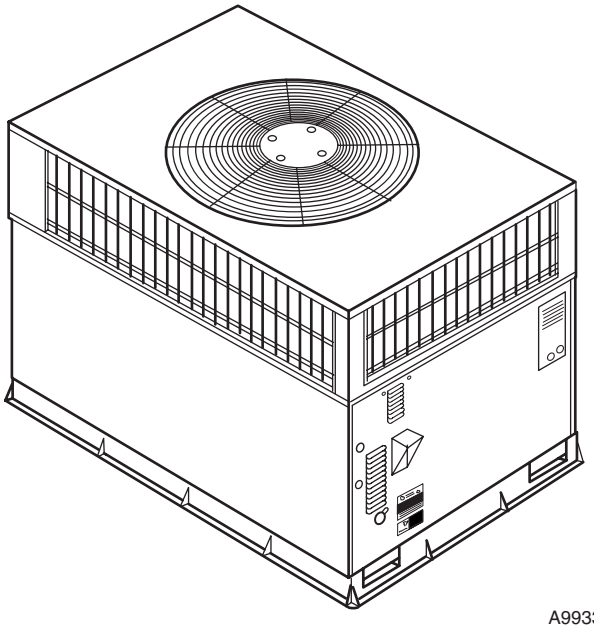
Visit www.carrier.com

Installation, Start-Up, and Operating Instructions
Size 024-060

NOTE: Read the entire instruction manual before starting the installation.

TABLE OF CONTENTS



A99338

Fig. 1—Unit 48SD (Low NO_x Model Available)

NOTE TO INSTALLER — Before the installation, READ THESE INSTRUCTIONS CAREFULLY AND COMPLETELY. Also, make sure the User's Manual and Replacement Guide are left with the unit after installation. The furnace is NOT to be used for temporary heating of buildings or structures under construction.

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags, and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

⚠ WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK AND CARBON MONOXIDE POISONING HAZARD

Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, fire, or an explosion which can result in personal injury or unit damage. Consult a qualified installer, service agency, or gas supplier for information or assistance. The qualified installer or agency must use only factory-authorized kits or accessories when modifying this product.

⚠ WARNING

FIRE, EXPLOSION AND ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Before performing service or maintenance operations on unit, turn off gas supply to unit. *Then* turn off unit main power switch and install lockout tag. Electrical shock or explosion could cause serious injury or death.

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in serious injury or death. WARNING signifies a hazard which **could** result in serious injury or death. CAUTION is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.

INTRODUCTION

The 48SD unit (See Fig. 1) is fully self-contained, combination Category I gas heating/electric cooling units designed for outdoor installation (See Fig. 2 and 3 for unit dimensions). All unit sizes have return and discharge openings for both horizontal and downflow configurations, and are factory shipped with all downflow duct openings covered. Units may be installed either on a rooftop, a cement slab, or directly on the ground if local codes permit (See Fig. 4 for roof curb dimensions).

Models with an N in the fifth position of the model number are dedicated Low NO_x units designed for California installations.

These models meet the California maximum oxides of nitrogen (NO_x) emissions requirements of 40 nanograms/joule or less as shipped from the factory and must be installed in California Air Quality Management Districts or any other regions in North America where a Low NO_x rule exists.

RECEIVING AND INSTALLATION

Step 1—CHECK EQUIPMENT

IDENTIFY UNIT

The unit model number and serial number are stamped on unit identification plate. Check this information against shipping papers and job data. Verify unit voltage and amperage requirements listed on unit rating plate agree with power supply provided to unit.

INSPECT SHIPMENT

Inspect for shipping damage while unit is still on shipping pallet. If unit appears to be damaged or is torn loose from its anchorage, have it examined by transportation inspectors before removal. Forward claim papers directly to transportation company. Manufacturer is not responsible for any damage incurred in transit.

Check all items against shipping list. Immediately notify the nearest distributor if any item is missing.

To prevent loss or damage, leave all parts in original packages until installation.

INSTALLATION

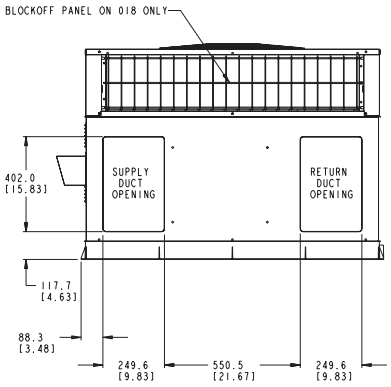
1. Remove unit from shipping carton. Leave top shipping skid on the unit as a spreader bar to prevent the rigging straps from damaging the unit. If the wood skid is not available, use a spreader bar of sufficient length to protect unit from damage.
2. Position the lifting bracket assembly around the base of the unit. Be sure the strap does not twist.
3. Place each of the 4 metal lifting brackets into the rigging holds in the composite pan.
4. Thread lifting bracket strapping around bottom perimeter of unit as follows:
   a. Open lever of tension buckle (ratchet type).
   b. Feed strapping through tension buckle as shown in Fig. 7A.
   c. Pull strapping through tension buckle unit taut.
   d. Snap lever down to lock strap in tension buckle. To release strapping, squeeze safety latch, lift lever, and pull webbing outward.
5. Tighten the tension buckle until it is taut. Lifting brackets must be secure in the rigging holds.
6. Attach field-supplied clevis or hook of sufficient strength to hole in the lifting bracket (See Fig. 7B).
7. Attach the 2 safety straps directly to the clevis or hook at the 4 rigging brackets. **DO NOT** attach the safety straps to the lifting brackets (See Fig. 7B).
8. Position lifting point directly over the unit's center of gravity.
9. Lift unit. When unit is directly over the roof curb, remove the 2 safety straps. Lower the equipment onto the roof curb.

Step 2—PROVIDE UNIT SUPPORT

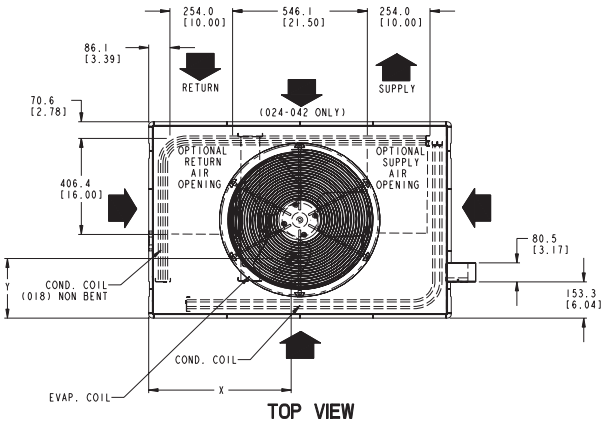
ROOF CURB

Install accessory roof curb in accordance with instructions shipped with curb (See Fig. 4 for roof curb dimensions). Install insulation, cant strips, roofing, and flashing. Ductwork must be attached to curb.

IMPORTANT: The gasketing of the unit to the roof curb is critical for a watertight seal. Install gasketing material supplied with the roof curb. Improperly applied gasketing can also result in air leaks and poor unit performance.



REAR VIEW



TOP VIEW

REQUIRED CLEARANCE TO COMBUSTIBLE MATL.
(Refer to Maximum Operating Clearances)

	INCHES [mm]
TOP OF UNIT	14.00 [355.6]
DUCT SIDE OF UNIT	2.00 [50.8]
SIDE OPPOSITE DUCTS	14.00 [355.6]
BOTTOM OF UNIT	0.50 [12.7]

NEC. REQUIRED CLEARANCES.

	INCHES [mm]
BETWEEN UNITS, POWER ENTRY SIDE	42.00 [1066.8]
UNIT AND UNGROUNDED SURFACES, POWER ENTRY SIDE	36.00 [914.0]
UNIT AND BLOCK OR CONCRETE WALLS AND OTHER GROUNDED SURFACES, POWER ENTRY SIDE	42.00 [1066.8]

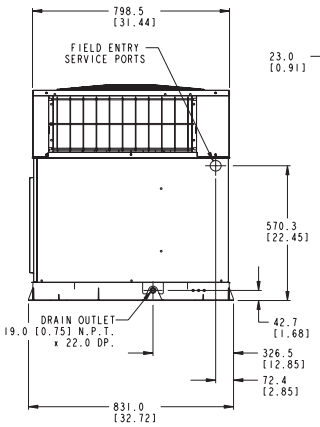
REQUIRED CLEARANCE FOR OPERATION AND SERVICING

	INCHES [mm]	
EVAP. COIL ACCESS SIDE	36.00 [914.0]	
POWER ENTRY SIDE	42.00 [1066.8]	
(EXCEPT FOR NEC REQUIREMENTS)		
UNIT TOP	48.00 [1219.2]	
SIDE OPPOSITE DUCTS	36.00 [914.0]	
DUCT PANEL	12.00 [304.8]	*

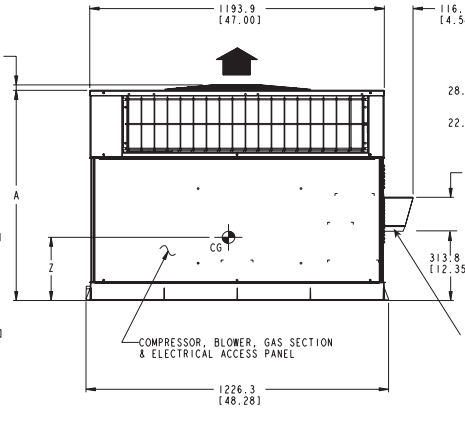
*MINIMUM DISTANCES: IF UNIT IS PLACED LESS THAN 12.00 [304.8] FROM WALL SYSTEM, THEN SYSTEM PERFORMANCE MAYBE COMPROMISE.

LEGEND
CG - Center of Gravity
COND - Condensor
EVAP - Evaporator
NEC - National Electrical Code
REQ'D - Required

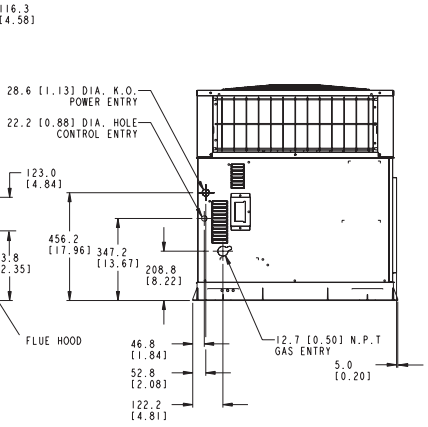
NOTE: Dimensions are in in. [mm]



LEFT SIDE VIEW



FRONT VIEW

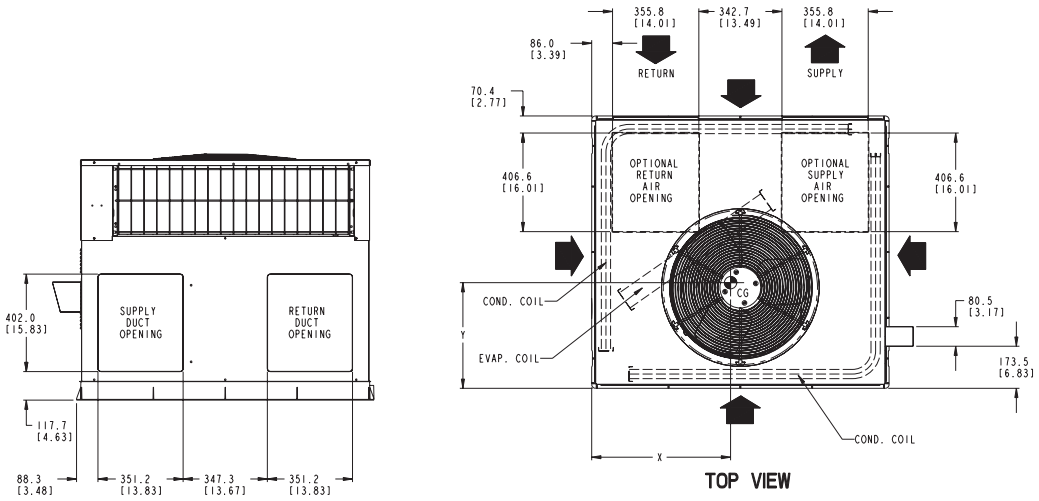


RIGHT SIDE VIEW

A05166

UNIT	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		UNIT HEIGHT IN. (MM) "A"	CENTER OF GRAVITY IN. (MM)		
		lb	kg		X	Y	Z
48SD024040/060	208/230-1-60	343.0	156.0	39.02 (991.0)	20.0 (508.0)	19.3 (490.0)	17.6 (447.0)
48SD030040/060	208/230-1-60	366.0	166.0	41.02 (1042.0)	20.0 (508.0)	14.0 (356.0)	13.0 (330.0)

Fig. 2—48SD024-030 Unit Dimensions



REQUIRED CLEARANCE TO COMBUSTIBLE MAT'L.
(Refer to Maximum Operating Clearances)

	INCHES [mm]
TOP OF UNIT	14.00 [355.6]
DUCT SIDE OF UNIT	2.00 [50.8]
SIDE OPPOSITE DUCTS	14.00 [355.6]
BOTTOM OF UNIT	0.50 [12.7]

NEC. REQUIRED CLEARANCES.

	INCHES [mm]
BETWEEN UNITS, POWER ENTRY SIDE	42.00 [1066.8]
UNIT AND UNGROUNDED SURFACES, POWER ENTRY SIDE	36.00 [914.0]
UNIT AND BLOCK OR CONCRETE WALLS AND OTHER GROUNDED SURFACES, POWER ENTRY SIDE	42.00 [1066.8]

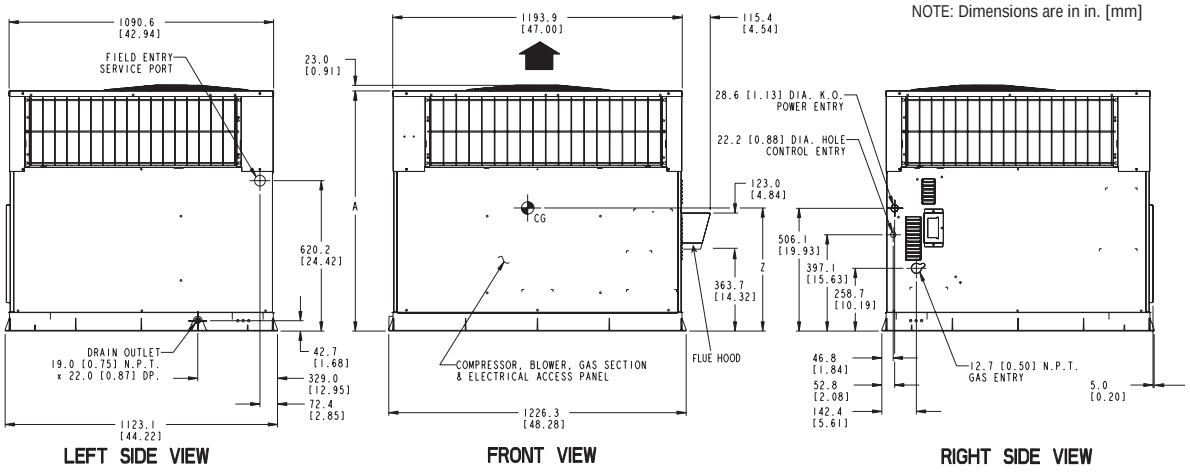
REQUIRED CLEARANCE FOR OPERATION AND SERVICING

	INCHES [mm]
EVAP. COIL ACCESS SIDE	36.00 [914.0]
POWER ENTRY SIDE	42.00 [1066.8]
(EXCEPT FOR NEC REQUIREMENTS)	
UNIT TOP	48.00 [1219.2]
SIDE OPPOSITE DUCTS	36.00 [914.0]
DUCT PANEL	12.00 [304.8] *

*MINIMUM DISTANCES: IF UNIT IS PLACED LESS THAN 12.00 [304.8] FROM WALL SYSTEM, THEN SYSTEM PERFORMANCE MAYBE COMPROMISE.

