bryant
Day & Night
PAYNE

installation, start-up and service instructions

DUAL FUEL HEAT PUMP UNITS

658A
Sizes 030-060
2½ to 5 Tons

Cancels: New

II 658A-24-1
5/1/95

IMPORTANT — READ BEFORE INSTALLING

1. Read and become familiar with these installation instructions before installing this unit (Fig. 1).
2. Be sure the installation conforms to all applicable local and national codes.
3. These instructions contain important information for the proper maintenance and repair of this equipment. Retain these instructions for future use.

CONTENTS

SAFETY CONSIDERATIONS

⚠ **WARNING:** Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electric shock, or other occurrences which may injure you or damage your property. Consult a qualified installer, service agency, or the gas supplier for information or assistance. The qualified installer or agency must use only factory-authorized kits or accessories when modifying this product.

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

Understand the signal words — DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. Danger identifies the most serious hazards which will result in severe personal injury or death. Warning indicates a condition that could result in personal injury. Caution is used to identify unsafe practices which would result in minor personal injury or product and property damage.

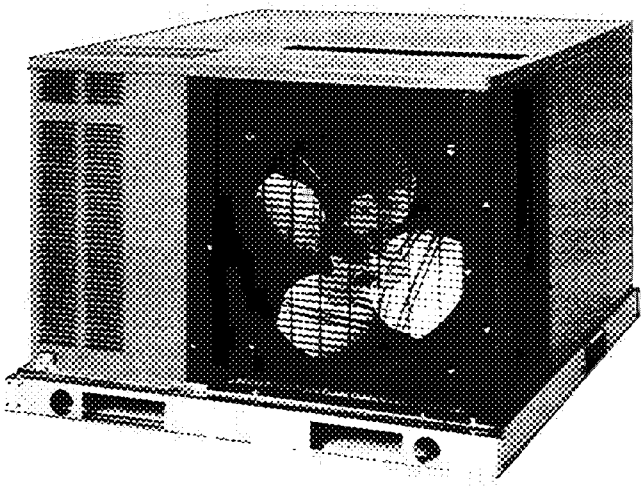


Fig. 1 — Unit 658A With Optional Base Rail Shown

⚠ **WARNING:** Disconnect gas piping from unit when leak testing at pressure greater than ½ psig. Pressures greater than ½ psig will cause gas valve damage resulting in hazardous condition. If gas valve is subject to pressure greater than ½ psig, it *must* be replaced before use. When pressure testing field-supplied gas piping at pressures of ½ psig or less, a unit connected to such piping must be isolated by manually closing the gas valve(s).

⚠ **WARNING:** Before performing service or maintenance operations on unit, turn off gas supply *then* main power switch to unit. Electrical shock could cause personal injury.

1. The power supply (v, ph, and Hz) must correspond to that specified on unit rating plate.
2. The electrical supply provided by the utility must be sufficient to handle load imposed by this unit.
3. Refer to Locate the Unit section and Fig. 2-7 (pages 2-6) for locations of gas inlet, electrical inlets, condensate drain, duct connections, and required clearances before setting unit in place. See Table 1 for unit physical data.
4. This installation must conform with local building codes and with the National Fuel Gas Code (NFGC), American National Standards Institute (ANSI) Z223.1-1988 (in Canada, CAN/CGA [Canadian Gas Association] B149.1, [2]-M86) or NFPA (National Fire Protection Association) 54-1988 TIA-54-84-1. Refer to Provincial and local plumbing or wastewater codes and other applicable local codes.
5. Approved for outdoor installation on wood flooring or on class A, B, or C roof covering materials.

INSTALLATION

Units are shipped with all 4 duct openings covered. Remove appropriate panels for intended installation.

These units are equipped with an energy-saving, automatic, electric, direct-spark ignition system that does not have a continuously burning pilot. All units are manufactured with natural gas controls.

All units can be connected into existing duct systems *that are sized properly and designed to handle the airflows shown in fan performance tables.*

NOTE: When installing any accessory item, see the manufacturer's installation instructions packaged with the accessory. A qualified agency must use factory-authorized kits or accessories when modifying this unit.

I. LOCATE THE UNIT

A. Clearance

Maintain clearance around and above unit to provide minimum distance from combustible materials, proper airflow, and service access. See Fig. 2-7.

⚠ CAUTION: Do not restrict outdoor airflow. An air restriction can be detrimental to compressor life.

The outdoor fan discharges through the top and sides of the unit. Ensure that the fan discharge does not recirculate to the outdoor coil. Do not locate the unit either in a corner or under a complete overhead obstruction and ensure the following clearances are provided:

On roof overhangs, provide a minimum clearance of 48 in. above the top of the unit for partial overhangs (such as a normal house roof overhang). If there is a horizontal extension on the partial overhang, it must not exceed 48 inches. For extended overhangs, provide a minimum clearance of 36 inches.

Provide a minimum clearance of 42 in. for the control box side next to a block wall or any other grounded surface. Provide a minimum clearance of 48 in. between the control box side of the unit and any electrically live parts, for example, another unit. Provide a minimum clearance of 36 in. for the accessory manual outdoor-air damper (if the unit is equipped with one). The clearance for under the unit is zero inches.

Minimum operating clearance to combustibles is 30 in. on flue panel side.

Do not install unit in an indoor location. Do not locate unit air inlets near exhaust vents or other sources of contaminated air. Do not install unit on carpeting, tile, or other combustible material. Unit may be installed on wood flooring, or on class A, B, or C roof covering materials.

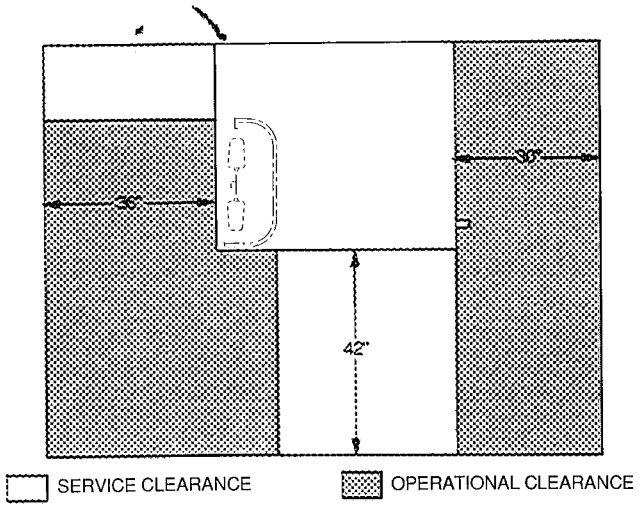
Be sure that unit is installed so that snow will not block the combustion intake or flue outlet.

Although unit is weatherproof, guard against water from higher level runoff and overhangs.

Slab-mounted units should be at least 4 in. above the highest expected water, flood, and runoff levels. Do not use the unit if it has been under water.

Locate mechanical draft system flue assembly at least 48 in. from any opening through which combustion products could enter the building, and at least 30 in. from an adjacent building. When unit is located adjacent to public walkways, flue assembly must be at least 7 ft above grade.

Flue gas can deteriorate building materials. Orient unit so that flue gas will not affect building materials.



*If next to block wall; 48-in. if next to electrically live parts

Fig. 2 — Service and Operational Clearance

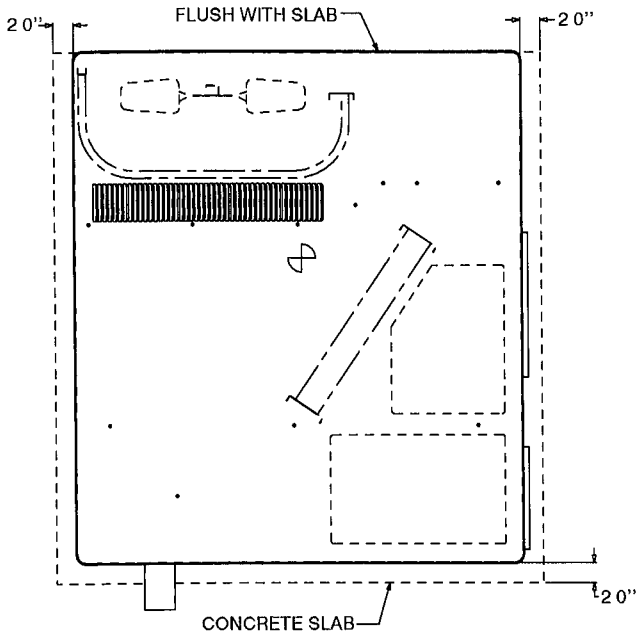


Fig. 3 — Slab Mounting Details

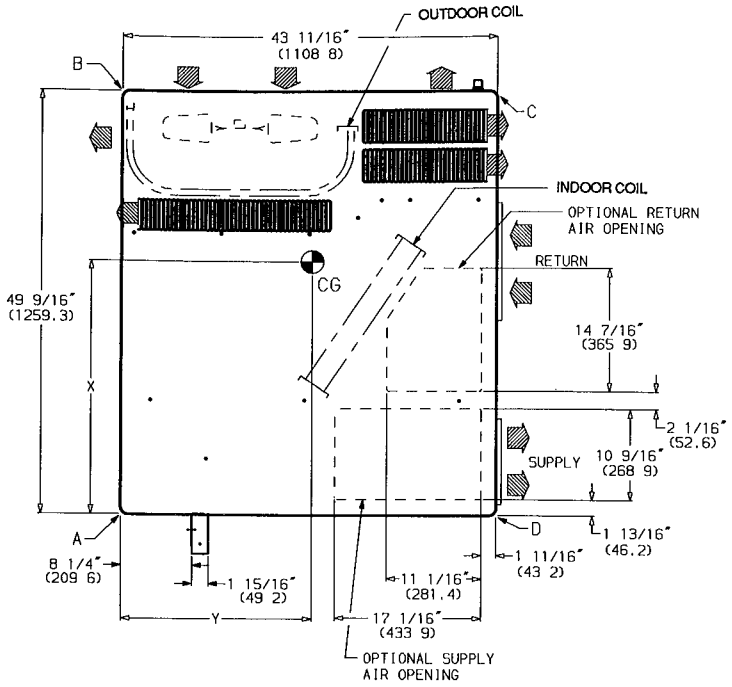
Adequate combustion-air space must be provided for proper operation of this equipment. Be sure that installation complies with all local codes.

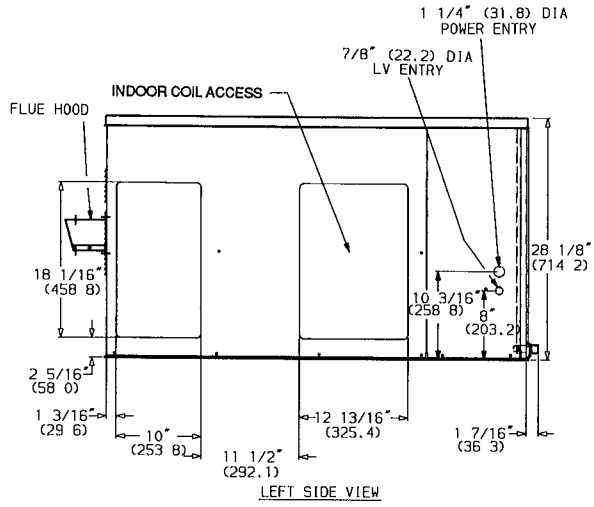
Flue vent discharge must have a minimum horizontal clearance of 4 ft from electric meters, gas meters, gas regulators, and gas relief equipment.

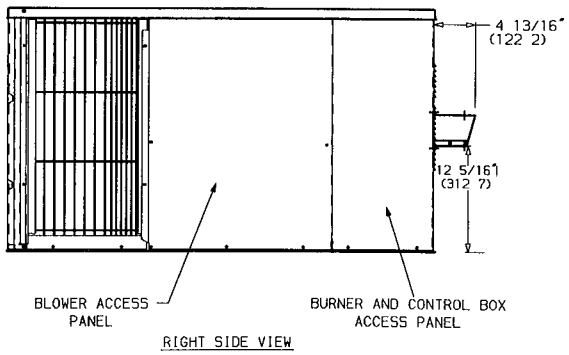
B. Rooftop Installation

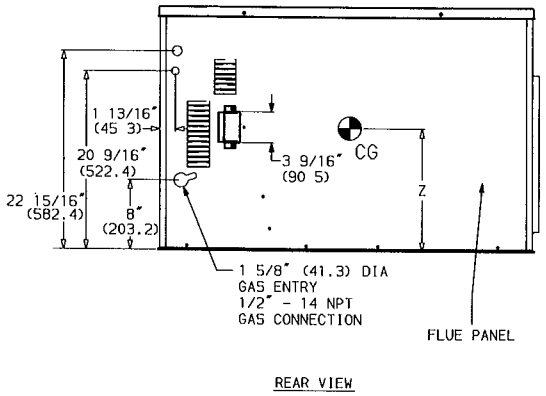
⚠ CAUTION: When installing the unit on a rooftop, be sure that the roof will support the additional weight. Refer to Fig. 4-7 for total weight and corner weight information. Refer to Fig. 8 for roof curb dimensions.

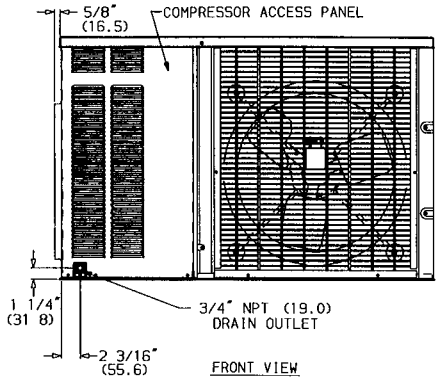
(text continued on page 8)











REQ'D CLEARANCES FOR SERVICING — in (mm)

Duct panel	0
Unit top	36 (914 4)
Side opposite ducts	36 (914 4)
Compressor access (Except for NEC requirements)	36 (914 4)

REQ'D CLEARANCES TO COMBUSTIBLE MAT'L — in. (mm)

Maximum extension of overhangs	48 (1219 2)
Unit top	14 (355 6)
Duct side of unit	0
Side opposite ducts	9 (228 6)
Bottom of unit	0
Flue panel	30 (762 0)

NEC REQ'D CLEARANCES — in (mm)

Between units, control box side	42 (1066 8)
Unit and ungrounded surfaces, control box side	36 (914 4)
Unit and block or concrete walls and other grounded surfaces, control box side	42 (1066 8)

UNIT	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		CORNER WEIGHT (lb/kg)			
		lb	kg	A	B	C	D
658A030040	208/230-1-60, 208/230-3-60	346	157	99/45	69/31	120/55	58/26
658A030060	208/230-1-60, 208/230-3-60	358	163	102/46	72/33	123/56	61/28
658A036060/080	208/230-1-60, 208/230-3-60, 460-3-60	376	171	96/44	87/40	119/54	71/32

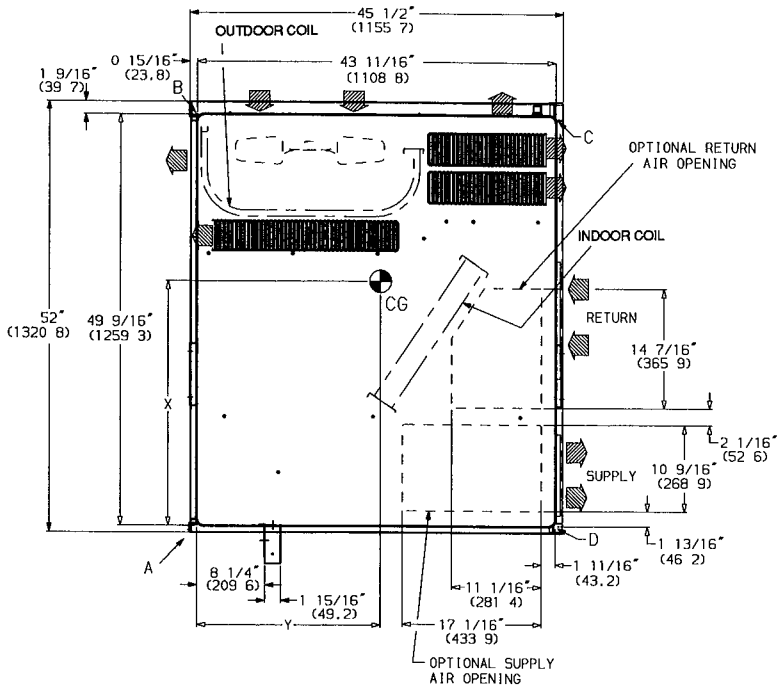
UNIT	CENTER OF GRAVITY (in./mm)		
	X	Y	Z
658A030040	26 99/686	22 62/575	12.65/321
658A030060	26 90/684	22 62/575	12.65/321
658A036060/080	27.06/688	22.62/575	12.65/321

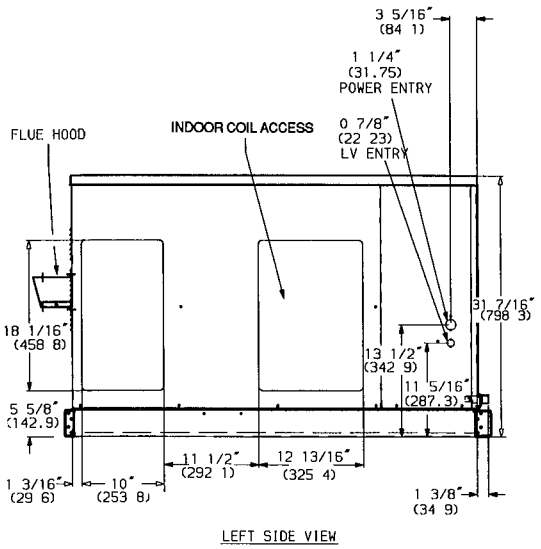
NOTE: Clearances must be maintained to prevent recirculation of air from outdoor fan discharge

