



Installation, Start-Up and Service Instructions

CONTENTS

Page

GENERAL	2
SAFETY CONSIDERATIONS	2
INSTALLATION	2-24
Jobsite Survey.....	2
Unit Placement.....	2
Roof Mount.....	5
Slab Mount.....	5
Field-Fabricated Ductwork.....	8
Rigging.....	8
Install Outdoor Hoods.....	8
Condensate Drain Connections.....	11
Field Wire Routing.....	16
Field Electrical Connections.....	16
Gas Piping (48FJ,FK,FP Only).....	19
Installing Flue/Inlet Hoods (48FJ,FK,FP Only).....	19
Air Pressure Tubing.....	21
Evaporator-Fan Shipping Brackets.....	22
Compressor Mounting.....	23
Install Accessories.....	23
CONTROLS INSTALLATION	25-40
Constant Volume (CV) Units.....	25
Variable Air Volume Units.....	26
Variable Frequency Drive (VFD).....	26
PIC Control Wiring (50FB,FPX,FPY).....	28
Carrier Comfort Network Interface.....	34
Smoke Control Modes.....	34
PRE-START-UP	41-54
System Check.....	41
25% Outdoor Air Damper.....	41
Economizer Inlet Screens.....	41
Economizer Dampers.....	41
Compressor Oil.....	41
Gas Manifold Pressure.....	41
Evaporator-Fan Belts, Pulleys, and Sheaves.....	42
Manual Outdoor-Air Inlet Adjustments.....	53
Economizer Settings.....	53
START-UP	55,56
Initial Check (Constant Volume Units).....	55
General.....	55
Operating Sequences.....	55
• COOLING, UNITS WITHOUT ECONOMIZER	
• HEATING, UNITS WITHOUT ECONOMIZER	
• COOLING, UNITS WITH ECONOMIZER	
• HEATING, UNITS WITH ECONOMIZER	
• VENTILATION AIR CIRCULATION (Continuous Fan)	
• AUTOMATIC CHANGEOVER USING AUTO- MATIC CHANGEOVER THERMOSTAT	
• POWER EXHAUST	
• NON-MODULATING POWER EXHAUST (CV Units Only)	
• MODULATING POWER EXHAUST (CV Units Only)	
Head Pressure Control.....	56
SERVICE	56-64
Service Access.....	56
• COMPRESSORS	
• LIQUID SERVICE VALVES, FILTER DRIERS, AND SIGHT GLASSES	
• EVAPORATOR-FAN MOTORS, PULLEYS, AND BELTS	
• POWER EXHAUST MOTORS, PULLEYS, AND BELTS	
• RETURN AIR FILTERS	
• GAS HEAT SECTION	
• MAIN BURNERS	
• FLUE GAS PASSAGEWAYS	
• COMBUSTION-AIR BLOWERS	
• UNIT CONTROL BOX	
• ECONOMIZER DAMPER MOTOR	
• CONDENSER FANS AND FAN MOTORS	
Adjustments.....	58
• EVAPORATOR FAN AND POWER EXHAUST MOTOR PLATE	
• MODULATING POWER EXHAUST DIFFERENTIAL PRESSURE SWITCH	
• INLET GUIDE VANE DIFFERENTIAL PRESSURE SWITCH (Units With Optional Inlet Guide Vanes and Static Pressure Control)	
• INLET GUIDE VANE MOTOR AND LINKAGE (Units with Optional Inlet Guide Vanes)	
• SWITCH ADJUSTMENT	
• BELT INSTALLATION AND TENSIONING	
• PULLEY ALIGNMENT	
• INSTALLING REPLACEMENT MOTOR PULLEY (Evaporator Fan Only)	
• CONDENSER FAN ADJUSTMENT	
• 25% OUTDOOR-AIR DAMPER	
Cleaning.....	61
Condenser Coil Maintenance and Cleaning.....	61
• REMOVE SURFACE LOADED FIBERS	
• PERIODIC CLEAN WATER RINSE	
• ROUTINE CLEANING OF COIL SURFACES	
Lubrication.....	61
• COMPRESSORS	
• FAN SHAFT BEARINGS	
• INLET GUIDE VANE BEARINGS (Units With Optional Inlet Guide Vanes)	
• FAN MOTOR BEARINGS	
• DOOR HINGES	
Refrigerant Feed Components.....	62
Thermostatic Expansion Valve (TXV).....	62
Compressor Discharge Service Valve.....	62
Protective Devices.....	62
• COMPRESSOR PROTECTION	

CONTENTS (cont)

	Page
• EVAPORATOR-FAN MOTOR PROTECTION	
• CONDENSER-FAN MOTOR PROTECTION	
• HIGH- AND LOW-PRESSURE SWITCHES	
Relief Devices	62
Refrigeration Circuits	62
Oil Charge	62
Moisture/Liquid Indicator	63
Filter Driers	63
Liquid Line Service Valve	63
Gas Heat	64
Gas Valve Adjustment	64
Main Burners	64
Compressor Removal	64
Compressor Replacement	64
TROUBLESHOOTING	65-73
Economizer	65
• ECONOMIZER MOTOR CHECKOUT	
• CONTROL BOARD CHECKOUT	
Unit Control Board Checkout	66
• BASIC CHECK	
• DETAILED CHECK	
Unit Wiring	68
TROUBLESHOOTING AND DIAGNOSTICS	74-76
START-UP CHECKLIST	CL-1, CL-2

GENERAL

This installation instruction contains base unit installation information, including installation of thermostats and remote temperature sensors. In addition, this instruction contains start-up, control, and troubleshooting information for the constant volume (CV) units only (48FJ and 50FJX,FJY,FW).

For complete information and service instructions for variable air volume (VAV) units (48FK and 50FKX,FKY,FY) and product integrated controls (PIC) units (48FP and 50FB, FPX,FPY), refer to the separate Controls and Troubleshooting literature also enclosed in this literature packet.

SAFETY CONSIDERATIONS

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

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

Follow all safety codes, including ANSI (American National Standards Institute) Z223.1. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

⚠ WARNING

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury.

FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

⚠ WARNING

Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information, consult a qualified installer, service agency, or the gas supplier.

FOR YOUR SAFETY WHAT TO DO IF YOU SMELL GAS

Do not try to light any appliance. Do not touch any electrical switch; do not use any phone in your building. Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you cannot reach your gas supplier, call the fire department.

⚠ CAUTION

Disconnect gas piping from units when leak testing at pressures greater than 0.5 psig (3448 Pa). Pressures greater than 0.5 psig (3448 Pa) will cause gas valve damage resulting in a hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig (3448 Pa), it must be replaced. When pressure testing field-supplied gas piping at pressures of 0.5 psig (3448 Pa) or less, the unit connected to such piping must be isolated by manually closing the gas valve.

INSTALLATION

Jobsite Survey — Complete the following checks before installation.

1. Consult local building codes and the NEC (National Electrical Code) (ANSI/NFPA [National Fire Protection Association] 70) for special installation requirements.
2. Determine unit location (from project plans) or select unit location.
3. Check for possible overhead obstructions which may interfere with unit lifting or rigging.

⚠ CAUTION

Do not lift unit with forklift truck. Move unit with overhead rigging only.

Unit Placement — Inspect unit for transportation damage. File claim with transportation agency.

Provide clearance around and above unit for airflow, safety, and service access. Do not restrict top (area above condenser fans) in any way. Allow at least 6 ft (1.8 m) on all sides for rated performance, code compliance, and service.

Check unit dimensional drawings for unit arrangement and minimum performance and service clearances.

Do not install unit in an indoor location. Do not locate air inlets near exhaust vents or other sources of contaminated air.

On units equipped with power exhaust option, high velocity air is exhausted out the hood. Unit should be positioned with at least 10 ft (3 m) clearance between the unit end and any obstruction. Although unit is weatherproof, guard against water from higher level runoff and overhangs.

Level by using unit frame as a reference. Physical data is shown in Tables 1A-3.

Table 1A — Physical Data (48FJ,FK,FP Units)

UNIT 48FJ,FJ,FP	078		088		104	
NOMINAL CAPACITY (tons)	75		85		100	
OPERATING WEIGHT (lb)						
Base Unit without Economizer	10,270/10,445		10,480/10,655		11,210/11,385	
Low Heat/High Heat						
With Economizer	10,800/10,975		11,010/11,185		11,740/11,915	
Low Heat/High Heat						
COMPRESSOR	Semi-Hermetic					
Number	2		2		4	
Circuit (No. Cyl)	A (6)	B (6)	A (6)	B (6)	A1 (6), A2 (4)	B1 (6), B2 (4)
Model 06E	-275	-299	-299	-299	-75, -250	-275, -250
Oil Charge (pints)	19	19	19	19	19, 14	19, 14
Capacity Steps (%)						
FJ	43, 100		50, 100		50, 100	
FK	14,29,43,71,86,100		17,33,50,67,83,100		20,30,50,60,70,80,90,100	
FP	19,38,57,71,86,100		17,33,50,67,83,100		20,30,40,50,60,70,80,90,100	
Number of Refrigerant Circuits	2		2		2	
REFRIGERANT	R-22					
Operating Charge (lb)	70.5/64.5		64.0/64.0		68.0/68.0	
Standard — Circuit A/Circuit B	73.5/64.5		67.0/64.0		71.0/68.0	
Optional HGBP — Circuit A/Circuit B						
CONDENSER COILS			3/8" Tube Diameter			
Quantity	4		4		4	
Rows...Fins/in.						
Aluminum	3...17.0		3...17.0		3...17.0	
Copper (Optional)	3...15.7		3...15.7		3...15.7	
Fin Type	Double Wavy		Lanced, Sine-wave		Lanced, Sine-wave	
Tube Type	Smooth		Cross-Hatched		Cross-Hatched	
Total Face Area (sq ft)	108.4		108.4		108.4	
EVAPORATOR COILS	1/2" Tube Diameter		3/8" Tube Diameter		3/8" Tube Diameter	
Quantity	2		2		2	
Rows...Fins/in.	4...17.0		4...17.0		4...17.0	
Total Face Area (sq ft)	61.5		61.5		61.5	
Fin Type	Double Wavy		Lanced, Sine-wave		Lanced, Sine-wave	
Tube Type	Smooth		Cross-Hatched		Cross-Hatched	
Refrigerant Feed Device...No. per Circuit	TXV...2		TXV...2		TXV...2	
HEATING SECTION	Low Heat		High Heat		Low Heat	
Number of Heat Exchangers	2	3	2	3	2	3
Input (MBtuh)	650	975	650	975	650	975
Output (MBtuh)	527	790	527	790	527	790
Temperature Rise Range (F)	10-40	20-50	10-40	20-50	10-40	20-50
Efficiency (%)	81	81	81	81	81	81
Burner Orifice Diameter						
Quantity (in. ...drill no.)	7 (.1285...30)	7 (.1285...30)	7 (.1285...30)	7 (.1285...30)	7 (.1285...30)	7 (.1285...30)
Manifold Pressure (in. wg)	3.3	3.3	3.3	3.3	3.3	3.3
Line Pressure (in. wg) (Min...Max)	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0
Number of Gas Valves	2	3	2	3	2	3
CONDENSER FAN			Propeller Type			
Quantity...Diameter (in.)	5...30		6...30		6...30	
Nominal Cfm	50,000		60,000		60,000	
Motor Hp (ea)...rpm	1.0...1140		1.0...1140		1.0...1140	
SUPPLY FAN			Centrifugal 36 x 30 in.			
Nominal Cfm	24,500		29,750		35,000	
Maximum Allowable Cfm	30,000		34,000		40,000	
Maximum Allowable Rpm	680		680		680	
Shaft Diameter at Pulley (in.)	1 11/16		1 11/16		1 11/16	
SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit.)					
Motor Hp	30	40	50	60	60	60
Motor Frame Size	S286T	S324T	S36T	S364T	S364T	S364T
Efficiency at Full Load (%)						
High Efficiency	92.4	93.0	93.0	93.6	93.6	93.6
Premium Efficiency	93.6	94.5	94.5	95.4	95.4	95.4
Fan Pulley Pitch Diameter (in.)	18.5	18.5	18.5	18.5	18.5	18.5
Motor Pulley Pitch Diameter (in.)	5.3	5.7	6.5	7.1	7.1	7.1
Resulting Fan Rpm	501	539	615	672	672	672
Belts Quantity...Model No.	3...5VX1320	4...5VX1320	4...5VX1320	4...5VX1320	4...5VX1320	4...5VX1320
Center Distance Range (in.)	47.88...45.01	47.64...44.76	47.42...44.52	47.42...44.52	47.42...44.52	47.42...44.52
OPTIONAL POWER EXHAUST	Centrifugal, 18 x 15 in. (Any motor available on any unit.)					
Quantity...Motor Hp	2...5.0		2...7.5		2...10.0	
Motor Frame Size	184T		213T		215T	
Efficiency at Full Load (%)						
High Efficiency	87.5		88.5		89.5	
Premium Efficiency	89.5		91.7		91.7	
Fan Pulley Pitch Diameter (in.)	10.6		10.6		10.6	
Motor Pulley Pitch Diameter (in.)	4.5		5.0		5.6	
Shaft Diameter at Pulley (in.)	1 7/16		1 7/16		1 7/16	
Resulting Fan Rpm	740		820		920	
Maximum Allowable Rpm	925		925		925	
FILTERS						
Medium Efficiency (30%) Pleated	15...20 x 25 x 2		18...20 x 25 x 2		18...20 x 25 x 2	
(Standard) Qty...Size (in.)	5...16 x 20 x 2		6...16 x 20 x 2		6...16 x 20 x 2	
High Efficiency (65%) Pleated	15...20 x 25 x 2		18...20 x 25 x 2		18...20 x 25 x 2	
(Optional) Qty...Size (in.)	5...16 x 20 x 2		6...16 x 20 x 2		6...16 x 20 x 2	
OUTSIDE AIR SCREENS						
Standard (25% Hoods) (Qty) Size (in.)	(4) 25 x 16 x 1		(4) 25 x 16 x 1		(4) 25 x 16 x 1	
	(2) 20 x 16 x 1		(2) 20 x 16 x 1		(2) 20 x 16 x 1	
Optional Economizer (Qty) Size (in.)	(12) 25 x 16 x 1		(12) 25 x 16 x 1		(12) 25 x 16 x 1	
	(2) 20 x 16 x 1		(2) 20 x 16 x 1		(2) 20 x 16 x 1	

LEGEND

HGBP — Hot Gas Bypass
TXV — Thermostatic Expansion Valve

Table 1B — Physical Data (50FB,FJX,FJY,FKX,FKY,FPX,FPY,FW,FY Units)