LEGEND
CG - Center of Gravity
COND - Condensor
EVAP - Evaporator
NEC - National Electrical Code
REQ'D - Required

NOTE: Dimensions are in in. [mm]



A05142

UNIT	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		UNIT HEIGHT IN. (MM) "A"	CENTER OF GRAVITY IN. (MM)		
		lb	kg		X	Y	Z
48SD036060/090	208/230-1-60	433.0	196.0	42.98 (1092.0)	21.0 (533.0)	20.5 (520.0)	16.6 (422.0)
48SD042060/090	208/230-1-60	460.0	209.0	46.98 (1193.0)	21.0 (533.0)	20.5 (520.0)	17.1 (434.0)
48SD048090/115/130	208/230-1-60	480.0	218.0	46.98 (1193.0)	21.0 (533.0)	20.0 (508.0)	17.4 (442.0)
48SD060090/115/130	208/230-1-60	492.0	223.0	46.98 (1193.0)	21.0 (533.0)	20.0 (508.0)	17.6 (447.0)

Fig. 3—48SD036-060 Unit Dimensions

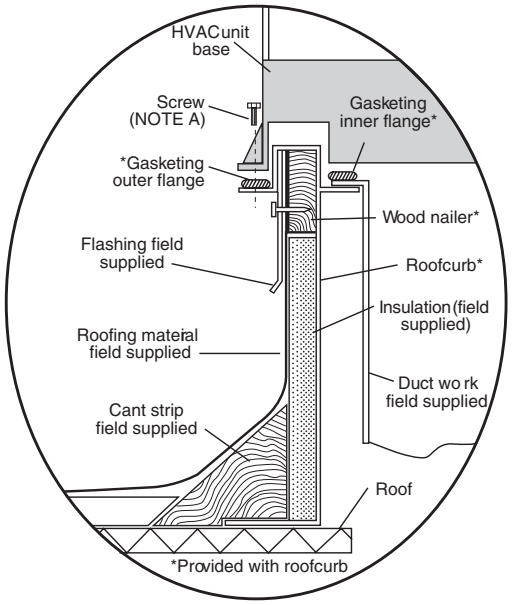
Curb should be level to within 1/4 in. This is necessary for unit drain to function properly. Refer to accessory roof curb installation instructions for additional information as required.

GROUND MOUNT

The unit may be installed either on a slab or placed directly on the ground if local codes permit. Place the unit on level ground prepared with gravel for condensate discharge.

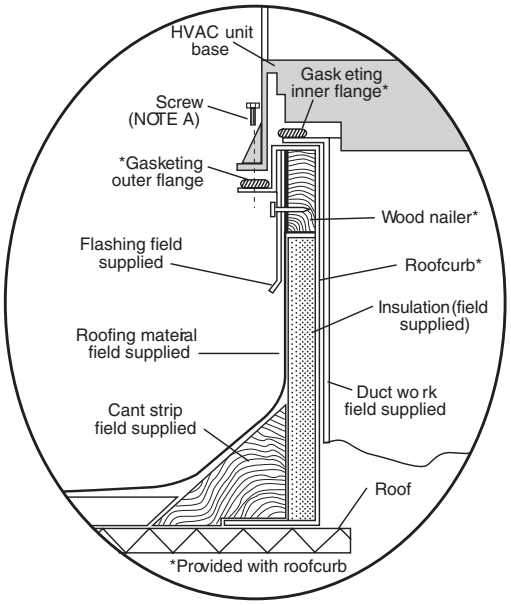
SLAB MOUNT

Place the unit on a solid, level concrete pad that is a minimum of 4 in. thick with 2 in. above grade. The slab should be flush on the compressor end of the unit (to allow condensate drain installation) and should extend 2 in. on the three remaining sides of the unit (See Fig. 6). Do not secure the unit to the slab *except* when required by local codes.



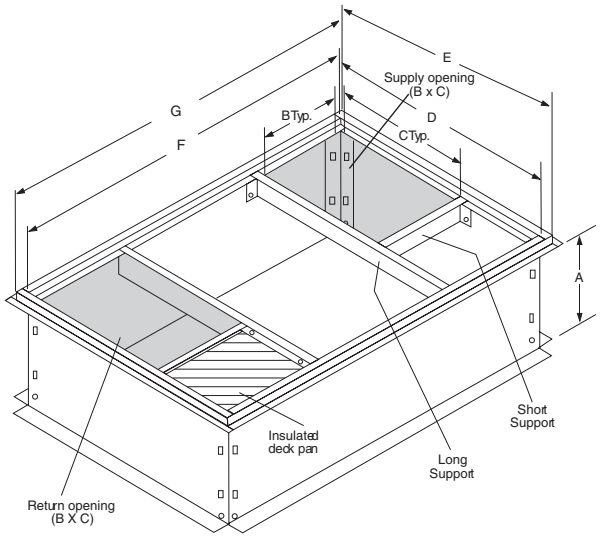
Roof Curb for Small Cabinet

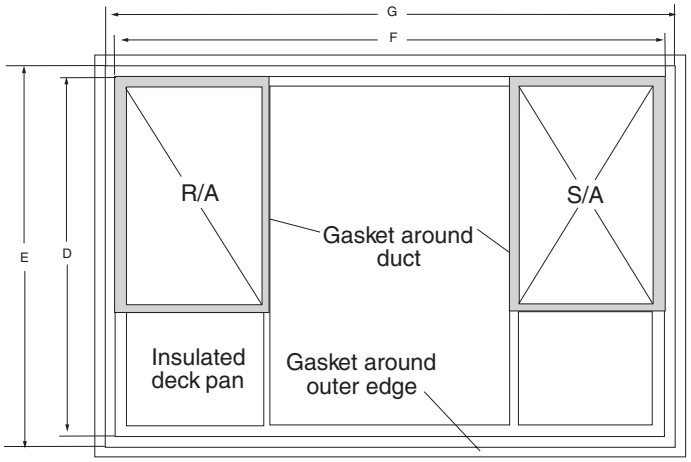
Note A: When unit mounting screw is used, retainer bracket must also be used.



Roof Curb for Large Cabinet

Note A: When unit mounting screw is used, retainer bracket must also be used.



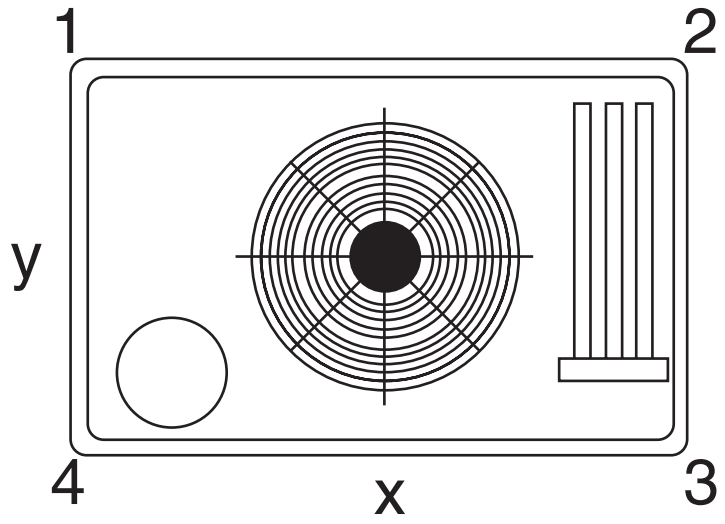


A05165

UNIT SIZE	ODS CATALOG NUMBER	A IN. (MM)	B IN. (MM)	C IN. (MM)	D IN. (MM)	E IN. (MM)	F IN. (MM)	G IN. (MM)
48SD024-030	CPRFCURB006A00	8 (203)	11(279)	161/2 (419)	28-3/4 (730)	30-3/8 (771)	44-5/16 (1126)	45-15/16 (1167)
	CPRFCURB007A00	14 (356)	11(279)	161/2 (419)	28-3/4 (730)	30-3/8 (771)	44-5/16 (1126)	45-15/16 (1167)
48SD036-060	CPRFCURB008A00	8 (203)	16 3/16 (411)	17 3/8 (441)	40-1/4 (1022)	41-15/16 (1065)	44-7/16 (1129)	46-1/16 (1169)
	CPRFCURB009A00	14 (356)	16 3/16 (411)	17 3/8 (441)	40-1/4 (1022)	41-15/16 (1065)	44-7/16 (1129)	46-1/16 (1169)

NOTES:
1. Roof curb must be set up for unit being installed.
2. Seal strip must be applied, as required, to unit being installed.
3. Dimensions in ( ) are in millimeters.
4. Roof curb is made of 16-gage steel.
5. Table lists only the dimensions, per part number, that have changed.
6. Attach ductwork to curb (flanges of duct rest on curb).
7. Insulated panels: 1-in. thick fiberglass 1 lb density.
8. Dimensions are in inches.
9. When unit mounting screw is used (see Note A), a retainer bracket must be used as well. This bracket must also be used when required by code for hurricane or seismic conditions. This bracket is available through Micrometl.

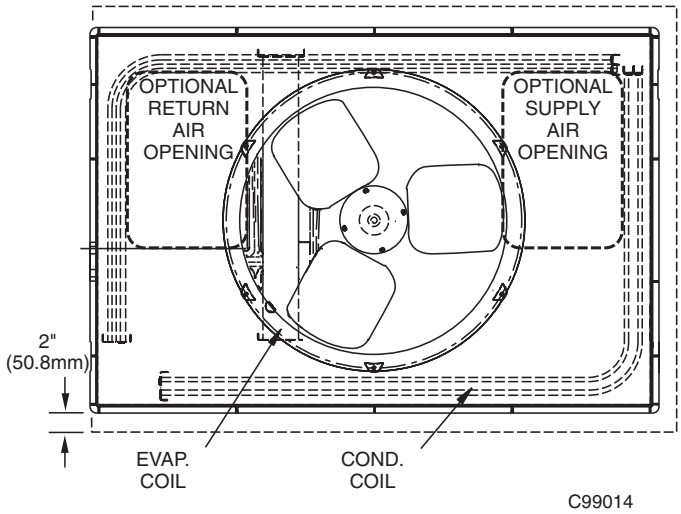
Fig. 4—Roof Curb Dimensions



C00070

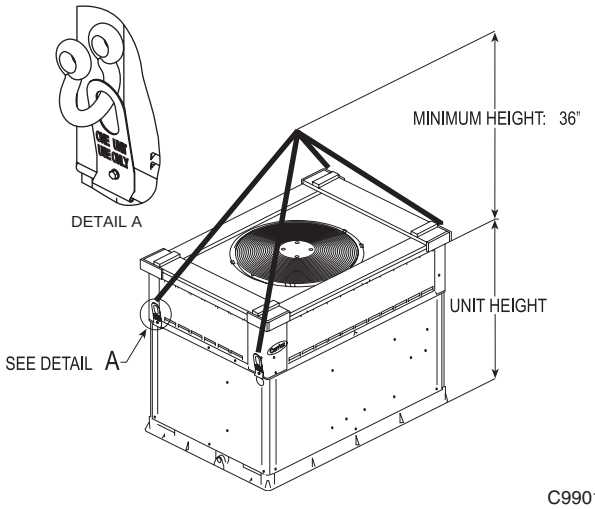
CORNER #	48SD					
	024	030	036	042	048	060
1	69	74	87	93	97	99
2	53	57	68	72	74	76
3	83	88	104	111	116	119
4	138	147	174	184	193	198
TOTAL WEIGHT	343	366	433	460	480	492

Fig. 5—48SD Unit Corner Weights (in Pounds)



C99014

Fig. 6—Slab Mounting Details



C99015

SIZE	MAXIMUM WEIGHT		A		B	
	lb	kg	in.	mm	in.	mm
UNIT 48SD						
024	372	169	20.0	508.0	19.3	490.2
030	395	179	20.0	508.0	14.0	355.6
036	462	210	21.0	533.4	20.5	520.7
042	489	222	21.0	533.4	20.5	520.7
048	509	231	21.0	533.4	20.0	508.0
060	521	236	21.0	533.4	20.0	508.0

Fig. 7—Suggested Rigging

Step 3—FIELD FABRICATE DUCTWORK

Secure all ducts to roof curb and building structure on vertical discharge units. *Do not connect ductwork to unit.* For horizontal applications, unit is provided with flanges on the horizontal openings. Installation of flexible duct connector is recommended to prevent transmission of vibration and /or noise to structure. All ductwork should be secured to the flanges. Insulate and weather-proof all external ductwork, joints, and roof openings with counter flashing and mastic in accordance with applicable codes.

Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier.

If a plenum return is used on a vertical unit, the return should be ducted through the roof deck to comply with applicable fire codes.

A minimum clearance is not required around ductwork. Cabinet return-air static shall not exceed -.25 in. wg.

Step 4—PROVIDE CLEARANCES

The required minimum operating and service clearances are shown in Fig. 2 and 3. Adequate combustion, ventilation and condenser air must be provided in accordance with section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code ANSI (American National Standards Institute) Z223.1 or applicable provisions of local building code. In Canada, follow sections 7.2,

Table 1 —Physical Data—Unit 48SD

UNIT SIZE 48SD	024040	024060	030040	030060	036060	036090	042060	042090
NOMINAL CAPACITY (ton)	2	2	2½	2½	3	3	3½	3½
OPERATING WEIGHT (lb.)	343	343	366	366	433	433	460	460
COMPRESSORS Quantity	Scroll 1							
REFRIGERANT (R-22) Quantity (lb.)	7.8	7.8	8.4	8.4	10.9	10.9	10.9	10.9
REFRIGERANT METERING DEVICE	Accurater							
Orifice ID (in.)	.065	.065	.070	.070	.080	.080	.088	.088
CONDENSER COIL Rows...Fins/in. Face Area (sq ft)	2...21 11.9	2...21 11.9	2...21 13.6	2...21 13.6	2...21 15.5	2...21 15.5	2...21 19.4	2...21 19.4
CONDENSER FAN Nominal Cfm Diameter (in.) Motor Hp (Rpm)	2700 22 1/8 (825)	2700 22 1/8 (825)	2700 22 1/8 (825)	2700 22 1/8 (825)	2800 22 1/8 (825)	2800 22 1/8 (825)	2800 22 1/8 (825)	2800 22 1/8 (825)
EVAPORATOR COIL Rows...Fins/in. Face Area (sq ft)	3...17 3.7	3...17 3.7	3...17 3.7	3...17 3.7	3...17 4.7	3...17 4.7	3...17 4.7	3...17 4.7
EVAPORATOR BLOWER Nominal Airflow (Cfm) Size (in.) Motor Hp (Rpm)	800 10 X 10 1/3 (1050)	800 10 X 10 1/3 (1050)	1000 10 X 10 1/3 (1050)	1000 10 X 10 1/3 (1050)	1200 11 X 10 1/2 (1000)	1200 11 X 10 1/2 (1000)	1400 11 X 10 1/2 (1075)	1400 11 X 10 1/2 (1075)
FURNACE SECTION* Burner Orifice No. (Qty...Drill Size) Natural Gas Burner Orifice No. (Qty...Drill Size) Propane Gas	2...44 2...50	2...38 2...46	2...44 2...50	2...38 2...46	2...38 2...46	3...38 3...46	2...38 2...46	3...38 3...46
RETURN-AIR FILTERS (in.)† Throwaway	20 X 24 X 1				24 X 36 X 1			

* Based on altitude of 0 to 2000 ft.

