determine the airflow for the system being installed as follows:

1. Start unit and measure static pressure in duct system at unit.

TABLE VI—AIR DELIVERY (Ft³/Min) AT INDICATED EXTERNAL STATIC PRESSURE & VOLTAGE*

Model	Blower Motor Speed	Operating Voltage	Application†	External Static Pressure—Inches wc							
				0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
542E024	Low	208	Heating	880	835	790	740	690	630	565	470
			Cooling	850	810	770	725	675	615	550	465
		230	Heating	965	925	880	835	780	720	655	575
			Cooling	940	900	855	810	755	700	635	560
	High	208	Heating	1015	970	920	870	815	750	685	605
			Cooling	985	940	890	840	785	730	665	585
		230	Heating	1070	1030	985	940	885	830	765	680
			Cooling	1040	1000	955	910	855	800	735	660
542E030	Low	208	Heating	995	965	930	890	845	785	705	590
			Cooling	980	945	910	865	820	760	680	560
		230	Heating	1070	1050	1025	995	960	915	840	730
			Cooling	1055	1030	1005	970	930	880	800	680
	High	208	Heating	1165	1145	1125	1095	1065	1020	955	845
			Cooling	1150	1130	1105	1075	1035	980	900	770
		230	Heating	1260	1245	1225	1200	1165	1125	1065	970
			Cooling	1245	1225	1200	1170	1135	1080	1005	875
542E036	Low	208	Heating	1280	1235	1185	1135	1080	1020	955	875
			Cooling	1225	1185	1140	1095	1040	985	920	850
		230	Heating	1485	1435	1380	1325	1265	1200	1115	1025
			Cooling	1400	1350	1300	1250	1190	1125	1050	970
	High	208	Heating	1685	1630	1575	1510	1440	1360	1275	1160
			Cooling	1565	1510	1455	1395	1325	1250	1160	1045
		230	Heating	1850	1785	1720	1650	1575	1490	1395	1280
			Cooling	1670	1615	1560	1495	1425	1345	1250	1100
542E042	Low	208	Heating	1400	1360	1315	1265	1205	1130	1015	—
			Cooling	1370	1330	1280	1230	1165	1085	955	—
		230	Heating	1655	1610	1560	1505	1435	1360	1270	1140
			Cooling	1615	1565	1510	1450	1380	1305	1205	1050
	High	208	Heating	1895	1840	1780	1715	1645	1570	1480	1365
			Cooling	1825	1770	1710	1645	1570	1490	1395	1270
		230	Heating	2125	2065	2005	1935	1860	1775	1685	1570
			Cooling	2030	1970	1905	1835	1760	1675	1575	1440
542E048	Low	208	Heating	1690	1635	1575	1510	1440	1360	1270	1140
			Cooling	1650	1595	1535	1475	1405	1325	1230	1100
		230	Heating	1905	1855	1800	1740	1675	1600	1510	1370
			Cooling	1860	1810	1755	1690	1625	1545	1445	1290
	High	208	Heating	2005	1955	1900	1845	1780	1705	1625	1510
			Cooling	1955	1905	1850	1790	1725	1650	1560	1430
		230	Heating	2270	2195	2120	2040	1955	1870	1765	1650
			Cooling	2180	2110	2040	1960	1880	1785	1685	1570
		460	Heating	2070	2000	1925	1845	1760	1665	1560	1425
			Cooling	2000	1930	1855	1775	1690	1595	1490	1355
542E060	Low	208	Heating	1860	1850	1840	1825	1805	1770	1710	1575
			Cooling	1840	1830	1820	1800	1765	1705	1600	—
		230	Heating	2250	2205	2160	2110	2050	1990	1915	1830
			Cooling	2180	2135	2085	2030	1970	1900	1815	1700
	High	208	Heating	2355	2315	2270	2220	2165	2105	2035	1950
			Cooling	2285	2240	2190	2135	2075	2005	1920	1800
		230	Heating	2700	2625	2550	2465	2380	2285	2175	2055
			Cooling	2550	2475	2395	2315	2220	2120	2005	1860
		460	Heating	2290	2260	2225	2185	2140	2090	2025	1940
			Cooling	2240	2205	2165	2115	2065	2000	1915	1770
542D060	Low	208	Heating	1840	1825	1805	1770	1710	1585	—	—
			Cooling	1820	1800	1765	1705	1600	—	—	—
		230	Heating	2160	2110	2050	1990	1915	1830	1695	—
			Cooling	2085	2030	1970	1900	1815	1700	—	—
	High	208	Heating	2270	2225	2170	2105	2035	1950	1815	—
			Cooling	2190	2135	2075	2005	1920	1800	—	—
		230	Heating	2550	2465	2380	2285	2180	2055	1905	—
			Cooling	2395	2315	2225	2120	2010	1860	—	—
		460	Heating	2225	2185	2140	2090	2025	1940	1790	—
			Cooling	2165	2115	2065	2000	1915	1770	—	—