LEGEND

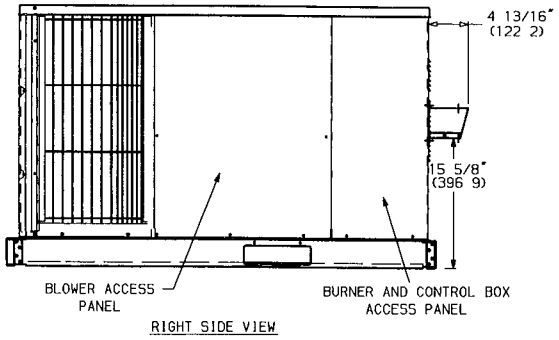
CG — Center of Gravity
LV — Low Voltage
MAT'L — Material
NEC — National Electrical Code
REQ'D — Required

Fig. 4 — Unit Dimensions; 658A030,036 Without Base Rail

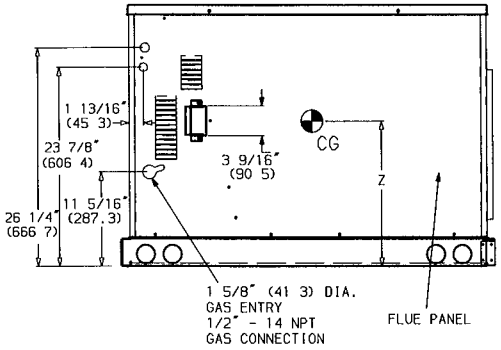




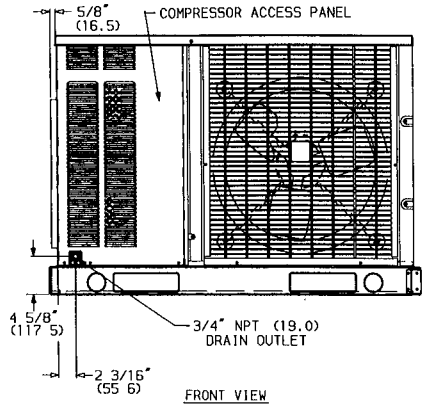
LEFT SIDE VIEW



RIGHT SIDE VIEW



REAR VIEW



FRONT VIEW

REQ'D CLEARANCES FOR SERVICING — in (mm)

Duct panel	0
Unit top	36 (914 4)
Side opposite ducts	36 (914 4)
Compressor access (Except for NEC requirements)	36 (914 4)

REQ'D CLEARANCES TO COMBUSTIBLE MAT'L — in (mm)

Maximum extension of overhangs	48 (1219 2)
Unit top	14 (355 6)
Duct side of unit	0
Side opposite ducts	9 (228 6)
Bottom of unit	0
Flue panel	30 (762 0)

NEC REQ'D CLEARANCES — in (mm)

Between units, control box side	42 (1066.8)
Unit and ungrounded surfaces, control box side	36 (914 4)
Unit and block or concrete walls and other grounded surfaces, control box side	42 (1066 8)

UNIT	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		CORNER WEIGHT (lb/kg)			
		lb	kg	A	B	C	D
658A030040	208/230-1-60, 208/230-3-60	370	169	105/48	75/34	126/57	64/29
658A030060	208/230-1-60, 208/230-3-60	382	174	108/49	78/35	129/59	67/30
658A036060/080	208/230-1-60, 208/230-3-60, 460-3-60	400	182	102/46	93/42	125/57	77/35

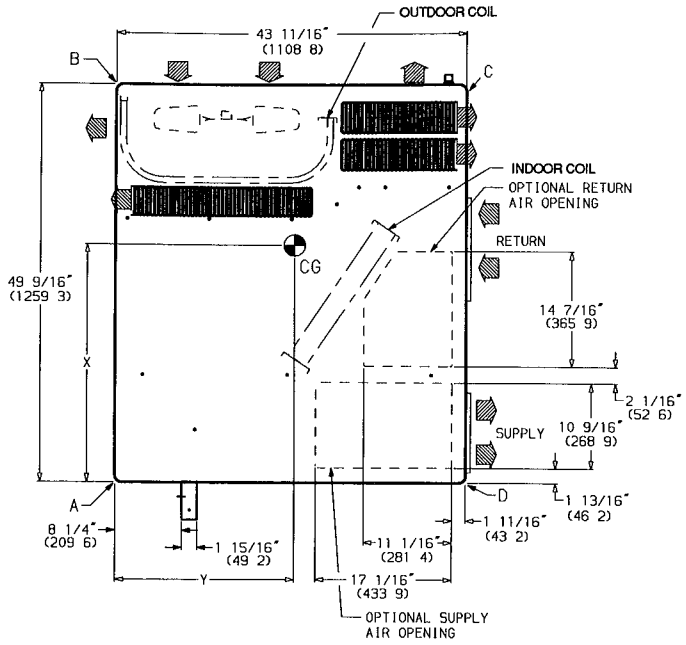
UNIT	CENTER OF GRAVITY (in./mm)		
	X	Y	Z
658A030040	26 85/682	23.25/590	15.96/405
658A030060	26.75/680	23.25/590	15.96/405
658A036060/080	26.95/684	23.25/590	15.96/405

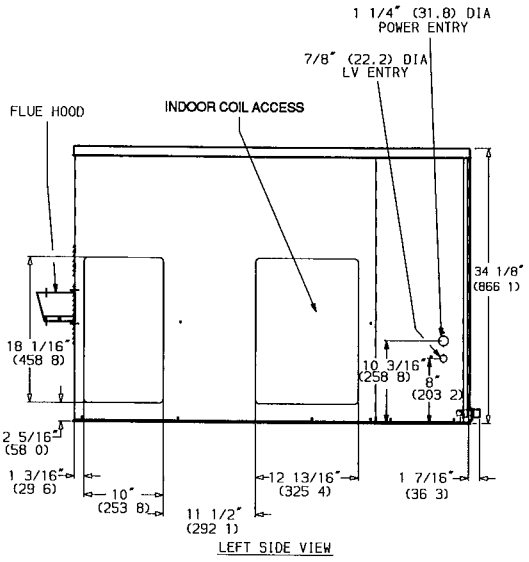
NOTE: Clearances must be maintained to prevent recirculation of air from outdoor fan discharge

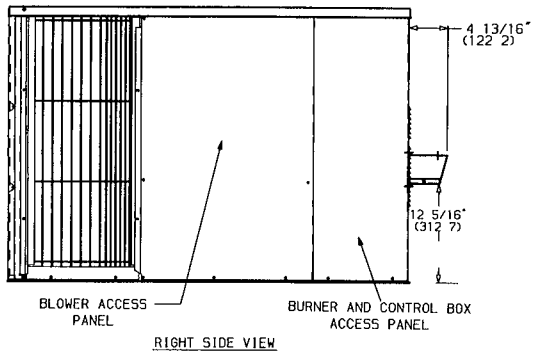
LEGEND

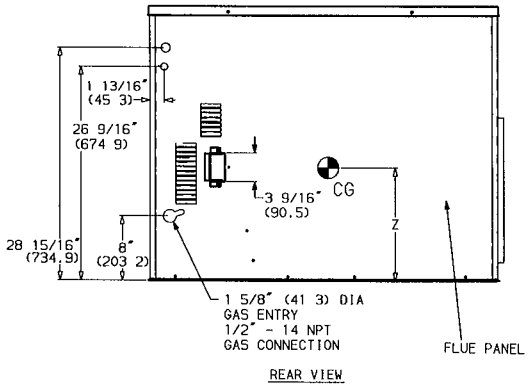
CG	— Center of Gravity	**NEC**	— National Electrical Code
LV	— Low Voltage		
MAT'L	— Material	**REQ'D**	— Required

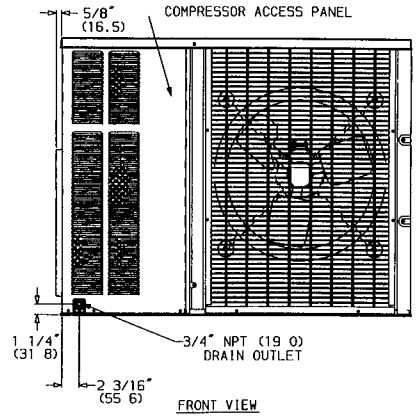
Fig. 5 — Unit Dimensions; 658A030,036 With Optional Base Rail











REQ'D CLEARANCES FOR SERVICING — in (mm)

Duct panel	0
Unit top	36 (914 4)
Side opposite ducts	36 (914 4)
Compressor access (Except for NEC requirements)	36 (914 4)

REQ'D CLEARANCES TO COMBUSTIBLE MAT'L — in (mm)

Maximum extension of overhangs	48 (1219 2)
Unit top	14 (355 6)
Duct side of unit	0
Side opposite ducts	9 (228 6)
Bottom of unit	0
Flue panel	30 (762.0)

NEC REQ'D CLEARANCES — in (mm)

Between units, control box side	42 (1066 8)
Unit and ungrounded surfaces, control box side	36 (914 4)
Unit and block or concrete walls and other grounded surfaces, control box side	42 (1066 8)

UNIT	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		CORNER WEIGHT (lb/kg)			
		lb	kg	A	B	C	D
658A048080/100	208/230-1-60, 208/230-3-60	432	196	111/50	88/40	160/73	73/33
658A060080/100	208/230-1-60, 208/230-3-60	463	210	119/54	96/44	167/76	81/37

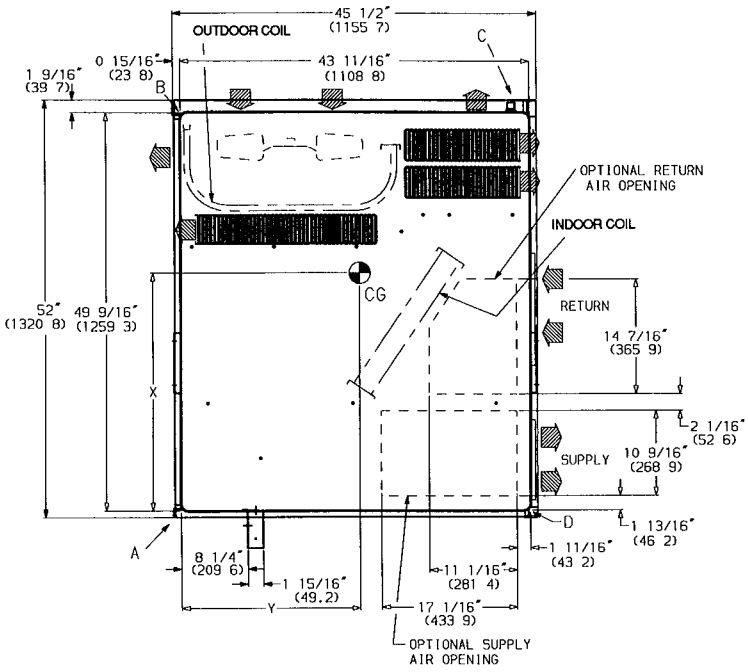
UNIT	CENTER OF GRAVITY (in./mm)		
	X	Y	Z
658A048080/100	28.38/720	23.75/604	15 35/390
658A060080/100	28.06/713	23.60/599	15.35/390

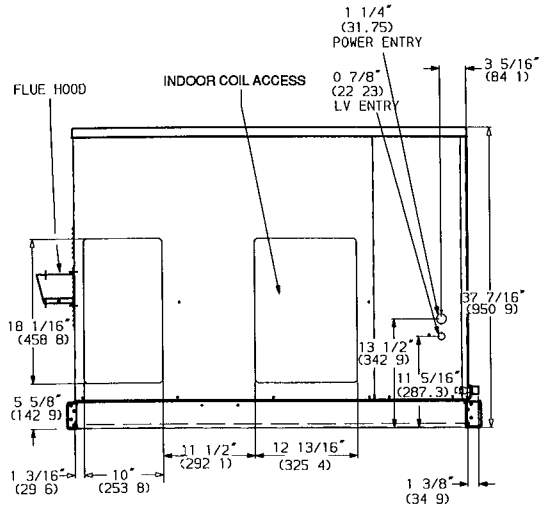
NOTE: Clearances must be maintained to prevent recirculation of air from outdoor fan discharge

LEGEND

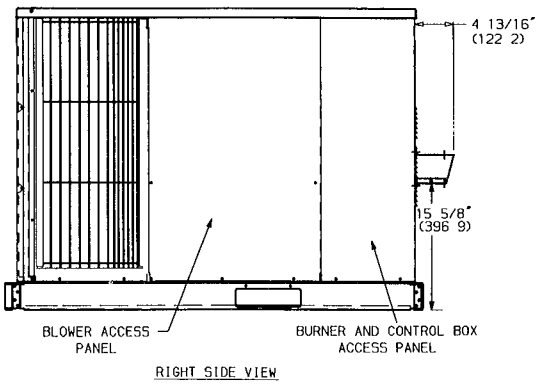
CG — Center of Gravity
LV — Low Voltage
MAT'L — Material
NEC — National Electrical Code
REQ'D — Required

Fig. 6 — Unit Dimensions; 658A048,060 Without Base Rail

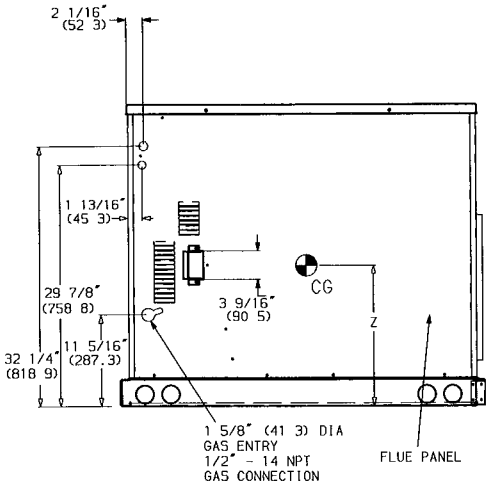




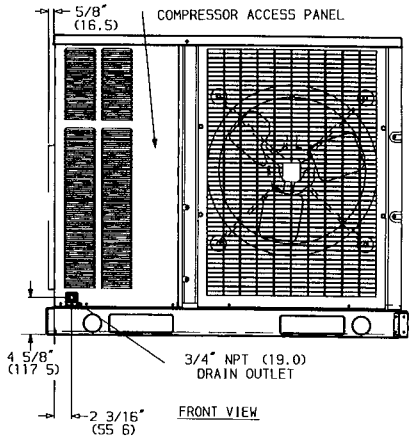
LEFT SIDE VIEW



RIGHT SIDE VIEW



REAR VIEW



FRONT VIEW

REQ'D CLEARANCES FOR SERVICING — in (mm)	
Duct panel	0
Unit top	36 (914 4)
Side opposite ducts	36 (914 4)
Compressor access (Except for NEC requirements)	36 (914 4)
REQ'D CLEARANCES TO COMBUSTIBLE MAT'L — in (mm)	
Maximum extension of overhangs	48 (1219 2)
Unit top	14 (355 6)
Duct side of unit	0
Side opposite ducts	9 (228 6)
Bottom of unit	0
Flue panel	30 (762 0)
NEC REQ'D CLEARANCES — in (mm)	
Between units, control box side	42 (1066 8)
Unit and ungrounded surfaces, control box side	36 (914 4)
Unit and block or concrete walls and other grounded surfaces, control box side	42 (1066 8)

UNIT	ELECTRICAL CHARACTERISTICS	UNIT WEIGHT		CORNER WEIGHT (lb/kg)			
		lb	kg	A	B	C	D
658A048080/100	208/230-1-60, 208/230-3-60	456	207	117/53	94/43	166/75	79/36
658A060080/100	208/230-1-60, 208/230-3-60	487	221	125/57	102/46	173/79	87/40

UNIT	CENTER OF GRAVITY (in./mm)		
	X	Y	Z
658A048080/100	28.16/716	24 50/622	18 66/474
658A060080/100	27.90/709	24.30/618	18.66/474

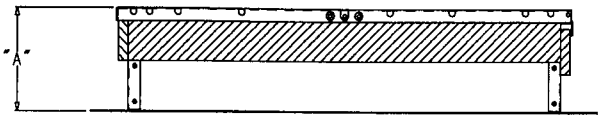
NOTE: Clearances must be maintained to prevent recirculation of air from outdoor fan discharge

LEGEND

CG — Center of Gravity
LV — Low Voltage
MAT'L — Material
NEC — National Electrical Code
REQ'D — Required