† Required filter sizes shown are based on the larger of the ARI (Air Conditioning and Refrigeration Institute) rated cooling airflow or the heating airflow velocity of 300 ft/minute for high-capacity type. Air filter pressure drop for non-standard filters must not exceed 0.08 in. wg.

7.3, or 7.4 or Can/CGA. (Canadian Gas Association) B149 Installation Codes or applicable provisions of local building code.

⚠ CAUTION

OPERATIONAL HAZARD

Failure to follow this caution may result in unit component damage.

Do not restrict condenser airflow. An air restriction at either the outdoor-air inlet or the fan discharge can be detrimental to compressor life.

The condenser fan pulls air through the condenser coil and discharges it through the top cover. Be sure that the fan discharge does not recirculate to the condenser coil. Do not locate the unit in either a corner or under an overhead obstruction. The minimum clearance under a partial overhang (such as a normal house overhang) is 48-in. above the unit top. The maximum horizontal extension of a partial overhang must not exceed 48-in.

Do not place the unit where water, ice, or snow from an overhang or roof will damage or flood the unit. Do not install the unit on carpeting, tile, or other combustible materials. The unit may be installed on wood flooring or on Class A, B, or C roof covering materials.

Step 5—RIG AND PLACE UNIT

⚠ CAUTION

PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in property damage.

When installing the unit on a rooftop, be sure the roof will support the additional weight.

Use spreader bars or crate top when rigging the unit. The units must be rigged for lifting (See Fig. 7). Refer to Table 1 for operating weight. *Use extreme caution to prevent damage when moving the unit. Unit must remain in an upright position during all rigging and moving operations.*The unit must be level within 1/4" for proper condensate drainage; therefore, the ground-level pad or accessory roof curb must be level before setting the unit in place. When a field-fabricated support is used, be sure that the support is level and properly supports the unit. Lifting point should be directly over the center of gravity for the unit.

Step 6—CONNECT CONDENSATE DRAIN

NOTE: When installing condensate drain connection be sure to comply with local codes and restrictions.

Model 48SD disposes of condensate water through a 3/4 in. NPT fitting which exits through the compressor access panel (See Fig. 2 and 3 for location).

Condensate water can be drained directly onto the roof in rooftop installations (where permitted) or onto a gravel apron in ground-level installations. Install a field-supplied condensate trap at end of condensate connection to ensure proper drainage. Make sure that the outlet of the trap is at least 1 in. lower than the drain pan

Table 1—Physical Data—Unit 48SD (Continued)

UNIT SIZE 48SD	048090	048115	048130	060090	060115	060130
NOMINAL CAPACITY (ton)	4	4	4	5	5	5
OPERATING WEIGHT (lb.)	480	480	480	492	492	492
COMPRESSORS Quantity	Scroll 1					
REFRIGERANT (R-22) Quantity (lb.)	12.3	12.3	12.3	12.0	12.0	12.0
REFRIGERANT METERING DEVICE	Accurater					
Orifice ID (in.)	.088	.088	.088	.101	.101	.101
CONDENSER COIL Rows...Fins/in. Face Area (sq ft)	2...21 19.4	2...21 19.4	2...21 19.4	2...21 19.4	2...21 19.4	2...21 19.4
CONDENSER FAN Nominal Cfm Diameter (in.) Motor Hp (Rpm)	3300 22 ¼ (1100)	3300 22 ¼ (1100)	3300 22 ¼ (1100)	3300 22 ¼ (1100)	3300 22 ¼ (1100)	3300 22 ¼ (1100)
EVAPORATOR COIL Rows...Fins/in. Face Area (sq ft)	4...15 4.7	4...15 4.7	4...15 4.7	4...15 4.7	4...15 4.7	4...15 4.7
EVAPORATOR BLOWER Nominal Airflow (Cfm) Size (in.) Motor Hp (Rpm)	1600 11 X 10 1/2 (1075)	1600 11 X 10 1/2 (1075)	1600 11 X 10 1/2 (1075)	1750 11 X 10 1.0 (1040)	1750 11 X 10 1.0 (1040)	1750 11 X 10 1.0 (1040)
FURNACE SECTION* Burner Orifice No. (Qty...Drill Size) Natural Gas Burner Orifice No. (Qty...Drill Size) Propane Gas	3...38 3...46	3...33 3...42	3...31 3...41	3...38 3...46	3...33 3...42	3...31 3...41
RETURN-AIR FILTERS (in.)† Throwaway	24 X 36 X 1					

* Based on altitude of 0 to 2000 ft.

† Required filter sizes shown are based on the larger of the ARI (Air Conditioning and Refrigeration Institute) rated cooling airflow or the heating airflow velocity of 300 ft/minute for high-capacity type. Air filter pressure drop for non-standard filters must not exceed 0.08 in. wg.

condensate connection to prevent the pan from overflowing (See Fig. 8). Prime the trap with water. When using a gravel apron, make sure it slopes away from the unit.

If the installation requires draining the condensate water away from the unit, install a 2-in. trap at the condensate connection to ensure proper drainage (See Fig. 8). Make sure that the outlet of the trap is at least 1 in. lower than the drainpan condensate connection. This prevents the pan from overflowing.

Prime the trap with water. Connect a drain tube – using a minimum of 3/4-in. PVC or 3/4-in. copper pipe (all field-supplied) – at the outlet end of the 2-in. trap. Do not undersize the tube. Pitch the drain tube downward at a slope of at least 1-in. for every 10 ft of horizontal run. Be sure to check the drain tube for leaks.

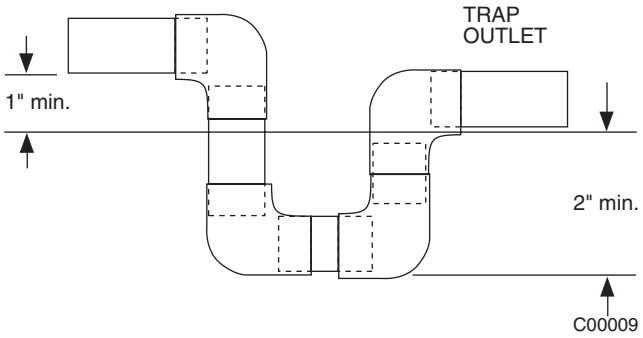


Fig. 8—Condensate Trap

Step 7—INSTALL FLUE HOOD

The flue assembly is secured and shipped in the return air duct. Remove duct cover to locate the assembly (See Fig. 10A).

NOTE: Dedicated low NO_x models MUST be installed in California Air Quality Management Districts where a Low NO_x rule exists.

These models meet the California maximum oxides of nitrogen (NO_x) emissions requirements of 40 nanograms/joule or less as shipped from the factory.

NOTE: Low NO_x requirements apply only to natural gas installations.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury or death.

The venting system is designed to ensure proper venting. The flue hood assembly must be installed as indicated in this section of the unit installation instructions.

Install the flue hood as follows:

1. This installation must conform with local building codes and with the National Fuel Gas Code (NFGC), ANSI Z223.1 (in Canada, CAN/CGA B149.1, and B149.2) or NFPA (National Fire Protection Association) latest revision. Refer to Provincial and local plumbing or wastewater codes and other applicable local codes.
2. Remove flue hood from shipping location (inside the blower compartment). Place vent cap assembly over flue panel. Orient screw holes in vent cap with holes in the flue panel.
3. Secure flue hood to flue panel by inserting a single screw on the right side and the left side of the hood.

Table 2—Maximum Gas Flow Capacity*

NOMINAL IRON PIPE, SIZE (IN.)	INTERNAL DIAMETER (IN.)	LENGTH OF PIPE, FT†													
		10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/2	.622	175	120	97	82	73	66	61	57	53	50	44	40	—	—
3/4	.824	360	250	200	170	151	138	125	118	110	103	93	84	77	72
1	1.049	680	465	375	320	285	260	240	220	205	195	175	160	145	135
1-1/4	1.380	1400	950	770	600	580	530	490	460	430	400	360	325	300	280
1-1/2	1.610	2100	1460	1180	990	900	810	750	690	650	620	550	500	460	430

* Capacity of pipe in cu ft of gas per hr for gas pressure of 0.5 psig or less. Pressure drop of 0.5-in. wg (based on a 0.60 specific gravity gas). Refer to Table C-4, National Fire Protection Association NFPA 54.

† This length includes an ordinary number of fittings.

Step 8—INSTALL GAS PIPING

The gas supply pipe enters the unit through the access hole provided. The gas connection to the unit is made to the 1/2-in. FPT gas inlet on the manual shutoff or gas valve.

Install a gas supply line that runs to the heating section. Refer to Table 2 and the NFGC for gas pipe sizing. *Do not use cast-iron pipe*. It is recommended that a black iron pipe is used. Check the local utility for recommendations concerning existing lines. Size gas supply piping for 0.5 in. wg maximum pressure drop. *Never use pipe smaller than the 1/2-in. FPT gas inlet on the unit gas valve.*

For natural gas applications, the gas pressure at unit gas connection must not be less than 4.0 in. wg or greater than 13 in. wg while the unit is operating. For propane applications, the gas pressure must not be less than 7.0 in. wg or greater than 13 in. wg at the unit connection.

An 1/8-in. NPT plugged tapping, accessible for test gage connection, must be installed immediately upstream of the gas supply connection to the gas valve.

When installing the gas supply line, observe local codes pertaining to gas pipe installations. Refer to the NFGC ANSI Z223.1-1988 NFPA latest edition (in Canada, CAN/CGA B149.1, (2)-M86). In the absence of local building codes, adhere to the following pertinent recommendations:

1. Avoid low spots in long runs of pipe. Grade all pipe 1/4 in. in every 15 ft to prevent traps. Grade all horizontal runs downward to risers. Use risers to connect to heating section and to meter.
2. Protect all segments of piping system against physical and thermal damage. Support all piping with appropriate straps, hangers, etc. Use a minimum of one hanger every 6 ft. For pipe sizes larger than 1/2 in., follow recommendations of national codes.
3. Apply joint compound (pipe dope) sparingly and only to male threads of joint when making pipe connections. Use only pipe dope that is resistant to action of liquefied petroleum gases as specified by local and/or national codes. *Never use Teflon tape.*
4. Install sediment trap in riser leading to heating section (See Fig. 9). This drip leg functions as a trap for dirt and condensate.

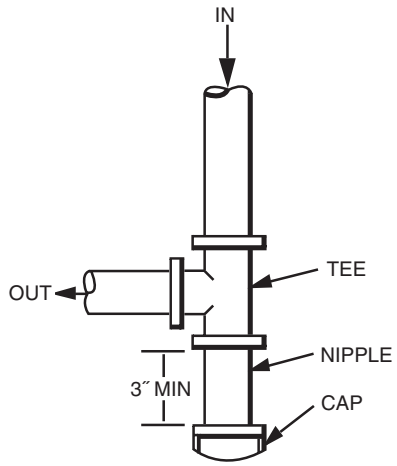


Fig. 9—Sediment Trap

5. Install an accessible, external, manual main shutoff valve in gas supply pipe within 6 ft of heating section.

6. Install ground-joint union close to heating section between unit manual shutoff and external manual main shut-off valve.
7. Pressure-test all gas piping in accordance with local and national plumbing and gas codes before connecting piping to unit.

NOTE: Pressure test the gas supply system *after* the gas supply piping is connected to the gas valve. The supply piping must be disconnected from the gas valve during the testing of the piping systems when test pressure is in excess of 0.5 psig. Pressure test the gas supply piping system at pressures equal to or less than 0.5 psig. The unit heating section must be isolated from the gas piping system by closing the external main manual shutoff valve and slightly opening the ground-joint union.

⚠ WARNING

FIRE OR EXPLOSION HAZARD
Failure to follow this warning could result in fire, explosion, personal injury, death and/or property damage.
-Connect gas pipe to unit using a backup wrench to avoid damaging gas controls.
-Never purge a gas line into a combustion chamber. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections.
-Use proper length of pipe to avoid stress on gas control manifold.
-If a flexible connector is required or allowed by authority having jurisdiction, black iron pipe shall be installed at furnace gas valve and extend a minimum of 2 in. outside furnace casing.
-If codes allow a flexible connector, always use a new connector. Do not use a connector which has previously serviced another gas appliance.

8. Check for gas leaks at the field-installed and factory-installed gas lines after all piping connections have been completed. Use soap-and-water solution (or method specified by local codes and/or regulations).

Step 9—INSTALL DUCT CONNECTIONS

The unit has duct flanges on the supply- and return-air openings on the side and bottom of the unit. For downshot applications, the ductwork connects to the roof curb (See Fig. 2 and 3 for connections sizes and locations).

CONFIGURING UNITS FOR DOWNFLOW (VERTICAL) DISCHARGE

⚠ WARNING

ELECTRICAL SHOCK HAZARD
Failure to follow this warning could result in personal injury or death.
Before performing service or maintenance operations on the system, turn off main power to unit.

1. Open all electrical disconnects before starting any service work.
2. Remove return duct cover located on duct panel by breaking connecting tabs with screwdriver and a hammer (See Fig. 10A & 10B).
3. To remove supply duct cover, break front and right side connecting tabs with a screwdriver and a hammer. Push louver down to break rear and left side tabs (See Fig. 10A & 10B).
4. If unit ductwork is to be attached to vertical opening flanges on the unit composite base (jackstand applications only), do so at this time.