*Air delivery values shown for Model 542D060 are with factory-supplied air filter and plenum. Air delivery values shown for all sizes of Model 542E are without air filter.

†Heating airflow values are with a dry coil. Cooling airflow values are with a wet coil.

NOTE: Shaded portions of this table fall below 350 ft³/min per 12,000 Btuh of rated cooling capacity. Indoor coil icing may occur at airflows below this point. Dashes are used in those areas of the table that fall beyond the capability of the indoor blower motor.

2. Refer to Table VI and determine airflow at static pressure measured.

When an accessory electric heater is being used, the system airflow can also be determined by measuring the temperature rise through the unit and using the following formula:

$$\text{AIRFLOW (ft}^3\text{/min)} = \frac{\text{KW}}{\text{TR}} \times \text{Y}$$

where,
KW = Heater nominal KW at 240 or 480V
TR = Measured temperature rise
Y =

200V	208V	220V	230V	240V
		440V	460V	480V
2195	2374	2655	2902	3160

NOTE: Value Y varies with the operating voltage at the heater. Interpolate to determine the value of Y for voltages not shown.

D. Unit Controls and Safety Devices

1. *High-Pressue Relief Valve*—This valve, which is located in the compressor, opens when the pressure differential between the low and high side becomes excessive.
2. *Compressor Internal Overload*—This overload, which is located in the compressor, interrupts power to the compressor when the current and internal temperature become excessive. It automatically resets when the internal motor temperature drops to a safe level. It may require up to 60 minutes or longer for this overload to reset; therefore, if an internal overload is suspected of being open, disconnect the electrical power to the unit and check the circuit thru the overload with an ohmmeter or continuity tester.
3. *Low-Pressure Switch*—This switch with automatic reset interrupts the compressor control circuit when the refrigerant high-side pressure becomes too low. It protects the compressor from damage attributable to loss of the refrigerant charge.
4. *Time/Temperature Defrost System*—The defrost control system consists of a defrost timer, a defrost thermostat switch, and a defrost relay. The system initiates defrost cycle operation every 90 minutes if a coil icing condition exists. See the defrost cycle sequence of operation in Section VIII.
5. *Crankcase Heater*—This device prevents overdilution of compressor oil with refrigerant during shutdown periods, thereby extending the life of the compressor. See the crankcase heater sequence of operation in Section VIII.
6. *Compressor Quick-Start Components*—These components are used with all single-phase units to improve compressor starting characteristics.
7. *Outdoor Fan Thermostat*—This control, which is featured on all 3-phase units, maintains the proper cooling mode condensing temperature by switching the outdoor fan motor to high- or low-speed operation. Low-speed fan operation permits low-ambient cooling operation down to 40°F outdoor temperature.

VIII. SEQUENCE OF OPERATION

Do not leave the installation until the heat pump has been observed throughout one or two complete cycles. The installer should make certain during this time that all components are operating in correct sequence.

The sequences of operation described in this section pertain to all 208/230-volt, 3-phase units; however, the sequence of operation of single-phase and 460-volt units is very similar. Refer to the line-to-line wiring diagram in Figure 16.

NOTE: Although the actual unit wiring may vary slightly from that shown in Figure 16, the sequence of operation will not be affected. The sequences of operation described in this section pertain to a typical system using room thermostat P/N 34427DP115 or P/N 34427DP118 for system control, and using an accessory electric resistance heater for supplemental heat.