UNIT 50FB,FJX,FJY,FKX,FKY,FPX,FPY,FW,FY	078	088	104
NOMINAL CAPACITY (tons)	75	85	100
OPERATING WEIGHT (lb)			
Base Unit without Economizer	9,870	10,080	10,810
With Economizer	10,400	10,610	11,340
COMPRESSOR	Semi-Hermetic		
Number	2	2	4
Circuit (No. Cyl)	A (6) B (6)	A (6) B (6)	A1 (6), A2 (4) B1 (6), B2 (4)
Model 06E	-275 -299	-299 -299	-275, -250 -275, -250
Oil Charge (pints)	19 19	19 19	19, 14 19, 14
Capacity Steps (%)			
FJX,FJY,FW	43,100	50,100	50,100
FKX,FKY,FY	14,29,43,71,86,100	17,33,50,67,83,100	20,30,50,60,70,80,90,100
FB,FPX,FPY	19,38,57,71,86,100	17,33,50,67,83,100	20,30,40,50,60,60,70,80,80,90,100
Number of Refrigerant Circuits	2	2	2
REFRIGERANT	R-22		
Operating Charge (lb)			
Standard — Circuit A/Circuit B	70.5/64.5	64.0/64.0	68.0/68.0
Optional HGBP — Circuit A/Circuit B	73.5/64.5	67.0/64.0	71.0/68.0
CONDENSER COILS	3/8 in. Tube Diameter		
Quantity	4	4	4
Rows...Fins/in.			
Aluminum	3...17.0	3...17.0	3...17.0
Copper (Optional)	3...15.7	3...15.7	3...15.7
Fin Type	Double Wavy	Lanced, Sine-wave	Lanced, Sine-wave
Tube Type	Smooth	Cross-Hatched	Cross-Hatched
Total Face Area (sq ft)	108.4	108.4	108.4
EVAPORATOR COILS	3/8 in. Tube Diameter		
Quantity	2	2	2
Rows...Fins/in.	4...17.0	4...17.0	4...17.0
Total Face Area (sq ft)	61.5	61.5	61.5
Fin Type	Double Wavy	Lanced, Sine-wave	Lanced, Sine-wave
Tube Type	Smooth	Cross-Hatched	Cross-Hatched
Refrigerant Feed Device...No. per Circuit	TXV...2	TXV...2	TXV...2
CONDENSER FAN	Propeller Type		
Quantity...Diameter (in.)	5...30	6...30	6...30
Nominal Airflow (Cfm)	50,000	60,000	60,000
Motor Hp (ea)...rpm	1.0...1140	1.0...1140	1.0...1140
SUPPLY FAN	Centrifugal 36 x 30 in., Forward Curved		
Nominal Airflow (Cfm)	24,500	29,750	35,000
Maximum Allowable Airflow (Cfm)	30,000	34,000	40,000
Maximum Allowable Wheel Speed (Rpm)	680	680	680
Shaft Diameter at Pulley (in.)	1 11/16	1 11/16	1 11/16
SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit)		
Motor Hp	30	40	50
Motor Frame Size	S286T	S324T	S36T
Efficiency at Full Load (%)			
High Efficiency	92.4	93.0	93.0
Premium Efficiency	93.6	94.5	94.5
Fan Pulley Pitch Diameter (in.)	18.5	18.5	18.5
Motor Pulley Pitch Diameter (in.)	5.3	5.7	6.5
Resulting Fan Speed (Rpm)	501	539	615
Belts — Quantity...Model No.	3...5VX1320	4...5VX1320	4...5VX1320
Center Distance Range (in.)	47.88...45.01	47.64...44.76	47.42...44.52
OPTIONAL POWER EXHAUST	Centrifugal, 18 x 15 in. (Any motor available on any unit)		
Quantity...Motor Hp	2...5.0	2...7.5	2...10.0
Motor Frame Size	184T	213T	215T
Efficiency at Full Load (%)			
High Efficiency	87.5	88.5	89.5
Premium Efficiency	89.5	91.7	91.7
Fan Pulley Pitch Diameter (in.)	10.6	10.6	10.6
Motor Pulley Pitch Diameter (in.)	4.5	5.0	5.6
Shaft Diameter at Pulley (in.)	1 7/16	1 7/16	1 7/16
Resulting Fan Rpm	740	820	920
Maximum Allowable Rpm	925	925	925
FILTERS			
Medium Efficiency (30%) Pleated (Standard)	15...20 x 25 x 2	18...20 x 25 x 2	18...20 x 25 x 2
Qty...Size (in.)	5...16 x 20 x 2	6...16 x 20 x 2	6...16 x 20 x 2
High Efficiency (65%) Pleated (Optional)	15...20 x 25 x 2	18...20 x 25 x 2	18...20 x 25 x 2
Qty...Size (in.)	5...16 x 20 x 2	6...16 x 20 x 2	6...16 x 20 x 2
OUTSIDE AIR SCREENS			
Standard (25% Hoods) (Qty) Size (in.)	(4) 25 x 16 x 1	(4) 25 x 16 x 1	(4) 25 x 16 x 1
	(2) 20 x 16 x 1	(2) 20 x 16 x 1	(2) 20 x 16 x 1
Optional Economizer (Qty) Size (in.)	(12) 25 x 16 x 1	(12) 25 x 16 x 1	(12) 25 x 16 x 1
	(2) 20 x 16 x 1	(2) 20 x 16 x 1	(2) 20 x 16 x 1

LEGEND

HGBP — Hot Gas Bypass
TXV — Thermostatic Expansion Valve

Table 2 — Operating Weights of Options and Accessories (lb)

OPTION OR ACCESSORY		UNIT SIZE		
		078	088	104
Roof Curb		560	560	560
Condenser Section Roof Curb		625	625	625
Economizer		530*	530*	530*
Power Exhaust†		710*	710*	710*
Barometric Relief†		200	200	200
Hail Guard		210	210	210
Copper Condenser Coil Fins		420	420	420
Inlet Guide Vanes		115	115	115
Variable Frequency Drive	30 hp 460 V	152	152	152
	40 hp 460 V	155	155	155
	50 hp 460 V	263	263	263
	60 hp 460 V	266	266	266

*Includes hood.

†Vertical discharge units only.

Table 3 — Fan Drive Data

HP	SHAFT DIA.	SPEED (rpm)	MOTOR SHEAVE	MOTOR PITCH DIA.	WHEEL SHEAVE	WHEEL PITCH DIA.	QUANTITY ...BELT
30	1 ⁷ / ₈	501	3B5V52	5.33	B5V184	18.5	3...5VX1320
40	2 ¹ / ₈	539	4B5V56	5.74	B5V184	18.5	4...5VX1320
50	2 ¹ / ₈	615	4B5V64	6.54	B5V184	18.5	4...5VX1320
60	2 ³ / ₈	672	4B5V70	7.14	B5V184	18.5	4...5VX1320

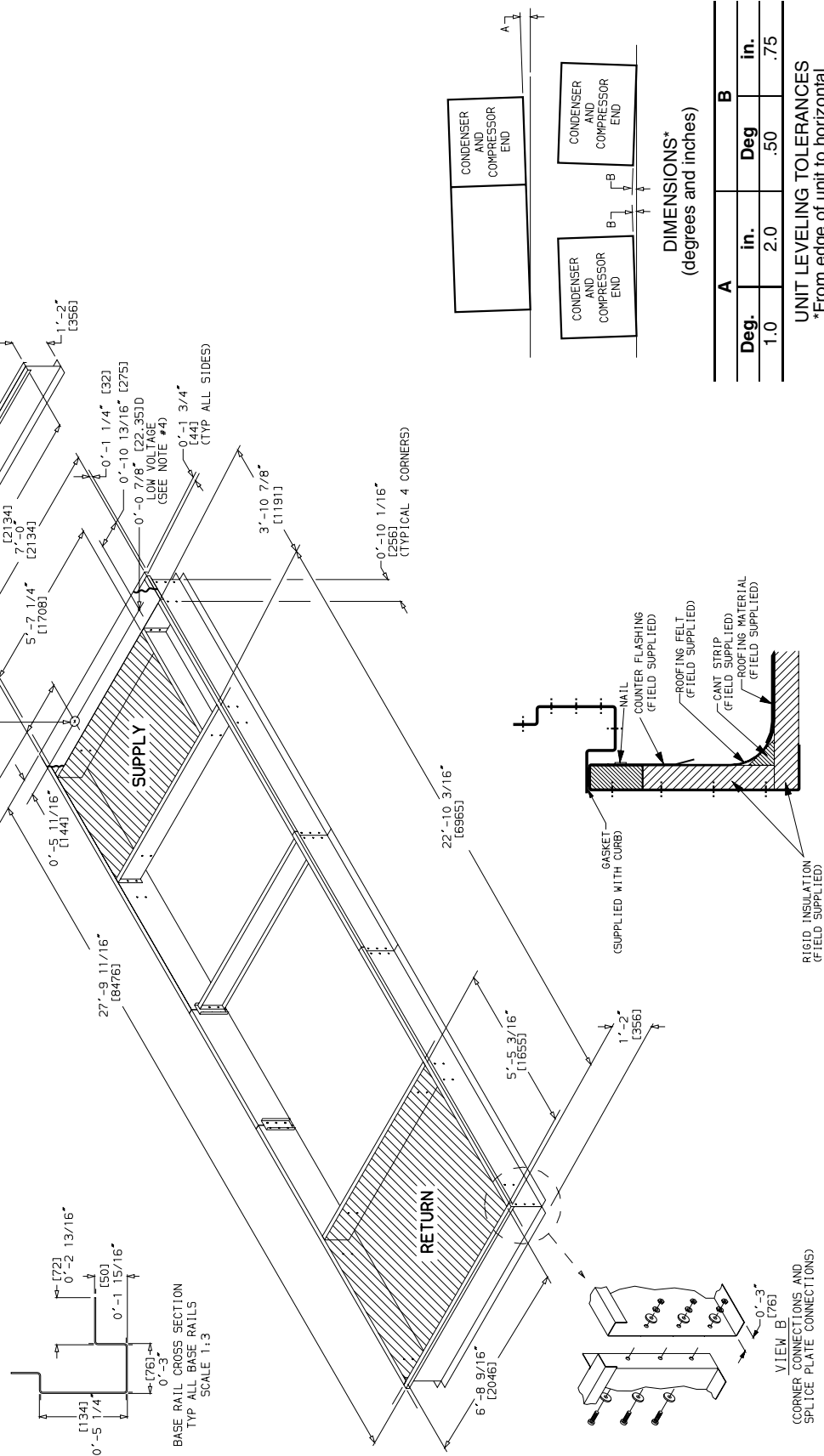
Roof Mount — Check building codes for weight distribution requirements. Unit weight is shown in Tables 1A, 1B, and 2. Unit may be mounted on class A, B, or C roofing material.

ROOF CURB — Assemble and install as described in instructions shipped with the accessory. Accessory roof curb and information required to field fabricate a roof curb is shown in Fig. 1 and 2. Install insulation, cant strips, roofing and counter flashing as required. For unit condensate drain to function properly, curb must be level or within tolerances shown in Fig. 1 and 2.

STEEL BEAMS — If roof curb is not used, support unit with steel beams along its entire length and then support steel as required. As a minimum, unit must be supported across its width at each lifting lug location.

Slab Mount — Provide a level concrete slab that extends beyond unit cabinet at least 6 in. (152 mm). Make a slab 8 in. (203 mm) thick with 4 in. (102 mm) above grade. Use gravel apron in front of condenser coil air inlet to prevent grass and foliage from obstructing airflow. Ensure that slab is of sufficient height to allow for 7-in. (178 mm) condensate trap.

- NOTES:
1. Roof curb is shipped disassembled.
 2. Roof curb: 14 gage (VA03-56) steel.
 3. Dimensions in [] are millimeters.
 4. Suggested hole location for field wiring through roof curb (holes to be supplied by field).



NOTES:

1. Roof curb is shipped disassembled.
2. Dimensions in [] are millimeters.
3. Roof curb: 14 gage (VA03-56) steel.
Roof curb pans, 16 gage (VA03-56) steel.

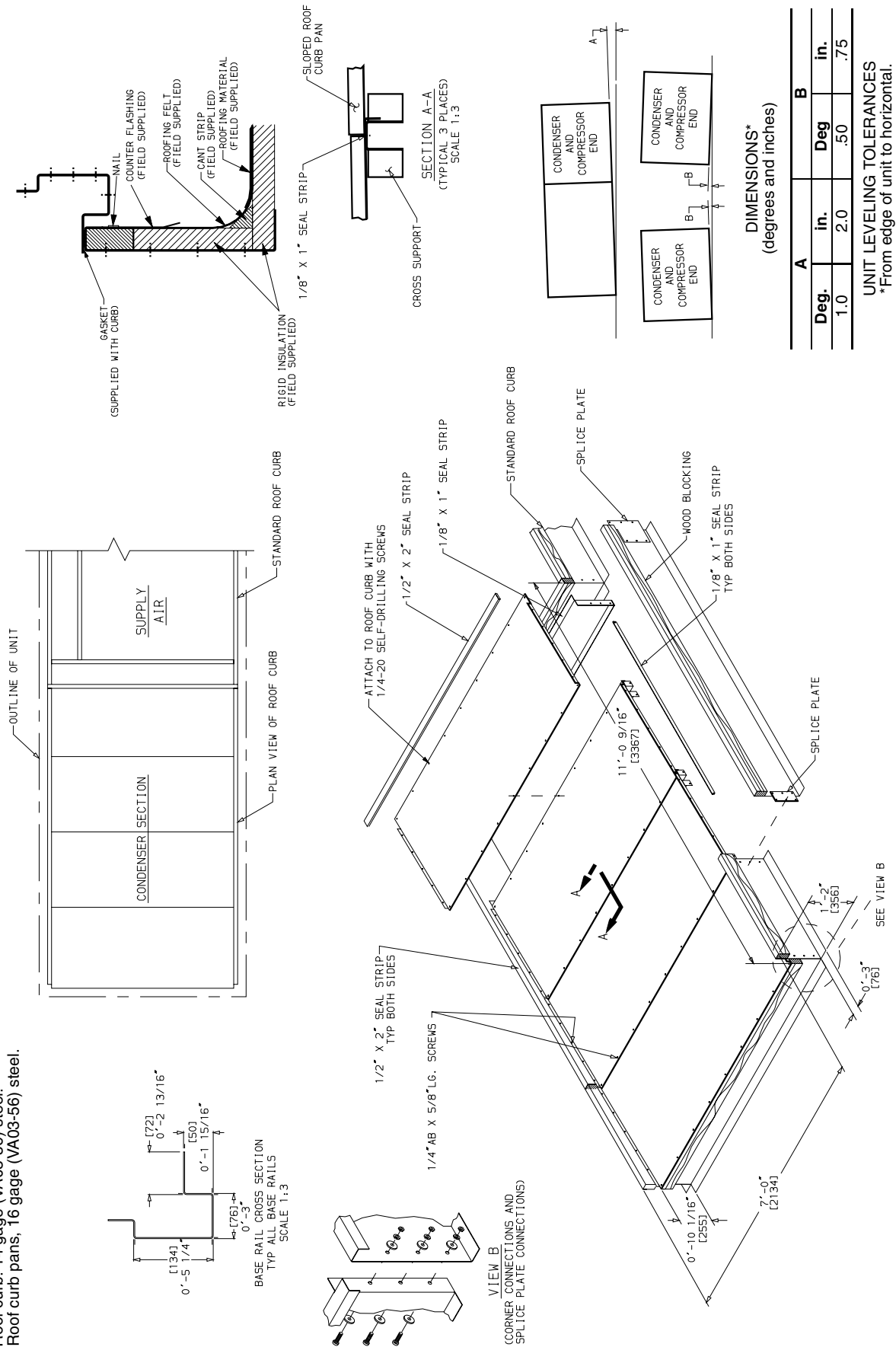


Fig. 2 — Condenser Section Roof Curb

Field-Fabricated Ductwork

⚠ WARNING

For vertical supply and return units, tools or parts could drop into ductwork and cause an injury. Install a 90-degree turn in the supply and return ductwork between the unit and the conditioned space. If a 90-degree elbow cannot be installed, then a grille of sufficient strength and density should be installed to prevent objects from falling into the conditioned space. Failure to follow these instructions could result in personal injury or property damage due to fire or falling objects.