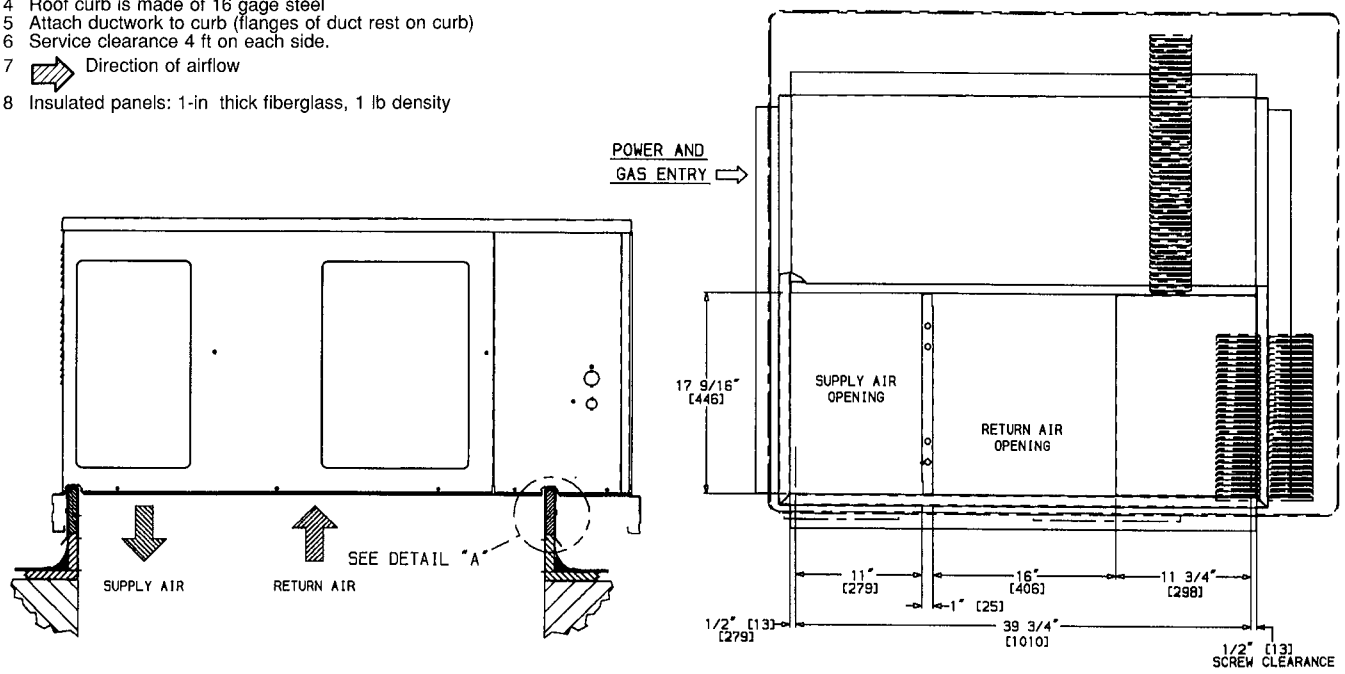
Fig. 7 — Unit Dimensions; 658A048,060 With Optional Base Rail

	PART NUMBER	"A"
FLAT	CPRFCURB001A00	8″ [203]
	CPRFCURB002A00	11″ [279]
	CPRFCURB003A00	14″ [356]



FLAT CURB

NOTES:
1 Roof curb must be set up for unit being installed
2 Seal strip must be applied as required for unit being installed
3 Dimensions in [ ] are in millimeters
4 Roof curb is made of 16 gage steel
5 Attach ductwork to curb (flanges of duct rest on curb)
6 Service clearance 4 ft on each side.
7 Direction of airflow
8 Insulated panels: 1-in thick fiberglass, 1 lb density



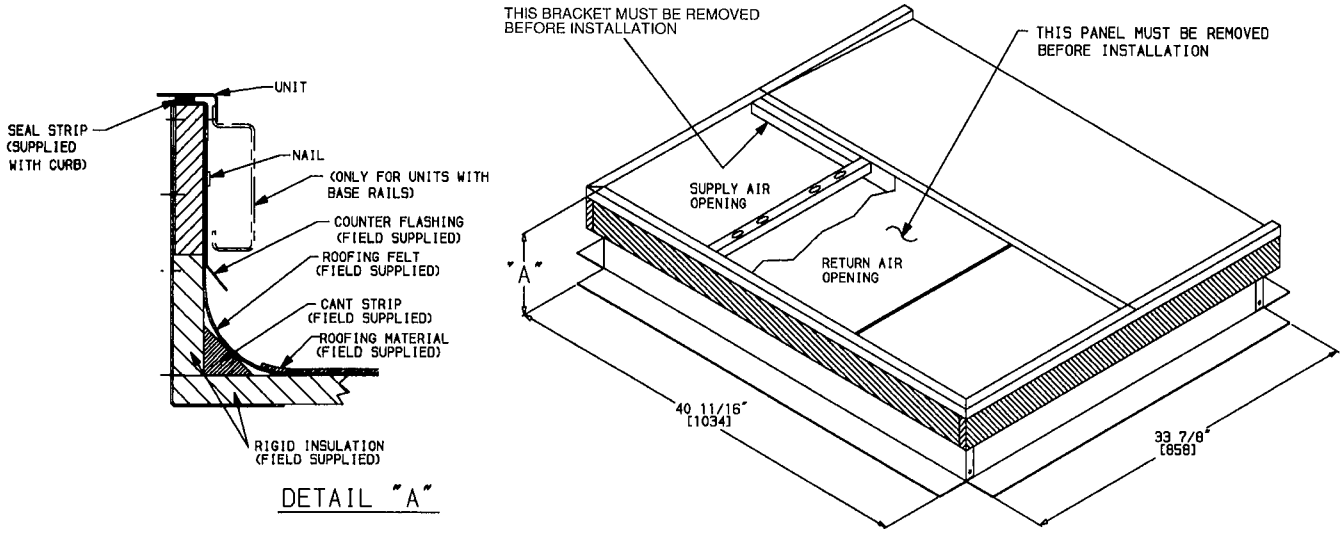


Fig. 8 — Roof Curb Dimensions

Table 1 — Specifications

UNIT SIZE 658A	030040	030060	036060	036080	048080	048100	060080	060100
NOMINAL CAPACITY (tons)	2½	2½	3	3	4	4	5	5
OPERATING WEIGHT (lb)								
Without Base Rail	346	358	376	376	432	432	463	463
With Optional Base Rail	370	382	400	400	456	456	487	487
COMPRESSOR	Scroll							
Quantity	1							
REFRIGERANT	R-22							
Charge (lb)	5 6	5 6	6 0	6.0	7.8	7.8	8 1	8.1
OUTDOOR COIL								
Rows...Fins/in.	2.. 17	2 .17	2...17	2.. 17	2.. 17	2 17	2 . 17	2 17
Face Area (sq ft)	7 0	7.0	7 0	7 0	8.66	8.66	8.66	8 66
OUTDOOR FAN (Propeller)								
Nominal Cfm	2200	2200	2200	2200	2400	2400	2400	2400
Diameter (in.)	20	20	20	20	20	20	20	20
Motor Hp	¼	¼	¼	¼	⅓	⅓	⅓	⅓
Motor Rpm	1100	1100	1100	1100	1100	1100	1100	1100
INDOOR COIL								
Rows...Fins/in.	3. 15	3 ..15	4. 15	4 . 15	4 . 15	4 ..15	4...15	4.. 15
Face Area (sq ft)	3.6	3 6	3.6	3 6	4 5	4.5	4.5	4 5
INDOOR FAN (Centrifugal)*								
Nominal Airflow (Cfm)	1000	1000	1300	1300	1600	1600	1800	1800
Size (in.)	10 x 10	10 x 10	10 x 10	10 x 10	10 x 10	10 x 10	10 x 10	10 x 10
Motor Hp	¼	¼	¼	½	1	1	1	1
Motor Rpm	1075	1075	1100	1100	Variable	Variable	Variable	Variable
FURNACE SECTION								
Heating Input† (Btuh)	40,000	56,000	56,000	80,000	80,000	95,000	80,000	95,000
Burner Orifice (Qty...drill size)								
Natural Gas	1. .32	2 .41	2.. 41	2.. 32	2 32	2 30	2 32	2 30
Propane Gas	1.. 41	2. .46	2 ..46	2.. 42	2 42	2...41	2...42	2...41
RETURN-AIR FILTERS**								
Throwaway (in.)	24 x 24	24 x 24	24 x 24	24 x 24	24 x 30	24 x 30	24 x 30	24 x 30

*Sizes 048 and 060 indoor fans are equipped with an integrated control motor (ICM) The ICM provides variable speed.
†Based on an altitude of 0 to 2000 feet
**Required filter sizes shown are based on the ARI (Air Conditioning & Refrigeration Institute) rated heating airflow at a velocity of 300 ft/min for throwaway type or 450 ft/min for high capacity type. Recommended filters are 1-in thick

For downflow applications, an accessory roof curb must be installed on and flashed into the roof before unit installation. Install insulation, cant strips, flashing, and gasket material per accessory roof curb installation instructions. The placement of the gasket material between the unit and roof curb is critical for watertightness. The curb should be level to within ¼ inch. Unit leveling tolerances are shown in Fig. 9.

For horizontal applications, place the unit on a level base that provides proper support. On flat roofs, be sure that the unit is located at least 4 in. above the highest expected water level on the roof to prevent flooding.

C. Ground-Level Installation

Place the unit on a solid, level, concrete pad that is a minimum of 4-in. thick with 2 in. above grade. The pad should be flush with front of unit, and extend approximately 2 in. beyond the casing on remaining 3 sides of the unit. See Fig. 3. Install a gravel apron in front of condenser-air inlets to prevent obstruction of airflow by grass, shrubs, etc. Do not secure the unit to the pad *except* when required by local codes.

NOTE: Horizontal units may be installed on a roof curb if required.

D. Flush Mount

Place side of unit with duct panel flush against transition. On units with optional base rails, the skirt on duct-panel side of unit can be removed or relocated to allow unit to be mounted flush against transitions that extend below basepan of unit.

To move skirt, proceed as follows:

1. Remove 4 screws holding skirt to base rail. Retain screws.
2. Remove skirt or slide skirt inwards until alternate clearance holes align with base rails.
3. Secure with screws removed in Step 1. Holes align with base rails.

To remove wood support under unit, loosen 4 screws above rigging holes and slide assembly out through rectangular hole.

II. UNIT DUCT CONNECTIONS

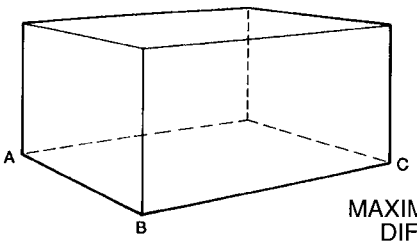
Secure all ducts to roof curb and building structure on vertical discharge units. *Do not connect ductwork to unit.* For horizontal applications, ductwork should be attached to flanges on horizontal discharge openings. Insulate and weatherproof all external ductwork, joints, and roof openings with counter 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.

NOTE: Connection may be made to roof curb before unit is set in place.



MAXIMUM ALLOWABLE DIFFERENCE (in.)

A-B	B-C	A-C
¼	¼	¼

Fig. 9 — Unit leveling Tolerances

III. RIG AND PLACE UNIT

⚠ CAUTION: When installing the unit on a rooftop, be sure the roof will support the additional weight. Refer to Fig. 4-7 for corner weight information.

Inspect unit for transportation damage. File any claim with transportation agency. Keep upright and do not drop. Spreader bars are not required if top crating is left on unit. Rollers may be used to move unit across a roof. Level by using unit frame as a reference. See Table 1 and Fig. 10 for additional information. Unit weight is shown in Fig. 4-7.

⚠ CAUTION: Use spreader bars and crate top when rigging the unit to be lifted. The units must be rigged for lifting as shown in Fig. 10. See Fig. 4-7 and Table 1 for additional information. 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 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, ensure that the support is level and properly supports the unit.

A. Units Without Base Rail

If accessory rigging brackets are to be used for rigging, install them as follows:

⚠ WARNING: Secure screws and paint protectors solidly against unit basepan to hold lifting brackets in position.
Never use lifting brackets when the temperature is below –10 F.
Never exceed 200 lbs per bracket of lifting force.
Never use lifting brackets for lifting other models of air-conditioning units or heat pumps.
Lifting point should be directly over the unit center of gravity.

1. Position brackets as close to the corners of unit as possible. Be sure brackets are well outside of center of gravity. (See Fig. 4, 6, and 10.)
2. Position paint protectors and foam strips between screws and painted surface of unit. Tighten screws until they make contact with the paint protectors.
3. Secure device or hook of sufficient strength to hole in bracket as shown in detail "C" of Fig. 10.
4. If wood top is available, use it for a spreader bar to prevent straps from damaging unit. If wood top is not available, use spreader bars of sufficient length.

B. Units With Optional Base Rail

Lifting holes are provided in optional base rail as shown in Fig. 10. Operating weights are shown in Table 1. Refer to rigging instructions on unit.

Protective wood support must be removed from unit before unit is mounted to curb. Remove 4 screws that secure support above rigging holes in rails. Slide support out through rectangular hole in rail. See Fig. 10.

IV. FIELD CONNECTIONS

A. Condensate Disposal

NOTE: Ensure that condensate-water disposal methods comply with local codes, restrictions, and practices.

Units dispose of condensate water through a ¾ in. NPT fitting which exits through the compressor access panel. See Fig. 4-7 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 condensate connection to prevent the pan from overflowing. See Fig. 11. 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. 11. Make sure that the outlet of the trap is at least 1 in. lower than the drain pan condensate connection to prevent the pan from overflowing. Prime the trap with water. Connect a drain tube using a minimum of ¾-in. PVC or ¾-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.

B. Install Flue Hood

The flue hood assembly is shipped screwed to the control box in the burner compartment. Remove the burner access panel to locate the assembly.

⚠ CAUTION: 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.

1. This installation must conform with local building codes and with the NFGC, ANSI Z223.1-1988 (in Canada, CAN/CGA B149.1, [2]-M86) or NFPA 54-1988 TIA-54-84-1. Refer to Provincial and local plumbing or wastewater codes and other applicable local codes.
2. Remove from shipping location. Place vent cap assembly over flue panel. Orient screw holes in vent cap with holes in flue panel.
3. Secure flue hood to flue panel with a screw on top, right, and left sides of flue hood.

C. Gas Piping

The gas supply pipe enters the unit through the access hole provided. The gas connection to the unit is made to the ½-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 NFGC for gas pipe sizing. *Do not use cast iron pipe.* Black iron pipe must be used for connections inside the unit. Check with 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 ½- in. FPT gas inlet on the unit gas valve.*

NOTICE TO RIGGERS

Hook rigging shackles through holes in lifting brackets, as shown in Details "A" and "C " Lifting brackets to be centered around the unit center of gravity Use wooden top skid when rigging, to prevent rigging straps from damaging unit On units with rails, remove 4 screws to slide wood support through rectangular hole in rail

⚠ CAUTION: All panels must be in place when rigging.

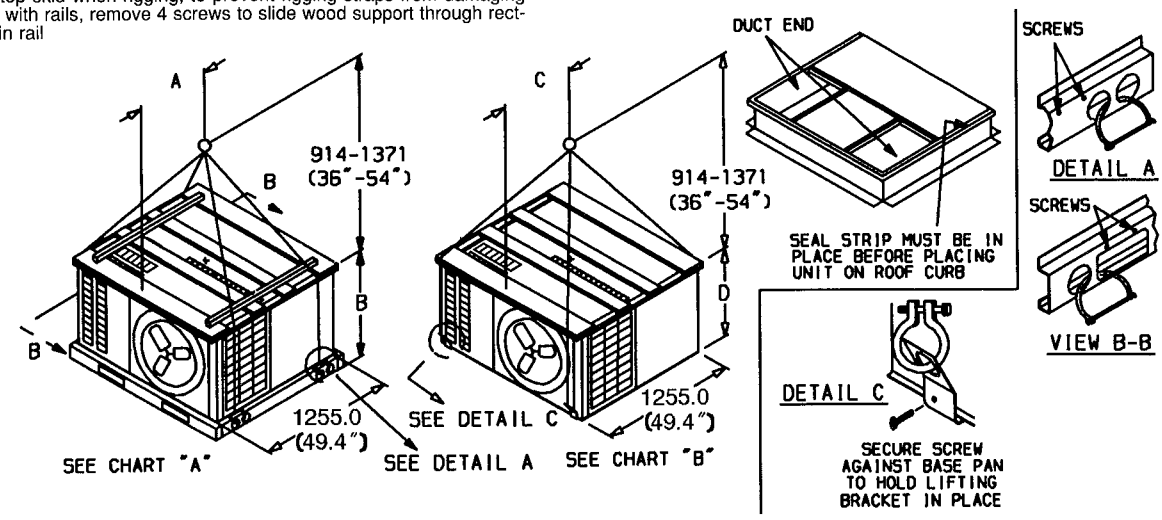


CHART "A" — UNITS WITH OPTIONAL BASE RAIL

UNIT SIZE 658A	MAXIMUM SHIPPING WEIGHT		A		B	
	Lb	Kg	in.	mm	in.	mm
030	401	182	22.6	575	32 2	817
036	421	191	22.4	569	32 2	817
048	477	217	21.2	537	38.2	969
060	506	230	21 5	546	38 2	969

CHART "B" — UNITS WITHOUT BASE RAIL

UNIT SIZE 658A	MAXIMUM SHIPPING WEIGHT		C		D	
	Lb	Kg	in.	mm	in.	mm
030	377	171	22 4	568	28 2	715
036	397	180	22.3	566	28 2	715
048	453	206	21.0	532	34 2	867
060	482	219	21 3	542	34 2	867

Fig. 10 — Suggested Rigging for 658A Units

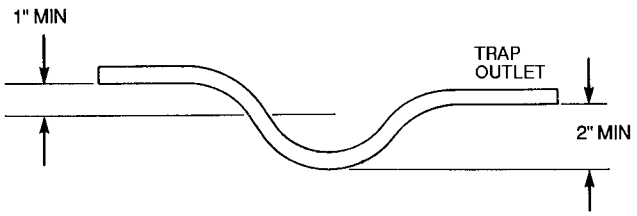


Fig. 11 — Condensate Trap

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 LP (liquid propane) applications, the gas pressure must not be less than 4.0 in. wg or greater than 13 in. wg at the unit connection.