NOTE: The indoor blower motor will operate continuously, regardless of the room thermostat SYSTEM switch position, when the FAN switch is in the ON position. The ON position of the FAN switch keeps the circuit through blower relay coil 2A closed and the coil energized. When the FAN switch is in the AUTO position, the blower operates only when the system is started by the room thermostat demand for heating or cooling.

A. Crankcase Heater Operation

Compressor crankcase heater 11A is connected across normally open compressor contractor 2D contacts between 13 and 23. When electric power is supplied to the heat pump, and the unit is not operating in either the heating or cooling mode, a completed circuit between power legs L1 and L3 permits current to flow through one leg of compressor motor 3F windings and through crankcase heater 11A. The high electrical resistance of the crankcase heater causes the heater to heat up, while the compressor motor windings serve only as a means of completing the circuit between L1 and L3.

When the heat pump receives a "call" for either heating or cooling, normally open compressor contactor 2D contacts between 13 and 23 are closed. (See heating and cooling sequences of operation in this section.) Electric current, which always follows the path of least resistance, now flows through the closed contacts and through both compressor motor 3F and outdoor fan motor 3D1. The crankcase heater, which offers a much higher electrical resistance than the two motors, receives virtually no electrical current as long as the contactor is energized.

B. Cooling Operation

With the room thermostat SYSTEM switch in COOL position and the FAN switch in AUTO position, the cooling sequence of operation is as follows:

When the room temperature rises to within 2 degrees of the room thermostat temperature setting, the thermostat cooling operation bulb "makes" and thermostat terminal R is connected to thermostat terminal O. This completed circuit through the thermostat completes the circuit through unit terminal O. Reversing valve solenoid coil 5B and outdoor fan relay coil 2C are now connected across the 24-volt secondary of unit transformer 1B.

Energized solenoid coil 5B switches the reversing valve from the normal heating mode position to the cooling mode position. Energized outdoor fan relay coil 2C closes its set of normally open contacts between 1 and 3, and opens its set of normally closed contacts between 1 and 2, permitting two-speed outdoor fan motor 3D1 to operate on either high- or low-speed depending on the outdoor ambient temperature.

NOTE: When the contacts of outdoor fan relay coil 2C are in their normal heating mode positions as shown in Figure 16, fan motor 3D1 operates on high speed, regardless of the outdoor ambient temperature.

The heat pump is now in a "standby" condition and ready to operate in the cooling mode when the room thermostat "calls" for cooling.

When the room temperature rises slightly above the thermostat temperature setting, the thermostat cooling bulb "makes" and thermostat terminal R is automatically connected to thermostat terminals G and Y. These completed circuits through the thermostat connect indoor blower relay coil 2A (through unit terminal G) and compressor contactor coil 2D (through unit terminal Y) across the 24-volt sec-

ondary of unit transformer 1B.

Energized indoor blower relay coil 2A closes its set of normally open contacts between 1 and 3, completing the circuit through indoor blower motor 3D2, and the motor starts.

Energized compressor contactor coil 2D closes its normally open contacts between 13 and 23, and 11 and 21, completing the circuit through compressor motor 3F and outdoor fan motor 3D1. Both motors start instantly. The current flow through outdoor fan motor 3D1 also flows through fan switching thermostat 7K which maintains the optimum cooling mode condensing temperature by switching the fan motor to high- or low-speed operation, depending on the outdoor ambient temperature.

The heat pump is now operating in the cooling mode. The energized reversing valve is directing the high-temperature, high-pressure discharge gas to the outdoor coil where the heat is transferred to the outdoor air.

All three energized motors will continue to run and the cooling cycle will remain "on" until the room temperature falls slightly below the room thermostat temperature setting. When this point is reached, the thermostat cooling bulb will tilt and break the circuit between thermostat R to terminals G and Y. These open circuits deenergize indoor blower relay coil 2A and compressor contactor coil 2D. All closed contacts return to their normally open position and all three motors stop.