VERTICAL SUPPLY/RETURN — The 48FJ,FK,FP and 50FJX,FJY,FKX,FKY,FPX,FPY units are designed for vertical supply/return only. Field-fabricated ductwork must be attached to the roof curb, or to the support steel, prior to the final rigging and installation of the unit. Supply and return duct dimensions are shown in Fig. 1.

To attach ductwork to roof curb, insert duct approximately 10 to 11 in. (255 to 280 mm) up into roof curb. Connect ductwork to 14-gage roof curb material with sheet metal screws driven from inside the duct.

Secure all ducts to the building structure, using flexible duct connectors between roof curbs and ducts as required. Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier. Outlet grilles must not lie directly below unit discharge. The return duct must have a 90-degree elbow before opening into the building space if the unit is equipped with power exhaust.

Design supply duct strong enough to handle expected static pressures.

CURB GASKETING — After the ductwork has been connected to the roof curb, apply gasket material (1½-in. thick x 1½ in. wide neoprene) where indicated.

Single-Thickness Gasketing (See Fig. 3 for Item Numbers)
Apply gasketing in the following places:

1. Along both side rails (1) — 2 places, full length
2. Along return air end rail (2) — 1 place
3. Around Return Air internal duct flange (3) — 1 place
4. Around Supply Air internal duct flanges (4) — 3 places

Double-Thickness Gasketing (See Fig. 3 and Detail A-A)
Locate a line 9¾-in. from the supply air end of the accessory curb. Apply a double-thickness of gasket material along with line per detail A-A.

NOTE: Do not apply gasket material along with outside edge of the curb (area “X”). This pan area of this curb extends out

beneath the end of the unit’s air handler section; applying gasket here develops a potential water trap area on top of the curb.

Condenser Section Roof Curb (See Fig. 4) — Apply single-thickness gasket along both side rails (5).

HORIZONTAL SUPPLY/RETURN — The 50FB,FW,FY units are designed for horizontal return (end of unit) and horizontal supply (left hand side of unit). Units are shipped with sheet metal duct opening covers. Units are provided with duct flanges on each opening. Ductwork should be connected directly to the unit duct flanges after the unit has been rigged, positioned, and installed. Remove and discard duct covers prior to connecting ductwork. Supply and return duct dimensions are shown in Base Unit Dimensional Drawings on pages 12-14.

To attach ductwork to unit flanges, insert duct approximately 3-in. (76 mm) over the flanges. Connect ductwork to 14-gage flanges with sheet metal screws driven from outside of the duct. Add sealant or caps to sharp points on screws where appropriate for technician safety.

Secure all ducts to the building structure, using flexible duct connectors between roof curbs and ducts as required. Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier.

Design supply duct strong enough to handle expected static pressures.

Rigging — Do not drop unit; keep upright. Use spreader bars over unit to prevent sling or cable damage. Sheets of plywood placed along the condenser coils will provide additional protection. All lifting lugs **MUST** be used when lifting unit. Level by using unit frame as a reference. See Fig. 5 for information. Unit and accessory weights are shown in Tables 1A, 1B, and 2. Weight distribution and center of gravity can be found in Fig. 6.

Install Outdoor Hoods

25% OUTDOOR-AIR HOODS — The outdoor-air hoods are factory installed on the size 078-104 units.

ECONOMIZER HOODS (Units With Economizer Option)

1. Remove the 6 screws holding each of the 4 economizer shipping covers in place.
2. Replace the screws.
3. Remove the holddown screw from each upper corner of each economizer hood.
4. Pivot hoods outward. (There are a total of 4 hoods.)
5. Install 18 screws, (5 each side, 6 top, and 2 bottom), around the outside of each hood. (Screws are in the fastener package taped to the basepan inside the fan section.)
6. Apply a bead of RTV or similar sealant to corner of economizer hood at pivot point to prevent water leaks. (See Fig. 7.)

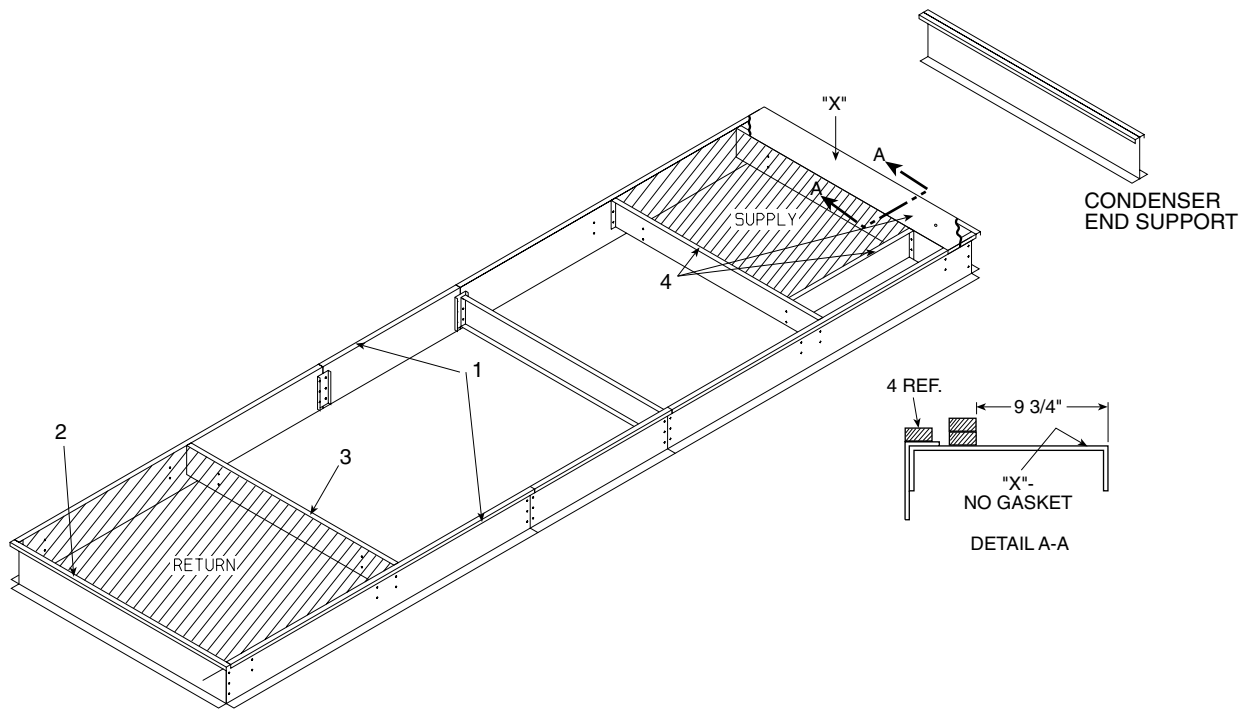


Fig. 3 — Gasket Location on Roof Curb

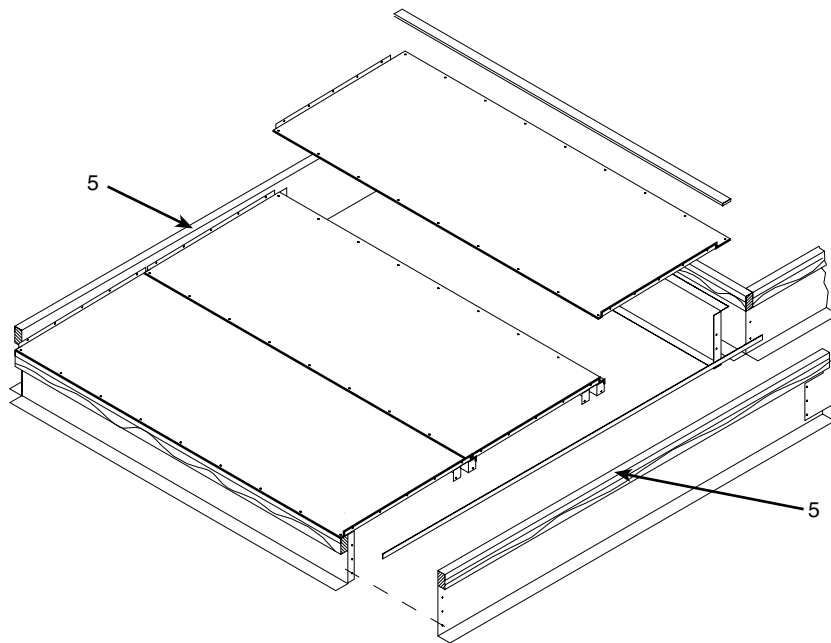
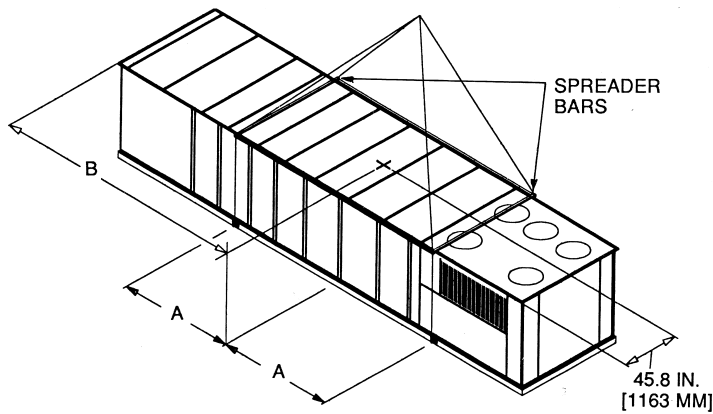


Fig. 4 — Gasket Location — Condenser Section Roof Curb



CAUTION

NOTICE TO ALL RIGGERS

1. All panels must be in place when rigging.
2. Do not attempt to forklift these units.

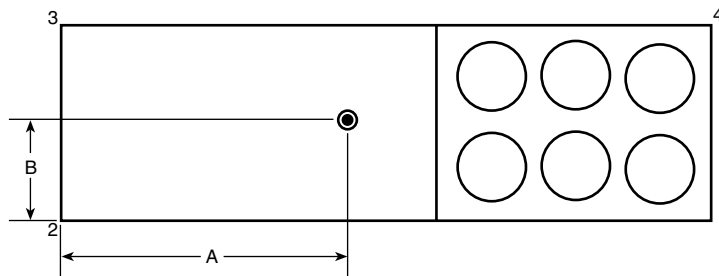
NOTES:

1. Rig with four cables and spread with two 95 in. (2413 mm) and two "A+A" long suitable spreader bars.
2. Center of gravity includes economizer, Unit weight does not include economizer.

UNIT	SIZE	WEIGHT		A		B		ECONOMIZER	
		Lb	Kg	in.	mm	in.	mm	lbs	kg
48FJD,FKD,FPD	078	10,270	4658	127.8	3247	259.5	6592	530	240.9
	088	10,480	4754	127.8	3247	261.4	6641	530	240.9
	104	11,210	5085	127.8	3247	270.1	6861	530	240.9
48FJE,FKE,FPE	078	10,445	4738	127.8	3247	260.6	6618	530	240.9
	088	10,655	4833	127.8	3247	262.5	6666	530	240.9
	104	11,385	5164	127.8	3247	271.0	6883	530	240.9

UNIT	SIZE	WEIGHT		A		B		ECONOMIZER	
		Lb	Kg	in.	mm	in.	mm	Lb	Kg
50FB,FJX,FJY FKX,FKY, FPX,FPY,FW,FY	078	9,870	4477	109.50	2782	257	6537	530	240.9
	088	10,080	4572	127.80	3247	267	6782	530	240.9
	104	10,810	4903	127.80	3247	267	6782	530	240.9

Fig. 5 — Rigging Label



UNIT CENTER OF GRAVITY AND CORNER WEIGHTS

UNIT	SIZE	CORNER WEIGHT (lb)					CENTER OF GRAVITY DIMENSIONS (ft-in.)	
		1	2	3	4	Total	A	B
48FJD,FKD,FPD	078	2954	2446	2446	2954	10,800	21- 7	3-10
	088	3033	2472	2472	3033	11,010	21- 9	3-10
	104	3340	2530	2530	3340	11,740	22- 6	3-10
48FJE,FKE,FPE	078	3014	2473	2473	3014	10,974	21- 8	3-10
	088	3093	2499	2499	3093	11,184	21-10	3-10
	104	3400	2557	2557	3400	11,914	22- 7	3-10

UNIT	SIZE	UNIT CORNER WEIGHTS (lbs)					CENTER OF GRAVITY (ft-in.)	
		1	2	3	4	Total	A	B
50FB,FJX, FJY, FKX,FKY,FPX, FPY,FW,FY	078	2821	2379	2379	2821	10,400	21-3	3-10
	088	2895	2410	2410	2895	10,610	21-7	3-10
	104	3205	2465	2465	3205	11,340	22-4	3-10

NOTE: Unit weight includes economizer weight.