When installing the gas supply line, observe local codes pertaining to gas pipe installations. Refer to NFGC, ANSI Z223.1-1988 (in Canada, CAN/CGA B149.1, [2]-M86) or NFPA 54-1988. 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 ¼ inch 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 ½ 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, per Fig. 12. This drip leg functions as a trap for dirt and condensate.
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 gas valve and external manual gas shutoff valve.
7. Pressure-test all gas piping in accordance with local and national plumbing and gas codes before connecting piping to unit.

NOTE: If gas supply system will be pressure tested *after* the gas supply piping has been connected to the unit gas valve, the following procedures must be observed:

When pressure testing the gas supply piping system at test pressure exceeding 0.5 psig, supply piping must be disconnected from the gas valve.

When pressure testing the gas supply system at test pressure less than or equal to 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.

⚠ CAUTION: Unstable operation may occur when the gas valve and manifold assembly are forced out of position while connecting improperly routed rigid gas piping to the gas valve. Use a backup wrench when making connection to avoid strain on, or distortion of, the gas control piping.

Table 2 — Maximum Gas Flow Capacity of Pipe in Cubic Feet of Gas Per Hour for Gas Pressures of 0.5 Psig or Less and a Pressure Drop of 0.5 in. wg (Based on a 0.60 Specific Gravity Gas)

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
½	.622	175	120	97	82	73	66	61	57	53	50	44	40	—	—
¾	.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
1¼	1 380	1400	950	770	600	580	530	490	460	430	400	360	325	300	280
1½	1 610	2100	1460	1180	990	900	810	750	690	650	620	550	500	460	430

Refer to Table C-4, National Fire Protection Association (NFPA) 54
*This length includes an ordinary number of fittings.
NOTE: Typical natural gas heating value is 1000 Btuh per cu ft
For example: A 96,000 Btuh input unit equals 96 cu ft per hour or $\frac{96{,}000}{1{,}000}$ = 96 cu ft/hr

⚠ CAUTION: If a flexible conductor is required or allowed by the authority having jurisdiction, black iron pipe shall be installed at the gas valve and extend a minimum of 9 in. outside the unit casing.

⚠ WARNING: Never use a match or other open flame when checking for gas leaks. Never purge gas line into combustion chamber. Failure to adhere to this warning could result in an explosion causing personal injury or death.

8. Check for gas leaks at all 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).

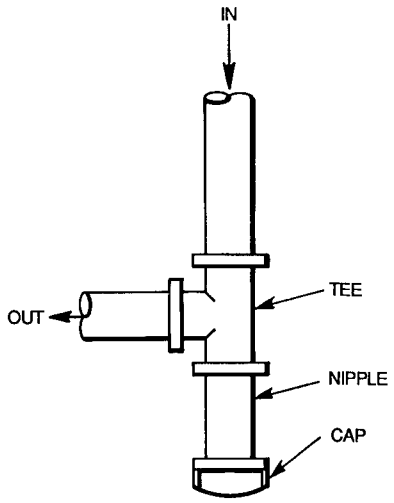


Fig. 12 — Sediment Trap

Liquid Propane

Units are shipped for use with natural gas, but may be field-converted for use with liquid propane (LP) using an accessory LP conversion kit.

All LP gas equipment must conform to NFPA safety standards.

The LP gas pressure at the unit must be 3.5 in. wg under full load. Maintaining proper gas pressure depends on:

- Vaporization rate (vaporization rate is determined by the temperature of the LP gas and the level of LP gas in the tank).
- Proper pressure regulation (2-stage regulation is more cost effective and more efficient).
- Pressure drop in lines between regulators and between the second-stage regulator and the appliance. Pipe size is determined by the length of the pipe run and the total load of all appliances.

Contact your LP gas supplier or regulator manufacturer for further details regarding tank sizing, recommended regulator settings, and pipe sizing.

Special pipe compound must be used when assembling piping for LP gas, as white lead or commercial compounds will be dissolved easily. Use a shellac-based compound suitable for use with LP.

D. Field Duct Connections

NOTE: The design and installation of the duct system must be in accordance with the standards of NFPA for the installation of nonresidence-type air conditioning and ventilating systems, NFPA 90A or residence-type, NFPA 90B; and/or local codes and ordinances.

Units have duct flanges on the supply- and return-air openings on the side and bottom of the unit.

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

1. Units are shipped with all 4 duct openings covered. Remove appropriate panels for intended installation.
2. Select and size ductwork, supply-air registers and return-air grilles according to ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) 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 accessory filter rack or field-supplied air filter(s) in return-air ductwork where they are easily accessible for service. Recommended filter sizes 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.
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 SMACNA (Sheet Metal and Air Conditioning Contractors National Association) and ACCA (Air-Conditioning Contractors of America) 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.

Configuring Units for Downflow (Vertical) Discharge

⚠ **WARNING:** Before performing service or maintenance operations on the system, turn off main power to unit or severe electrical shock could result.

1. Open all electrical disconnects before starting any service work.
2. Remove return duct cover located on duct panel. Save duct cover and screws. See Fig. 13 for illustration of duct cover removed.
3. Locate lances in basepan insulation that are placed over the perimeter of the vertical duct opening cover (Fig. 14).
4. Using a straight edge and sharp knife, cut and remove the insulation around the perimeter of the cover. Remove and save 5 screws securing the cover to the basepan and slide out the cover. Discard the cover (Fig. 15).
5. Remove supply duct cover located on duct panel. Save duct cover and screws. See Fig. 13 for illustration of duct cover removed.
6. Remove and discard the 2 screws securing the vertical discharge opening cover (Fig. 16) to the basepan. Slide cover forward to disengage, then tilt and remove cover through vertical discharge opening in bottom of unit. Discard the cover (Fig. 17).

⚠ **CAUTION:** Collect ALL screws that were removed. Do not leave screws on rooftop as permanent damage to the roof may occur.

7. If unit ductwork is to be attached to vertical opening flanges on the unit basepan (jackstand applications only), do so at this time.
8. It is recommended that the basepan insulation around the perimeter of the vertical return air opening be secured to the basepan with aluminum tape. Applicable local codes may require aluminum tape to prevent exposed fiberglass.
9. Cover both horizontal duct openings with the duct covers from Steps 2 and 5. Make sure opening is air- and watertight.
10. 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 residence-type, NFPA 90B; and/or local codes and ordinances.

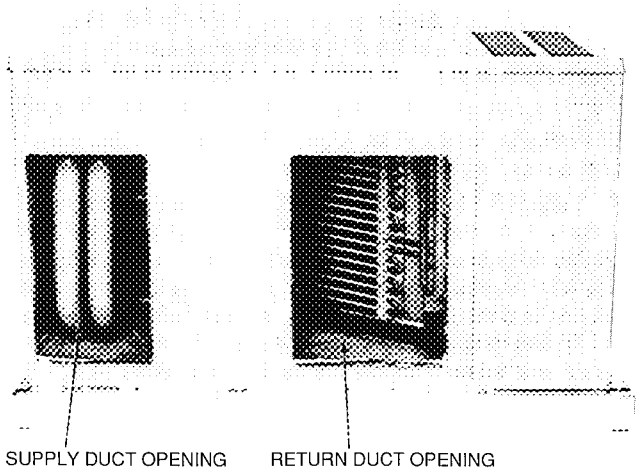


Fig. 13 — Supply and Return Duct Openings

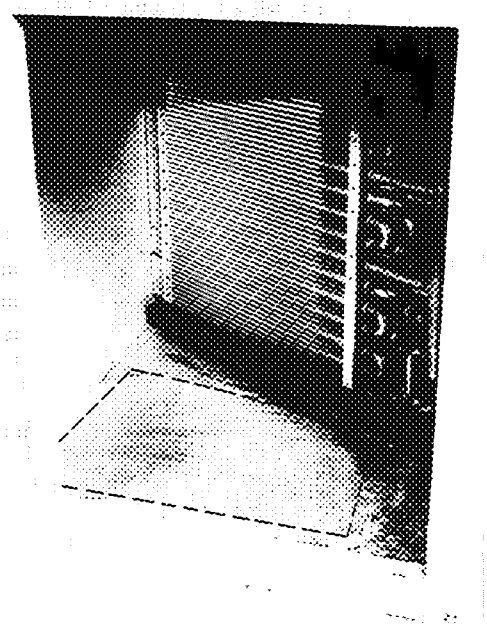


Fig. 14 — Lance Location for Vertical Duct Opening Cover

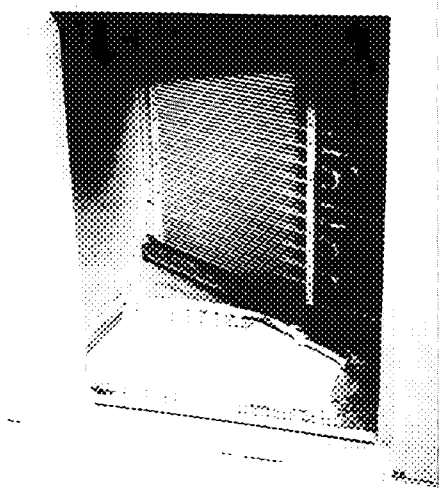


Fig. 15 — Vertical Duct Cover Removed

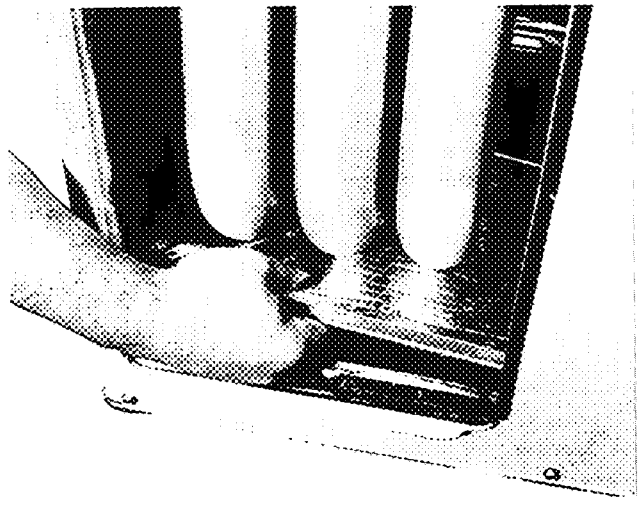


Fig. 16 — Removal of Vertical Discharge Opening Cover

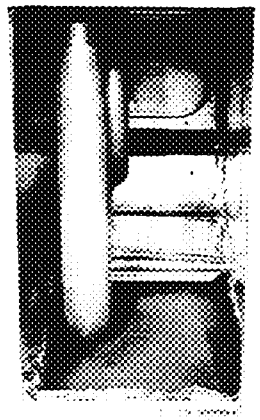


Fig. 17 — Vertical Discharge Cover Removed

E. Electrical Connections

⚠ WARNING: The unit cabinet must have an uninterrupted, unbroken, electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to the unit ground lug in the control compartment, or conduit approved for electrical ground when installed in accordance with NEC (National Electrical Code), ANSI/NFPA 70-1990 (in Canada, Canadian Electrical Code CSA C22.1) and local electrical codes. *Do not use gas piping as an electrical ground.* Failure to adhere to this warning could result in personal injury.

⚠ CAUTION: Failure to follow these precautions could result in damage to the unit being installed:

Field Power Supply

1. Make all electrical connections in accordance with NEC ANSI/NFPA and local electrical codes governing such wiring. In Canada, all electrical connections must be in accordance with CSA (Canadian Standards Association) Standard C22.1 Canadian Electrical Code Part 1 and applicable local codes. Refer to unit wiring diagram.
2. Use only *copper or copper-clad* conductor for connections between field-supplied electrical disconnect switch and unit. DO NOT USE ALUMINUM WIRE. Maximum wire size is no. 6 AWG (American Wire Gage).
3. Voltage to compressor terminals during operation must be within voltage range indicated on unit nameplate (also see Table 3). On 3-phase units, ensure phases are balanced within 2 percent. Consult local power company for correction of improper voltage and/or phase imbalance.
4. Do not damage internal components when drilling through any panel to mount electrical hardware, conduit, etc.

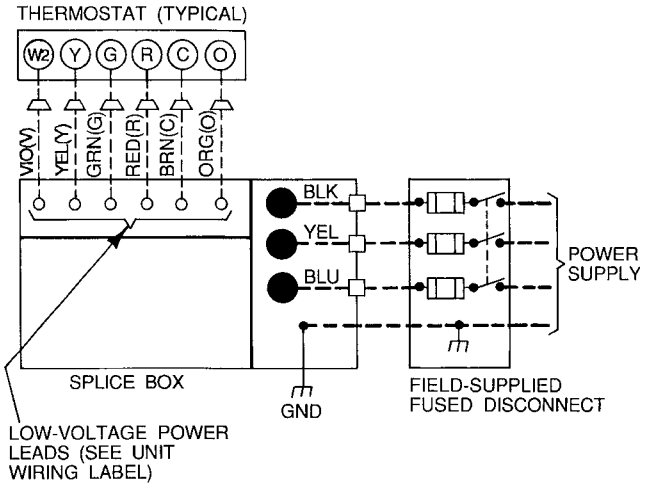
High-Voltage Connections

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. Table 3 shows recommended wire sizes based on rating plate data.

The field-supplied disconnect switchbox 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. 4-7 for acceptable locations.

Proceed as follows to complete the connections to the unit:

1. Remove knockouts in fixed compressor panel located on duct panel side of unit.
2. Route high-voltage leads into high-voltage terminal box.
3. Connect ground wire to green-yellow wire using field-supplied splice.
4. Connect power wires to unit high-voltage leads.
5. On 3-phase units, locate blue wire projecting from compressor junction box. Cut wire at partition and route into high-voltage junction box through grommet in back of junction box.
6. On 3-phase units, strip back blue lead and connect to third leg of the power wires. See Fig. 18.



LEGEND

- - - - Field Control-Voltage Wiring
———— Field High-Voltage Wiring

NOTE: Use blue wire for 3-phase units only

Fig. 18 — High- and Control-Voltage Connections

Table 3 — Electrical Data

UNIT SIZE	V-PH-Hz	VOLTAGE RANGE		COMPRESSOR		OUTDOOR-FAN MOTOR	INDOOR-FAN MOTOR	POWER SUPPLY		AWG 60 C MIN WIRE SIZE	MAX WIRE LENGTH (ft)
		Min	Max	RLA	LRA	FLA	FLA	MCA	MOCP*		
030	208/230-1-60	187	253	15 0	73	1 4	2 6	22 8	30	10	100
	208/230-3-60	187	253	10 1	63	1 4	2.8	16 6	25	12	75
036	208/230-1-60	187	253	17.2	88	1 4	2 8	25 7	40	10	90
	208/230-3-60	187	253	11 4	77	1.4	2 8	18.5	25	12	65
	460-3-60	414	506	5 7	39	0 8	1 4	9 3	15	14	100
048	208/230-1-60	187	253	26.4	129	1 4	7.2	41 6	60	6	100
	208/230-3-60	187	253	15 0	99	1 4	7 2	27.4	40	10	70
060	208/230-1-60	187	253	32.1	169	2 1	7 2	49 4	60	6	100
	208/230-3-60	187	253	19 3	123	2 1	7 2	33 4	50	8	100

LEGEND

AWG — American Wire Gage
CUL — Canadian Underwriters' Laboratories
FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
RLA — Rated Load Amps

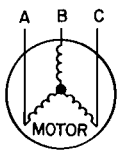
*Fuse or HACR breaker

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 fuse or HACR breaker The CUL 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
3. **Unbalanced 3-Phase Supply Voltage**
Never operate a motor where a phase imbalance in supply voltage is greater than 2% Use the following formula to determine the percent of voltage imbalance

$$\% \text{ Voltage imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3} = \frac{1371}{3} = 457$$

Determine maximum deviation from average voltage
(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v

Maximum deviation is 7 v
Determine percent of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{7}{457} = 1\ 53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately

Special Procedures for 208-V Operation

⚠ WARNING: Make sure that the gas supply *then* the power supply to the unit is switched OFF before making any wiring changes. Electrical shock can cause personal injury or death.

For operation on 208 v:

1. Disconnect the red transformer-primary lead from the contactor. See the unit wiring label.
2. Remove the tape and wirenut from the terminal on the end of the blue transformer-primary lead. Save the wirenut.
3. Connect the blue lead to the contactor terminal from which the red lead was disconnected.
4. Using the wirenut removed from the blue lead, insulate the loose terminal on the red lead.
5. Wrap the cover with electrical tape so that the metal terminal cannot be seen.

Control Voltage Connections

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

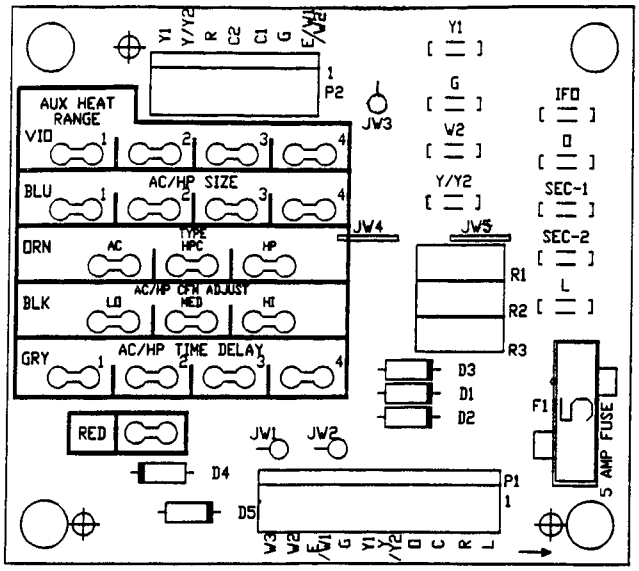
NOTE: Do not use any type of power-stealing thermostat. Unit control problems may result.