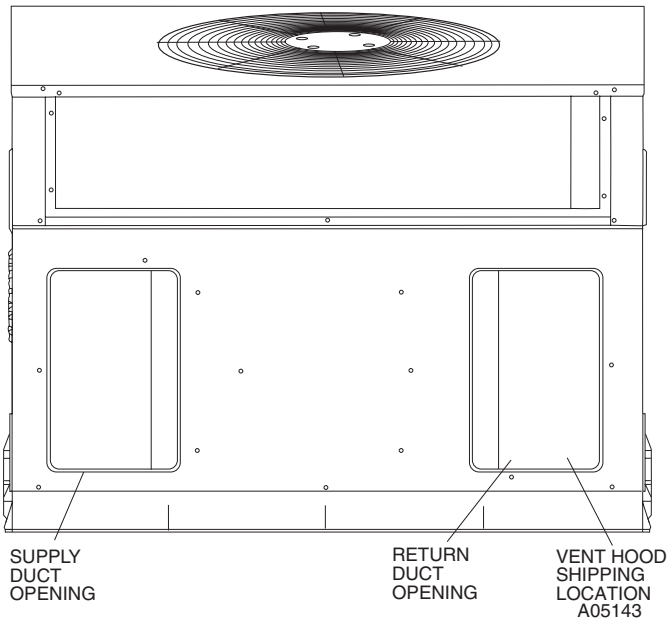


Fig. 10A Supply and Return Duct Opening

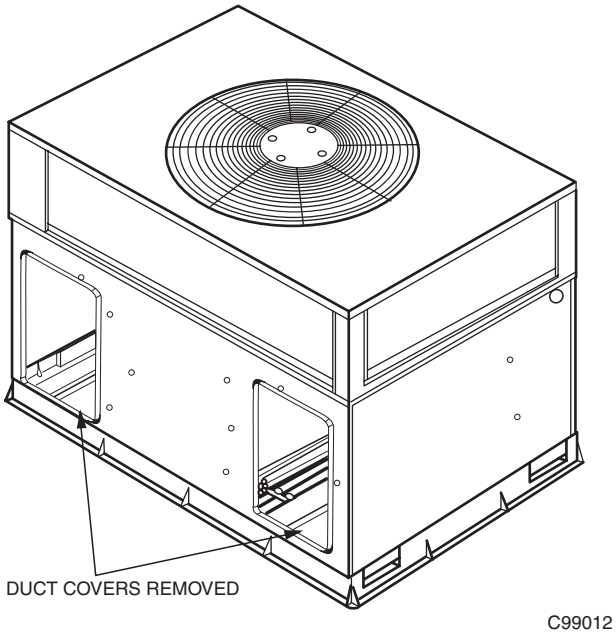


Fig. 10B—Vertical Duct Cover Removed

⚠ CAUTION

PROPERTY DAMAGE HAZARD
Failure to follow this caution may result in property damage.
Collect ALL screws that were removed. **Do not** leave screws on rooftop as permanent damage to the roof may occur.

5. It is recommended that the unit base insulation around the perimeter of the vertical return-air opening be secured to the unit base with aluminum tape. Applicable local codes may require aluminum tape to prevent exposed fiberglass.
6. Cover both horizontal duct openings with the duct covers from the accessory duct cover kit. Ensure opening is air- and watertight.
7. After completing unit conversion, perform all safety checks and power up unit.

NOTE: The design and installation of the duct system must be in accordance with the standards of the NFPA for installation of

nonresidence-type air conditioning and ventilating systems, NFPA 90A or residence-type, NFPA 90B; and/or local codes and ordinances.

Adhere to the following criteria when selecting, sizing, and installing the duct system:

1. Units are shipped for horizontal duct installation (by removing duct covers).
2. Select and size ductwork, supply-air registers, and return-air grilles according to American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) recommendations.
3. Use flexible transition between rigid ductwork and unit to prevent transmission of vibration. The transition may be screwed or bolted to duct flanges. Use suitable gaskets to ensure weathertight and airtight seal.
4. All units must have field-supplied filters or accessory filter rack installed in the return-air side of the unit. Recommended sizes for filters are shown in Table 1.
5. Size all ductwork for maximum required airflow (either heating or cooling) for unit being installed. Avoid abrupt duct size increases or decreases or performance may be affected.
6. Adequately insulate and weatherproof all ductwork located outdoors. Insulate ducts passing through unconditioned space, and use vapor barrier in accordance with latest issue of Sheet Metal and Air Conditioning Contractors National Association (SMACNA) and Air Conditioning Contractors of America (ACCA) minimum installation standards for heating and air conditioning systems. Secure all ducts to building structure.
7. Flash, weatherproof, and vibration-isolate all openings in building structure in accordance with local codes and good building practices.

Step 10—INSTALL ELECTRICAL CONNECTIONS

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

The unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of serious injury if an electrical fault should occur. This ground may consist of an electrical wire connected to the unit ground lug in the control compartment, or conduit approved for electrical ground when installed in accordance with NEC (National Electrical Code) ANSI/NFPA (latest edition) and local electrical codes. In Canada, follow Canadian Electrical Code CSA (Canadian Standards Association) C22.1 and local electrical codes.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow these precautions may result in damage to the unit being installed:

1. Make all electrical connections in accordance with NEC ANSI/NFPA (latest edition) and local electrical codes governing such wiring. In Canada, all electrical connections must be in accordance with CSA standard C22.1 Canadian Electrical Code Part 1 and applicable local codes. Refer to unit wiring diagram.
2. Use only *copper* conductor for connections between field-supplied electrical disconnect switch and unit. DO NOT USE ALUMINUM WIRE.
3. Be sure that high-voltage power to unit is within operating voltage range indicated on unit rating plate.
4. Do not damage internal components when drilling through any panel to mount electrical hardware, conduit, etc. Consult local power company for correction of improper voltage and/or phase imbalance.

HIGH-VOLTAGE CONNECTIONS

The unit must have a separate electrical service with a field-supplied, waterproof, disconnect switch mounted at, or within sight from, the unit. Refer to the unit rating plate for maximum fuse/circuit breaker size and minimum circuit amps (ampacity) for wire sizing (See Table 3 for electrical data).

The field-supplied disconnect switch box may be mounted on the unit over the high-voltage inlet hole when the standard power and low-voltage entry points are used (See Fig. 2 and 3 for acceptable location).

See unit wiring label and Fig. 11 for reference when making high voltage connections. Proceed as follows to complete the high-voltage connections to the unit.

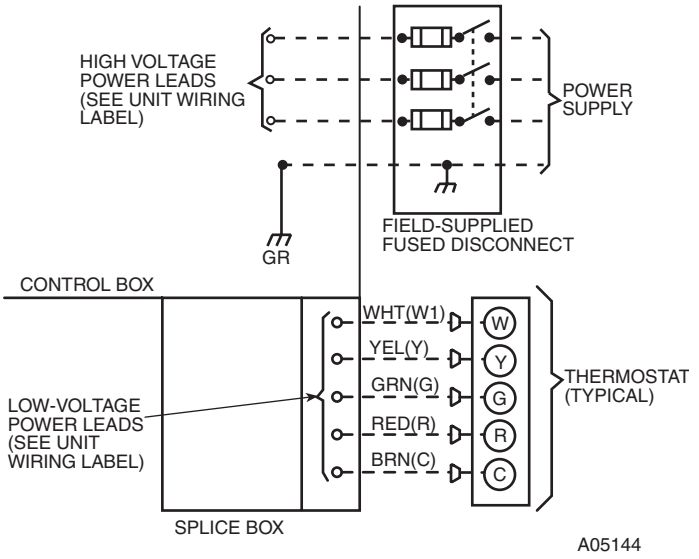


Fig. 11—High- and Control-Voltage Connections

Single phase units:

1. Run the high-voltage (L1, L2) and ground leads into the control box.
2. Connect ground lead to chassis ground connection.
3. Connect L1 to pressure lug connection 11 of the compressor contactor.
4. Connect L2 to pressure lug connection 23 of the compressor contactor.

Table 3—Electrical Data—Unit 48SD

UNIT SIZE 48SD	V-PH-HZ	VOLTAGE RANGE		COMPRESSOR		OUTDOOR FAN MOTOR	INDOOR FAN MOTOR	POWER SUPPLY	
		Min	Max	RLA	LRA	FLA	FLA	MCA	Max Fuse or Ckt Bkr
024	208/230–1–60	187	253	10.9	54.0	0.9	2.0	16.5/16.5	20/20
030	208/230–1–60	187	253	14.0	72.5	0.9	2.0	20.4/20.4	25/25
036	208/230–1–60	187	253	16.0	88.0	0.9	3.1	24.0/24.0	30/30
042	208/230–1–60	187	253	18.4	104.0	0.9	4.1	28.0/28.0	35/35
048	208/230–1–60	187	253	18.3	109.0	1.5	4.1	28.5/28.5	35/35
060	208/230–1–60	187	253	25.0	148.0	1.5	6.2	39.0/39.0	50/50

LEGEND

FLA — Full Load Amps
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
RLA — Rated Load Amps

NOTES:
1. In compliance with NEC (National Electrical Code) requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be Power Supply fuse. The CGA (Canadian Gas Association) units may be fuse or circuit breaker.
2. Minimum wire size is based on 60 C copper wire. If other than 60 C wire is used, or if length exceeds wire length in table, determine size from NEC.

C99024

Table 3—Legend

SPECIAL PROCEDURES FOR 208-V OPERATION

⚠ WARNING

FIRE, EXPLOSION AND ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Before making any wiring changes, **make sure** the gas supply is switched off first. *Then* switch off the power supply to the unit and install lockout tag.

CONTROL VOLTAGE CONNECTIONS

Do not use any type of power-stealing thermostat. Unit control problems may result.

Use no. 18 American Wire Gage (AWG) color-coded, insulated (35 C minimum) wires to make the control voltage connections between the thermostat and the unit. If the thermostat is located more than 100 ft from the unit (as measured along the control voltage wires), use no. 16 AWG color-coded, insulated (35 C minimum) wires.

Standard Connection

Remove knockout hole located in the flue panel adjacent to the control access panel (See Fig. 2 and 3). Remove the rubber grommet from the installer's packet (included with unit) and install grommet in the knockout opening. Provide a drip loop before running wire through panel.

Run the low-voltage leads from the thermostat, through the inlet hole, and into unit low-voltage splice box.

Locate five 18-gage wires leaving control box. These low-voltage connection leads can be identified by the colors red, green, yellow, brown, and white (See Fig. 11). Ensure the leads are long enough to be routed into the low-voltage splice box (located below right side of control box). Route leads through hole in bottom of control box and make low-voltage connections (See Fig. 11). Secure all cut wires, so that they do not interfere with operation of unit.

HEAT ANTICIPATOR SETTING

The room thermostat heat anticipator must be properly adjusted to ensure proper heating performance. Set the heat anticipator, using an ammeter between the W and R terminals to determine the exact required setting.

NOTE: For thermostat selection purposes, use 0.18 amp for the approximate required setting. Failure to make a proper heat anticipator adjustment will result in improper operation, discomfort to the occupants of the conditioned space, and inefficient energy utilization; however, the required setting may be changed slightly to provide a greater degree of comfort for a particular installation.

TRANSFORMER PROTECTION

The *transformer* is of the energy-limiting type. It is set to withstand a 30-sec. overload or shorted secondary condition.

PRE-START-UP

⚠ WARNING

FIRE, EXPLOSION AND ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

1. Follow recognized safety practices and wear protective goggles when checking or servicing refrigerant system.
2. Do not operate compressor or provide any electric power to unit unless compressor terminal cover is in place and secured.
3. Do not remove compressor terminal cover until all electrical sources are disconnected.
4. Relieve and recover all refrigerant from system before touching or disturbing anything inside terminal box if refrigerant leak is suspected around compressor terminals.
5. Never attempt to repair soldered connection while refrigerant system is under pressure.
6. Do not use torch to remove any component. System contains oil and refrigerant under pressure. To remove a component, wear protective goggles and proceed as follows:
   a. Shut off gas supply and *then* electrical power to unit.
   b. Relieve and recover all refrigerant from system using both high- and low-pressure ports.
   c. Cut component connecting tubing with tubing cutter and remove component from unit.
   d. Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

Proceed as follows to inspect and prepare the unit for initial startup:

1. Remove access panel.

2. Read and follow instructions on all WARNING, CAUTION, and INFORMATION labels attached to, or shipped with, unit.
3. Make the following inspections:
   a. Inspect for shipping and handling damages such as broken lines, loose parts, disconnected wires, etc.
   b. Inspect for oil at all refrigerant tubing connections and on unit base. Detecting oil generally indicates a refrigerant leak.
   c. Leak test all refrigerant tubing connections using electronic leak detector, halide torch, or liquid-soap solution. If a refrigerant leak is detected, see the *Check for Refrigerant Leaks* section.
   d. Inspect all field- and factory-wiring connections. Be sure that connections are completed and tight.
   e. Ensure wires do not contact refrigerant tubing or sharp sheet metal edges.
   f. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.
4. Verify the following conditions:

⚠ WARNING

FIRE, EXPLOSION HAZARD
Failure to follow this warning could result in personal injury, death and/or property damage.
Do not purge gas supply into the combustion chamber. Do not use a match or other open flame to check for gas leaks.

   a. Make sure gas line is free of air. Before lighting the unit for the first time, perform the following with the gas valve in the ''OFF'' position:
      If the gas supply pipe was not purged before connecting the unit, it will be full of air. It is recommended that the ground joint union be loosened, and the supply line be allowed to purge until the odor of gas is detected. Never purge gas lines into a combustion chamber. Immediately upon detection of gas odor, retighten the union. Allow 5 minutes to elapse, then light unit.
   b. Make sure that condenser-fan blade is correctly positioned in fan orifice. Leading edge of condenser-fan blade should be 1/2 in. maximum from fan orifice venturi.
   c. Ensure fan hub is 1/8 in. maximum from motor housing (See Fig. 12).

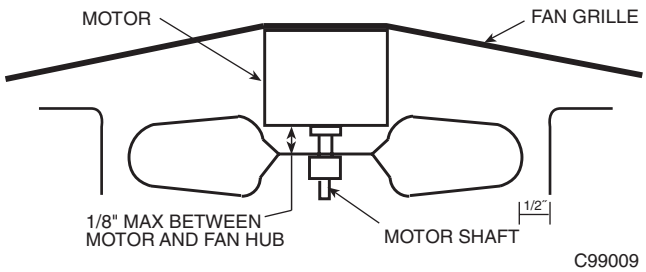


Fig. 12—Fan Blade Clearance

   d. Make sure that air filter(s) is in place.
   e. Make sure that condensate drain trap is filled with water to ensure proper drainage.
   f. Make sure that all tools and miscellaneous loose parts have been removed.

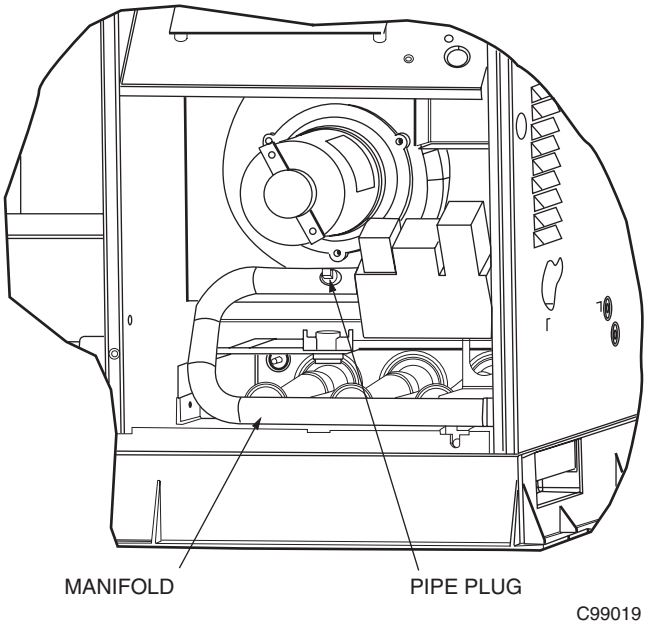


Fig. 13—Burner Assembly

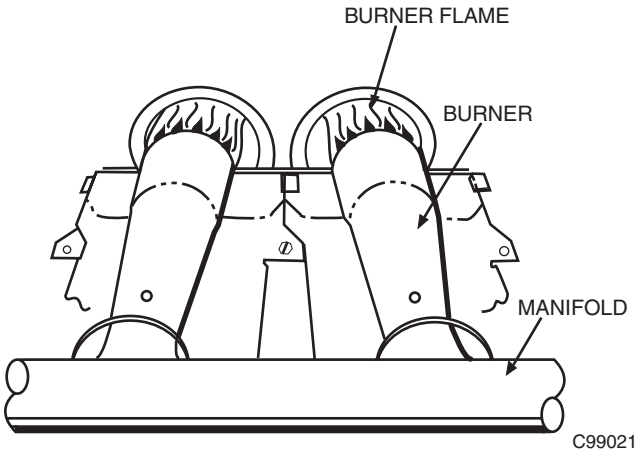


Fig. 14—Monoport Burner

START-UP

Step 1—CHECK FOR REFRIGERANT LEAKS

Proceed as follows to locate and repair a refrigerant leak and to charge the unit:

1. Locate leak and make sure that refrigerant system pressure has been relieved and reclaimed from both high- and low-pressure ports.
2. Repair leak following Refrigerant Service procedures.