Fig. 6 — Weight Distribution and Center of Gravity

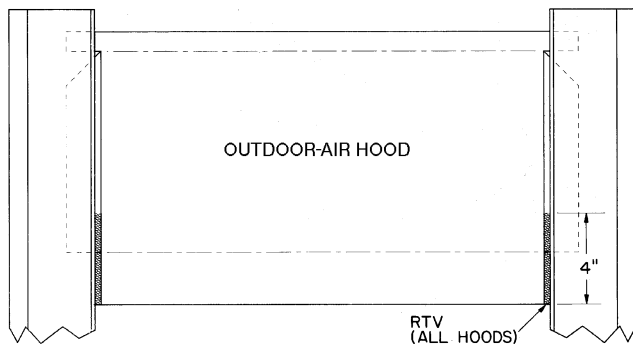


Fig. 7 — Outdoor-Air and Economizer Hood

Condensate Drain Connections — There will be three drain connections required on each unit: one primary (on right-hand side of the unit) and two secondary drains (one on each side of the unit).

PRIMARY DRAIN — The primary drain is a 2-in. NPT pipe connection located on the right hand side of the unit (at 176.34-in. [4479 mm] from return air end of unit). See Fig. 8-10.

With field-supplied fittings and pipe sections, plumb the primary condensate drain to the 2-in. FPT connector on the base rail. See Fig. 11. Use a trap height of at least 7-in. (178-mm). Install with a height dimension from the top of the exit pipe from the trap section to the bottom of the connector of at least 2-in. (51-mm). See Fig. 12. Apply a bead of RTV or similar sealant around the pipe joint at the connector in the base rail.

SECONDARY DRAINS (48FJ,FK,FP and 50FJX,FJY,FKX,FKY,FPX,FPY Only, Unit Installed on Curb) — The unit is provided with a total of four secondary drain locations: two on each side (at locations designated as A and B in Fig. 13). Selection of which drains to pipe (and which to seal) is based on the installed pitch of the unit. Determine pitch direction of curb or unit, then refer to Fig. 13 and determine action required at each base rail hole location.

Locate the 1¹/₄-in. drain coupling assemblies, seal plates and mounting screws (shipped in a bag taped to the basepan in the supply fan section, located behind the access panel marked FAN SECTION). The drain couplings are a 10-gage (3.30-mm) plate with a 1¹/₄-in. half coupling welded to the plate. Seal plates are 16-gage (1.50-mm), used to cover unused drain hole openings.

At each secondary drain hole location, there is a 1³/₈-in. (35-mm) hole pre-drilled in the bottom of the base rail, surrounded by four 0.20-in. (5.0-mm) engagement holes. Where a secondary drain will be piped (per Fig. 13), install a drain

coupling assembly. Where a pre-drilled hole will be sealed, install a seal plate.

Where a piped connection will be made, attach a drain coupling assembly to the bottom of the base rail using 4 screws provided. See Fig. 14. Using field-supplied fittings and pipe sections, assemble U-traps at each secondary drain fitting. Provide a minimum size of 1¹/₂-in. pipe for secondary drains.

NOTE: Use a trap at least 7-in. (178-mm) deep.

Cover the remaining drain holes with the seal plates and screws provided. See Fig. 15. Apply a bead of RTV or similar sealant around the drain assemblies and seal plates where they attach to the base rail. See Fig. 16.

Consult local plumbing codes for direction on joining multiple drain lines. Total size of any combined line does not need to exceed nominal 2-in. size of primary drain connection.

Fill the U-traps at the secondary drain locations prior to unit start-up. Also check the U-traps before each season to ensure the traps are filled and functioning properly.

SECONDARY DRAINS (48FJ,FK,FP and 50FJX,FJY,FKX,FKY,FPX,FPY Units Installed on Steel Beam or Slab and All 50FB,FW,FY Units) — Prior to final positioning, apply a bead of sealant around each drain hole in the base rail. Then position the unit into final location.

After final positioning of unit, perform the following procedure:

1. Locate the appropriate drain locations (per Fig. 13) and select locations marked as "Pipe." Secondary drains will be required on both sides. Measure from the unit Return Air end and mark the base rails.
2. Position the drain coupling assembly on the base rail. Mark the screw holes and the drain hole locations on the base rail.
3. Drill holes for drain outlet (use 1³/₈-in. hole saw) and for screws (use 3³/₁₆-in. drill bit).
4. Using field-supplied fittings and pipe sections, assemble U-traps at each secondary drain fitting. Provide a minimum size of 1¹/₂-in. pipe for secondary drains.

NOTE: Use a trap at least 7-in. (178-mm) deep.

5. Apply a bead of RTV or similar sealant around the drain assemblies where they attach to the base rail. See Fig. 17.

Consult local plumbing codes for direction on joining multiple drain lines. Total size of any combined line does not need to exceed nominal 2-in. size of primary drain connection.

Fill the U-traps at the secondary drain locations prior to unit start-up. Also check the U-traps before each season to ensure the traps are filled and functioning properly.

UNIT SIZE	WEIGHT		A		B		C		D		E		F	
	Lb	Kg	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm
48FJD,FKO,FPD078	10,270	4658	3544	11-7 1/2	6494	21-35 1/8	6592	21- 7 1/2	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2
48FJD,FKO,FPD088	10,480	4754	3544	11-7 1/2	6494	21-35 1/8	6641	21- 9 1/16	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2
48FJD,FKO,FPD104	11,210	5085	3544	11-7 1/2	6494	21-35 1/8	6861	22- 6 1/8	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2
48FJE,FKE,FPD078	10,445	4738	3544	11-7 1/2	6494	21-35 1/8	6618	21- 8 9/16	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2
48FJE,FKE,FPD088	10,655	4833	3544	11-7 1/2	6494	21-35 1/8	6666	21-10 7/16	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2
48FJE,FKE,FPD104	11,385	5164	3544	11-7 1/2	6494	21-35 1/8	6883	22- 7	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2

NOTES:

- Dimensions in [] are in millimeters.
- Center of Gravity includes economizer. Unit weight does not include economizer.
- Unit clearances:
Top — Do not restrict condenser fans
Control Box End — 6'-0"
Sides — 6'-0"
Economizer End — 6'-0" (except power exhaust units 10'-0")
For smaller service and operational clearances, contact Carrier Application Engineering Department.
- Downshot ducts designed to be attached to accessory roof curb. If unit is mounted on downshot, it is recommended the ducts be supported by cross braces as done on the accessory roof curb.
- When the unit is slab mounted, plug the factory drilled auxiliary condensate drain holes.
- Economizer side hoods are folded inside unit for shipping.

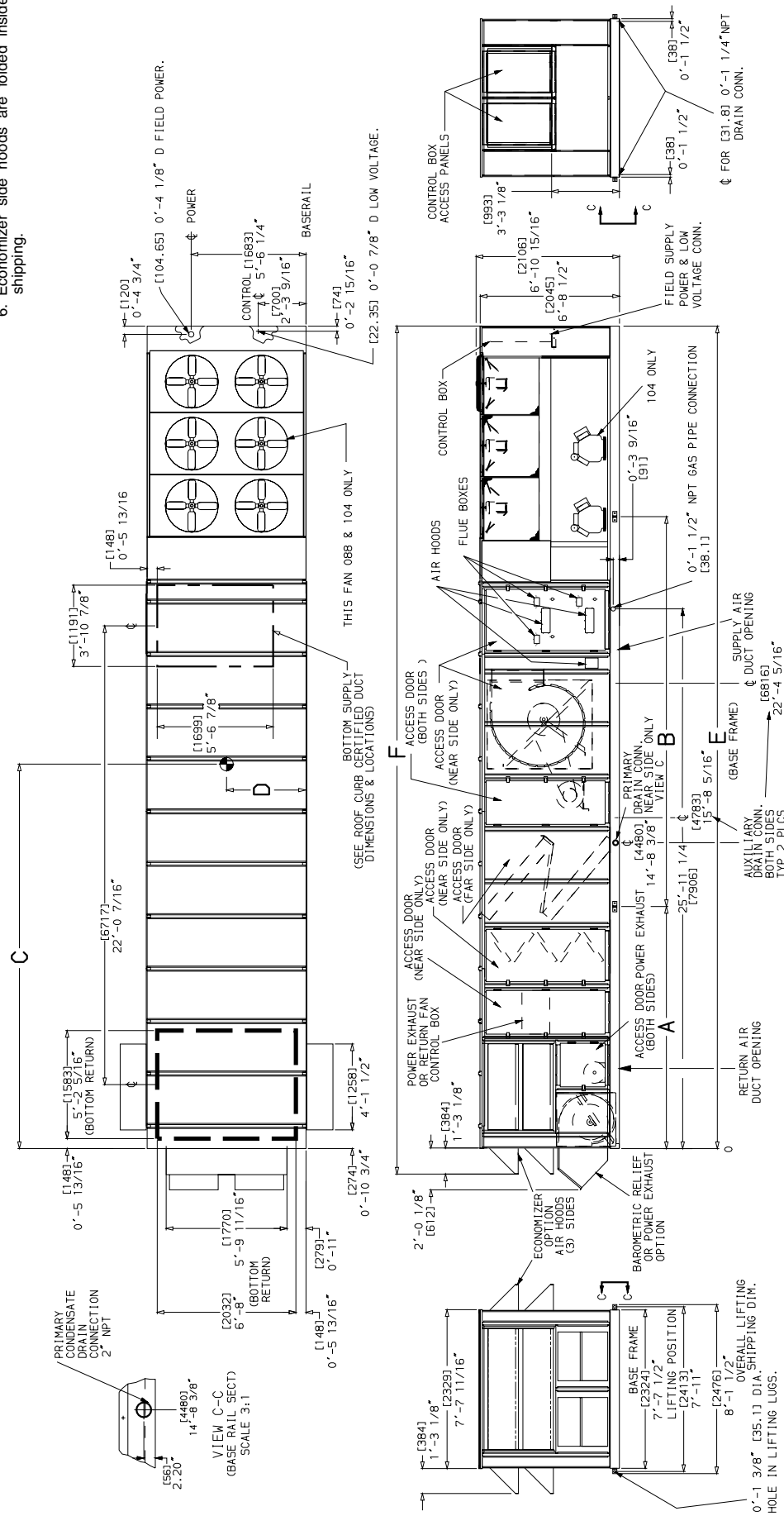
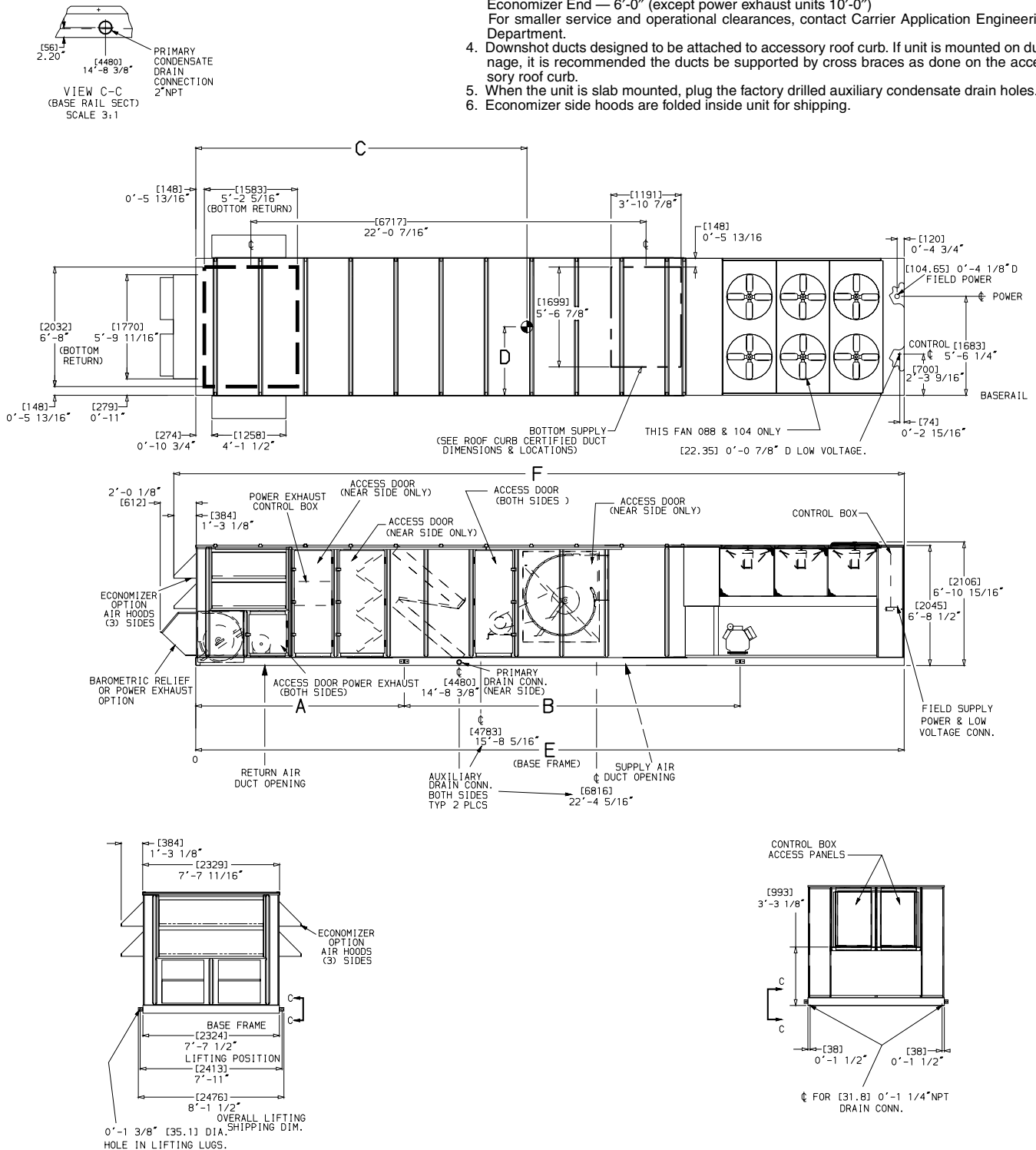


Fig. 8 — Base Unit Dimensional Drawing — 48FJ,FK,FPD078-104 Units

NOTES:

1. Dimensions in [] are in millimeters.
2.  Center of Gravity includes economizer. Unit weight does not include economizer.
3. Unit clearances:
Top — Do not restrict condenser fans
Control Box End — 6'-0"
Sides — 6'-0"
Economizer End — 6'-0" (except power exhaust units 10'-0")
For smaller service and operational clearances, contact Carrier Application Engineering Department.
4. Downshot ducts designed to be attached to accessory roof curb. If unit is mounted on dunnage, it is recommended the ducts be supported by cross braces as done on the accessory roof curb.
5. When the unit is slab mounted, plug the factory drilled auxiliary condensate drain holes.
6. Economizer side hoods are folded inside unit for shipping.