Use no. 18 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 (24 v) — Units Without Integrated Control Motor (Size 030,036) — Remove knockout in compressor fixed panel located below high-voltage knockout. Remove the rubber grommet from the installer's packet (included with unit) and install grommet in the knockout opening. Route thermostat wires through grommet providing drip loop at panel. Connect low-voltage leads as shown in Fig. 18.

Routing Control Power Wires (24 v) — Units with Integrated Control Motor (ICM) (Size 048,060) — Remove knockout in compressor fixed access panel located below high-voltage knockout. Remove the rubber grommet from the installer's packet (included with unit) and install grommet in the knockout opening. Route thermostat wires through grommet providing drip loop at panel. Connect low-voltage leads to the thermostat.

The Easy Select interface board is located in the burner section. The Easy Select interface board is factory wired to the motor, and factory default selections are preset. See Fig. 19.



LEGEND

IFO — Indoor Fan On
JW — Jumper Wire

Fig. 19 — Easy Select Interface Board

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 0.6 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.

Recommended thermostat and subbase is as follows:

TYPE	THERMOSTAT PART NO.	SUBBASE PART NO.
2-Stage Heat and 1-Stage Cool, Auto, Changeover	HH07AT171	HH93AZ188

Transformer Protection

The unit transformer protection may be one of 2 types.

The first transformer type may contain an auto. reset overcurrent protector for control circuit protection. If this device trips, it may reset without warning, starting the heating or cooling section of this product. Use caution when servicing; if overcurrent protector continues to trip, there is a problem in the low-voltage electrical circuit, such as an electrical short, ground, or transformer overload. Disconnect power, correct the condition, and check for normal unit operation.

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

There is also a 5-amp fuse on integrated gas control (IGC) board and easy select interface board which provide additional overcurrent protection.

Outdoor-Air Thermostat

The outdoor-air thermostat (OAT) is a field-adjustable control that controls the temperature at which the 658A changes from heat pump operation to gas burner operation in first-stage heating. It adjusts temperatures from 0° to 52 F. (Second-stage heating is always gas-fired heat.)

As outdoor temperatures decrease, the efficiency of heat pumps decrease and a point is reached where gas heat becomes more economical than the heat pump. This point is known as the economic balance point (EBP). At outdoor air temperatures above the EBP, the 658A operates the heat pump on a call for first-stage heat and operates the gas burners on a call for second-stage heat. At temperatures below the EBP, the OAT locks out the heat pump and operates the gas burners for both the first- and second-stage heat.

The EBP is dependent on local utility rates. If the local cost of electricity is high or the local cost of gas is low, it is cost effective to switch to gas-fired heating at a warmer outdoor temperature.

Conversely, if the local cost of electricity is low or the local cost of gas is high, it is cost effective to switch to gas-fired heating at a colder outdoor temperature.

The OAT must be field set based on the local EBP. To determine the EBP, first find the cost of gas on a $/Therm basis and the cost of electricity on a $/kW basis. Refer to Fig. 20, 658A Economic Balance Point. On the horizontal axis plot the cost of electricity and draw a vertical line from this point. On the vertical axis plot the cost of gas and draw a horizontal line until it intersects the vertical line. This intersection is the economic balance point and can be read directly by determining where the intersection falls in the set of curves. This value will be in degrees Fahrenheit.

Once this value has been determined, the outdoor-air thermostat can be set to provide for the most economical operation.

EXAMPLE: Cost of Electricity $ 0.1/kW
Cost of Gas $0.9/Therm

From Economic Balance Point Chart, Fig. 20, read that the EBP is 30 F.

The EBP differs from the thermal balance point. The thermal balance point is the outdoor temperature below which the heat pump can no longer satisfy the heating requirements of the building. The thermal balance point is determined by the thermal loss of the building and the size of the heat pump. Unlike the EBP, no adjustment is necessary based on the thermal balance point; the thermostat simply calls for first-stage heat or second-stage heat as necessary.

To Set OAT — The OAT is located in the control box beneath the mounting bracket and is factory set at 40 F. Turn knob on the OAT to the temperature that is equal to the EBP. Refer to Fig. 20 and determine EBP as described above. Uncoil the OAT capillary and run it outside the unit to sense outdoor temperature. The capillary may be supported by any object outside the unit that does not get warm (such as the incoming gas line) but must not rest on the unit itself. If the outdoor-air temperature is below the OAT setting, the cooling mode is locked out.

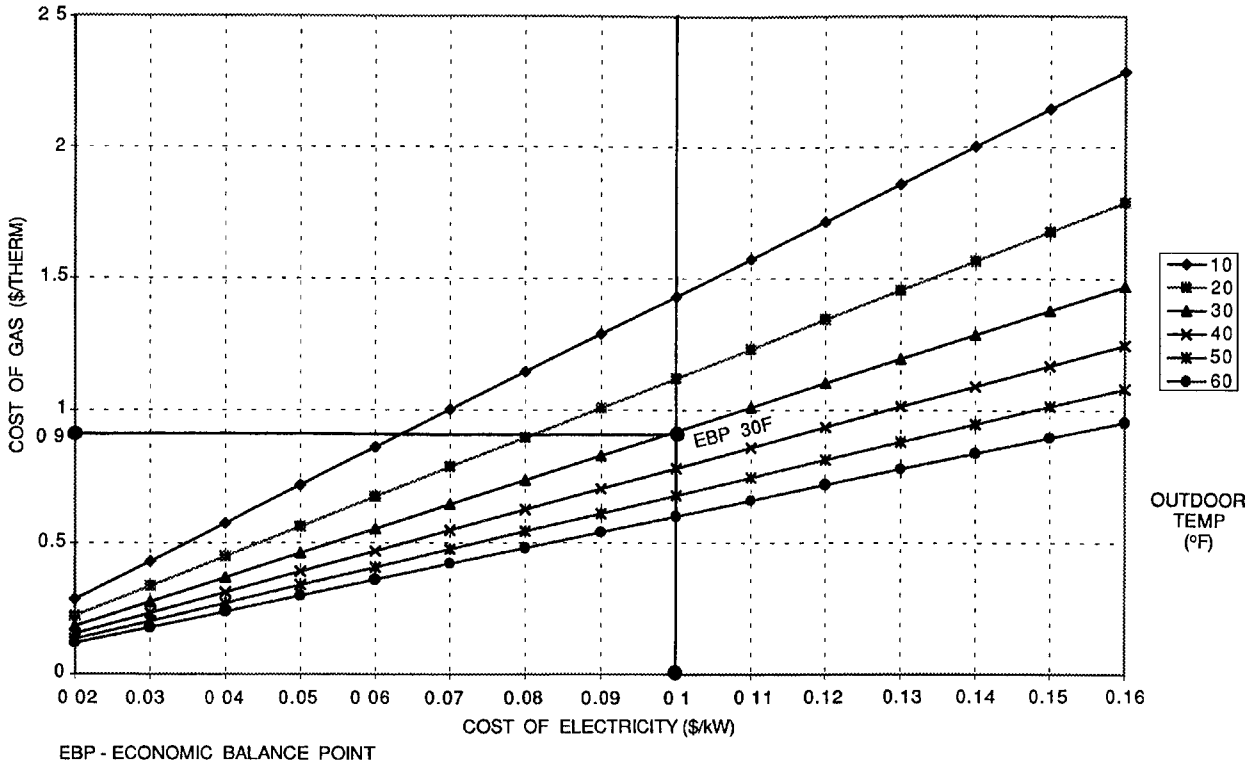


Fig. 20 — 658A Economic Balance Point

F. Accessory Installation

At this time, any required accessories should be installed on the unit. Control wiring information is provided in the unit wiring book.

PRE-START-UP

⚠ **WARNING:** Failure to observe the following warnings could result in serious personal injury:

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 reclaim all refrigerant from system using both high- and low-pressure service ports 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 reclaim all refrigerant from system.
   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 all access panels.
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. Leak-test all refrigerant tubing connections using electronic leak detector, halide torch, or liquid-soap solution. If refrigerant leak is detected, see Repairing Refrigerant Leaks section on page 24.
   c. Inspect all field- and factory-wiring connections. Be sure that connections are completed and tight.
   d. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.
4. Verify the following conditions:

⚠ **DANGER:** Do not purge gas supply into the combustion chamber. Do not use a match or other open flame to check for gas leaks. Failure to adhere to this warning could result in an explosion causing personal injury or death.

   a. Make sure that gas supply has been purged, and that all gas piping has been checked for leaks.
   b. Make sure that outdoor-fan blade is positioned correctly in fan orifice. Leading edge of outdoor fan blade should be ½-in. maximum from plastic fan orifice. See Fig. 21.
   c. Make sure that air filter(s) is in place.

d. Make sure that condensate drain trap is filled with water to ensure proper drainage.

e. Make sure that all tools and miscellaneous loose parts have been removed.

5. Compressors are internally spring mounted. Do not loosen or remove compressor holddown bolts.

6. Each unit system has 2 Schrader-type ports, one on the suction line and one on the compressor discharge line. Be sure that caps on the ports are tight.

Unit is now ready for initial start-up.

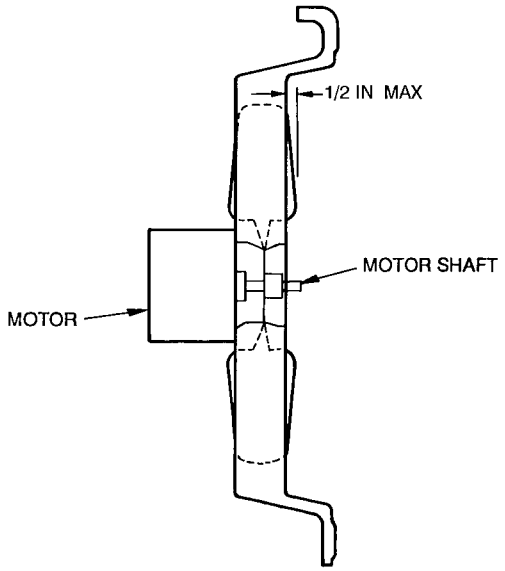


Fig. 21 — Fan Blade Clearance

START-UP

I. 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 accepted practices.

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. Evacuate and reclaim refrigerant from refrigerant system 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.

II. HEATING SECTION START-UP AND ADJUSTMENTS

⚠CAUTION: Complete the required procedures given in Pre-Start-Up section, page 16, before starting unit.

Do not jumper any safety devices when operating the unit.

Ensure that burner orifices are aligned properly. 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.

However, when lighting the unit for the first time, perform the following additional steps: 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 in accordance with Checking Heating Control Operation section below.

A. Checking Heating Control Operation

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 the room thermostat SYSTEM switch in the HEAT position and the fan switch in the AUTO. position.
2. Ensure that OAT capillary is above 55 F. Set the heating temperature control of the thermostat above room temperature only enough to call first-stage heat.
3. Observe compressor, outdoor fan, and indoor fan operate in heat pump mode.
4. Set the heating temperature control of the thermostat enough above room temperature to call second-stage heat.
5. Observe the induced-draft motor start.
6. After a call for second-stage heat, the main burner should light within 5 seconds. If the burners do not light, there is 22-second delay before another 5-second 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.
7. The indoor fan will turn on 45 seconds after the flame has been established. The indoor fan will turn off 45 seconds after the thermostat has been satisfied.

B. Gas Input

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

⚠CAUTION: These units are designed to consume the rated gas inputs using the fixed orifices at specified manifold pressures as shown in Table 4. DO NOT REDRILL THE ORIFICES UNDER ANY CIRCUMSTANCES.

The rated gas inputs shown in Table 4 are for altitudes from sea level up 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 LP gas with a heating value of 2500 Btu/ft^3 at 1.5 specific gravity. For elevations above 2000 ft, reduce input 4% for each 1000 ft above sea level. 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.

C. Adjusting 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 LP gas units.

Measuring Gas Flow at Meter Method — Natural Gas Units

Minor adjustment 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.

Table 4 — Rated Gas Inputs at Indicated Manifold Pressures

UNIT 658A	NUMBER OF ORIFICES	GAS SUPPLY PRESSURE (in. wg)				MANIFOLD PRESSURE (in. wg)		NATURAL GAS		PROPANE*	
		Natural		Propane				Orifice Drill Size	Heating Input (Btuh)†	Orifice Drill Size	Heating Input (Btuh)†
		Min	Max	Min	Max	Natural	Propane				
030040	1	4 0	13 0	4 0	13 0	3 5	3 5	32	40,000	41	40,000
030060, 036060	2	4 0	13.0	4.0	13 0	3.5	3.5	41	56,000	46	54,000
036080, 048080, 060080	2	4 0	13 0	4 0	13 0	3 5	3 5	32	80,000	42	80,000
048100, 060100	2	4.0	13 0	4.0	13 0	3.5	3 5	30	95,000	41	95,000

*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% for each 1000 ft above sea level In Canada, from 2000 ft above sea level to 4500 ft above sea level, derate the unit 10%

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

Proceed as follows:

a. Turn off gas supply to unit.

b. Remove pipe plug on manifold (Fig. 22) then connect manometer at this point. Turn on gas to unit.

c. Record number of seconds for gas meter test dial to make one revolution.

d. Divide number of seconds in Step c into 3600 (number of seconds in one hour).

e. Multiply result of Step d by the number of cubic feet shown for one revolution of test dial to obtain cubic feet of gas flow per hour.

f. Multiply result of Step e 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.)

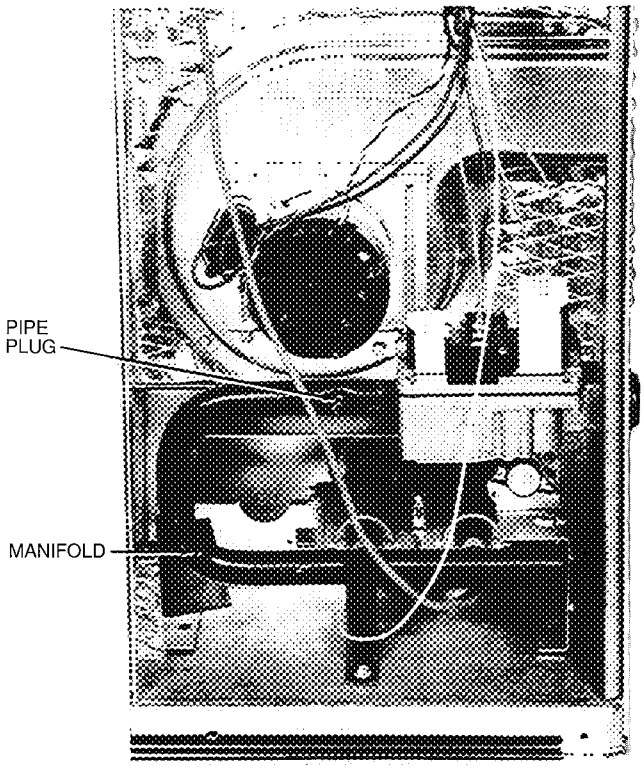


Fig. 22 — Burner Assembly

Example: Assume that the size of test dial is one cubic foot, one revolution takes 50 seconds and the heating value of the gas is 1050 Btu/ft^3. Proceed as follows:

a. 50 seconds to complete one revolution.

b. 3600 ÷ 50 = 72.

c. 72 x 1 = 72 ft^3 of gas flow/hr.

d. 72 x 1050 = 75,600 Btuh input.

If the desired gas input is 80,000 Btuh, only a minor change in the manifold pressure is required.

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

a. Remove cover screw over regulator adjustment screw on gas valve.

b. 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.

⚠ WARNING: Unsafe operation of the unit may result if manifold pressure is outside this range. Personal injury or unit damage may result.

c. Replace cover screw cap on gas valve.

d. Turn off gas supply to unit. Remove manometer from pressure tap. Replace pipe plug on gas valve. Turn on gas to unit. Check for leaks.

Measuring Manifold Pressure — LP Gas Units

The main burner orifices on an LP gas unit are sized for the unit rated input when the manifold pressure is 3.5 in. wg.

Proceed as follows to adjust gas input on an LP gas unit:

a. Turn off gas to unit.

b. Remove pipe plug on manifold (Fig. 22) then connect manometer at this point.

c. Turn on gas to unit.

d. Remove cover screw over regulator adjustment screw on gas valve.

e. Adjust regulator adjustment screw for a manifold pressure reading of 3.5 in. wg. Turn adjusting screw clockwise to increase manifold pressure, or turn adjusting screw counterclockwise to decrease manifold pressure.

f. Replace cover screw.

g. 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.

D. 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 in appearance for each burner. See Fig. 23. Refer to maintenance section for information on burner cleaning and removal.

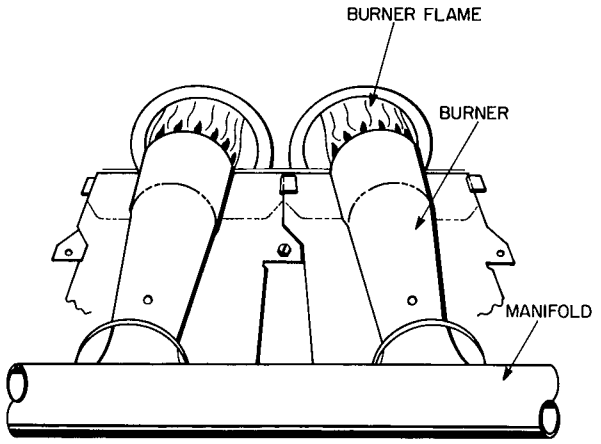


Fig. 23 — Monoport Burners

E. Airflow and Temperature Rise

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

Table 5 shows the approved temperature rise range for each rated 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 on page 20, to adjust heating airflow when required.