NOTE: Install a filter drier whenever the system has been opened for repair.

3. Add a small charge of R-22 refrigerant vapor to system and leak-test unit.
4. Recover refrigerant from refrigerant system and evacuate to 500 microns if additional leaks are not found.
5. Charge unit with R-22 refrigerant, using a volumetric-charging cylinder or accurate scale. *Refer to unit rating plate for required charge.* Be sure to add extra refrigerant to compensate for internal volume of filter drier.

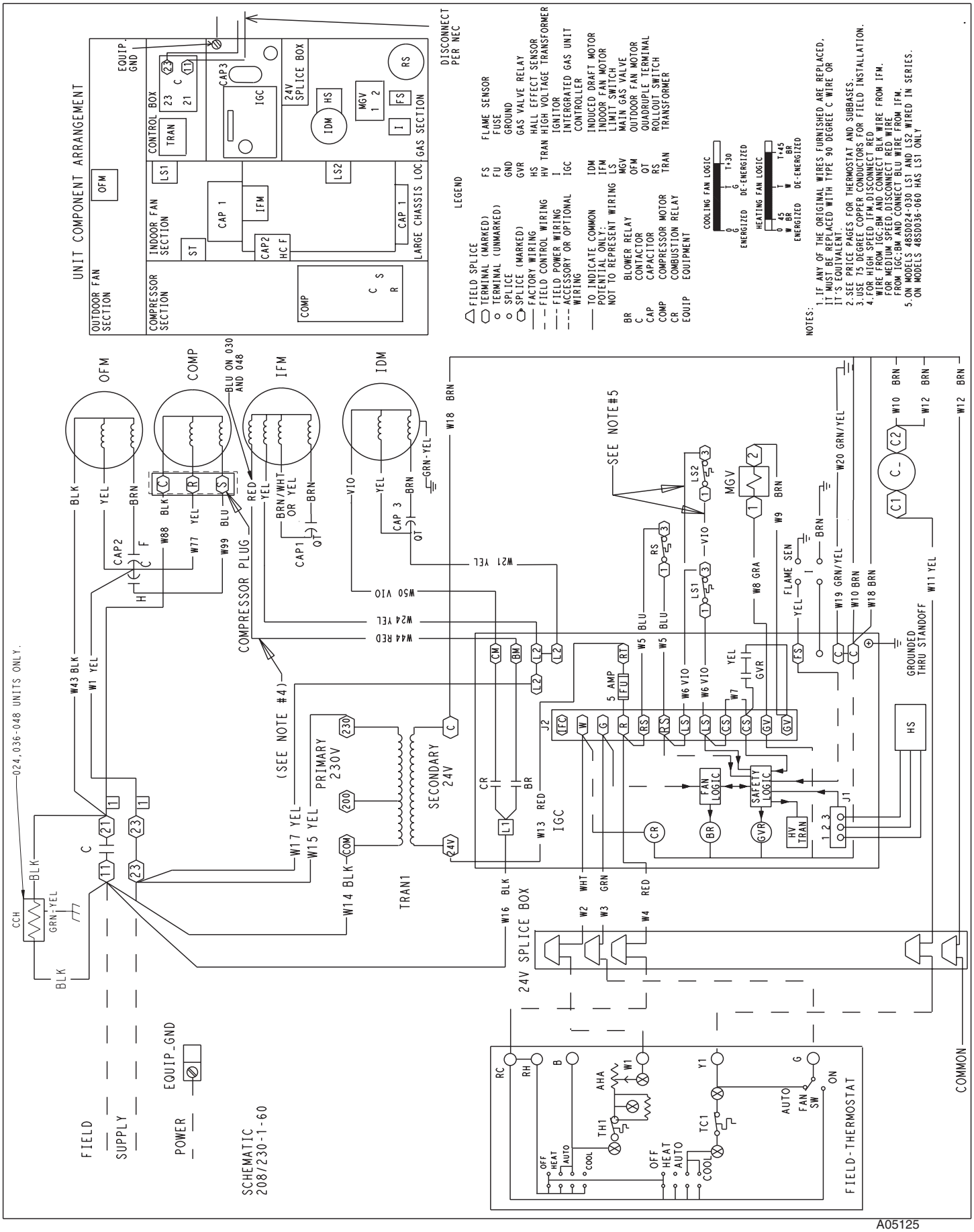


Fig. 15—208/230-1-60 Wiring Diagram, Units 48SD

Table 4—Heating Inputs

HEATING INPUT (BTUH)*	NUMBER OF ORIFICES	GAS SUPPLY PRESSURE (IN. WG)				MANIFOLD PRESSURE (IN. WG)	
		Natural		Propane†			
		Min	Max	Min	Max	Natural	Propane†
40,000	2	4.0	13.0	4.0	13.0	3.5	3.5
60,000	2	4.0	13.0	4.0	13.0	3.5	3.5
90,000	3	4.0	13.0	4.0	13.0	3.5	3.4
115,000	3	4.0	13.0	4.0	13.0	3.5	3.7
130,000	3	4.0	13.0	4.0	13.0	3.5	3.5

* When a unit is converted to propane, different size orifices must be used. See separate, natural-to-propane conversion kit instructions.
† Based on altitudes from sea level to 2000 ft above sea level. For altitudes above 2000 ft, reduce input rating 4 percent for each additional 1000 ft above sea level. In Canada, from 2000 ft above sea level to 4500 ft above sea level, derate the unit 10 percent.

Step 2—START-UP HEATING AND MAKE ADJUSTMENTS

⚠ CAUTION

UNIT OPERATION HAZARD
Failure to follow this caution may result in improper unit operation.
Complete the required procedures given in the *Pre-Start-Up* section before starting the unit.

Do not jumper any safety devices when operating the unit.

Make sure that burner orifices are properly aligned. Unstable operation may occur when the burner orifices in the manifold are misaligned.

Follow the lighting instructions on the heating section operation label (located inside the burner or blower access door) to start the heating section.

NOTE: Make sure that gas supply has been purged, and that all gas piping has been checked for leaks.

CHECK HEATING CONTROL

Start and check the unit for proper heating control operation as follows (see furnace lighting instructions located inside burner or blower access panel):

1. Place room thermostat SYSTEM switch in the HEAT position and the fan switch is placed in AUTO position.
2. Set the heating temperature control of the thermostat above room temperature.
3. The induced-draft motor will start.
4. After a call for heating, the main burner should light within 5 sec. If the burners do not light, there is a 22-sec. delay before another 5-sec. try. If the burners still do not light, this sequence is repeated. If the burners do not light within 15 minutes from the initial call for heat, there is a lockout. To reset the control, break the 24-v power to W.
5. The evaporator fan will turn on 45 sec. after the flame has been established. The evaporator fan will turn off 45 sec. after the thermostat has been satisfied.

CHECK GAS INPUT

Check gas input and manifold pressure after unit start-up (See Table 4). If adjustment is required proceed as follows:

- The rated gas inputs shown in Table 4 are for altitudes from sea level to 2000 ft above sea level. These inputs are based on natural gas with a heating value of 1050 Btu/ft^3 at 0.65 specific gravity, or propane gas with a heating value of 2500 Btu/ft^3 at 1.5 specific gravity.
- For elevations above 2000 ft, reduce input 4 percent for each 1000 ft above sea level. For example at 2001 ft. a 12% total derate is required.
- When the gas supply being used has a different heating value or specific gravity, refer to national and local codes, or contact your distributor to determine the required orifice size.

⚠ CAUTION

UNIT DAMAGE HAZARD
Failure to follow this caution may result in component damage due to flame impingement of burners and heat exchangers.
Do Not redrill an orifice. Improper drilling (burrs, out-of-round holes, etc.) can cause excessive burner noise and misdirection of burner flame. If orifice hole appears damaged or it is suspected to have been redrilled, check orifice hole with a numbered drill bit of correct size.

ADJUST GAS INPUT

The gas input to the unit is determined by measuring the gas flow at the meter or by measuring the manifold pressure. Measuring the gas flow at the meter is recommended for natural gas units. The manifold pressure must be measured to determine the input of propane gas units.

Measure Gas Flow (Natural Gas Units)

Minor adjustment to the gas flow can be made by changing the manifold pressure. The manifold pressure must be maintained between 3.4 and 3.6 in. wg.
If larger adjustments are required, change main burner orifices following the recommendations of national and local codes.

NOTE: All other appliances that use the same meter must be turned off when gas flow is measured at the meter.

Proceed as follows:

1. Turn off gas supply to unit.
2. Remove pipe plug on manifold (See Fig. 13) and connect manometer. Turn on gas supply to unit.
3. Record number of seconds for gas meter test dial to make one revolution.
4. Divide number of seconds in Step 3 into 3600 (number of seconds in one hour).
5. Multiply result of Step 4 by the number of cu ft shown for one revolution of test dial to obtain cu ft of gas flow per hour.
6. Multiply result of Step 5 by Btu heating value of gas to obtain total measured input in Btuh. Compare this value with heating input shown in Table 4 (Consult the local gas supplier if the heating value of gas is not known).

EXAMPLE: Assume that the size of test dial is 1 cu ft, one revolution takes 32 sec., and the heating value of the gas is 1050 Btu/ft^3. Proceed as follows:

1. 32 sec. to complete one revolution.
2. 3600 ÷ 32 = 112.5.

3. 112.5 x 1 =112.5 ft^3 of gas flow/hr.
4. 112.5 x 1050 = 118,125 Btuh input.

If the desired gas input is 115,000 Btuh, only a minor change in the manifold pressure is required.

Observe manifold pressure and proceed as follows to adjust gas input:

1. Remove cover screw over regulator adjustment screw on gas valve.
2. Turn regulator adjustment screw clockwise to increase gas input, or turn regulator adjustment screw counterclockwise to decrease input. Manifold pressure must be between 3.4 and 3.6 in. wg. Unsafe operation of the unit may result if manifold pressure is outside this range. Personal injury or unit damage may result.

⚠ WARNING

FIRE AND UNIT DAMAGE HAZARD

Failure to follow this warning couild result in personal injury, death and/or property damage.

Unsafe operation of the unit may result if manifold pressure is outside this range. Serious injury , death or unit damage may result.

3. Replace cover screw cap on gas valve.
4. Turn off gas supply to unit. Remove manometer from pressure tap and replace pipe plug on gas valve. Turn on gas to unit and check for leaks.

Measure Manifold Pressure (Propane Units)

The main burner orifices on a propane gas unit are sized for the unit rated input when the manifold pressure reading matches the level specified in Table 4.

Proceed as follows to adjust gas input on a propane gas unit:

1. Turn off gas to unit.
2. Remove pipe plug on manifold and connect manometer (See Fig. 13).
3. Turn on gas to unit.
4. Remove cover screw over regulator adjustment screw on gas valve.
5. Adjust regulator adjustment screw to the correct manifold pressure, as specified in Table 4. Turn adjusting screw clockwise to increase manifold pressure, or turn adjusting screw counterclockwise to decrease manifold pressure.
6. Replace cover screw.
7. Turn off gas to unit. Remove manometer from pressure tap. Replace pipe plug on gas valve, then turn on gas to unit. Check for leaks.

CHECK BURNER FLAME

With burner access panel removed, observe the unit heating operation. Watch the burner flames to see if they are light blue and soft in appearance, and that the flames are approximately the same for each burner. Propane will have blue flame (See Fig. 14). Refer to the *Maintenance* section for information on burner removal.

AIRFLOW AND TEMPERATURE RISE

The heating section for each size unit is designed and approved for heating operation within the temperature-rise range stamped on the unit rating plate.

Table 9 shows the approved temperature rise range for each heating input, and the air delivery cfm at various temperature rises. The heating operation airflow must produce a temperature rise that falls within the approved range.

Refer to *Indoor Airflow and Airflow Adjustments* section to adjust heating airflow when required.

HEATING SEQUENCE OF OPERATION

(See Fig. 15 and unit wiring label).

On a call for heating, terminal ‘‘W’’ of the thermostat is energized, starting the induced-draft motor. When the hall-effect sensor on the induced-draft motor senses that it has reached the required speed, the burner sequence begins. This function is performed by the integrated gas control (IGC). The indoor (evaporator)-fan motor is energized 45 sec. after flame is established. When the thermostat is satisfied and ‘‘W’’ is de-energized, the burners stop firing and the indoor (evaporator) fan motor shuts off after a 45-sec. time-off delay.

An LED (light-emitting diode) indicator is provided on the control board to monitor operation. The control board is located by removing the burner access panel. During normal operation, the LED is continuously on (See Table 5 for error codes).

Table 5—LED Indications

ERROR CODE	LED INDICATION
Normal Operation	On
Hardware Failure	Off
Fan On/Off Delay Modified	1 Flash
Limit Switch Fault	2 Flashes
Flame Sense Fault	3 Flashes
Four Consecutive Limit Switch Faults	4 Flashes
Ignition Lockout Fault	5 Flashes
Induced-Draft Motor Fault	6 Flashes
Rollout Switch Fault	7 Flashes
Internal Control Fault	8 Flashes
Temporary lock-out (1 hr)	9 Flashes

NOTES:
1. There is a 3-sec. pause between error code displays.
2. If more than one error code exists, all applicable error codes will be displayed in numerical sequence
3. This chart is on the wiring diagram located inside the burner access panel.

LIMIT SWITCHES

Normally closed limit switch (LS) completes the control circuit through the thermostat R circuit. Should the leaving-air temperature rise above the maximum allowable temperature, the limit switch opens and the R control circuit ‘‘breaks.’’ Any interruption in the R control circuit instantly closes the gas valve and stops gas flow to the burners and pilot. The blower motor continues to run until LS resets.

When the air temperature at the limit switch drops to the low-temperature setting of the limit switch, the switch closes and completes the R control circuit. The electric-spark ignition system cycles and the unit returns to normal heating operation.

ROLLOUT SWITCH

The function of the rollout switch is to close the main gas valve in the event of flame rollout. The switch is located above the main burners. When the temperature at the rollout switch reaches the maximum allowable temperature, the R control circuit trips,

closing the gas valve and stopping gas flow to the burners. The indoor (evaporator) fan motor (IFM) and induced draft motor continue to run until switch is reset. The IGC LED will display FAULT CODE 7.