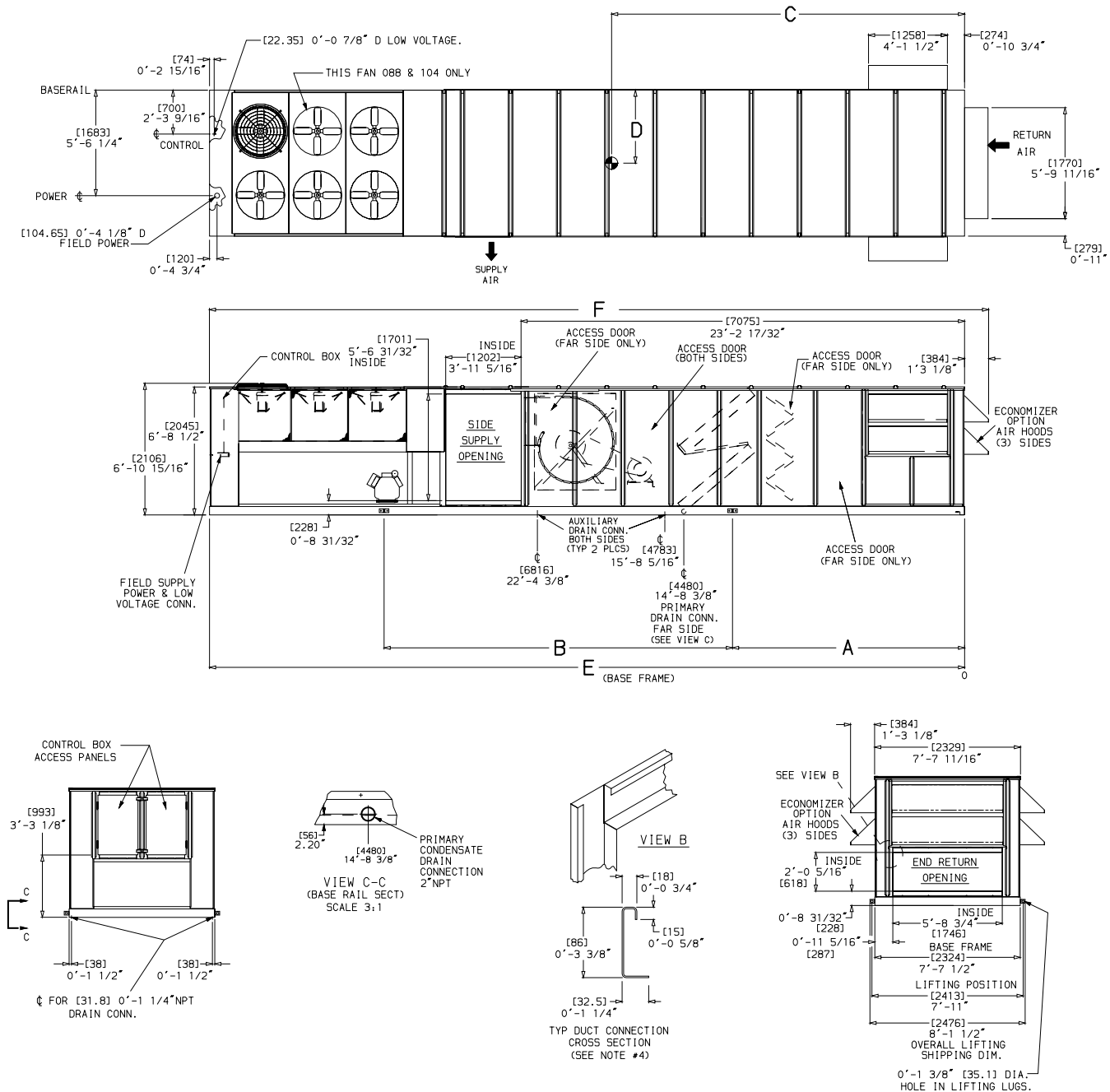


UNIT SIZE 50FJX,FJY,FKX, FKY,FPX,FPY	WEIGHT		A		B		C		D		E		F	
	Lb	Kg	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.
078	9,870	4477	3543	11-7 1/2	6494	21-3 5/8	5512	18- 1	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2
088	10,080	4572	3543	11-7 1/2	6494	21-3 5/8	5461	17-11	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2
104	10,810	4903	3543	11-7 1/2	6494	21-3 5/8	5232	17 2	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2

Fig. 9 — Base Unit Dimensional Drawing — 50FJX,FJY,FKX,FKY,FPX,FPY078-104 Units

NOTES:

1. Dimensions in [] are in millimeters.
2.  Center of Gravity includes economizer. Unit weight does not include economizer.
3. Unit clearances:
Top — Do not restrict condenser fans
Control Box End — 6'-0"
Sides — 6'-0"
Economizer End — 6'-0" (except power exhaust units 10'-0")
For smaller service and operational clearances, contact Carrier Application Engineering Department.
4. Suggested field connections to be made inside or outside of 1 1/4 in. [32.5 mm] flange.
5. When the unit is slab mounted, plug the factory drilled auxiliary condensate drain holes.
6. Economizer side hoods are folded inside unit for shipping.



UNIT SIZE 50FB,FW,FY	WEIGHT		A		B		C		D		E		F	
	Lb	Kg	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.
078	9,870	4477	3544	11-7 1/2	6494	21-3 5/8	5512	18- 1	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2
088	10,080	4572	3544	11-7 1/2	6494	21-3 5/8	5461	17-11	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2
104	10,810	4903	3544	11-7 1/2	6494	21-3 5/8	5232	17- 2	1163	3-9 13/16	12 049	39-6 3/8	12 433	40-9 1/2

Fig. 10 — Base Unit Dimensional Drawing — 50FB,FW,FY078-104 Units

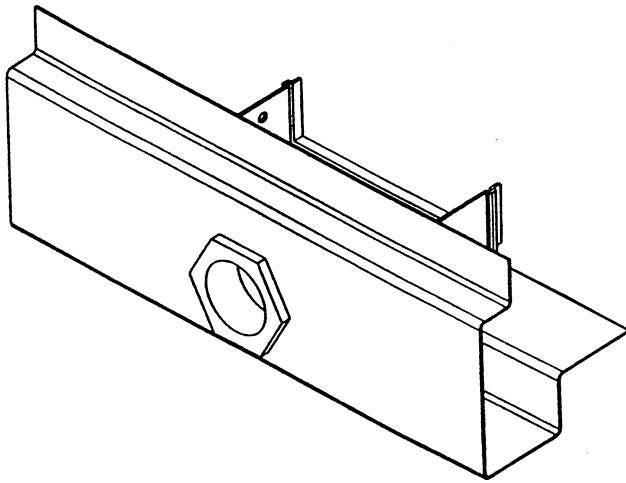


Fig. 11 — Primary Drain Connection

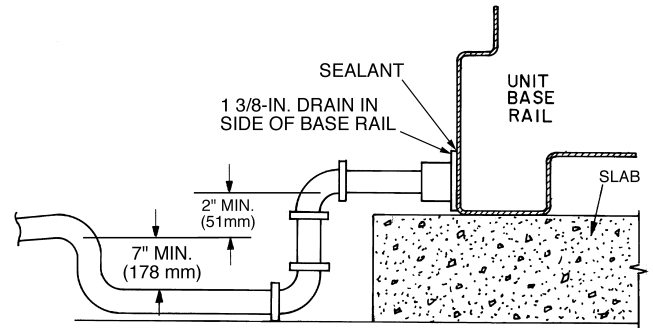
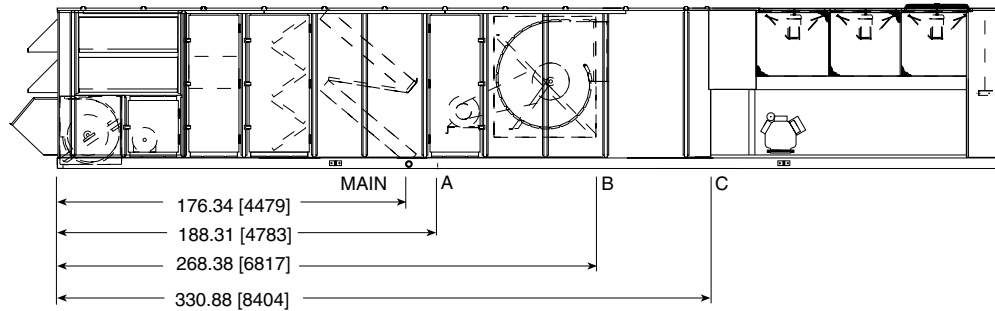


Fig. 12 — Slab Mounted Primary Condensate Drain Piping Details



PITCH	DRAIN LOCATION		
	A	B	C*
Return Air End High	Seal	Pipe	Open
Control Box End High	Pipe	Seal	Open

*Drain location C: These drain locations (on both sides of the unit) permit drainage from the base rail sections of water that has entered the rail from under the condenser section. Do not seal or install traps at these locations.

Fig. 13 — Condensate Drain Locations

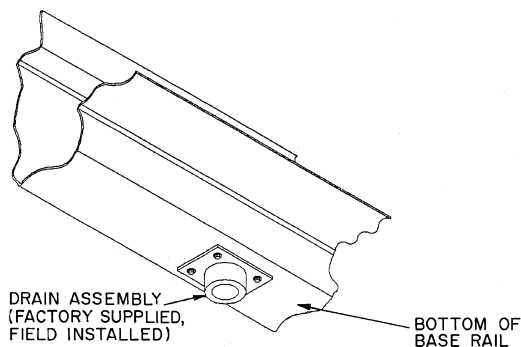


Fig. 14 — Secondary Condensate Drain Location

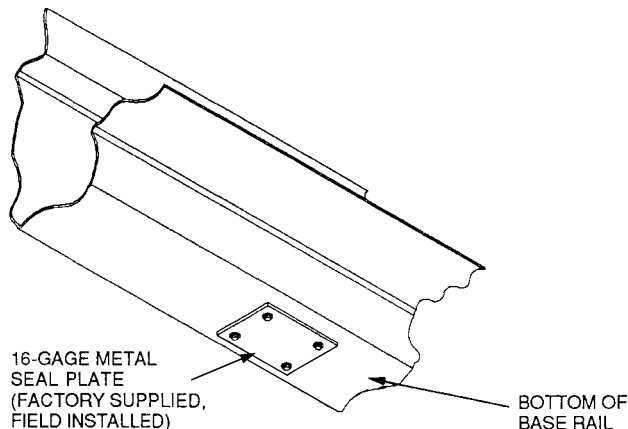


Fig. 15 — Secondary Drain Seal Plate Location

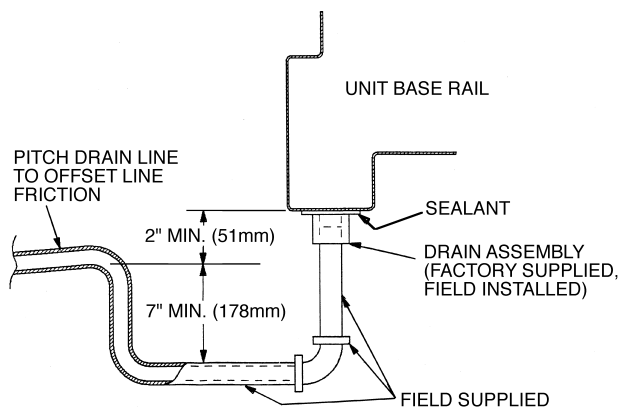


Fig. 16 — Curb Mounted Condensate Drain Pipe Details

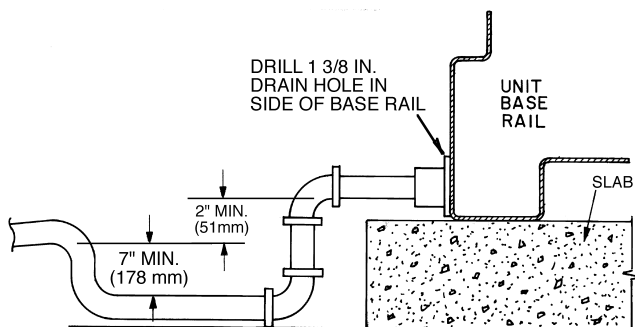


Fig. 17 — Slab Mounted Secondary Condensate Drain Piping Details

Field Wire Routing — Field wiring is brought into the unit through the bottom of the control box. Wiring can be brought through the roof curb through field-supplied watertight connections. See Fig. 18.

A 4⁵/₃₂-in. hole for field power wiring and a 7/8-in. hole for 24 v control wiring are provided in the bottom of the control box. Field-supplied couplings must be used when routing wiring into the control box.

See Fig. 18 for recommended disconnect location.

Field Electrical Connections

IMPORTANT: The 48FK,FP and 50FB,FKX,FKY, FPX,FPY,FY units generate, use, and can radiate radio frequency energy. If units are not installed and used in accordance with these instructions, they may cause radio interference. They have been tested and found to comply with limits of a Class A computing device as defined by FCC (Federal Communications Commission) regulations, Subpart J of Part 15, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

POWER WIRING — Units are factory wired for the voltage shown on the unit nameplate. The main terminal block is suitable for use with aluminum or copper wires. Maximum wire size is 3/0 AWG (American Wire Gage).