F. Heating Sequence of Operation

See wiring diagrams in back of book and unit wiring label.

On a call for heat, one of 2 Heating modes occurs, depending on the field setting of the economic balance point.

The first Heating mode occurs when the outdoor temperature is warmer than the EBP. On a call for heat, the thermostat makes circuits R-Y and R-G. When compressor time delay (5 ± 2 minutes) is completed, a circuit is made to C, starting compressor (COMP) and outdoor-fan motor (OFM). Circuit R-G also is completed, energizing indoor-fan relay (IFR) and starting indoor-fan motor (IFM) after a 1-second delay. Should room temperature continue to fall, circuit R-W is made through second-stage thermostat bulb. One relay opens, turning off the compressor, and another relay is energized signaling the integrated gas control (IGC) board to bring on the gas heat. When the thermostat is satisfied, contacts open, deenergizing contactor and relay; motors and gas heater deenergize. The IFM may be controlled by a time-delay relay that keeps the fan on for 30 seconds.

The second Heating mode occurs when the outdoor temperature is colder than the EBP. On a call for heat, the thermostat energizes the gas heat relay, signaling the IGC board to bring on the gas heat. In this Heating mode, both first- and second-stage heat is gas heating. When thermostat is satisfied, contacts open, deenergizing contactor and relay; motors and gas heater deenergize. The IFM may be controlled by a time-delay relay that keeps the fan on for 30 seconds.

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 6.

Table 6 — 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
Five Consecutive Limit Switch Faults	4 Flashes
Ignition Lockout Fault	5 Flashes
Inducer Switch Fault	6 Flashes
Rollout Switch Fault	7 Flashes
Internal Control Fault	8 Flashes

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

G. 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.

H. Auxiliary Limit Switch — Rollout

The function of the 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 auxiliary switch reaches the maximum allowable temperature, the R control circuit trips, closing the gas valve and stopping gas flow to the burners. The indoor fan motor (IFM) and induced draft motor continue to run until switch is reset.

Table 5 — Air Delivery (Cfm) at Indicated Temperature Rise and Rated Heating Input

HEATING INPUT (Btuh)	TEMPERATURE RISE °F												
	20	25	30	35	40	45	50	55	60	65	70	75	80
40,000	1389	1111	926	794	694	617	556	—	—	—	—	—	—
56,000	1944	1556	1296	1111	972	864	778	707	—	—	—	—	—
80,000	2778	2222	1852	1587	1389	1235	1111	1010	926	855	794	—	—
95,000	3299	2639	2199	1885	1649	1466	1319	1199	1100	1015	942	880	825

NOTE: Dashed areas do not fall within the approved temperature rise range of the unit

III. COOLING SECTION START-UP AND ADJUSTMENTS

⚠ CAUTION: Complete the required procedures given in Pre-Start-Up section, page 16, 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. A 5-minute time delay is provided to prevent compressor damage.

A. 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, outdoor fan, and indoor blower motors start. Observe that cooling cycle shuts down when control setting is satisfied. The indoor fan will continue to run for 30 seconds.
3. When using an autochangeover 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).

IMPORTANT: Three-phase, scroll compressor units are direction-oriented. These units must be checked to ensure proper compressor 3-phase power lead orientation. If not corrected within 5 minutes, the internal protector will shut off the compressor. The 3-phase power leads to the unit must be reversed to correct rotation. When turning backwards, scroll compressors emit elevated noise levels, and the difference between compressor suction and discharge pressures may be dramatically lower than normal.

NOTE: Do not operate the unit if the outdoor air is below the OAT (outdoor-air thermostat) setting.

B. 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.

See Refrigerant Charge section on page 27 for procedure to check and adjust R-22 charge.

C. Unit Controls

Compressor Overload

All compressors have an internal overcurrent protection device located inside the compressor. This overload interrupts power to the compressor when the current becomes excessive, and automatically resets when the temperature drops to a safe level.

High-Pressure Relief Valve

Valve opens when the pressure differential between the low and high side becomes excessive.

Loss-of-Charge Switch Kit

When the refrigerant low-side pressure drops below 27 psig, the loss-of-charge switch opens 24-v power to the compressor contactor and stops the compressor. When the pressure reaches 60 psig, the switch resets and the compressor is allowed to come back on.

Accessory High-Pressure Switch (HPS) Kit

When the refrigerant high-side pressure reaches 428 psig, the HPS opens 24-v power to the compressor contactor and stops the compressor. When the pressure drops to 320 psig, the switch resets and the compressor is allowed to restart.

D. Cooling Sequence Of Operation

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 connect contactor coil (C) (through unit wire Y) and blower relay coil (BR) (through unit wire G) across the 24-v secondary of transformer (TRAN).

NOTE: The blower relay coil (BR) is used on non-ICM units, ICM units use evaporator (indoor) fan on (IFO) connection.

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.

On non-ICM units, the set of normally-open contacts of energized relay BR closes and completes the circuit through evaporator blower (indoor) fan motor (IFM). On ICM units, the IFO completes the circuit through evaporator blower IFM. The blower motor starts instantly.

NOTE: Once the compressor has started and then has stopped, it should not be started again until 5 minutes have elapsed.

The cooling cycle remains "on" until the room temperature drops to 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 and relay coil BR. The OFM and compressor motor stop. After a 30-second delay, the IFM stops. The unit is in a standby condition, waiting for the next call for cooling from the room thermostat.

E. Defrost

Defrost board (DB) is a time and temperature control, which includes a field-selectable time period between checks for defrost (30, 50, and 90 minutes). Electronic timer and defrost cycle start only when contactor is energized and defrost thermostat (DFT) is closed.

Defrost mode is identical to Cooling mode, except outdoor-fan motor stops and gas heat turns on to warm air supplying the conditioned space. Once the gas heat has been energized, it is locked in for a minimum of 1 minute.

IV. INDOOR AIRFLOW AND AIRFLOW ADJUSTMENTS

⚠ CAUTION: 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.

⚠ WARNING: Shut off gas supply, *then* disconnect electrical power to the unit before changing blower speed. Electrical shock can cause personal injury or death.

Table 7 shows the temperature rise at various airflow rates.

A. Size 030 and 036

Table 7 shows both heating and cooling airflows at various external static pressures for unit sizes 030 and 036. Refer to this table to determine the airflow for the system being installed. See Table 8 for wet coil pressure drop.

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

Airflow can be changed by changing the lead connections of the blower motor.

Unit 658A030 is factory wired for medium speed; unit 658A036 two or 3-speed motors are factory wired for low speed.

For 208/230-v and A.O. Smith 460-v Blower Motors

The motor leads are color-coded as follows:

3-SPEED	2-SPEED
black = high speed	black = high speed
blue = medium speed	red = low speed
red = low speed	

To change the speed of the blower motor, remove the fan motor speed leg lead from the blower relay (BR). This wire is attached to terminal BM for single-phase and 3-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.*

For 460-v GE Motors

The motor leads are color-coded as follows:

3-SPEED	2-SPEED
black = high speed	black = high speed
blue = jumper	blue = jumper
orange = medium	red = low speed
red = low speed	

To change the speed of the blower motor, remove fan motor speed lead from the blower relay (BR) and replace with the lead for the desired blower motor speed. The motor speed lead is attached to terminal BM. *Insulate removed lead end to avoid contact with chassis parts.* On 3-speed motors only, connect orange lead to terminal BM of BR. To select high speed on 460-v GE motors, separate the black (female QC) from the blue lead (male QC) and connect the black lead to the BR. *Insulate the blue lead to avoid contact with any chassis parts.*

B. Size 048 and 060

These units have an integrated control motor (ICM). To configure the unit, move the 5 Easy Select board wires to the terminals which control the airflow. Refer to the Easy Select interface board (Fig. 19) located next to the terminals and wiring diagrams for sizes 048 and 060 in back of book.

Perform the following steps for basic system configuration.

AUX HEAT RANGE (VIO)

The airflow for unit is preset at the factory. The airflow selection must not be set at a setting lower than the default. Refer to Table 9 for airflow and gas heat input for terminals 1-4.

AC/HP SIZE (BLU)

The preset factory default selection for AC/HP SIZE (air conditioner/heat pump) is set to terminal 3 for size 048 and terminal 4 for size 060. See Table 10 for airflows supplied at terminals. See Table 11 for air delivery in FAN ONLY mode.

TYPE (ORN)

The TYPE is a preset factory default selection. The preset factory default setting is HPC for size 048 and HP for size 060. Default setting should not be altered.

AC/HP CFM ADJUST (BLK)

The preset factory default selection is MED. Selections HI and LO will adjust the airflow supplied for all operational modes (see table below). The selection options allow installer to adjust airflow to meet such individual needs as noise and static compensation, etc.

MODE	FAN ONLY	COOLING	HEATING
LO — Adjust	–15%	–10%	–10%
HI — Adjust	15%	10%	10%

Table 7 — Dry-Coil Air Delivery* — Horizontal and Downflow Discharge at 230 and 460 V — Sizes 030,036 (Deduct 10% from Cfm and Watts for 208 V Operation)

UNIT 658A	MOTOR SPEED	AIR DELIVERY	EXTERNAL STATIC PRESSURE (in. wg)										
			0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
030	Low	Watts	280	275	265	255	250	245	240	†	†	†	†
		Cfm	820	810	755	700	660	600	560	†	†	†	†
	Med	Watts	365	360	350	345	340	330	320	310	300	†	†
		Cfm	1025	1010	975	940	900	850	800	720	630	†	†
	High	Watts	†	†	490	480	470	460	445	430	410	390	380
		Cfm	†	†	1300	1255	1200	1150	1080	1005	915	790	620
036	Low	Watts	520	495	474	458	445	425	†	†	†	†	†
		Cfm	1375	1335	1290	1240	1200	1140	†	†	†	†	†
	Med	Watts	575	560	535	510	480	460	440	425	†	†	†
		Cfm	1520	1490	1450	1400	1380	1300	1200	1080	†	†	†
	High	Watts	†	†	†	†	650	614	575	540	510	480	†
		Cfm	†	†	†	†	1560	1500	1380	1280	1170	1060	†

*Air delivery values are without air filter and are for dry coil. See Table 8 for wet coil pressure drop Deduct field-supplied air filter pressure drop and wet coil pressure drop to obtain external static pressure available for ducting

†Unit air delivery is outside of operating range.

NOTE: Do not operate the unit at a cooling airflow that is less than 350 cfm for each 12,000 Btuh of rated cooling capacity. Indoor-coil icing may occur at airflows below this point Water blow-off may occur at airflows above 450 cfm per 12,000 Btuh of rated cooling capacity

Table 8 — Wet Coil Pressure Drop

UNIT SIZE	AIRFLOW (cfm)	PRESSURE DROP (in. wg)
030	800	0.025
	900	0 039
	1000	0 057
	1200	0 072
036	1000	0.068
	1200	0 096
	1400	0.116
	1600	0.136
048	1400	0 068
	1600	0.075
	1800	0.088
060	1700	0.082
	1900	0.095
	2100	0.108
	2300	0 123

Table 9 — Dry Coil Air Delivery* — Gas Heating; Sizes 048,060; Horizontal and Vertical Discharge for Integrated Control Motor Units at 230-V (Deduct 10% from Cfm for 208-V Operation)

HEATING INPUT (Btuh)	EASY SELECT BOARD TERMINALS			
	1	2	3	4
	Airflow (Cfm)			
80,000	1300	1400	1600	1750
100,000	—	1400	1600	1750

*Air delivery values are for dry coil at 230 v. Airflow is independent of external static pressure within ± 5% of table values up to 0.8 in. wg.

NOTES:
1 Dashed area does not fall within approved range.
2 The above values occur with the AC/HP CFM ADJUST select jumper on the Easy Select interface board set on MED.
3. Airflow can be adjusted +10% or –10% by selecting HI or LO for all modes except FAN ONLY.

Table 10 — Dry-Coil Air Delivery* Cooling and Heat Pump Heating; Sizes 048,060; Horizontal and Vertical Discharge for Integrated Control Motor Units at 230-V (Deduct 10% from Cfm for 208-V Operation)

UNIT SIZE	EASY SELECT BOARD TERMINALS			
	1	2	3	4
	Airflow (Cfm)			
048,060 Cooling Mode 048 Heating Mode	1260	1440	1575	1800
060 Heating Mode	1400	1600	1750	2000

*Air delivery values are for dry coil at 230 v Airflow is independent of external static pressure within ±5% of table values up to 0 8 in wg

NOTE: Do not operate the unit at a cooling airflow that is less than 350 cfm for each 12,000 Btuh of rated cooling capacity Indoor-coil icing may occur at airflows below this point Water blow-off may occur at airflows above 450 cfm per 12,000 Btuh of rated cooling capacity

Table 11 — Dry Coil Air Delivery* Fan Only; Sizes 048,060; Horizontal and Vertical Discharge for Integrated Control Motor Units at 230-V (Deduct 10% from Cfm for 208-V Operation)

UNIT 658A	FAN ONLY AIRFLOW (Cfm)
048	1400
060	1750

*Air delivery values are for dry coil at 230 V Airflow is independent of external static pressure within ±5% of table values up to 0 8 in. wg

CARE AND MAINTENANCE

To ensure continuing high performance, and to minimize the possibility of premature equipment failure, periodic maintenance must be performed on this equipment. This dual fuel heat pump should be inspected at least once each year by a qualified service person. To troubleshoot heating or cooling of units, refer to Troubleshooting tables in back of book.

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

⚠ **WARNING:** 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. FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS PERSONAL INJURY AND POSSIBLE DAMAGE TO THIS EQUIPMENT.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect air filter(s) each month. Clean or replace when necessary.
2. Inspect indoor coil, drain pan, and condensate drain each cooling season for cleanliness. Clean when necessary.
3. Inspect blower motor and wheel for cleanliness, and check lubrication each heating and cooling season. Clean and lubricate (if required) when necessary. For first heating season, inspect blower wheel bimonthly 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. Check and inspect heating section before each heating season. Clean and adjust when necessary.
6. Check flue hood and remove any obstructions if necessary.
7. Check vent screen and clean, if necessary.

⚠ **WARNING:** Failure to follow these warnings could result in serious personal injury:

1. Turn off gas supply, *then* turn off electrical power to the unit 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, shut off the external main manual gas valve to the unit, *then* shut off the electrical supply.

I. AIR FILTER

⚠ **CAUTION:** 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 (cleanable-type) at least twice during each heating and cooling season or whenever the filter(s) becomes clogged with dust and lint.

II. INDOOR BLOWER AND MOTOR

NOTE: Motors without oilers are prelubricated. Do not attempt to lubricate these motors.

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

Lubricate the motor every 5 years if the motor is used intermittently (thermostat FAN switch in AUTO. position), or every 2 years if the motor is used continuously (thermostat FAN switch in ON position).

⚠ **WARNING:** Turn off the gas supply, *then* disconnect and tag electrical power to the unit before cleaning and lubricating the blower motor and wheel. Failure to adhere to this warning could cause personal injury or death.

Clean and lubricate the blower motor and wheel as follows for direct-drive models:

1. Remove and disassemble blower assembly as follows:
   a. Remove blower access door.
   b. On non-ICM units, disconnect motor lead from blower relay (BR). Disconnect yellow lead from terminal L2 of the contactor.
   c. On all units remove blower assembly from unit. Remove screws securing blower to gas 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. Then remove screws that secure motor mount brackets to housing and slide motor and motor mount out of housing.
2. Lubricate motor as follows:
   a. Thoroughly clean all accumulations of dirt or grease from motor housing.
   b. Remove dust caps or plugs from oil ports located at each end of motor.
   c. Use a good grade of SAE 20 nondetergent motor oil and put one teaspoon (3/16 ounce or 16 to 25 drops) in each oil port.
   d. Allow time for oil to be absorbed by each bearing, then wipe excess oil from motor housing.
   e. Replace dust caps or plugs in oil ports.
3. 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.
   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.

4. Reinstall blower assembly into unit, route blower motor leads into control compartment, and reconnect all blower motor leads. Replace panels.
5. Restore electrical power, then gas supply to unit. Start unit and check for proper blower rotation and motor speeds during heating and cooling cycles.

SERVICE

⚠ WARNING: When servicing unit, shut off gas supply *then* shut off all electrical power to unit to avoid shock hazard or injury from rotating parts.

I. CLEANING

Inspect unit interior at the beginning of each heating and cooling season or as operating conditions require. To inspect and clean, the unit top must be removed.

A. Unit Top Removal

NOTE: When performing maintenance or service procedures that require removal of the unit top, be sure to perform *all* of the routine maintenance procedures that require top removal, including: inspection of the heat exchanger area, coil inspection and cleaning, and condensate drain pan inspection and cleaning. Be sure to wear work gloves while servicing unit.

Only qualified service personnel should perform maintenance and service procedures that require unit top removal. Refer to the following top removal procedures:

1. Turn off gas supply, *then* turn off electric power to unit.
2. Remove all screws that secure unit top, including screws around 4 sides and those on top that screw into internal divider panels. Save all screws.
3. Lift top from unit carefully. Set top on edge.
4. Carefully replace and secure unit top to unit, using screws removed in Step 2, when maintenance and/or service procedures are concluded. (Be sure to use original screws that have rubber washers to seal out water when securing top to internal divider panels.)

B. Repairing Refrigerant Leaks

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

1. Locate leak and ensure that refrigerant system pressure has been relieved and reclaimed from both high- and low-pressure ports.
2. Repair leak following accepted practices.