Step 3—START-UP COOLING AND MAKE ADJUSTMENTS

⚠ CAUTION

UNIT DAMAGE HAZARD
Failure to follow this caution may result in unit and/or property damage.
Complete the required procedures given in the *Pre-Start-Up* section before starting the unit.
Do not jumper any safety devices when operating the unit.
Do not operate the compressor when the outdoor temperature is below 40°F (unless accessory low-ambient kit is installed).
Do not rapid-cycle the compressor. Allow 5 minutes between ''on'' cycles to prevent compressor damage.

CHECKING COOLING CONTROL OPERATION

Start and check the unit for proper cooling control operation as follows:

1. Place room thermostat SYSTEM switch in OFF position. Observe that 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 cooling control below room temperature. Observe that compressor, condenser fan, and evaporator blower motors start. Observe that cooling cycle shuts down when control setting is satisfied. The evaporator fan will continue to run for 30 sec.
3. When using an auto-changeover room thermostat, place both SYSTEM and FAN switches in AUTO. positions. Observe that unit operates in Heating mode when temperature control is set to ''call for heating'' (above room temperature) and operates in Cooling mode when temperature control is set to ''call for cooling'' (below room temperature).

CHECKING AND ADJUSTING REFRIGERANT CHARGE

The refrigerant system is fully charged with R-22 refrigerant, tested, and factory-sealed.

NOTE: Adjustment of the refrigerant charge is not required unless the unit is suspected of **not** having the proper R-22 charge.

A superheat charging chart is attached to the outside of the service access panel. The chart includes the required suction line temperature at given suction line pressures and outdoor ambient temperatures.

An accurate superheat, thermocouple- or thermistor-type thermometer, and a gauge manifold are required when using the superheat charging method for evaluating the unit charge. *Do not use mercury or small dial-type thermometers because they are not adequate for this type of measurement.*

⚠ CAUTION

UNIT DAMAGE HAZARD
Failure to follow this caution may result in unit damage.
When evaluating the refrigerant charge, an indicated adjustment to the specified factory charge must always be very minimal. If a substantial adjustment is indicated, an abnormal condition exists somewhere in the cooling system, such as insufficient airflow across either coil or both coils.

Proceed as follows:

1. Remove caps from low- and high-pressure service fittings.
2. Using hoses with valve core depressors, attach low- and high-pressure gauge hoses to low- and high-pressure service fittings, respectively.
3. Start unit in Cooling mode and let unit run until system pressures stabilize.
4. Measure and record the following:
   a. Outdoor ambient-air temperature (°F db).
   b. Suction-tube temperature (°F) at low-side service fitting.
   c. Suction (low-side) pressure (psig).
5. Using "Cooling Charging Charts," compare outdoor-air temperature (°F db) with the suction line pressure (psig) to determine desired system operating suction line temperature (See Table 7).
6. Compare actual suction-tube temperature with desired suction-tube temperature. Using a tolerance of ± 3°F, add refrigerant if actual temperature is more than 3°F higher than proper suction-tube temperature, or remove refrigerant if actual temperature is more than 3°F lower than required suction-tube temperature.

NOTE: If the problem causing the inaccurate readings is a refrigerant leak, refer to the *Check for Refrigerant Leaks* section.

INDOOR AIRFLOW AND AIRFLOW ADJUSTMENTS

⚠ CAUTION

UNIT OPERATION HAZARD
Failure to follow this caution may result in unit damage.
For cooling operation, the recommended airflow is 350 to 450 cfm for each 12,000 Btuh of rated cooling capacity. For heating operation, the airflow must produce a temperature rise that falls within the range stamped on the unit rating plate.

Table 9 shows the temperature rise at various airflow rates. Table 9 shows both heating and cooling airflows at various external static pressures. Refer to these tables to determine the airflow for the system being installed (See Table 10 for wet coil pressure drop).

NOTE: Be sure that all supply- and return-air grilles are open, free from obstructions, and adjusted properly.

⚠ WARNING

FIRE, EXPLOSION AND ELECTRICAL SHOCK HAZARD
Failure to follow this warning could result in personal injury death and/or property damage.
Before changing blower speed, shut off gas supply. *Then* disconnect electrical power to the unit and install lockout tag.

Airflow can be changed by changing the lead connections of the indoor (evaporator) fan motor.

All 48SD units are factory wired for low speed, except sizes 030 and 048 which are wired for medium speed.

For 208/230V

For color coding on the 208/230V motor leads, see Table 6.

Table 6–Color Coding for 208/230-V Motor Leads

BLACK = HIGH SPEED
Blue = medium speed
Red = low speed

To change the speed of the indoor (evaporator) fan motor, remove the fan motor speed leg lead from the blower relay (BR). This wire is attached to terminal BM of the integrated gas control (IGC) board for single-phase units. To change the speed, remove and replace with lead for desired blower motor speed. *Insulate the removed lead to avoid contact with chassis parts.*

COOLING SEQUENCE OF OPERATION

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

1. When the room temperature rises to a point that is slightly above the cooling control setting of the thermostat, the thermostat completes the circuit between thermostat terminal R to terminals Y and G. These completed circuits through the thermostat:
2. The normally open contacts of energized contactor (C) close and complete the circuit through compressor motor (COMP) to condenser (outdoor) fan motor (OFM). Both motors start instantly.
3. The set of normally open contacts of energized relay BM close and complete the circuit through evaporator blower (indoor) fan motor (IFM).

NOTE: Once the compressor has started and then stopped, it **should not** be started again until 5 minutes have elapsed. The cooling cycle remains "on" until the room temperature drops to a point that is slightly below the cooling control setting of the room thermostat. At this point, the thermostat "breaks" the circuit between thermostat terminal R to terminals Y and G. These open circuits deenergize contactor coil C. The condenser and compressor motors stop. After a 30-sec. delay, the blower motor stops. The unit is in a "standby" condition, waiting for the next "call for cooling" from the room thermostat.

MAINTENANCE

To ensure continuing high performance and to minimize the possibility of premature equipment failure, periodic maintenance must be performed on this equipment. This combination heating/cooling unit should be inspected at least once each year by a qualified service person. To troubleshoot cooling or heating of units, refer to Tables 11-13.

NOTE: Consult your local dealer about the availability of a maintenance contract.

⚠ WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

The ability to properly perform maintenance on this equipment requires certain expertise, mechanical skills, tools, and equipment. If you do not possess these, do not attempt to perform any maintenance on this equipment other than those procedures recommended in the User's Manual.

⚠ WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK, PERSONAL INJURY HAZARD

Failure to follow these warnings could result in serious injury:

1. First, turn off gas supply to the unit. *Then* turn off electrical power to the unit and install lockout tag before performing any maintenance or service on the unit.
2. Use extreme caution when removing panels and parts. As with any mechanical equipment, personal injury can result from sharp edges, etc.
3. Never place anything combustible either on, or in contact with, the unit.
4. Should overheating occur or the gas supply fail to shut off, turn off external main manual gas valve to the unit. *Then* shut off electrical supply and install lockout tag.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in unit damage.

Errors made when reconnecting wires may cause improper and dangerous operation. Label all wires prior to disconnection when servicing.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect air filter(s) each month. Clean or replace when necessary. Certain geographical locations may require more frequent inspections.
2. Inspect indoor coil, outdoor coil, drain pan, and condensate drain each cooling season for cleanliness. Clean at least once per heating / cooling season or more often if needed.
3. Inspect indoor (evaporator) fan motor and wheel for cleanliness at the beginning of each heating and cooling season. Clean when necessary. For *first* heating and cooling season, inspect blower wheel bi-monthly to determine proper cleaning frequency.
4. Check electrical connections for tightness and controls for proper operation each heating and cooling season. Service when necessary.
5. Ensure wires are not contacting refrigerant tubes or sharp sheet metal edges.
6. Check and inspect heating section before each heating season. Clean and adjust when necessary.
7. Check flue hood and remove any obstructions, if necessary.

AIR FILTER

⚠ CAUTION

UNIT PERFORMANCE AND DAMAGE HAZARD

Failure to follow this caution may result in improper unit operation and damage to unit components.

Never operate the unit without a suitable air filter in the return-air duct system. Always replace the filter with the same dimensional size and type as originally installed (See Table 1 for recommended filter sizes).

Inspect air filter(s) at least once each month and replace (throwaway-type) or clean (permanent) at least twice during each heating and cooling season or whenever the filter(s) becomes clogged with dust and/or lint.

INDOOR (EVAPORATOR) MOTOR

NOTE: All motors are permanently lubricated. Do not attempt to lubricate these motors.

Table 7—Cooling Checking Chart

Suction Line Temperature (°F)															
OD Temp. (°F)	Suction Line Pressure (PSIG)														
	52	54	56	59	61	64	67	70	73	76	79	82	85	89	92
45	51	55	60	64	69	-	-	-	-	-	-	-	-	-	-
55	-	-	53	57	62	66	70	-	-	-	-	-	-	-	-
65	-	-	-	-	53	57	62	66	71	75	-	-	-	-	-
75	-	-	-	-	-	-	-	56	61	66	71	76	-	-	-
85	-	-	-	-	-	-	-	-	53	58	63	67	72	-	-
95	-	-	-	-	-	-	-	-	-	50	54	58	62	66	-
105	-	-	-	-	-	-	-	-	-	-	50	53	57	60	64
115	-	-	-	-	-	-	-	-	-	-	49	52	55	58	61
125	-	-	-	-	-	-	-	-	-	-	-	50	53	56	59

Suction Line Temperature (°C)															
OD Temp. (°F)	Suction Line Pressure (kPa)														
	361	370	387	405	423	442	462	482	502	523	544	566	589	612	636
7	11	13	15	18	21	-	-	-	-	-	-	-	-	-	-
13	-	-	12	14	16	19	21	-	-	-	-	-	-	-	-
18	-	-	-	-	12	14	17	19	21	24	-	-	-	-	-
24	-	-	-	-	-	-	-	13	16	19	22	24	-	-	-
29	-	-	-	-	-	-	-	-	12	14	17	20	22	-	-
35	-	-	-	-	-	-	-	-	-	10	12	14	17	19	-
41	-	-	-	-	-	-	-	-	-	-	10	12	14	16	18
46	-	-	-	-	-	-	-	-	-	-	9	11	13	14	16
52	-	-	-	-	-	-	-	-	-	-	-	10	11	13	15

Table 8—Filter Pressure Drop (In. wg)

UNIT SIZE	FILTER SIZE	CFM																		
		500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
024, 030	20 X 20 X 1	0.05	0.07	0.08	0.10	0.12	0.13	0.14	0.15	—	—	—	—	—	—	—	—	—	—	—
036	20 X 24 X 1	—	—	—	—	0.09	0.10	0.11	0.13	0.14	0.15	0.16	—	—	—	—	—	—	—	—
042, 048, 060	24 X 30 X 1	—	—	—	—	—	—	—	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18

For longer life, operating economy, and continuing efficiency, clean accumulated dirt and grease from the blower wheel and motor annually.

⚠ WARNING

FIRE, EXPLOSION AND ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Before cleaning the blower motor and wheel, disconnect gas supply. *Then* turn off and tag electrical power to the unit.

Cleaning the Blower Motor and Wheel

1. Remove and disassemble blower assembly as follows:
   a. Remove unit access panel.
   b. Disconnect motor lead from blower relay (BM). Disconnect yellow lead from terminal L2 of the contactor.
   c. On *all* units, remove blower assembly from unit. Remove screws securing blower to blower partition and slide assembly out. Be careful not to tear insulation in blower compartment.
   d. Ensure proper reassembly by marking blower wheel and motor in relation to blower housing before disassembly.
   e. Loosen setscrew(s) that secures wheel to motor shaft. Remove screws that secure motor mount brackets to housing, and slide motor and motor mount out of housing.
2. Remove and clean blower wheel as follows:
   a. Ensure proper reassembly by marking wheel orientation.
   b. Lift wheel from housing. When handling and/or cleaning blower wheel, be sure not to disturb balance weights (clips) on blower wheel vanes.
   c. Remove caked-on dirt from wheel and housing with a brush. Remove lint and/or dirt accumulations from wheel and housing with vacuum cleaner, using soft brush attachment. Remove grease and oil with mild solvent.

Table 9—Dry Coil Air Delivery* – Horizontal and Downflow Discharge – Unit 48SD024-060 (Deduct 10 percent for 208 Volts)

UNIT	HEATING RISE RANGE (°F)	MOTOR SPEED		EXTERNAL STATIC PRESSURE (WC)								
				0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
48SD(-,N)024040	20-50	Low[1]	Watts	311	309	304	301	286	—	—	—	—
			CFM	935	885	820	757	686	—	—	—	—
			Heating Rise (°F)	32	34	37	40	44	—	—	—	—
		Medium	Watts	—	—	—	—	379	357	357	345	—
			CFM	—	—	—	—	957	868	769	647	—
			Heating Rise (°F)	—	—	—	—	31	35	39	46	—
		High	Watts	—	—	—	—	—	—	447	435	421
			CFM	—	—	—	—	—	—	970	853	712
			Heating Rise (°F)	—	—	—	—	—	—	31	35	42
48SD(-,N)024060	35-65	Low[1]	Watts	311	309	304	301	—	—	—	—	—
			CFM	935	885	820	757	—	—	—	—	—
			Heating Rise (°F)	48	51	55	59	—	—	—	—	—
		Medium	Watts	411	405	398	390	379	357	357	—	—
			CFM	1195	1155	1100	1028	957	868	769	—	—
			Heating Rise (°F)	38	39	41	44	47	52	59	—	—
		High	Watts	—	—	—	—	—	—	447	435	421
			CFM	—	—	—	—	—	—	970	853	712
			Heating Rise (°F)	—	—	—	—	—	—	46	53	63
48SD(-,N)030040	20-50	Low	Watts	311	309	304	301	—	—	—	—	—
			CFM	935	885	820	757	—	—	—	—	—
			Heating Rise (°F)	32	34	37	40	—	—	—	—	—
		Medium[1]	Watts	411	405	398	390	379	357	357	—	—
			CFM	1195	1155	1100	1028	957	868	769	—	—
			Heating Rise (°F)	25	26	27	29	31	35	39	—	—
		High	Watts	—	—	—	—	477	467	447	435	—
			CFM	—	—	—	—	1185	1088	970	853	—
			Heating Rise (°F)	—	—	—	—	25	28	31	35	—
48SD(-,N)030060	35-65	Low	Watts	311	309	304	301	—	—	—	—	—
			CFM	935	885	820	757	—	—	—	—	—
			Heating Rise (°F)	48	51	55	59	—	—	—	—	—
		Medium[1]	Watts	411	405	398	390	379	357	357	—	—
			CFM	1195	1155	1100	1028	957	868	769	—	—
			Heating Rise (°F)	38	39	41	44	47	52	59	—	—
		High	Watts	—	—	—	—	477	467	447	435	—
			CFM	—	—	—	—	1185	1088	970	853	—
			Heating Rise (°F)	—	—	—	—	38	41	46	53	—
48SD(-,N)036060	25-55	Low[1]	Watts	437	433	424	417	403	391	379	362	—
			CFM	1353	1318	1283	1235	1187	1123	1059	975	—
			Heating Rise (°F)	33	34	35	36	38	40	42	46	—
		Medium	Watts	—	—	—	531	516	496	478	459	435
			CFM	—	—	—	1489	1437	1362	1289	1208	1099
			Heating Rise (°F)	—	—	—	30	31	33	35	37	41
		High	Watts	—	—	—	—	—	—	—	629	602
			CFM	—	—	—	—	—	—	—	1470	1357
			Heating Rise (°F)	—	—	—	—	—	—	—	31	33
48SD(-,N)036090	40-70	Low[1]	Watts	437	433	424	417	403	391	379	362	—
			CFM	1353	1318	1283	1235	1187	1123	1059	975	—
			Heating Rise (°F)	50	51	53	55	57	60	64	69	—
		Medium	Watts	—	—	—	531	516	496	478	459	435
			CFM	—	—	—	1489	1437	1362	1289	1208	1099
			Heating Rise (°F)	—	—	—	45	47	50	52	56	61
		High	Watts	—	—	—	—	—	—	—	629	602
			CFM	—	—	—	—	—	—	—	1470	1357
			Heating Rise(°F)	—	—	—	—	—	—	—	46	50
48SD(-,N)042060	25-55	Low[1]	Watts	625	606	586	571	550	534	509	483	457
			CFM	1539	1496	1466	1437	1387	1330	1264	1183	1093
			Heating Rise (°F)	29	30	31	31	32	34	36	38	41
		Medium	Watts	—	741	715	694	669	645	610	573	544
			CFM	—	1738	1698	1653	1604	1538	1457	1362	1271
			Heating Rise (°F)	—	26	27	27	28	29	31	33	35
		High	Watts	—	—	—	—	—	798	772	738	700
			CFM	—	—	—	—	—	1720	1648	1540	1414
			Heating Rise (°F)	—	—	—	—	—	26	27	29	32