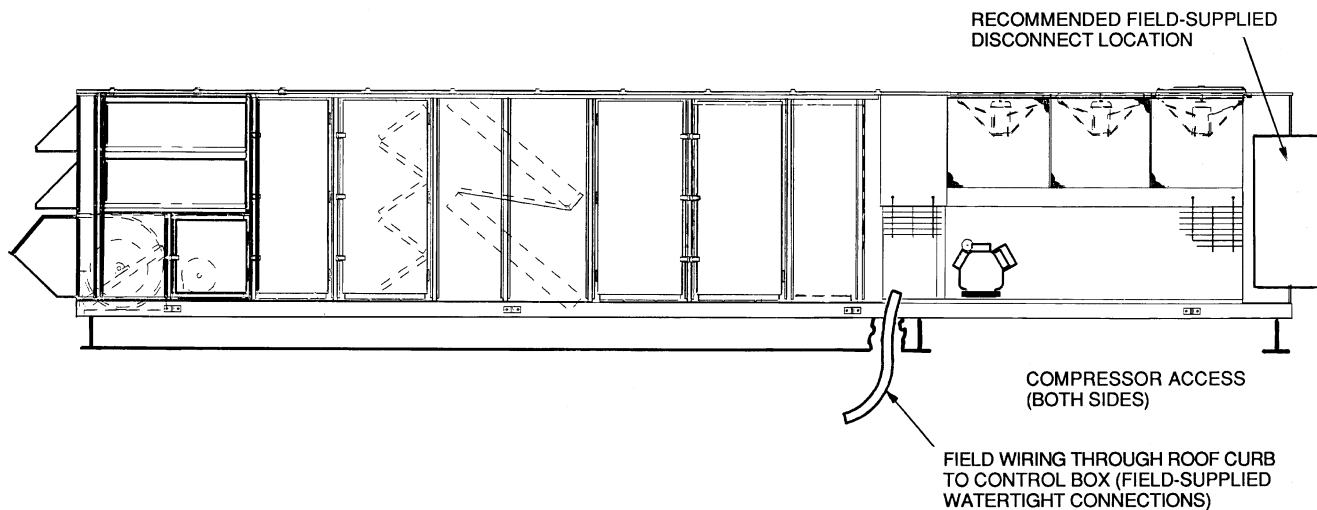
Units Without Factory-Installed Disconnect — When installing units, provide a disconnect per NEC of adequate size (MOCP [Maximum Overcurrent Protection] of unit is on the informative plate). All field wiring must comply with NEC and all local codes. Size wire based on MCA (Minimum Circuit Amps) on the unit informative plate. See Fig. 19 for power wiring connections to the unit power terminal block and equipment ground.

Units with Factory-Installed Disconnect — The factory-installed disconnect is an interlocking door-type. The disconnect handle locks the door when it is in the ON position. The disconnect handle must be in the OFF position to open the control box door. The disconnect is located inside the main control box. See Fig. 20.

All field wiring must comply with NEC and all local codes. Wire must be sized based on MCA (Minimum Circuit Amps) on the unit informative plate. See Fig. 21 for power wiring connections to the unit disconnect and equipment ground.

Operating voltage to the compressor must be within the voltage range indicated on the unit nameplate. Voltages between phases must be balanced within 2%, and the current must be balanced within 10%. See Table 4 for unit electrical data.

(Text continued on page 19.)



⚠ CAUTION

Use care when drilling into corner post to avoid damage to condenser coil.

Fig. 18 — Disconnect Location

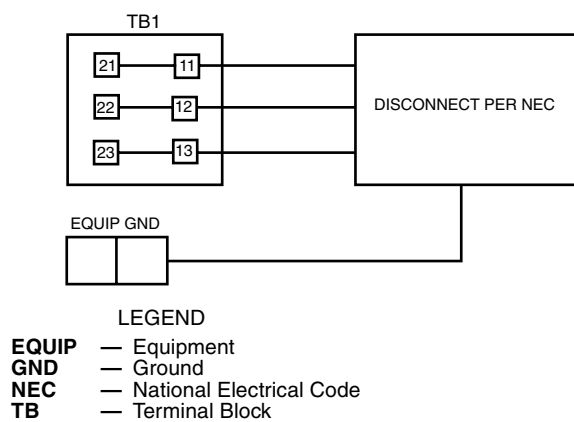


Fig. 19 — Field Power Wiring Connections

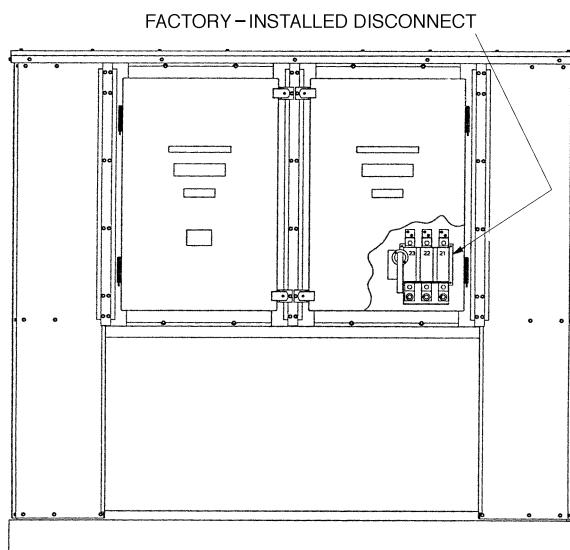


Fig. 20 — Factory-Installed Disconnect Location

Table 4 — Electrical Data — 48FJ,FK,FP and 50FB,FJX,FJY,FKX,FKY,FPX,FPY,FW,FY Units

SIZE	VOLTAGE (V-Ph-Hz)	VOLTAGE RANGE	COMPRESSOR								OFM Total FLA	IFM Hp FLA		BASE UNIT ONLY MCA MOCp		OPTIONAL POWER EXHAUST FAN Total Hp Total FLA		BASE UNIT WITH EXHAUST FAN MCA MOCp	
			No. 1		No. 2		No. 3		No. 4										
			RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA									
078	460-3-60	414-508	50.6	253	65.4	345	—	—	—	—	16.5	30	40.0	188.9	250	10	15.2	204.1	250
																15	22.0	210.9	250
																20	28.0	216.9	250
																10	15.2	216.1	250
																15	22.0	222.9	250
																20	28.0	228.9	250
												40	52.0	200.9	250	10	15.2	229.1	250
																15	22.0	235.9	300
																20	28.0	241.9	300
																10	15.2	244.0	300
																15	22.0	250.8	300
																20	28.0	256.8	300
50	65.0	213.9	250	10	15.2	255.1	300												
				15	22.0	261.9	350												
				20	28.0	267.9	350												
				10	15.2	269.1	350												
				15	22.0	275.9	350												
				20	28.0	281.9	350												
60	77.0	228.8	300	10	15.2	281.1	350												
				15	22.0	287.9	350												
				20	28.0	293.9	350												
				10	15.2	295.1	350												
				15	22.0	301.9	350												
				20	28.0	307.9	350												
088	460-3-60	414-508	65.4	345	65.4	345	—	—	—	—	19.8	30	40.0	207.0	250	10	15.2	222.2	250
																15	22.0	229.0	250
																20	28.0	235.0	300
																10	15.2	234.2	250
																15	22.0	241.0	300
																20	28.0	247.0	300
												40	52.0	219.0	250	10	15.2	247.2	300
																15	22.0	254.0	300
																20	28.0	260.0	300
																10	15.2	262.1	300
																15	22.0	268.9	300
																20	28.0	274.9	350
50	65.0	232.0	250	10	15.2	272.1	300												
				15	22.0	278.9	300												
				20	28.0	284.9	300												
				10	15.2	286.1	300												
				15	22.0	292.9	300												
				20	28.0	298.9	350												
60	77.0	246.9	300	10	15.2	298.1	350												
				15	22.0	304.9	350												
				20	28.0	310.9	350												
				10	15.2	312.1	350												
				15	22.0	318.9	350												
				20	28.0	324.9	350												
104	460-3-60	414-508	50.6	253	34.6	173	50.6	253	34.6	173	19.8	30	40.0	242.9	250	10	15.2	258.1	300
																15	22.0	264.9	300
																20	28.0	270.9	300
																10	15.2	270.4	300
																15	22.0	277.2	300
																20	28.0	283.2	300
												40	52.0	255.2	300	10	15.2	286.7	350
																15	22.0	293.5	350
																20	28.0	299.5	350
																10	15.2	301.7	350
																15	22.0	308.5	350
																20	28.0	314.5	350
50	65.0	271.5	300	10	15.2	311.1	350												
				15	22.0	317.9	350												
				20	28.0	323.9	350												
				10	15.2	325.1	350												
				15	22.0	331.9	350												
				20	28.0	337.9	350												
60	77.0	286.5	350	10	15.2	336.1	350												
				15	22.0	342.9	350												
				20	28.0	348.9	350												
				10	15.2	350.1	350												
				15	22.0	356.9	350												
				20	28.0	362.9	350												

LEGEND

FLA	— Full Load Amps
Hp	— Nominal Horsepower
IFM	— Indoor (Evaporator) Fan Motor
LRA	— Locked Rotor Amps
MCA	— Minimum Circuit Amps (for wire sizing)
MOC	— Maximum Overcurrent Protection
OFM	— Outdoor (Condenser) Fan Motor
RLA	— Rated Load Amps



NOTE: 48FJ,FK,FP units use 2 (low heat) or 3 (high heat) combustion fan motors rated at 460 v, 1 phase, 60 hertz and 0.3 FLA each.

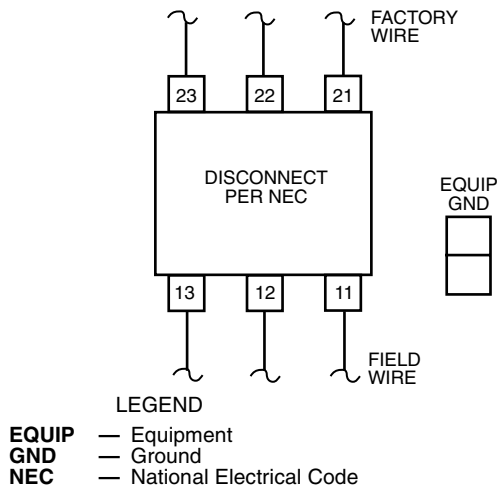


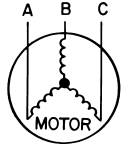
Fig. 21 — Field Power Wiring Connections for Factory-Installed Disconnect

Use the following formula to determine the percentage of voltage imbalance.

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

$$\begin{aligned} \text{Average Voltage} &= \frac{455 + 464 + 455}{3} \\ &= \frac{1371}{3} \\ &= 457 \end{aligned}$$

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 voltage imbalance:

$$\begin{aligned} \% \text{ Voltage Imbalance} &= 100 \times \frac{7}{457} \\ &= 1.53\% \end{aligned}$$

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 local utility immediately.

Unit failure as a result of operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components.

Gas Piping (48FJ,FK,FP Only) — Unit is equipped for use with natural gas only. Installation must conform with local building codes, or in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1.

A 1/8-in. NPT tapping plug, accessible for test gage connection, must be field installed immediately upstream of gas supply connection to unit, but after manual gas valve. See Fig. 22. Natural gas pressure at unit gas connection must not be less than 5 in. wg (1245 Pa) or greater than 13 in. wg (3238 Pa).

Size gas supply piping for 0.5 in. wg (124.5 Pa) maximum pressure drop. Do not use supply pipe smaller than unit gas connection.

⚠ CAUTION

Disconnect gas piping from unit when leak testing at pressures greater than 0.5 psig (3448 Pa). Pressures greater than 0.5 psig (3448 Pa) will cause gas valve damage resulting in a hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig (3448 Pa), it must be replaced.

Installing Flue/Inlet Hoods (48FJ,FK,FP Only) — The flue/inlet hoods are shipped in a bag taped to the basepan in the supply fan section.

The 48 series high-heat units have 2 large inlet hoods, 1 small inlet hood, 3 flue hoods, and 3 flue deflector hoods. See Fig. 23-27. The 48 series low-heat units have one large inlet hood, 1 small inlet hood, 2 flue hoods, and 2 flue deflector hoods. (See Fig. 26 and 27.)

Remove shipping block-offs and shipping tape from openings in access panels. Inlet hoods are shipped unassembled and must be assembled in place. See Fig. 23. Inlet hoods consist of a hood, 2 side plates, and an inlet screen.

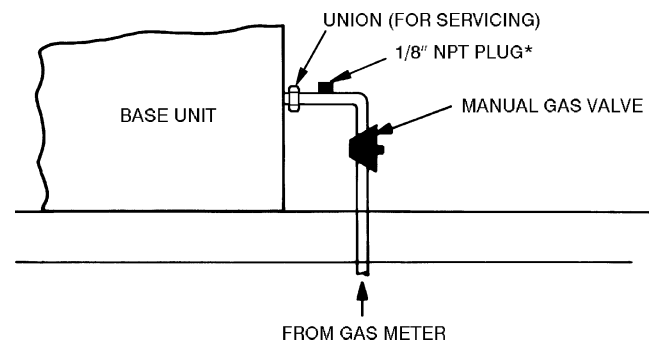
Install large and small inlet hoods using screws provided.

NOTE: Hoods must be assembled in place on the access panel. Flanges on hood and side plates go to the inside of the access panel.

Install inlet screen in each inlet hood using speed clips and screws provided. Attach flue hoods (see Fig. 27) to access panel using screws provided. Hoods go over each combustion air outlet.

Sub-assemble flue deflector baffle inside flue deflector hood as shown in Fig. 24. Install flue deflector hoods over flue hoods. (See Fig. 27.)

NOTE: Be sure deflector hoods are installed as shown and not upside down. The holes in the mounting flange must be at the bottom when installed on access panel.



*NPT plug is field supplied.

NOTE: Follow all local codes.