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. Evacuate and reclaim refrigerant from refrigerant system 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.

NOTE: See Checking and Adjusting Refrigerant Charge on page 20.

C. Outdoor Coil, Indoor Coil, and Condensate Drain Pan

Inspect the outdoor coil, indoor coil, and condensate drain pan at least once each year. Proper inspection and cleaning requires the removal of the unit top. See Unit Top Removal section on this page.

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 outdoor 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 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 outdoor coil fins from inside to outside the unit. On units with an outer and inner outdoor 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.

D. Outdoor Fan

⚠ CAUTION: Keep the outdoor 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 2 screws at bottom and 2 screws along side of outdoor air intake grille and remove plastic grille.
2. Inspect the fan blades for cracks or bends.
3. If fan needs to be removed, loosen the setscrew and slide the fan off the motor shaft.
4. When replacing fan blade, position blade so that leading edge is ½ in. from fan orifice. See Fig. 21.
5. Ensure that setscrew engages the flat area on the motor shaft when tightening.
6. Replace grille.

E. 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 the control, blower, and compressor compartment access panels 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 and clean all the parts. Then restrip the wire end, and reassemble the connection properly and securely.

After inspecting the electrical controls and wiring, replace all of the panels. 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.

F. Gas Input

The gas input does not require checking unless improper heating performance is suspected. If a problem exists, refer to Adjusting Gas Input section on page 17.

G. Indoor 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 Indoor Airflow and Airflow Adjustments section on page 20 to check the system airflow.

H. Metering Device

Fixed Orifice Metering Device

This metering device is located in the header to the indoor and outdoor coils.

I. Liquid Line Strainer

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

J. Heating Section

Ensure dependable and efficient heating operation by inspecting the heating section before each heating season, and cleaning when necessary.

Proceed as follows to inspect and clean heating section:

1. Turn off gas and power to unit.
2. Remove burner access door.
3. Disconnect 2 wires from inducer motor.
4. Remove complete inducer assembly from unit.
5. Remove screws that secure collector box to heat exchanger, exposing flue openings.
6. Remove flue choke.
7. Clean tubes using field-provided wire brush and vacuum cleaner.
   a. Assemble wire brush. Use a 2-in. diameter steel brush (commonly known as a boiler brush Rooter cable).

NOTE: The items called for above can be purchased at a local hardware store or heating supply store.

   (1.) Insert end of brush into end of tube, and run back and forth. *Tightness is very important.*
   (2.) Remove wire brush to allow proper brush action.

   b. Clean each heat exchanger tube by repeating procedure above.
   (1.) Remove burner assembly.
   (2.) Insert brush end in lower opening of tube, and proceed to clean in same manner.
   (3.) Repeat above procedures until each tube in unit has been cleaned.
   (4.) Using vacuum cleaner, remove residue from each tube.
   (5.) Reinstall burner assembly.
8. After cleaning, check sealant and gaskets to ensure that they have not been damaged. If new sealants or gaskets are needed, contact your distributor.
9. Reinstall flue choke. Be sure all screws are in and tight.
10. Clean and replace flue collector assembly, making sure all screws are secure.
11. Replace inducer assembly.
12. Reconnect 2 wires to inducer motor.
13. Replace burner access door.
14. Turn on power and gas.
15. Set thermostat and check unit for proper operation.

K. 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 Combustion-Air Blower section below.
2. Remove the 3 screws holding the blower housing to the flue collector box cover. (See Fig. 24.)
3. Remove the 12 screws holding the flue collector box cover (Fig. 24) to the heat exchanger assembly. Inspect the heat exchangers.
4. Clean all surfaces as required using a wire brush.

L. Combustion-Air Blower

Clean periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically during heating season. For the first heating season, inspect blower wheel bimonthly 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 burner access panel. (See Fig. 25.)
2. Remove the 7 screws that attach induced-draft motor mounting plate to blower housing. (See Fig. 24.)
3. Slide the motor and blower wheel assembly out of the blower housing. Clean the blower wheel. If additional cleaning is required, continue with Steps 4 and 5. (See Fig. 24.)
4. To remove blower, remove 2 setscrews. (See Fig. 26.)
5. To remove motor, remove 4 screws that hold blower housing to mounting plate. Remove the motor cooling fan by removing one setscrew. Remove nuts that hold motor to mounting plate.
6. To reinstall, reverse the procedure outlined above.

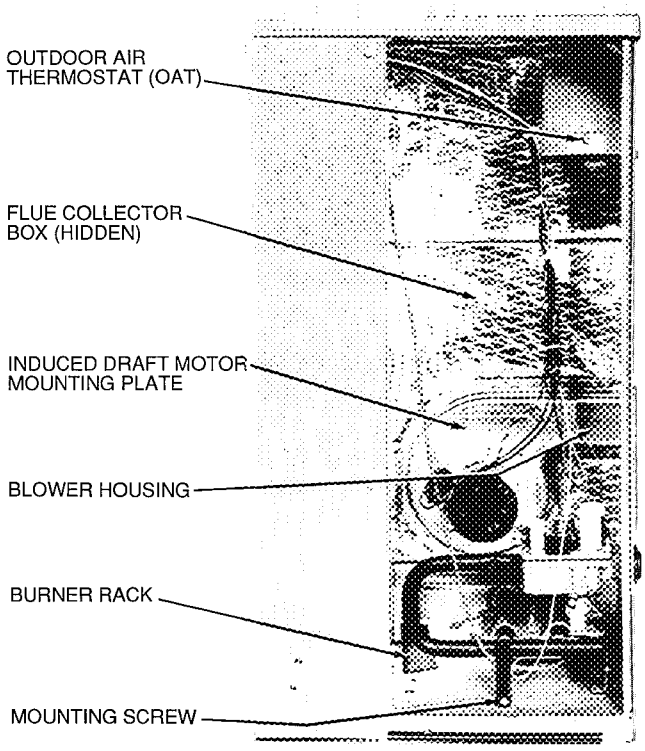


Fig. 24 — Blower Housing and Flue Collector Box

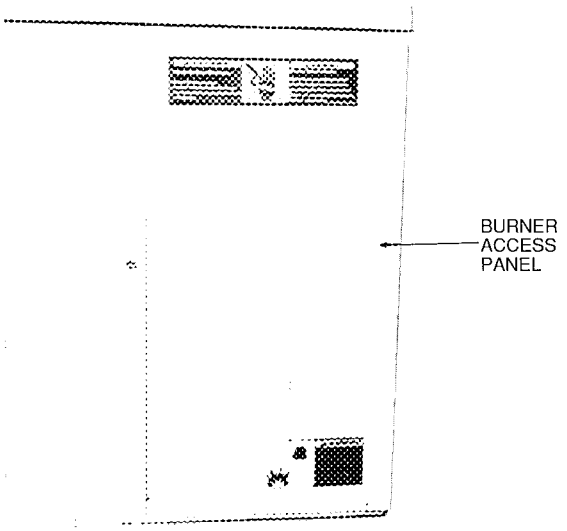


Fig. 25 — Burner Access Panel

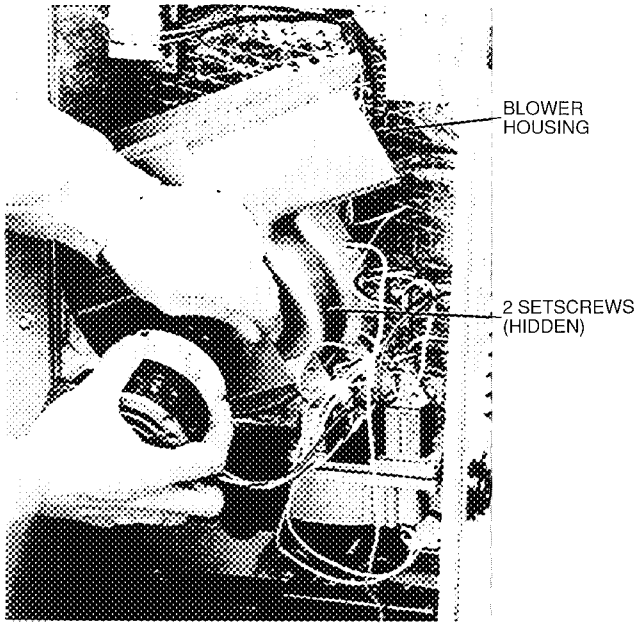


Fig. 26 — Removal of Motor and Blower Wheel

M. Limit Switch

Remove blower panel. Limit switch is located on the gas partition.

N. Burner Ignition

Unit is equipped with a direct spark ignition 100% lockout system. Ignition module is located in the control box. Module contains a self-diagnostic LED. During servicing, refer to module nameplate for LED interpretation.

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

O. 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:** When servicing gas train, do not hit or plug orifice spuds.

Removal of Gas Train

1. Shut off manual gas valve.
2. Shut off power to unit.
3. Remove burner access panel. (See Fig. 25.)
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 basepan. (See Fig. 24.)
8. Slide the burner rack out of the unit. (See Fig. 24 and 27.)
9. To reinstall, reverse the procedure outlined above.

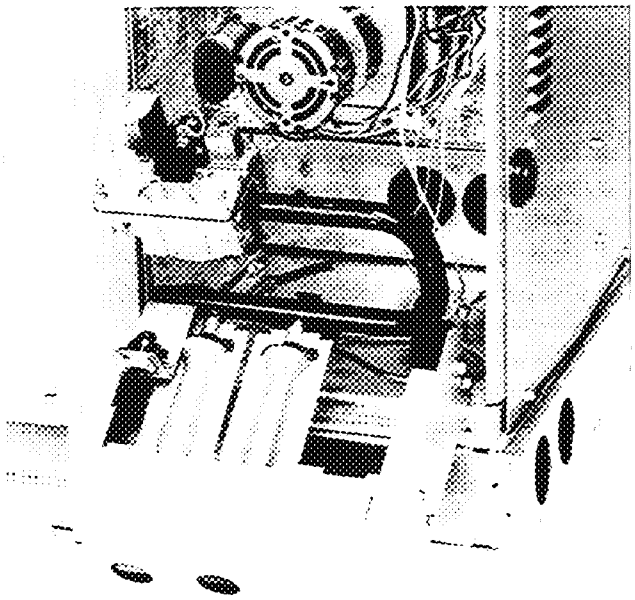


Fig. 27 — Burner Rack Removed

II. REFRIGERANT CHARGE

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

A superheat charging label is attached to the outside of the compressor access door. The label includes a "Field Superheat Charging Table" and a "Required Suction-Tube Temperature (° F)" chart.

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

⚠ CAUTION: 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 gage 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. Indoor inlet-air temperature (F wb).
   c. Suction-tube temperature (F) at low-side service fitting.
   d. Suction (low-side) pressure (psig).
5. Using "Superheat Charging Table," compare outdoor-air temperature (F db) with indoor inlet-air temperature (F wb) to determine desired system operating superheat temperature. See Tables 12-15.
6. Next, using "Required Suction-Tube Temperature (F)" table, compare desired superheat temperature with suction (low-side) operating pressure (psig) to determine proper suction-tube temperature. See Table 16.
7. Compare actual suction-tube temperature with proper 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; remove and reclaim 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 Repairing Refrigerant Leaks section on page 24.

III. REPLACEMENT PARTS

A complete list of replacement parts may be obtained from your distributor upon request.

Table 12 — Superheat Charging Table, 658A030

TEMP (F) OUTDOOR ENTERING AIR		INDOOR AIR — 1000 CFM											
		Indoor Air — Ewb (F)											
		54	56	58	60	62	64	66	68	70	72	74	76
65	SPH	5 5	5 5	5.5	5.5	12 5	19.6	26 6	26 9	27 2	27.5	26 5	25.4
70	SPH	*	*	*	*	10 5	17.5	24 5	24.8	25.1	25.4	25 1	24.8
75	SPH	*	*	*	*	8.4	15.5	22 5	22.8	23 1	23 4	23 8	24 2
80	SPH	*	*	*	*	6 8	12 9	18 9	20 3	21 5	22 9	23 0	23 0
85	SPH	*	*	*	*	5.1	10.2	15.4	17.7	20 1	22 3	22 1	21 8
90	SPH	*	*	*	*	*	7 9	11 9	15 2	18 5	21 8	21 5	21 2
95	SPH	*	*	*	*	*	5.6	8.4	12.7	17 0	21 2	20.8	20 6
100	SPH	*	*	*	*	*	*	*	9.2	14.1	19 1	19 5	19 9
105	SPH	*	*	*	*	*	*	*	5.7	11 4	17 1	18 2	19.3
110	SPH	*	*	*	*	*	*	*	5 0	10 0	15 1	16 9	18 6
115	SPH	*	*	*	*	*	*	*	*	8 7	13 0	15.5	18 0

LEGEND

Ewb — Entering Wet Bulb
SPH — Superheat at Compressor (F)

*Do not attempt to charge system under these conditions — refrigerant slugging may occur

Table 13 — Superheat Charging Table, 658A036

TEMP (F) OUTDOOR ENTERING AIR		INDOOR AIR — 1300 CFM											
		Indoor Air — Ewb (F)											
		54	56	58	60	62	64	66	68	70	72	74	76
65	SPH	21 0	21 0	21 0	21 0	21.6	22.2	22 8	23 1	23.5	23 8	23 5	23 1
70	SPH	16.5	16 5	16.5	16 5	18 0	19 6	21 3	21.6	22 0	22.3	22 2	22 1
75	SPH	12.0	12.0	12 0	12 0	14.6	17.2	19 7	20.1	20.6	20 9	21 0	21.0
80	SPH	7 5	7 5	7 5	7 5	10 3	13.1	15.9	17.1	18 2	19.5	19.4	19 4
85	SPH	*	*	*	*	6 0	9 0	12 0	14.0	16 0	18 0	17 9	17 8
90	SPH	*	*	*	*	*	5.5	7 5	10 3	13 1	16 0	16 6	17 3
95	SPH	*	*	*	*	*	*	*	6.6	10.3	13.9	15 3	16 8
100	SPH	*	*	*	*	*	*	*	5 0	8 4	11 9	13.6	15 4
105	SPH	*	*	*	*	*	*	*	*	6 6	9.8	11 9	14 1
110	SPH	*	*	*	*	*	*	*	*	*	6 3	9 2	12 1
115	SPH	*	*	*	*	*	*	*	*	*	*	6 3	10 0

LEGEND

Ewb — Entering Wet Bulb
SPH — Superheat at Compressor (F)

*Do not attempt to charge system under these conditions — refrigerant slugging may occur

Table 14 — Superheat Charging Table, 658A048

TEMP (F) AIR ENT COND		EVAP AIR — 1600 CFM											
		Evap Air — Ewb (F)											
		54	56	58	60	62	64	66	68	70	72	74	76
65	SPH	25 8	26.3	27 0	27 6	28 6	29 6	30 5	30 9	31 3	31 7	31.2	30 7
70	SPH	24 2	24.0	23 8	23 6	25 0	26 4	27 8	28 4	29 0	29 7	29.6	29.5
75	SPH	19.7	19.7	19 7	19.7	21.4	23 2	25 0	25.9	26.8	27 6	27.9	28.2
80	SPH	15 8	15 8	15 8	15 8	17 6	19 4	21.2	22.7	24 1	25 6	26 2	26 9
85	SPH	12.0	12 0	12 0	12 0	13 8	15.6	17 5	19 5	21 5	23 5	24.5	25.6
90	SPH	7.5	7 5	7 5	7.5	9 4	11 3	13 2	16 3	19 3	22 4	23.3	24.2
95	SPH	*	*	*	*	5 0	7 0	9 0	13 1	17 1	21 2	22.0	22 8
100	SPH	*	*	*	*	*	*	*	9.4	14.3	19 1	20 3	21 4
105	SPH	*	*	*	*	*	*	*	5.7	11.4	17 1	18.6	20.1
110	SPH	*	*	*	*	*	*	*	*	9 0	13 5	15.8	18 0
115	SPH	*	*	*	*	*	*	*	*	6 7	10 0	13.0	16 0

LEGEND

Ewb — Entering Wet Bulb
SPH — Superheat at Compressor (F)

*Do not attempt to charge system under these conditions — refrigerant slugging may occur

Table 15 — Superheat Charging Table, 658A060

TEMP (F) AIR ENT COND		EVAP AIR — 1800 CFM											
		Evap Air — Ewb (F)											
		54	56	58	60	62	64	66	68	70	72	74	76
65	SPH	21 0	21 0	21.0	21.0	22 8	24.7	26.5	27.8	29.1	30 4	29.5	28.6
70	SPH	16 5	16.5	16.5	16.5	18.8	21 1	23 5	25.2	27 0	28.8	28 2	27.6
75	SPH	12 0	12.0	12.0	12 0	14.8	17.6	20.4	22.7	24.9	27 2	26.9	26.6
80	SPH	10 5	10.5	10.5	10 5	12 7	14.9	17.1	19.8	22.5	25.2	25 4	25.5
85	SPH	9 0	9.0	9.0	9 0	10.6	12 3	13 9	17.0	20.0	23 1	23.8	24 5
90	SPH	4.5	4.5	4 5	4.5	6.5	8 5	10.5	14.3	18.1	21.9	22 7	23.5
95	SPH	*	*	*	*	*	4.8	7 2	11.7	16.2	20 7	21.6	22 5
100	SPH	*	*	*	*	*	*	3 6	8.6	13.6	18.6	20 0	21.4
105	SPH	*	*	*	*	*	*	*	5.5	11.1	16 6	18 5	20 4
110	SPH	*	*	*	*	*	*	*	*	10 0	15 5	17 5	19 4
115	SPH	*	*	*	*	*	*	*	*	9.2	14 7	16 5	18 5

LEGEND

Ewb — Entering Wet Bulb
SPH — Superheat at Compressor (F)

*Do not attempt to charge system under these conditions — refrigerant slugging may occur

Table 16 — Required Suction-Tube Temperature (F)*

SUPERHEAT TEMP (F)	SUCTION PRESSURE AT SERVICE PORT (psig)								
	61.5	64.2	67.1	70.0	73.0	76.0	79.2	82.4	85.7
0	35	37	39	41	43	45	47	49	51
2	37	39	41	43	45	47	49	51	53
4	39	41	43	45	47	49	51	53	55
6	41	43	45	47	49	51	53	55	57
8	43	45	47	49	51	53	55	57	59
10	45	47	49	51	53	55	57	59	61
12	47	49	51	53	55	57	59	61	63
14	49	51	53	55	57	59	61	63	65
16	51	53	55	57	59	61	63	65	67
18	53	55	57	59	61	63	65	67	69
20	55	57	59	61	63	65	67	69	71
22	57	59	61	63	65	67	69	71	73
24	59	61	63	65	67	69	71	73	75
26	61	63	65	67	69	71	73	75	77
28	63	65	67	69	71	73	75	77	79
30	65	67	69	71	73	75	77	79	81
32	67	69	71	73	75	77	79	81	83
34	69	71	73	75	77	79	81	83	85
36	71	73	75	77	79	81	83	85	87
38	73	75	77	79	81	83	85	87	89
40	75	77	79	81	83	85	87	89	91

*Temperature at suction service valve.