The heat pump has now returned to a "standby" condition, awaiting another "call" for cooling by the room thermostat. If the room temperature should continue to fall, the thermostat cooling operation bulb will tilt and break the circuit between thermostat terminals R and O. This open circuit deenergizes reversing valve solenoid coil 5B and outdoor fan realy coil 2C. The fan relay contacts open and the reversing valve switches to the normal heating mode position.

Except for the crankcase heater, all heat pump components are now deenergized. When the room temperature rises again and reaches the room thermostat control points, the cooling sequence will start again. If the room temperature continues to drop, the heat pump will remain "off" and the heating mode will not start until the room thermostat SYSTEM switch is moved to the HEAT position (either HEAT or AUTO when using autochangeover thermostat P/N 34427DP115).

C. Heating Operation

With the room thermostat SYSTEM switch in HEAT position and the FAN switch in AUTO position, the heating sequence of operation is as follows:

When the room temperature drops slightly below the thermostat temperature setting, the thermostat first-stage heating bulb "makes" and thermostat terminal R is connected to thermostat terminals G and Y. These completed circuits through the thermostat connect indoor blower relay coil 2A (through unit terminal G) and compressor contactor coil 2D (through unit terminal Y) across the 24-volt secondary of unit transformer 1B.

Energized indoor blower relay coil 2A closes its set of normally open contacts between 1 and 3, completing the circuit through indoor blower motor 3D2, and the motor starts.

Energized compressor contactor coil 2D closes its normally open contacts between 13 and 23, and 11 and 21, completing the circuit through compressor motor 3F and outdoor fan motor 3D1. Both motors start instantly. Outdoor fan motor 3D1 will operate on high speed regardless of the outdoor temperature because outdoor fan relay contacts 2C are in their normal heating mode positions as shown in Figure 16. In these normal positions, the line-voltage circuit to fan motor 3D1 is always to the high-speed motor windings, regardless of the switching action of fan switching thermostat 7K.

The heat pump is now operating in the heating mode. The nonenergized reversing valve is in the normal heating mode position and the high-temperature, high-pressure discharge gas is being directed to the indoor coil, where the heat is transferred to the indoor air.

All three energized motors will continue to run and the heating cycle will remain "on" until the room temperature rises slightly above the room thermostat temperature setting. If the outdoor temperature has dropped to the point where the heating capacity of the heat pump cannot maintain the desired indoor room temperature, the second-stage heating bulb will "make" when the indoor temperature continues to drop to a point slightly below the room thermostat factory differential setting. Thermostat terminal R is automatically connected to thermostat terminals W1 and W2. These completed circuits through the thermostat connect the relay coil (or coils if using a two- or three-bank heater) of the supplemental electric heater across the 24-V secondary of heat pump transformer 1B. The electric heater energizes to provide supplemental electric heat to the system.

NOTE: See the Installation Instructions packaged with the electric heater for a more comprehensive description of the electric heater sequence of operation.

When the room temperature rises slightly above the room thermostat second-stage heat setting, the second-stage heating bulb will tilt and break the circuit between thermostat terminal R to terminals W1 and W2. The supplemental electric heat deenergizes. When the room temperature continues to rise to a point slightly above the room thermostat temperature setting, the first-stage heating bulb will tilt and break the circuit between thermostat terminal R to terminals G and Y. These open circuits deenergize indoor blower relay coil 2A and compressor contactor coil 2D. All closed contacts return to their normally open position and all three motors stop.

The heat pump has now returned to a "standby" condition awaiting another "call" for heating by the room thermostat. Except for the crankcase heater, all heat pump components are now deenergized. If the room temperature continues to rise, the heat pump will remain "off" and the cooling mode will not start until the room thermostat SYSTEM switch is moved to the COOL position (either COOL or AUTO when using autochangeover thermostat P/N 34427DP115).

D. Defrost Cycle

The defrost control circuit consists of defrost timer 3M, defrost thermostat switch 7M, and defrost relay 2P. The defrost timer is factory-set for 90-minute intervals of elapsed running time, which results in optimum heating mode efficiency for most installations; however, the adjustable cam can be reset for a 30-minute interval when abnormal climatic conditions dictate. The conditions include such things as excessive outdoor humidity at low outdoor temperatures.