Fig. 22 — Gas Piping Details

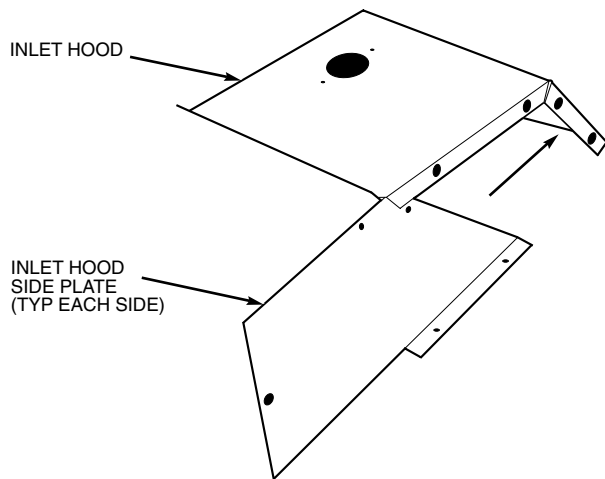


Fig. 23 — Small Inlet Hood

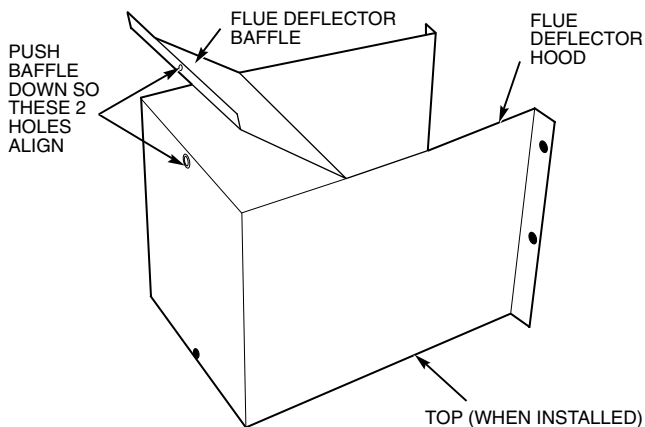


Fig. 26 — Flue Deflector Baffle Assembled (Low Heat)

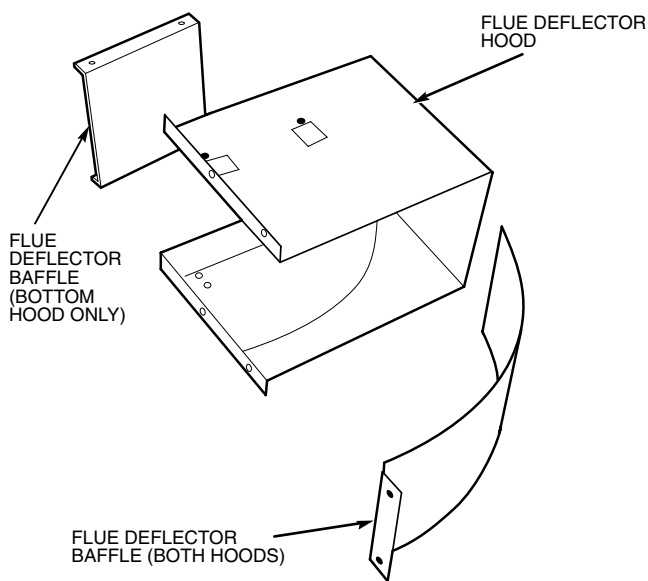


Fig. 24 — Flue Deflector Baffles (High Heat)

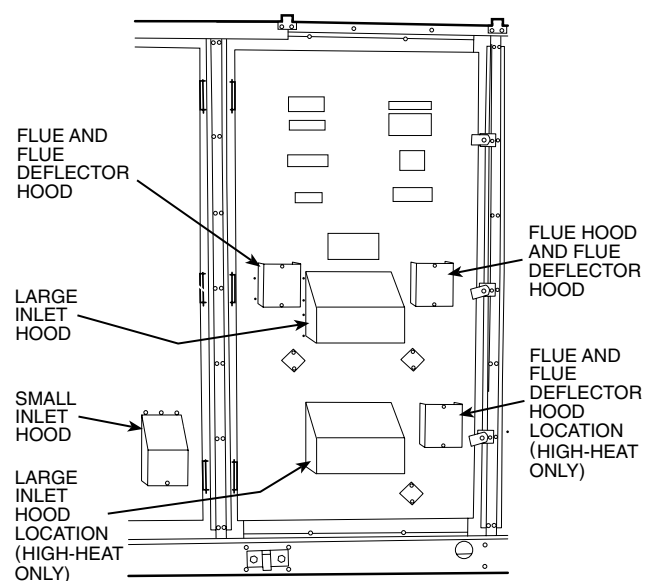


Fig. 27 — Flue/Inlet Hood Locations

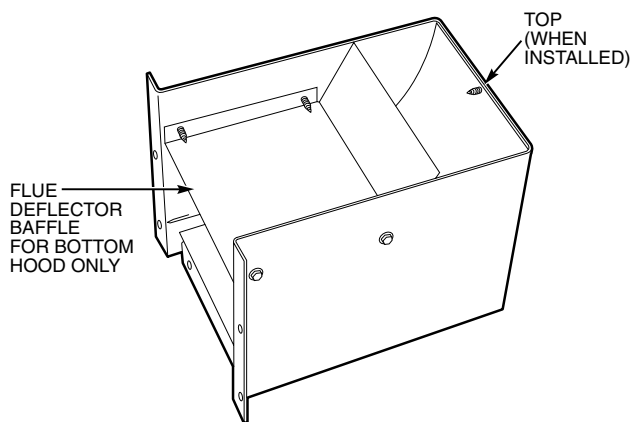


Fig. 25 — Flue Deflector Hood Assembled (High Heat)

Air Pressure Tubing — Before options such as Inlet Guide Vanes (IGV), Variable Frequency Drive (VFD), and/or Modulating Power Exhaust can operate properly, the pneumatic tubing for pressure sensing must be installed. Use fire-retardant plenum tubing (field-supplied). Tubing size depends on type of control device (see Table 5). Tubing must be run from the appropriate sensing location (in the duct or in the building space) to the control device location in the unit.

Table 5 — Tubing Size

OPTION	UNITS	NOMINAL TUBE SIZE (in.)
Inlet Guide Vanes (IGV)	48FK and 50FKX,FKY,FY	3/8
	48FP and 50FB,FPX,FPY	1/4
Variable Frequency Drive (VFD)	48FK and 50FKX,FKY,FY	1/4
	48FP and 50FB,FPX,FPY	1/4
Modulating Power Exhaust	48FJ,FK and 50FJX,FJY,FKX,FKY	3/8
	48FP and 50FPX,FPY	1/4

INLET GUIDE VANES — The tubing for the duct pressure (DP) control option should sample supply duct pressure about $\frac{2}{3}$ of the way out from the unit in the main trunk duct, at a location where a constant duct pressure is desired.

48FK and 50FKX,FKY,FY Units — On these units, the inlet guide vanes are controlled by a differential pressure switch (DPS). The DPS is located in the Supply Fan section. See Fig. 28. Use a nominal $\frac{3}{8}$ -in. plastic tubing.

48FP and 50FB,FPX,FPY Units — On these units, the duct pressure is sensed by a pressure transducer. The output of the pressure transducer is directed to the unit control module.

DP transducer is located in the unit auxiliary control box. See Fig. 29. Use a nominal $\frac{1}{4}$ -in. plastic tubing.

VARIABLE FREQUENCY DRIVE — The tubing for the duct pressure (DP) control option should sample supply duct pressure about $\frac{2}{3}$ of the way out from the unit in the main trunk duct, at a location where a constant duct pressure is desired.

48FK and 50FKX,FKY,FY Units — On these units, the duct pressure is sensed by a pressure transducer. The pressure transducer output is directed to the VFD. The DP transducer is located in the supply fan section. See Fig. 28. Use a nominal $\frac{1}{4}$ -in. plastic tubing.

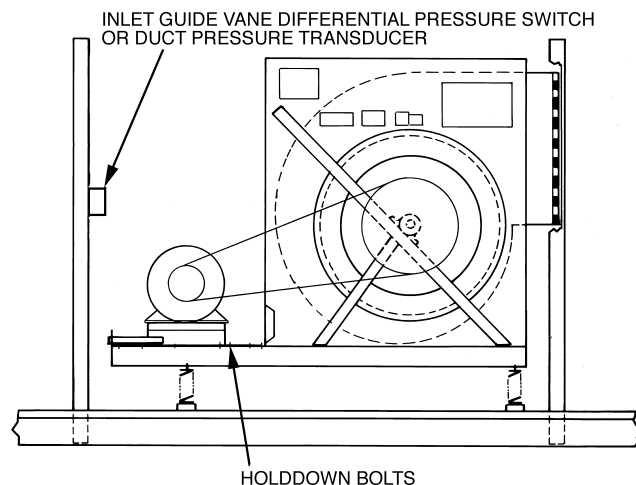


Fig. 28 — Inlet Guide Vane Differential Pressure Switch and Variable Frequency Drive Duct Pressure Transducer

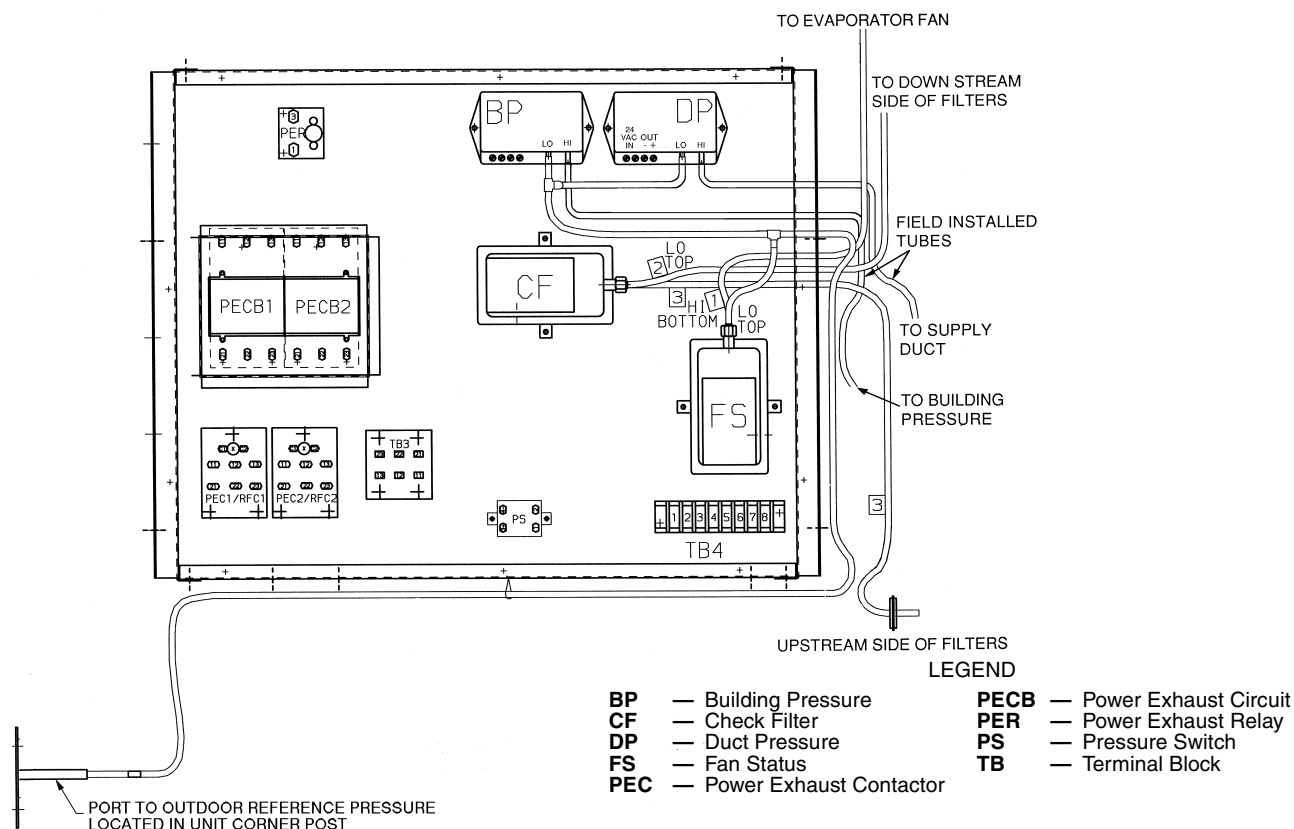


Fig. 29 — Auxiliary Control Box Details; 48FP and 50FB,FPX,FPY Units

48FP and 50FB.FPX.FPY Units — On these units, the duct pressure is sensed by a pressure transducer. The pressure transducer output is directed to the unit control module. The DP transducer is located in the unit auxiliary control box. See Fig. 29. Use a nominal 1/4-in. plastic tubing.

Refer to appropriate base unit Controls and Troubleshooting book for instructions on adjusting set points for Duct Pressure controls.

MODULATING POWER EXHAUST — The tubing for the building pressure control (achieved via the Modulating Power Exhaust package) should sample building pressure in the area near the entrance lobby (or other appropriate and sensitive location) so that location is controlled as closely to design pressures as possible.

48FJ.FK and 50FJK.FJY.FKX.FKY Units — These units use a differential pressure switch (DPS) to control the actuator on the modulating discharge damper in exhaust fan no. 1. The building pressure (BP) DPS is mounted below the auxiliary control box next to the access door labeled FILTER SECTION. See Fig. 30. Use a nominal 3/8-in. plastic tubing.

For instructions on adjusting BP control set points, refer to Service, Adjustments section in this book.

48FP and 50FPX.FPY Units — These units use a pressure transducer for sensing building pressure. The BP transducer is mounted below the unit auxiliary control box next to the access door labeled FILTER SECTION. See Fig. 30. Use a nominal 1/4-in. plastic tubing.

For instructions on adjusting BP control set points on PIC units, refer to the Controls and Troubleshooting book for these units.

Evaporator-Fan Shipping Brackets — Evaporator-fan shipping brackets (4 per unit) must be removed from each corner of the fan sled before starting unit.

To remove shipping brackets, remove the 6 screws holding each bracket to the cross rail. There are 4 brackets per unit. See Fig. 31.

After removing all shipping brackets, level fan sled using the adjusting screws. On all 4 corners dimension from cross rail to fan sled should be as shown in Fig. 31.