LEGEND AND NOTES FOR FIG. 28 AND 29

AWG — American Wire Gage
BD — Board
BR — Blower Relay
C — Contactor, Compressor
CAP — Capacitor
COMP — Compressor Motor
CR — Combustion Relay
CTD — Compressor Time Delay
DB — Defrost Board
DFT — Defrost Thermostat
DR — Defrost Relay
DT — Discharge Thermostat
EQUIP — Equipment
FS — Flame Sensor
FU — Fuse
GND — Ground
GVR — Gas Valve Relay
HR — Heater Relay
HS — Hall Effect Sensor
HV TRAN — High-Voltage Transformer
ICM — Integrated Control Motor
IDM — Induced Draft Motor
IFM — Indoor-Fan Motor
IGC — Integrated Gas Controller
IP — Internal Protector
LR — Lockout Relay
LS — Limit Switch
MGV — Main Gas Valve
NEC — National Electrical Code
OAT — Outdoor-Air Thermostat
OF — Outdoor Fan
OFM — Outdoor-Fan Motor
PL — Plug
PWR — Power
QT — Quadruple Terminal
RS — Rollout Switch
RVS — Reversing Valve Solenoid
SUPL — Supplementary
TRAN — Transformer
TSTAT — Thermostat


Field Splice

Terminal (Marked)


Terminal (Unmarked)

Terminal Block


Splice

Factory Wiring

Field Control Wiring

Field Power Wiring

To Indicate Common Potential Only, Not to Represent Wiring

NOTES:
1. If any of the original wire furnished must be replaced, it must be replaced with type 90 C wire or its equivalent
2. Use thermostat: HH07AT171, with subbase HH93AZ188
3. Set heat anticipator at 0 6
4. Use copper conductors only

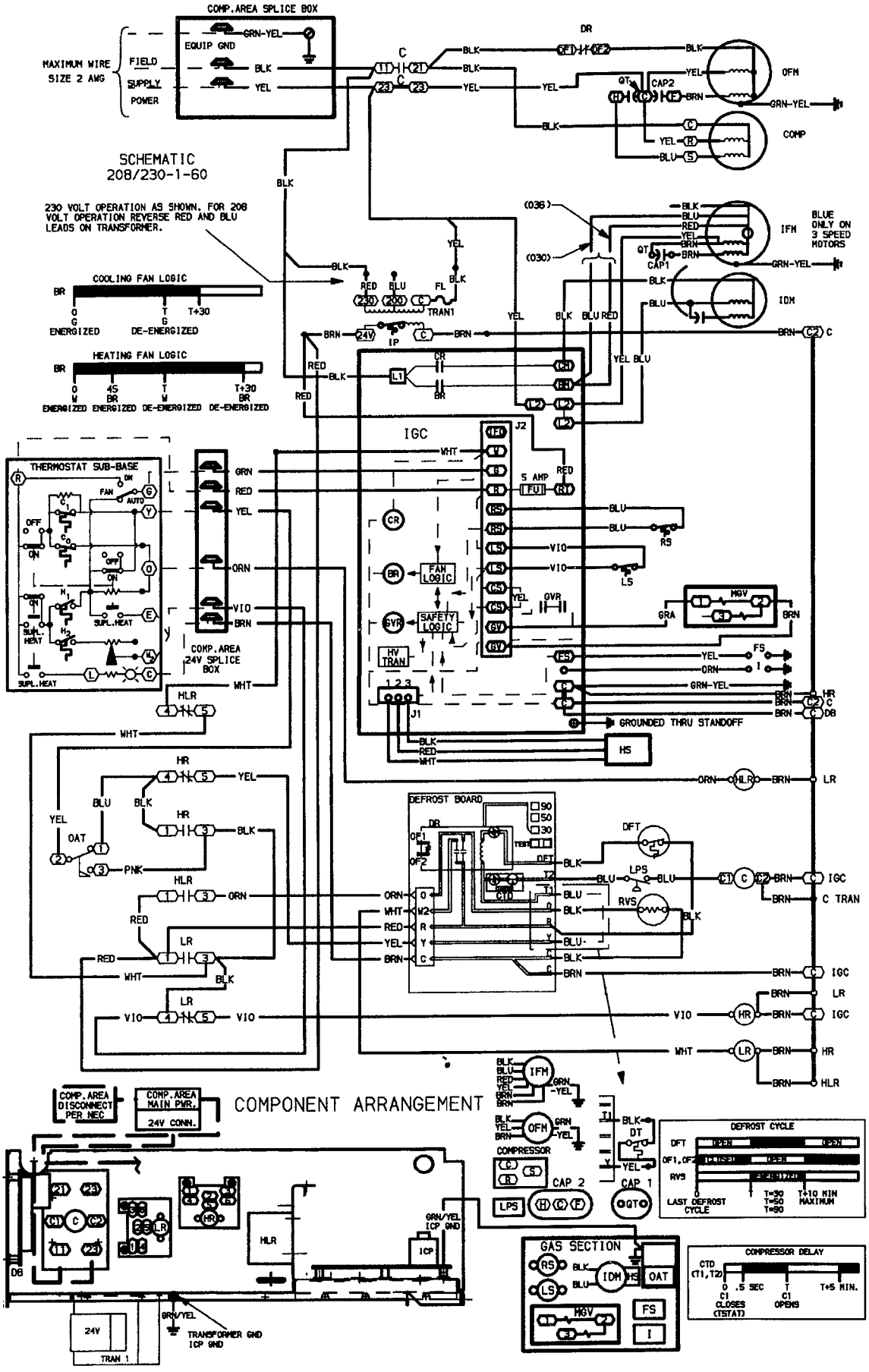


Fig. 28 — Wiring Diagram; Units 658A030,036; 208/230-1-60

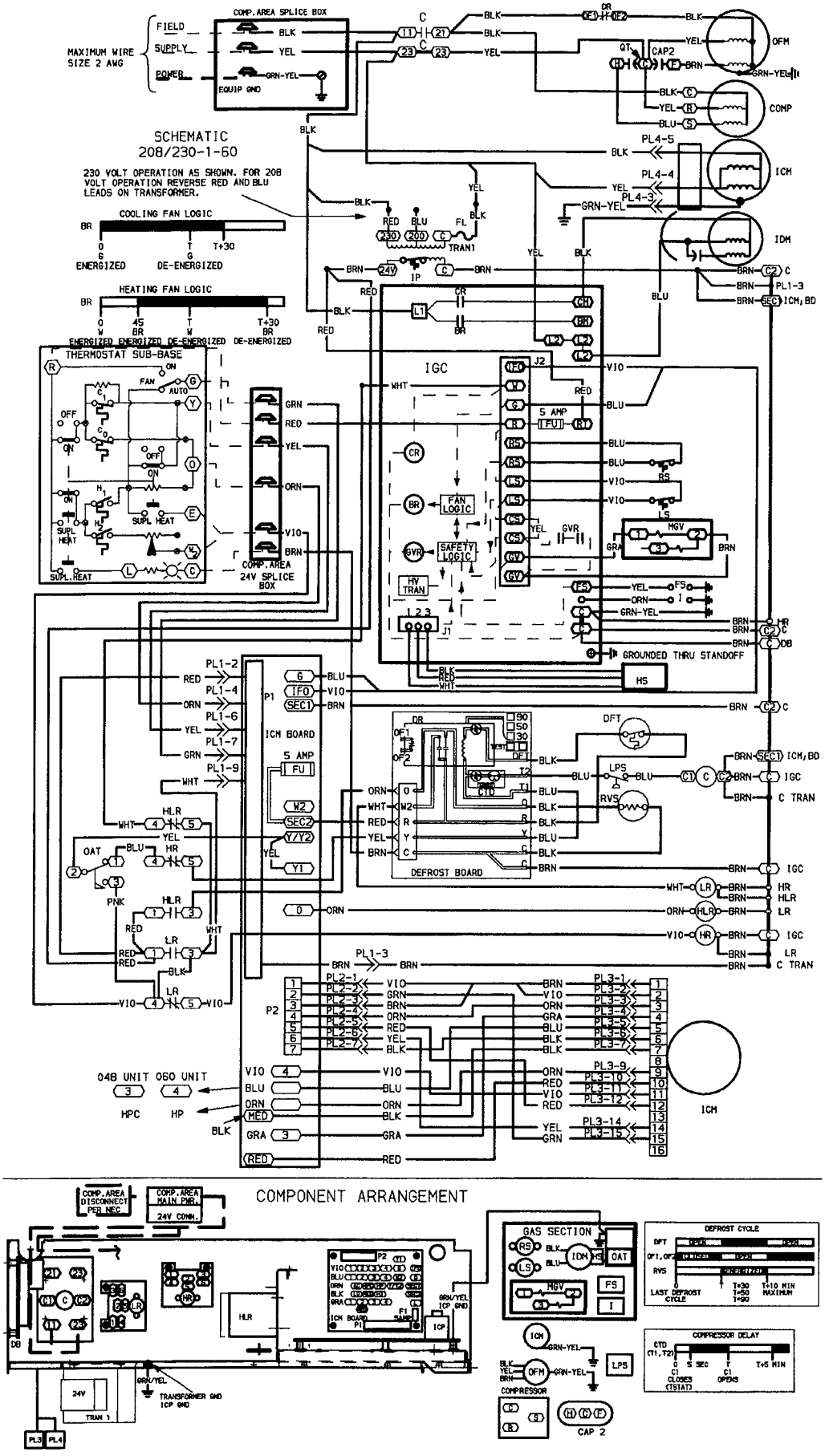


Fig. 29 — Wiring Diagram; Units 658A048,060; 208/230-1-60

TROUBLESHOOTING

Cooling and Heating

SYMPTOM	CAUSE	REMEDY
Compressor and outdoor fan will not start.	OAT set above outdoor ambient temperature	Lower OAT setting.
	Power failure	Call power company
	Fuse blown or circuit breaker tripped	Replace fuse or reset circuit breaker
	Defective thermostat, contactor, transformer, control relay, or defrost board	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.
Indoor fan runs, but outdoor fan and compressor do not.	Units have a 5-minute time delay (do not bypass this compressor time delay)	Wait for 5 minutes until time-delay relay is deenergized
Compressor will not start but outdoor 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 capacitor or overload	Determine cause and replace
	One leg of 3-phase power dead	Replace fuse or reset circuit breaker Determine cause
	Low input voltage (20% low)	Determine cause and correct.
Three-phase scroll compressor makes excessive noise, and there may be a low pressure differential	Scroll compressor is rotating in the wrong direction	Correct the direction of rotation by reversing the 3-phase power leads to the unit. Shut down unit to allow pressures to equalize.
Compressor cycles (other than normally satisfying thermostat).	Refrigerant overcharge or undercharge	Reclaim 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 coil	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
	Damaged reversing valve	Determine cause and correct.
	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
	Frosted coil with incorrect defrost operation	Check defrost time settings. Reset as necessary. Check defrost temperature switch. Replace as necessary.
	Air in system	Reclaim refrigerant, evacuate system, and recharge.
	Outdoor coil dirty or restricted	Clean coil or remove restriction.
Excessive head pressure.	Dirty air filter	Replace filter.
	Dirty condenser coil	Clean coil.
	Refrigerant overcharged	Reclaim excess refrigerant.
	Air in system	Reclaim refrigerant, evacuate system, and recharge.
	(Heat) Indoor air restricted or recirculating	Determine cause and correct.
	Indoor or outdoor 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.

OAT — Outdoor Air Thermostat

Cooling and Heating (cont)

SYMPTOM	CAUSE	REMEDY
Excessive suction pressure.	(Cool) High heat load	Check for source and eliminate.
	Reversing valve hung up or leaking internally	Replace valve.
	Refrigerant overcharged	Reclaim excess refrigerant
Suction pressure too low.	(Cool) Dirty air filter	Replace filter.
	(Heat) Outdoor coil frosted	Move timer on control board to 30 minutes between defrost cycles.
	Low refrigerant charge	Check for leaks, repair and recharge.
	Metering device or low side restricted	Remove source of restriction.
	(Cool) Insufficient coil airflow	Increase air quantity. Check filter — replace if necessary.
	(Cool) Temperature too low in conditioned area	Reset thermostat.
	(Cool) Outdoor ambient below 40 F	Install low-ambient kit.
	Field-installed filter-drier restricted	Replace.
Compressor runs but outdoor fan does not.	NC (normally closed) contacts on defrost board open	Check condition of relay on board. Replace if necessary.
Integrated control motor (sizes 048 and 060) IFM does not run.	Motor overload open	Check motor temperature. Replace motor or capacitor.
	Blower wheel not secured to shaft	Properly tighten blower wheel to shaft
	Insufficient voltage at motor	Determine cause and correct.
	Power connectors not properly seated	Connectors should snap easily; do not force.
Integrated control motor (sizes 048 and 060) IFM runs when it should be off.	Motor programmed with a delay profile	Allow a few minutes for motor to shut off.
	With thermostat in off state, the voltage on G,Y1,Y,Y2,W with respect to common, should be less than ½ of actual low voltage supply	If measured voltage is more than ½, the thermostat is incompatible with motor. If voltage is less than ½, the motor has failed.
Integrated control motor (sizes 048 and 060) IFM operation is intermittent.	Water dripping into motor	Verify proper drip loops in connector wires.
	Connectors not firmly seated	Gently pull wires individually to be sure they are crimped into the housing

IFM — Indoor Fan Motor

Gas 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 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
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

LED Troubleshooting

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
Limit switch fault. (LED 2 flashes)	High temperature limit switch is open.	Check the operation of the indoor-fan motor Ensure that the supply-air temperature rise is in accordance with the range on the unit nameplate
Flame sense fault. (LED 3 flashes)	The IGC sensed flame that should not be present.	Reset unit. If problem persists, replace control board
5 consecutive limit switch trips. (LED 4 flashes)	Inadequate airflow to unit	Check operation of indoor-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. 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

⚠ **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 the other Troubleshooting charts for additional troubleshooting analysis

LEGEND

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

PACKAGED SERVICE TRAINING

Our packaged service training programs provide an excellent way to increase your knowledge of the equipment discussed in this manual. Product programs cover:

- Unit Familiarization
- Installation Overview
- Maintenance
- Operating Sequence

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START-UP CHECKLIST

(Remove and Store in Job File)

I. PRELIMINARY INFORMATION

MODEL NO.: _____ SERIAL NO.: _____

DATE: _____ TECHNICIAN: _____

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

- ☐ VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT
- ☐ REMOVE ALL SHIPPING HOLDDOWN BOLTS AND BRACKETS PER INSTALLATION INSTRUCTIONS
- ☐ 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-AIR FILTER IS CLEAN AND IN PLACE
- ☐ VERIFY THAT UNIT INSTALLATION IS LEVEL
- ☐ CHECK FAN WHEEL AND PROPELLER FOR LOCATION IN HOUSING/ORIFICE AND SETSCREW TIGHTNESS
- ☐ SET OUTDOOR-AIR THERMOSTAT (OAT) TO SELECTION BASED ON ECONOMIC BALANCE POINT (EBP). SEE PAGE 15.

III. START-UP

ELECTRICAL

SUPPLY VOLTAGE L1-L2 _____ L2-L3 _____ L3-L1 _____

COMPRESSOR AMPS L1 _____ L2 _____ L3 _____

COMPRESSOR AMPS L1 _____ L2 _____ L3 _____

INDOOR-FAN AMPS _____

TEMPERATURES

OUTDOOR-AIR TEMPERATURE _____ DB

RETURN-AIR TEMPERATURE _____ DB _____ WB

COOLING SUPPLY AIR _____

GAS HEAT SUPPLY AIR _____

PRESSURES

GAS INLET PRESSURE _____ IN. WG

GAS MANIFOLD PRESSURE _____ IN. WG

REFRIGERANT SUCTION _____ PSIG

REFRIGERANT DISCHARGE _____ PSIG

☐ VERIFY REFRIGERANT CHARGE USING CHARGING TABLES

☐ VERIFY THAT 3-PHASE SCROLL COMPRESSOR ROTATING IN CORRECT DIRECTION

CUT ALONG PERFORATED LINE