CAUTION: The factory-set 90-minute interval should never be adjusted unless the unit does not completely defrost after the 10-minute time-terminated defrost cycle.

With the heat pump operating in the heating mode, the defrost cycle sequence of operation is as follows:

Defrost thermostat 7M switches to the closed position when the outdoor coil refrigerant temperature drops to approximately 30°F. When defrost timer 3M completes 90 minutes of elapsed running time, a coil in the timer energizes and the normally open timer contacts between 3 and 4 for approximately 10 seconds. (The normally closed timer contacts between 3 and 5 do not open at this time, as explained later.) If defrost thermostat switch 7M has not switched close, the normally open timer contacts return to the open position and the heat pump continues to operate in the heating mode.

LEGEND

1B-Transformer
2A-Indoor Blower Relay SPST (N.O.)
2C-Outdoor Fan Relay SPDT
2D-Compressor Contactor DPST (N.O.)
2P-Defrost Relay TPDT
3D1-Outdoor Fan Motor
3D2-Indoor Blower Motor
3F-Compressor
3M-Defrost Timer
4A1-Fan Motor Capacitor
4A2-Blower Motor Capacitor
5B-Reversing Valve Solenoid
7K-Fan Switching Thermostat SPDT
7M-Defrost Thermostat Switch (N.O.)
7P-Low-Pressure Switch SPST (N.O.)
11A-Crankcase Heater

When normally open defrost timer contacts between 3 and 4 close for their 10-second interval and defrost thermostat switch 7M has switched close, the defrost control circuit is completed and defrost relay coil 2P is energized.

Energized defrost relay coil 2P switches all of its contacts and each of the following events occur simultaneously:

1. Normally open defrost relay contacts between 7 and 9 close before defrost timer 3M contacts between 3 and 4 complete their 10-second interval. The defrost control circuit is maintained and defrost relay coil 2P remains energized.
2. Normally closed defrost relay contacts between 7 amd 8 open and the circuit through outdoor fan motor 3D1 is broken. The motor stops running.
3. Normally open defrost relay contacts between 1 and 3 close, completing the circuit to reversing valve solenoid 5B. The reversing valve switches from the normal heating mode position to the cooling mode position and the hot discharge gas is directed to the outdoor coil to melt the frost on the coil.
4. Normally open defrost relay contacts between 4 and 6 close. Unit terminal R is now connected to unit terminal W1 and the first bank of supplemental electric heat is automatically energized. Terminals W1 and W2 of the room thermostat are internally connected; therefore, any additional banks of supplemental electric heat are also automatically energized.

The system is now heating the conditioned space with the supplemental heaters while the outdoor coil is defrosting. When the outdoor coil refrigerant temperature rises to approximately 67°F, defrost thermostat 7M switches to the open position to terminate the defrost cycle; however, if the defrost thermostat 7M has not terminated the defrost cycle within a 10-minute interval, normally closed timer 3M contacts between 3 and 5 automatically open and terminate the defrost cycle.

When the defrost cycle is terminated by either the defrost thermostat or the timer contacts, defrost relay 2P is deenergized. Outdoor fan motor 3D1 restarts and reversing valve solenoid 5B is deenergized. The reversing valve switches to the normal heating mode position. The supplemental electric heaters are deenergized if the room thermostat is not "calling" for second-stage heating.

The system has now returned to normal heating mode operation. After 90 minutes of elapsed running time, defrost timer 3M will automatically make another check to determine if the outdoor coil requires defrosting.