Table 9—Dry Coil Air Delivery* – Horizontal and Downflow Discharge – Unit 48SD024-060 (Deduct 10 percent for 208 Volts)

UNIT	HEATING RISE RANGE (°F)	MOTOR SPEED		EXTERNAL STATIC PRESSURE (WC)								
				0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
48SD(-,N)042090	40-70	Low[1]	Watts	625	606	586	571	550	534	509	483	457
			CFM	1539	1496	1466	1437	1387	1330	1264	1183	1093
			Heating Rise (°F)	44	45	46	47	49	51	53	57	62
		Medium	Watts	—	—	715	694	669	645	610	573	544
			CFM	—	—	1698	1653	1604	1538	1457	1362	1271
			Heating Rise (°F)	—	—	40	41	42	44	46	50	53
		High	Watts	—	—	—	—	—	—	772	738	700
			CFM	—	—	—	—	—	—	1648	1540	1414
			Heating Rise (°F)	—	—	—	—	—	—	41	44	48
48SD(-,N)048090	25-55	Low	Watts	627	617	607	584	567	548	528	503	—
			CFM	1550	1530	1493	1461	1414	1361	1320	1250	—
			Heating Rise (°F)	44	44	45	46	48	50	51	54	—
		Medium[1]	Watts	771	755	734	711	690	665	639	607	572
			CFM	1798	1771	1734	1687	1645	1595	1530	1449	1355
			Heating Rise (°F)	38	38	39	40	41	42	44	47	50
		High	Watts	—	—	908	887	858	827	804	767	748
			CFM	—	—	2000	1944	1876	1811	1735	1647	1555
			Heating Rise (°F)	—	—	34	35	36	37	39	41	43
48SD(-,N)048115	35-65	Low	Watts	627	617	607	584	567	548	528	—	—
			CFM	1550	1530	1493	1461	1414	1361	1320	—	—
			Heating Rise (°F)	56	56	58	59	61	63	65	—	—
		Medium[1]	Watts	771	755	734	711	690	665	639	607	572
			CFM	1798	1771	1734	1687	1645	1595	1530	1449	1355
			Heating Rise (°F)	48	49	50	51	52	54	56	60	64
		High	Watts	—	—	908	887	858	827	804	767	748
			CFM	—	—	2000	1944	1876	1811	1735	1647	1555
			Heating Rise (°F)	—	—	43	44	46	48	50	52	55
48SD(-,N)048130	40-70	Low	Watts	627	617	607	584	567	—	—	—	—
			CFM	1550	1530	1493	1461	1414	—	—	—	—
			Heating Rise (°F)	63	64	65	67	69	—	—	—	—
		Medium[1]	Watts	771	755	734	711	690	665	639	607	—
			CFM	1798	1771	1734	1687	1645	1595	1530	1449	—
			Heating Rise (°F)	54	55	56	58	59	61	64	67	—
		High	Watts	—	—	908	887	858	827	804	767	748
			CFM	—	—	2000	1944	1876	1811	1735	1647	1555
			Heating Rise (°F)	—	—	49	50	52	54	56	59	63
48SD(-,N)060090	25-55	Low[1]	Watts	786	769	754	736	722	705	684	658	—
			CFM	2027	1960	1901	1821	1759	1693	1616	1513	—
			Heating Rise (°F)	33	34	36	37	38	40	42	45	—
		Medium	Watts	873	849	833	815	798	782	763	748	—
			CFM	2095	1962	1887	1817	1748	1679	1583	—	
			Heating Rise (°F)	32	33	34	36	37	39	40	42	—
		High	Watts	1012	993	981	963	948	927	904	886	—
			CFM	2184	2109	2036	1963	1886	1812	1729	1647	—
			Heating Rise (°F)	31	32	33	34	36	37	39	41	—
48SD(-,N)060115	35-65	Low[1]	Watts	786	769	754	736	722	705	684	658	—
			CFM	2027	1960	1901	1821	1759	1693	1616	1513	—
			Heating Rise (°F)	43	44	45	47	49	51	53	57	—
		Medium	Watts	873	849	833	815	798	782	763	748	—
			CFM	2095	2026	1962	1887	1817	1748	1679	1583	—
			Heating Rise (°F)	41	43	44	46	47	49	51	54	—
		High	Watts	1012	993	981	963	948	927	904	886	—
			CFM	2184	2109	2036	1963	1886	1812	1729	1647	—
			Heating Rise (°F)	39	41	42	44	46	48	50	52	—

Table 9—Dry Coil Air Delivery* – Horizontal and Downflow Discharge – Unit 48SD024-060 (Deduct 10 percent for 208 Volts)

UNIT	HEATING RISE RANGE (°F)	MOTOR SPEED		EXTERNAL STATIC PRESSURE (WC)								
				0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
48SD(-,N)060130	40-70	Low[1]	Watts	786	769	754	736	722	705	684	658	—
			CFM	2027	1960	1901	1821	1759	1693	1616	1513	—
			Heating Rise (°F)	48	50	51	54	55	58	60	64	—
		Medium	Watts	873	849	833	815	798	782	763	748	—
			CFM	2095	2026	1962	1887	1817	1748	1679	1583	—
			Heating Rise (°F)	47	48	50	52	54	56	58	62	—
		High	Watts	1012	993	981	963	948	927	904	886	—
			CFM	2184	2109	2036	1963	1886	1812	1729	1647	—
			Heating Rise (°F)	45	46	48	50	52	54	56	59	—

* Air delivery values are without air filter and are for dry coil (See Table 10—48SD Wet Coil Pressure Drop table and Table 8 Filter Pressure Drop).
[1]Factory-shipped heating/cooling speed
NA = Not allowed for heating speed.
Note: Deduct field-supplied air filter pressure drop and wet coil pressure drop to obtain external static pressure available for ducting.

d. Reassemble wheel into housing.

e. Reassemble motor into housing. Be sure setscrews are tightened on motor shaft flats and not on round part of shaft.

f. Reinstall unit access panel.

3. Restore electrical power to unit. Start unit and check for proper blower rotation and motor speeds during heating and cooling cycles.

FLUE GAS PASSAGEWAYS

To inspect the flue collector box and upper areas of the heat exchanger:

1. Remove the combustion blower wheel and motor assembly according to directions in the *Combustion-Air Blower* section.
2. Remove the 3 screws holding the blower housing to the flue collector box cover (See Fig. 16–19).
3. Remove the 12 screws holding the flue collector box cover (See Fig. 18–19) to the heat exchanger assembly. Inspect the heat exchangers.
4. Clean all surfaces, as required, using a wire brush.

INDUCED DRAFT (COMBUSTION AIR) BLOWER

Clean periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically during the heating season. For the first heating season, inspect blower wheel bi-monthly to determine proper cleaning frequency.

To inspect blower wheel, remove draft hood assembly. Shine a flashlight into opening to inspect wheel. If cleaning is required, remove motor and wheel as follows:

1. Remove unit access panel (See Fig. 17).
2. Remove the 7 screws that attach induced-draft motor mounting plate to blower housing (See Fig. 18).
3. Slide the motor and blower wheel assembly out of the blower housing (See Fig. 18). Clean the blower wheel. If additional cleaning is required, continue with Steps 4 and 5.
4. To remove blower, remove 2 setscrews.
5. To remove motor and cooling fan assembly, remove 4 screws that hold blower housing to mounting plate.
6. To reinstall, reverse the procedure outlined above.

LIMIT SWITCH

Remove unit access panel. Limit switch is located on the blower partition.

BURNER IGNITION

Unit is equipped with a direct spark ignition 100 percent lockout system. Ignition module is located in the control box (See Fig. 16).Module contains a self-diagnostic LED. During servicing, refer to label diagram for LED interpretation.

If lockout occurs, unit may be reset by either momentarily interrupting power supply to unit or by turning selector switch to OFF position at the thermostat.

MAIN BURNERS

At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames and adjust, if necessary.

⚠ CAUTION

UNIT DAMAGE HAZARD
Failure to follow this caution may result in component damage and cause flame impingement of burners and heat exchangers.
When servicing gas train, do not hit or plug orifice spuds.

Removal of Gas Train

To remove the gas train for servicing:

1. Shut off main gas valve.
2. Shut off power to unit and install lockout tag.
3. Remove unit access panel (See Fig. 17).
4. Disconnect gas piping at unit gas valve.
5. Remove wires connected to gas valve. Mark each wire.
6. Remove ignitor and sensor wires at the ignitor module.
7. Remove the mounting screw that attaches the burner rack to the unit base (See Fig. 16).
8. Slide the burner rack out of the unit (See Fig. 16 and 19).
9. To reinstall, reverse the procedure outlined above.

CONDENSER COIL, EVAPORATOR COIL, AND CONDENSATE DRAIN PAN

Inspect the condenser coil, evaporator coil, and condensate drain pan at least once each year or more often if necessary.

The coils are easily cleaned when dry; therefore, inspect and clean the coils either before or after each cooling season. Remove all obstructions, including weeds and shrubs, that interfere with the airflow through the condenser coil.

Straighten bent fins with a fin comb. If coated with dirt or lint, clean the coils with a vacuum cleaner, using the soft brush

Table 10—48SD Wet Coil Pressure Drop

UNIT SIZE 48SD	STANDARD CFM (S.C.F.M.)														
	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
024	.030	.037	.044	.053	.063	-	-	-	-	-	-	-	-	-	-
030	-	.037	.044	.053	.063	.072	.081	.105	-	-	-	-	-	-	-
036	-	-	-	.038	.044	.051	.059	.065	.072	.080	-	-	-	-	-
042	-	-	-	-	.044	.051	.059	.065	.072	.080	.088	.095	.105	-	-
048	-	-	-	-	-	-	.044	.050	.053	.059	.066	.072	.077	.086	
060	-	-	-	-	-	-	-	-	-	.079	.087	.095	.102	.113	.123

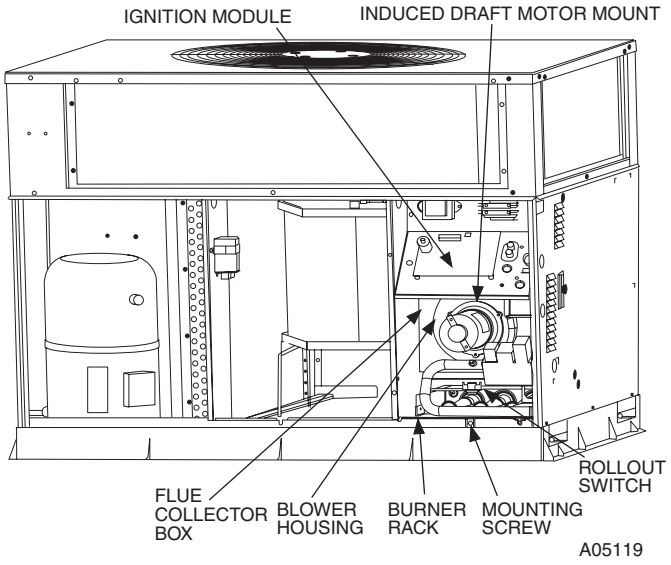


Fig. 16—Blower Housing and Flue Collector Box

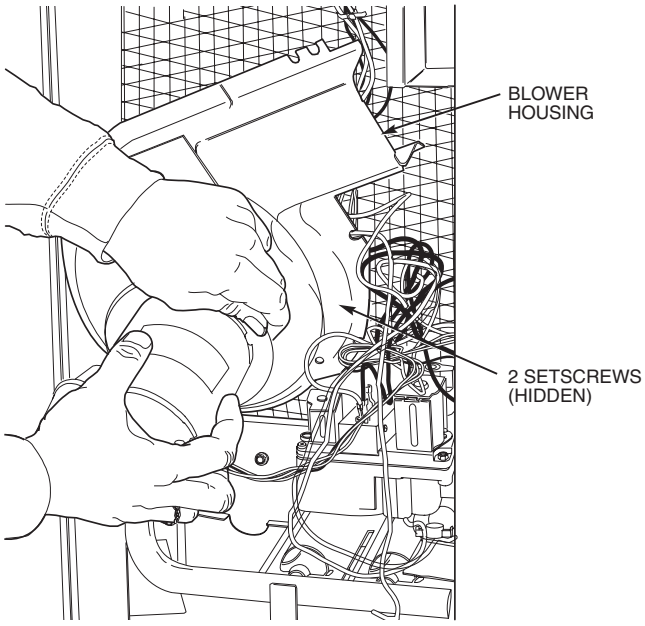


Fig. 18—Removal of Motor and Blower Wheel

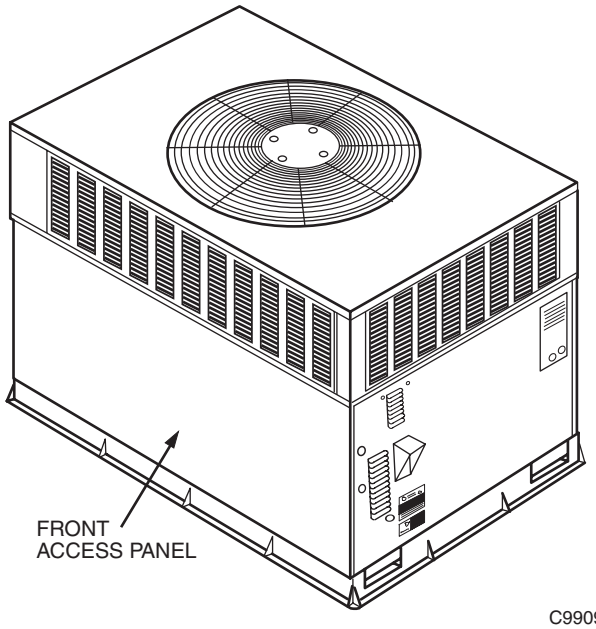


Fig. 17—Unit Access Panel

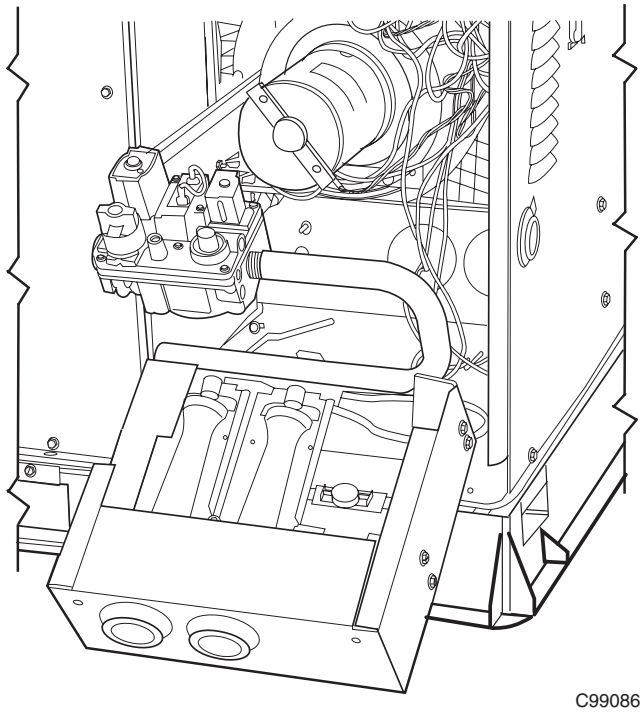


Fig. 19—Burner Rack Removed

attachment. Be careful not to bend the fins. If coated with oil or grease, clean the coils 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 air filter(s). For best results, spray condenser coil fins from inside to outside the unit. On units with an outer and inner condenser coil, be sure to clean between the coils. Be sure to flush all dirt and debris from the unit base.