E. Emergency Heat Operation

When there is a heat pump compressor malfunction or other

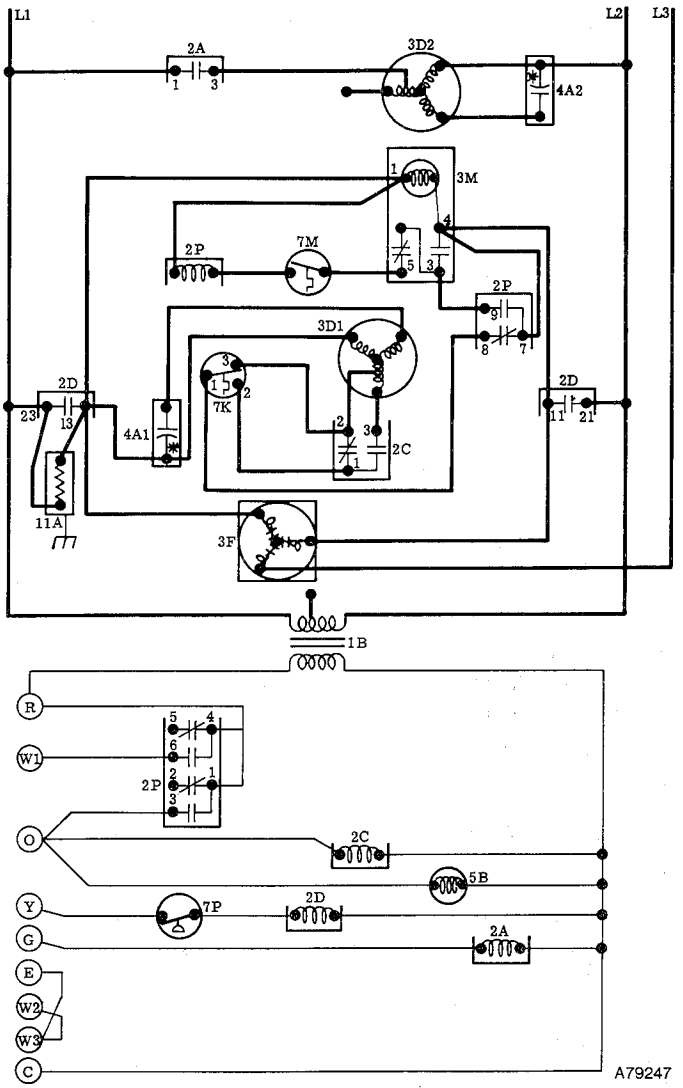

Figure 16—Typical Line-to-Line Wiring Diagram

malfunction in normal heat pump heating operation, it is desirable to deactivate the compressor control circuit and to remove the compressor from the heating system while continuing to supply the conditioned space with heat. Room thermostats P/N 34427DP115 and P/N 34427DP118, which have an emergency heat switch, are used to deactivate the compressor and are used in conjunction with the accessory supplemental electric heater to continue supplying heat. See the Installation Instructions packaged with the electric heaters for the emergency heat sequence of operation.

F. Automatic Changeover Operation

When autochangeover thermostat P/N 34427DP115 is being used, the switching from heating to cooling to heating, is automatically controlled by the room thermostat when the SYSTEM switch is in the AUTO position.

To prevent unwanted cycling between heating and cooling mode operation, the heating and cooling temperature selection levers provide for a 4°F *minimum* temperature setting differential. For most installations, this differential will probably be set closer to 10°F to comply with recommended guidelines for energy conservation.

With both the SYSTEM and FAN switches in the AUTO position, the heat pump will start operation in the heating mode when the room temperature drops to the thermostat heating temperature setting, or will start operation in the cooling mode when the room temperature rises to the thermostat cooling temperature setting.

IX. CARE AND MAINTENANCE

WARNING: A failure to follow these instructions could result in serious personal injury:

1. Disconnect all electrical power to system before performing any maintenance or service on the unit.
2. Because of possible personal injury or damage to the equipment, maintenance and/or service should be performed by qualified persons only.
3. As with any mechanical equipment, personal injury can result from sharp edges, etc.; therefore, be very careful when removing panels and parts.
4. Never place anything combustible on, in contact with, or near the unit.

To ensure continuing high performance, and to minimize possible equipment failure, it is essential that periodic maintenance be performed on this equipment. Consult your local Dealer as to the proper frequency of maintenance and the availability of a maintenance contact.

The ability to perform maintenance on this equipment requires certain mechanical skills and tools. If you do not possess these, contact your Dealer for maintenance.

The minimum maintenance that should be performed on this equipment is as follows:

1. Inspect air filter after each month of system operation. Clean or replace as required.
2. Inspect coils, drain pan, and condensate drain before each heating and cooling season for cleanliness. Clean as necessary.
3. Inspect blower motor and wheel for cleanliness and lubrication each heating and cooling season. Clean and lubricate as necessary.
4. Inspect all electrical connections for tightness and controls for proper operation each heating and cooling season. Service as necessary.