Inspect the drain pan and condensate drain line when inspecting the coils. Clean the drain pan and condensate drain by removing all foreign matter from the pan. Flush the pan and drain tube with clear water. Do not splash water on the insulation, motor, wiring, or air filter(s). If the drain tube is restricted, clear it with a "plumbers snake" or similar probe device. Ensure that the auxiliary drain port above the drain tube is also clear.

CONDENSER FAN

⚠ CAUTION

OPERATIONAL HAZARD
Failure to follow this caution may result in unit component damage.
Keep the condenser fan free from all obstructions to ensure proper cooling operation. Never place articles on top of the unit. Damage to unit may result.

1. Remove 6 screws holding condenser grille and motor to top cover.
2. Turn motor/grille assembly upside down on top cover to expose the fan blade.
3. Inspect the fan blades for cracks or bends.
4. If fan needs to be removed, loosen the setscrew and slide the fan off the motor shaft.
5. When replacing fan blade, position blade so the hub is 1/8 in. away from the motor end (1/8 in. of motor shaft will be visible. See Fig. 12).
6. Ensure that setscrew engages the flat area on the motor shaft when tightening.
7. Replace grille.

ELECTRICAL CONTROLS AND WIRING

Inspect and check the electrical controls and wiring annually. *Be sure to turn off the gas supply, and then the electrical power to the unit.*

Remove access panel to locate all the electrical controls and wiring. Check all electrical connections for tightness. Tighten all screw connections. If any smoky or burned connections are noticed, disassemble the connection, clean all the parts, restrip the wire end and reassemble the connection properly and securely.

After inspecting the electrical controls and wiring, replace the access panel. Start the unit, and observe at least one complete heating cycle and one complete cooling cycle to ensure proper operation. If discrepancies are observed in either or both operating cycles, or if a suspected malfunction has occurred, check each electrical component with the proper electrical instrumentation. Refer to the unit wiring label when making these checkouts.

NOTE: Refer to the heating and/or cooling sequence of operation in this publication as an aid in determining proper control operation.

REFRIGERANT CIRCUIT

Annually inspect all refrigerant tubing connections and the unit base for oil accumulations. Detecting oil generally indicates a refrigerant leak.

⚠ WARNING

FIRE, EXPLOSION HAZARD
Failure to follow this warning could result in personal injury, death and/or property damage.
System under pressure. Relieve pressure and recover all refrigerant before system repair or final unit disposal to avoid serious injury or death. Use all service ports and open all flow-control devices, including solenoid valves.

If oil is detected or if low cooling performance is suspected, leak-test all refrigerant tubing using an electronic leak-detector, halide torch, or liquid-soap solution. If a refrigerant leak is detected, refer to the *Check for Refrigerant Leaks* section.

If no refrigerant leaks are found and low cooling performance is suspected, refer to the *Checking and Adjusting Refrigerant Charge* section.

GAS INPUT

The gas input does not require checking unless improper heating performance is suspected. If a problem exists, refer to the *Start-Up* section.

EVAPORATOR AIRFLOW

The heating and/or cooling airflow does not require checking unless improper performance is suspected. *If a problem exists, be sure that all supply- and return-air grilles are open and free from obstructions, and that the air filter is clean.* When necessary, refer to the *Indoor Airflow and Airflow Adjustments* section to check the system airflow.

METERING DEVICE — ACCURATER

This metering device is a fixed orifice and is located in the distributor assembly to the indoor coil.

LIQUID LINE STRAINER

The liquid line strainer (to protect metering device) is made of wire mesh and located in the liquid line on the inlet side of the metering device.

TROUBLESHOOTING

Use the *Troubleshooting Guides* (See Tables 11–13) if problems occur with these units.

START-UP CHECKLIST

Use the *Start-Up Checklist* to ensure proper start-up procedures are followed.

Table 11—Troubleshooting Guide—Cooling

SYMPTOM	CAUSE	REMEDY
Compressor and condenser fan will not start.	Power Failure	Call power company.
	Fuse blown or circuit breaker tripped	Replace fuse or reset circuit breaker.
	Defective thermostat, contactor, transformer, or control relay	Replace component.
	Insufficient line voltage	Determine cause and correct.
	Incorrect or faulty wiring	Check wiring diagram and rewire correctly.
	Thermostat setting too high	Lower thermostat setting below room temperature.
Compressor will not start but condenser fan runs.	Faulty wiring or loose connections in compressor circuit	Check wiring and repair or replace.
	Compressor motor burned out, seized, or internal overload open	Determine cause Replace compressor.
	Defective run/start capacitor, overload, start relay	Determine cause and replace.
Compressor cycles (other than normally satisfying thermostat).	Refrigerant overcharge or undercharge	Recover refrigerant, evacuate system, and recharge to capacities shown on nameplate.
	Defective compressor	Replace and determine cause.
	Insufficient line voltage	Determine cause and correct.
	Blocked condenser	Determine cause and correct.
	Defective run/start capacitor, overload or start relay	Determine cause and replace.
	Defective thermostat	Replace thermostat.
	Faulty condenser-fan motor or capacitor	Replace.
	Restriction in refrigerant system	Locate restriction and remove.
Compressor operates continuously.	Dirty air filter	Replace filter.
	Unit undersized for load	Decrease load or increase unit size.
	Thermostat set too low	Reset thermostat.
	Low refrigerant charge	Locate leak, repair, and recharge.
	Leaking valves in compressor	Replace compressor.
	Air in system	Recover refrigerant, evacuate system, and recharge.
	Condenser coil dirty or restricted	Clean coil or remove restriction .
Excessive head pressure.	Dirty air filter	Replace filter.
	Dirty condenser coil	Clean coil.
	Refrigerant overcharged	Recover excess refrigerant.
	Air in system	Recover refrigerant, evacuate system, and recharge.
	Condenser air restricted or air short-cycling	Determine cause and correct.
Head pressure too low.	Low refrigerant charge	Check for leaks, repair, and recharge.
	Compressor valves leaking	Replace compressor.
	Restriction in liquid tube	Remove restriction.
Excessive suction pressure.	High heat load	Check for source and eliminate.
	Compressor valves leaking	Replace compressor.
	Refrigerant overcharged	Recover excess refrigerant.
Suction pressure too low.	Dirty air filter	Replace Filter.
	Low refrigerant charge	Check for leaks, repair, and recharge.
	Metering device or low side restricted	Remove source of restriction.
	Insufficient evaporator airflow	Increase air quantity. Check filter — replace if necessary.
	Temperature too low in conditioned area	Reset thermostat.
	Outdoor ambient below 40°F	Install low-ambient kit .
	Field-installed filter-drier restricted	Replace.

Table 12—Troubleshooting Guide–Heating

SYMPTOM	CAUSE	REMEDY
Burners will not ignite.	Water in gas line	Drain. Install drip leg.
	No power to furnace	Check power supply fuses, wiring, or circuit breaker.
	No 24-v power supply to control circuit	Check transformer. Check fuse on ignition control. NOTE: Some transformers have internal overcurrent protection that requires a cool-down period to reset.
	Miswired or loose connections	Check all wiring and wirenut connections
	Burned-out heat anticipator in thermostat	Replace thermostat.
	Broken thermostat wire	Run continuity check. Replace wire if necessary.
	Misaligned spark electrodes	Check flame ignition and sense electrode positioning. Adjust as necessary.
	No gas at main burners	1.Check gas line for air. Purge as necessary. NOTE: After purging gas line of air, wait at least 5 minutes for any gas to dissipate before attempting to light unit. 2. Check gas valve. Turn gas valve switch to ″ON″. Make sure wires properly connected to gas valve.
Inadequate heating.	Dirty air filter	Clean or replace filter as necessary.
	Gas input to furnace too low	Check gas pressure at manifold match with that on unit nameplate.
	Unit undersized for application	Replace with proper unit or add additional unit.
	Restricted airflow	Clean or replace filter. Remove any restriction.
	Blower speed too low	Use faster speed tap if available, or install alternate motor.
	Limit switch cycles main burners	Check rotation of blower, thermostat heat anticipator settings, temperature rise of unit. Adjust as necessary.
Poor flame characteristics.	Incomplete combustion results in: Aldehyde odors, carbon monoxide, sooting flame, floating flame	1.Tighten all screws around burner compartment. 2. Cracked heat exchanger. Replace. 3. Unit overfired. Reduce input (change orifices or adjust gas line or manifold pressure). 4. Check burner alignment. 5. Inspect heat exchanger for blockage. Clean as necessary.

Table 13—Troubleshooting Guide–LED Error Codes

SYMPTOM	CAUSE	REMEDY
Hardware failure. (LED OFF)	Loss of power to control module (IGC)*.	Check 5-amp fuse on IGC*, power to unit, 24–v circuit breaker, and transformer. Units without a 24–v circuit breaker have an internal overload in the 24–v transformer. If the overload trips, allow 10 minutes for automatic reset.
Fan ON/OFF delay modified (LED/FLASH)	High limit switch opens during heat exchanger warm-up period before fan-on delay expires. Limit switch opens within three minutes after blower-off delay timing in Heating mode.	Ensure unit is fired on rate; ensure temperature rise is correct. Ensure unit's external static pressure is within application guidelines.
Limit switch faults. (LED 2 flashes)	High temperature limit switch is open.	Check the operation of the indoor (evaporator) fan motor. Ensure that the supply-air temperature rise is in accordance with the range on the unit nameplate. Clean or replace filters.
Flame sense fault. (LED 3 flashes)	The IGC* sensed flame that should not be present.	Reset unit. If problem persists, replace control board.
4 consecutive limit switch faults. (LED 4 flashes)	Inadequate airflow to unit	Check operation of indoor (evaporator) fan motor and that supply-air temperature rise agrees with range on unit nameplate information.
Ignition lockout. (LED 5 flashes)	Unit unsuccessfully attempted ignition for 15 minutes.	Check ignitor and flame sensor electrode spacing, gaps, etc. Ensure that flame sense and ignition wires are properly terminated. Verify that unit is obtaining proper amount of gas.
Induced-draft motor fault. (LED 6 flashes)	IGC does not sense that induced-draft motor is operating.*	Check for proper voltage. If motor is operating, check the speed sensor plug/IGC Terminal J2 connection. Proper connection: PIN 1— White PIN 2 — Red PIN 3 — Black.
Rollout switch fault. (LED 7 flashes)	Rollout switch has opened.	Rollout switch will automatically reset, but IGC* will continue to lockout unit. Check gas valve operation. Ensure that induced-draft blower wheel is properly secured to motor shaft. Inspect Heat Exchanger. Reset unit at unit disconnect.
Internal control fault. (LED 8 flashes)	Microprocessor has sensed an error in the software or hardware.	If error code is not cleared by resetting unit power, replace the IGC*.
Temporary software lock out. (LED 9 flashes)	Electrical interference impeding IGC software	Reset 24-v. to control board or turn thermostat off, then on again. Fault will automatically reset itself in one (1) hour.

* **WARNING** ⚠ : If the IGC must be replaced, be sure to ground yourself to dissipate any electrical charge that may be present before handling new control board. The IGC is sensitive to static electricity and may be damaged if the necessary precautions are not taken.

IMPORTANT: Refer to Table 12—Troubleshooting Guide—Heating for additional troubleshooting analysis.

LEGEND

IGC — Integrated Gas Unit Controller
LED — Light-Emitting Diode

START-UP CHECKLIST
(Remove and Store in Job File)

I. PRELIMINARY INFORMATION

MODEL NO: .....
SERIAL NO: .....
DATE: .....
TECHNICIAN: .....
JOB LOCATION: .....

II. PRE-START-UP (insert checkmark in box as each item is completed)

____ VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT
____ VERIFY THAT CONDENSATE CONNECTION IS INSTALLED PER INSTALLATION INSTRUCTIONS
____ CHECK ALL ELECTRICAL CONNECTIONS AND TERMINALS FOR TIGHTNESS
____ CHECK GAS PIPING FOR LEAKS
____ CHECK THAT INDOOR (EVAPORATOR) AIR FILTER IS CLEAN AND IN PLACE
____ VERIFY THAT UNIT INSTALLATION IS LEVEL
____ CHECK FAN WHEEL PROPELLER FOR LOCATION IN HOUSING ORIFICE AND SETSCREW TIGHTNESS

III. START-UP

ELECTRICAL

SUPPLY VOLTAGE L1-L2 _____
COMPRESSOR AMPS L1 _____
COMPRESSOR AMPS L1 _____
INDOOR (EVAPORATOR) FAN AMPS _____

TEMPERATURES

OUTDOOR (CONDENSER) AIR TEMPERATURE: _____ DB
RETURN-AIR TEMPERATURE: _____ DB _____ WB
COOLING SUPPLY AIR: _____ DB _____ WB
GAS HEAT SUPPLY AIR: _____

PRESSURES

GAS INLET PRESSURE _____ IN. WG
GAS MANIFOLD PRESSURE_____ IN. WG
REFRIGERANT SUCTION _____ PSIG SUCTION LINE TEMP*_____
REFRIGERANT DISCHARGE _____ PSIG DISCHARGE LINE TEMP† _____

____ VERIFY REFRIGERANT CHARGE USING CHARGING TABLES

* Measured at suction inlet to compressor

† Measured at liquid line leaving condenser