A. Air Filter

CAUTION: Do not operate the unit without having a suitable air filter in place in the return-air duct system. Always replace filter with same size and type.

Air filters should be inspected at least once each month and replaced (disposable-type) or cleaned (cleanable-type) at least twice during each heating and cooling season or whenever the filter becomes clogged with dust and lint.

Filters are not supplied as an integral part of the 542E. The field-supplied air filter may be either disposable or cleanable. Contact your Dealer if you cannot determine the location or type of air filter in your system.

Model 542D units have two factory-supplied disposable filters located in the down-discharge plenum section of the unit. The access door on the return-air inlet side of the plenum must be removed to gain access to the filters. See Figure 4. When clogged with dirt or lint, these filters should be replaced with the same size and type.

B. Lubrication

The outdoor fan motor and indoor blower are prelubricated for 2 years of heavy duty or 5 years of normal duty. When lubrication is necessary, call your Dealer for service.

C. Indoor and Outdoor Coils

WARNING: Be sure all electrical power to the system is turned OFF before cleaning coils.

The unit top cover must be removed to gain access to the coils. The outdoor fan motor leads must be disconnected in the unit control box before lifting the cover, and reconnected in accordance with the unit wiring label after replacing the top cover.

The coils are easily cleaned when they are dry; therefore, they should be inspected and cleaned before each cooling season, and inspected periodically during the year.

If the coils are coated with dirt or lint, they should be vacuumed with a vacuum cleaner soft brush attachment. Be careful not to bend the fins. If the coils are coated with oil or grease, they can be cleaned with a mild detergent and water solution. Rinse coils with clear water, using a garden hose. Be careful not to splash water on motors, insulation, wiring, or filters. For best results, spray outdoor fins from inside to outside the unit. On units with an outer and inner outdoor coil, be sure to clean between coils. Be sure to flush all dirt and debris from the unit base, from the condensate drain pan located under the indoor coil, and from the condensate drain line.

D. Condensate Drain

The drain pan and condensate drain should be checked at the same time the coils are checked. Clean the pan and drain pan and condensate drain by removing all foreign matter from the pan. Flush pan and drain tube with clear water. Be careful not to splash water on insulation, motor, wiring, or air filter. If the drain tube is restricted, it can generally be cleared with high-pressure water. If this does not work, try a "plumber's snake" or similar probe device.

E. Indoor Blower

WARNING: Be sure all electrical power to the unit is turned off before servicing the blower.

The blower should be inspected at least once each year. Remove caked-on dirt from the blower wheel and housing with a brush; remove grease with a mild solvent. Make sure the blower is centered in the blower housing. Be careful not to disturb balance weights.

F. Outdoor Fan

WARNING: Be sure all electrical power to the unit is off before servicing the fan. Do not poke sticks, screwdrivers, or any other object into revolving fan blades—severe bodily injury may result.

The fan should be kept free of all obstructions to ensure proper operation. Do not set articles on top of unit that could possibly interfere with the airflow of the fan.

Each year the fan blades should be inspected for cracks or bends. The blades should clear the motor by no more than 1/4 inch. If the blade assembly has slipped down the motor shaft, adjust the fan position on the motor shaft by loosening the setscrew(s) and moving the blade assembly up. Be sure the setscrew(s) is on the flat of the motor shaft before tightening.

G. Electrical Controls and Wiring

WARNING: Be sure all electrical power to the unit and the heaters (if used) is turned off.

NOTE: When an accessory supplemental electrical heater is being used in the system, there may be a separate electrical supply to the heater.

With power disconnected to the unit, check all electrical connections for tightness. Tighten all screws on connections. If any smoky or burned connections are noticed, disassemble the connections, clean all parts, strip the wire, and reassemble properly and securely. Electrical controls are difficult to check without proper instrumentation; therefore, reconnect electrical power to the unit and observe the unit through one complete operating cycle. If there are any discrepancies in the operating cycle, contact your Dealer and request service.

H. Refrigerant Circuit

The refrigerant circuit is difficult to check for leaks without proper equipment; therefore, if inadequate performance is suspected, contact your local Dealer for service.

TABLE VII—TROUBLESHOOTING CHART—HEATING CYCLE

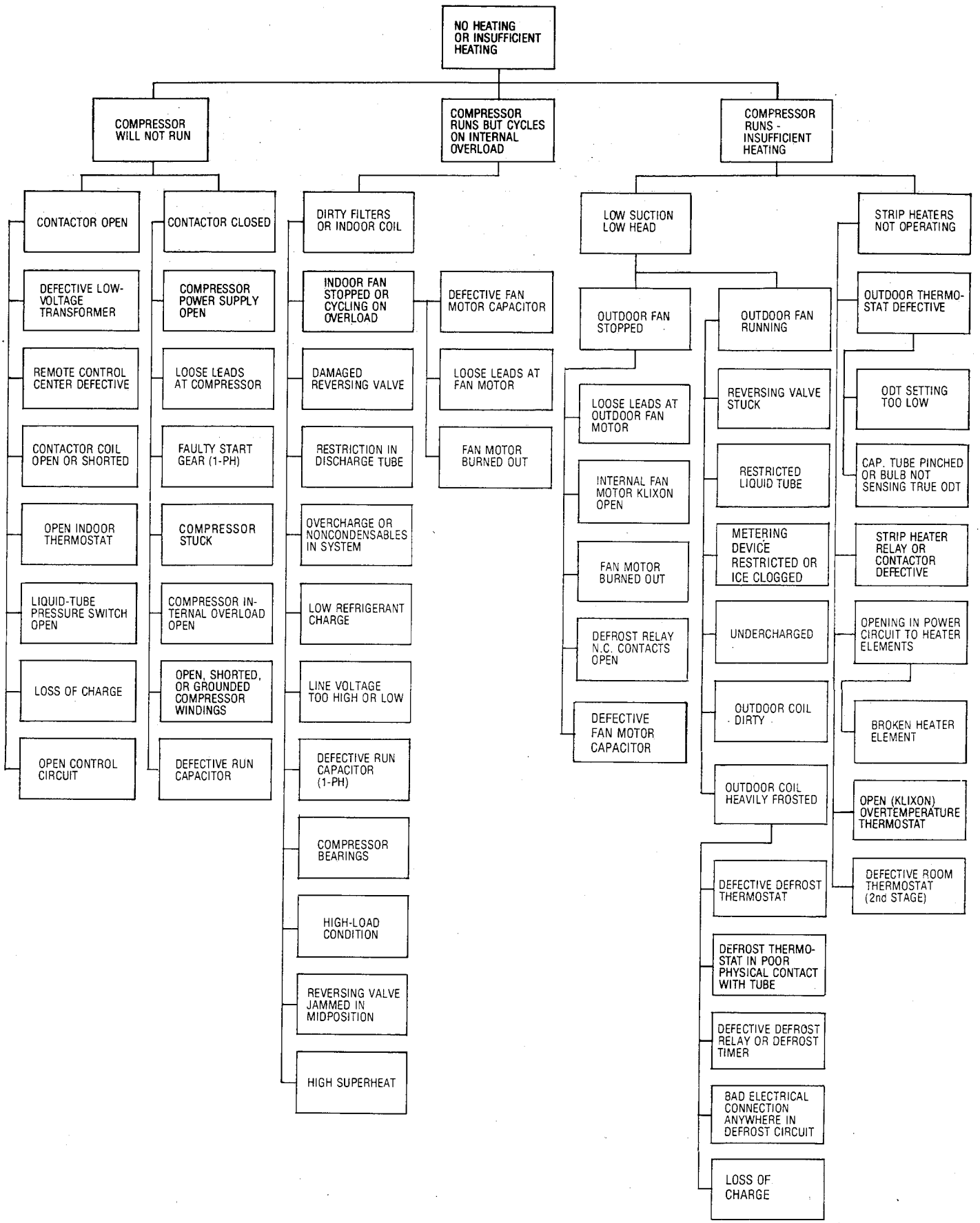

TABLE VIII—TROUBLESHOOTING CHART—COOLING CYCLE