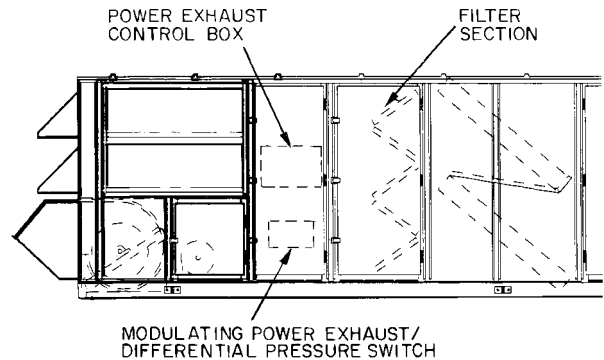


Fig. 30 — Modulating Power Exhaust Differential Pressure Switch

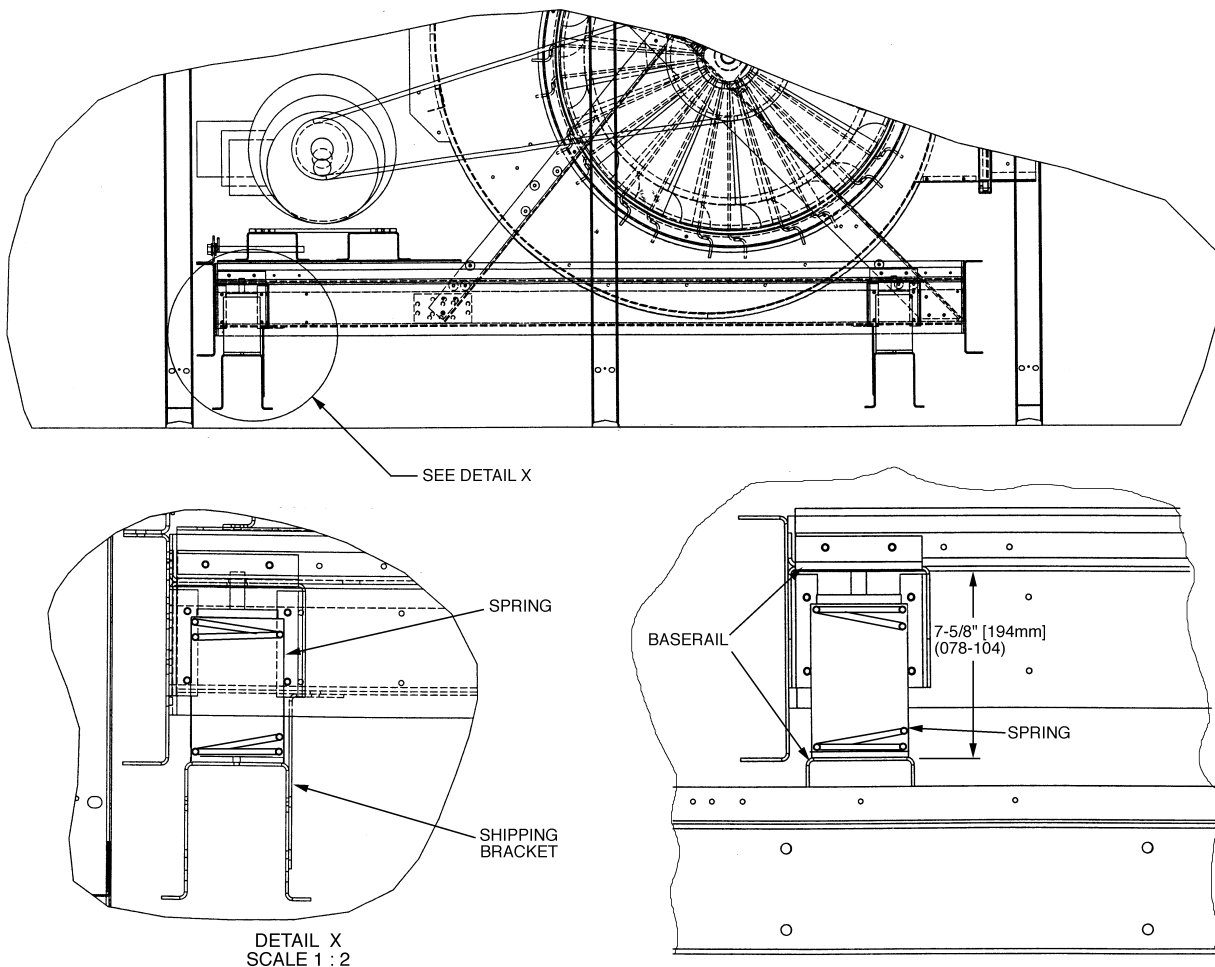


Fig. 31 — Shipping Brackets

Compressor Mounting

SIZES 078 AND 088 — Each compressor is supported on 4 springs. The springs are compressed for shipment. After the unit is installed, the holddown nuts need to be loosened for normal operation. See Fig. 32 for compressor mounting details. Loosen each bolt using nut indicated until the flatwasher ($\frac{3}{8}$ -in.) can be moved with finger pressure. Do not remove the locknuts. Check each compressor mounting to ensure all 4 springs have been loosened properly.

SIZE 104 — Compressors are mounted on rails and held down by rail bolts during shipment. After unit is installed, loosen the rail bolts to allow the rails and compressors to float freely on the springs located under the rails. See Fig. 33 and 34.

Install Accessories — For applications requiring accessories, the following packages are available:

All Units:

- Barometric relief
- Condenser hail guard
- Differential enthalpy sensor

48FJ and 50FJX,FJY,FW Units:

- Time Guard® II time delay
- Modulating power exhaust
- Pressure operated unloaders
- Motormaster® I control
- Thermostats

48FK and 50FKX,FKY,FY Units:

- Demand limit
- Space temperature reset
- VAV (variable air volume) remote panel
- Modulating power exhaust
- Motormaster I control

48FP and 50FB,FPX,FPY Units:

- HSIO keypad and display module
- Pressure transducers
- Indoor air quality sensor
- Relative humidity sensor(s)
- Outdoor air control package

Refer to the individual accessory installation instructions in each package for information on installing accessories.

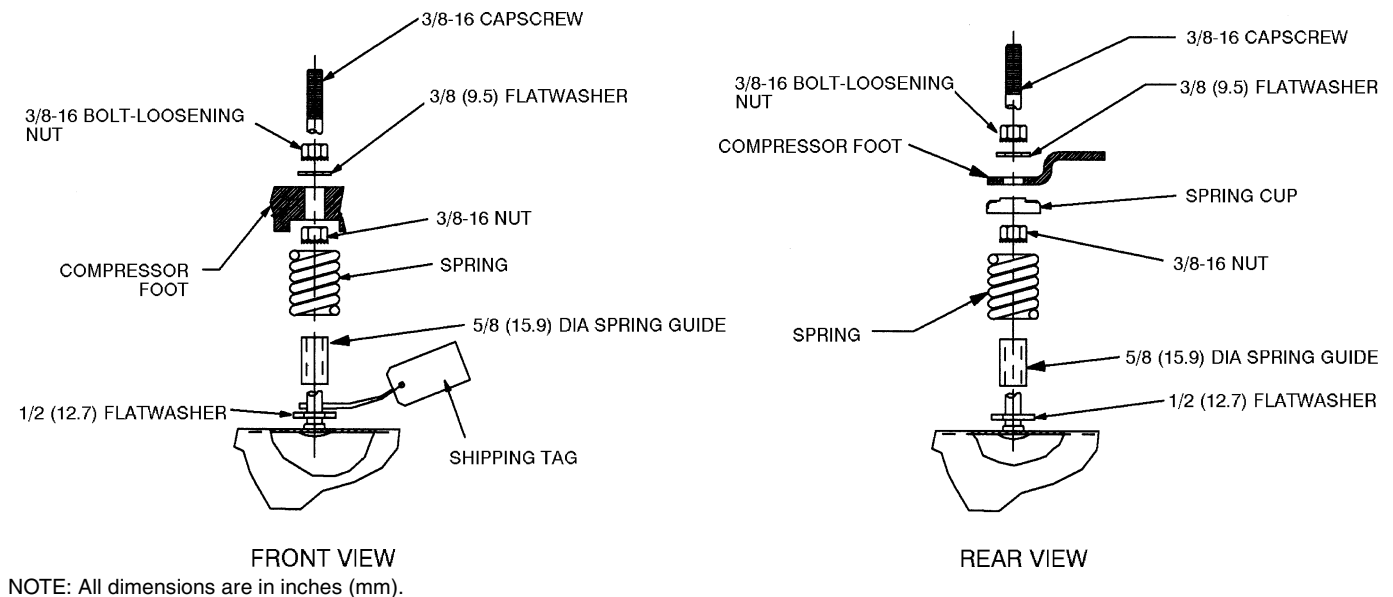


Fig. 32 — Compressor Mounting (Sizes 078 and 088)

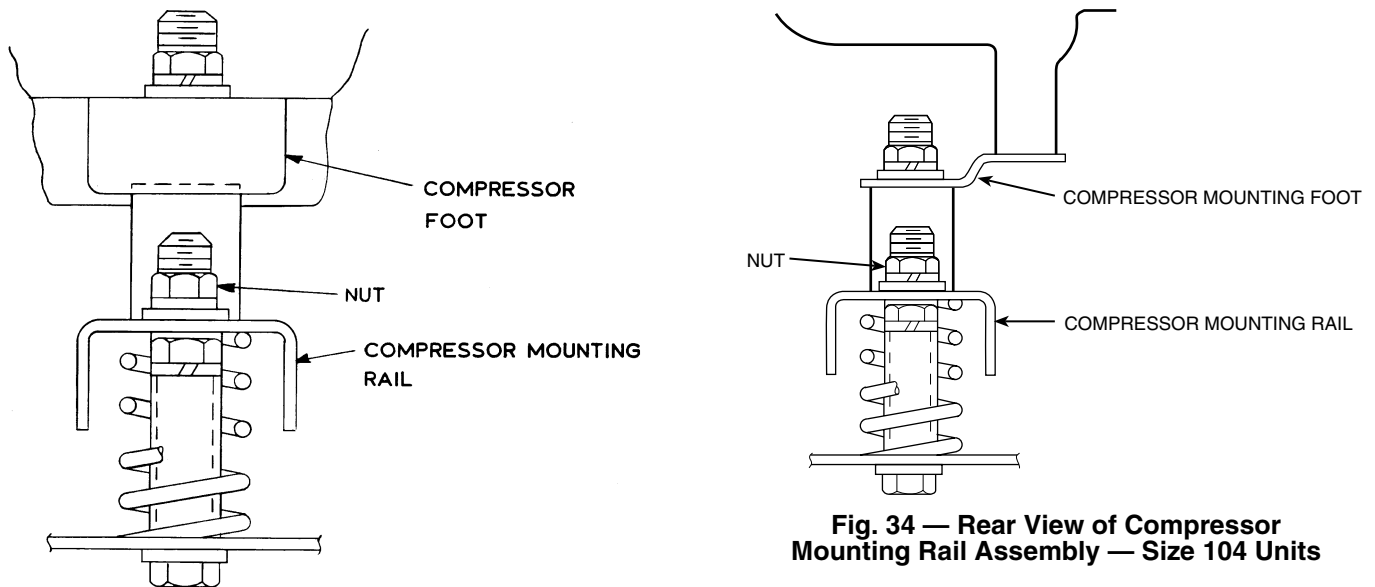


Fig. 33 — Front View of Compressor Mounting Rail Assembly — Size 104 Units

Fig. 34 — Rear View of Compressor Mounting Rail Assembly — Size 104 Units

MOTORMASTER® CONTROL ACCESSORY INSTALLATION — The accessory Motormaster I head pressure controller is used to control the speed of the outdoor (condenser) fan motor, permitting the unit to operate in cooling down to -20 F (-29 C) outdoor ambient temperature. See Motormaster I accessory instructions for complete installation information. See Fig. 35 for location of Motormaster I sensor. See Fig. 36 for identification of Circuit 1 suction headers. Attach freeze-stat to any convenient 1/2-in. (12 mm) (size 078) or 3/8-in. (9.5 mm) (sizes 088 and 104) tube between either header and the evaporator coil. See Fig. 37 for coil baffle dimensions.

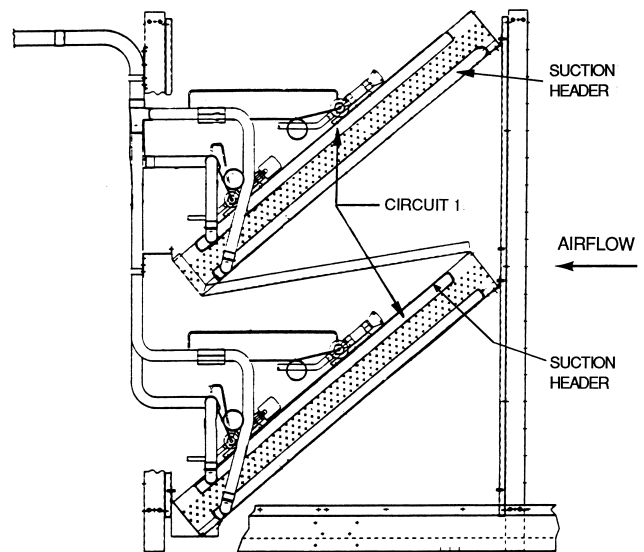


Fig. 36 — Circuit 1 Evaporator Suction Headers for Freeze Protection Thermostat Location

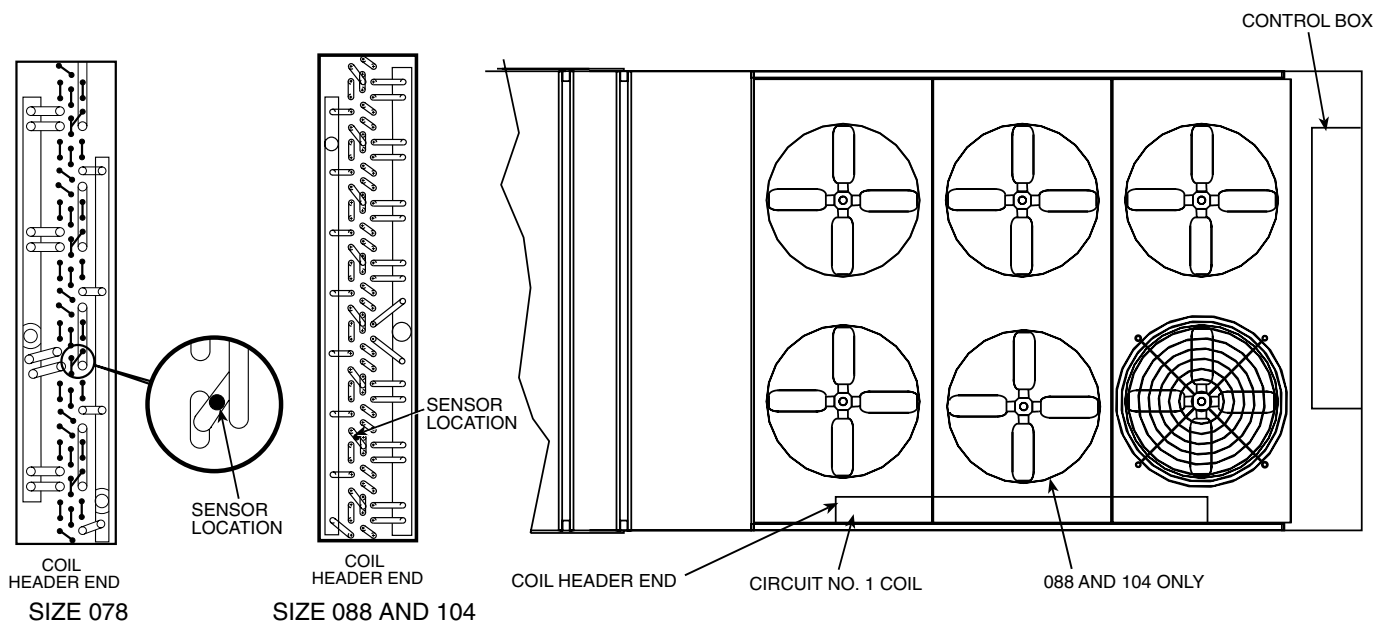


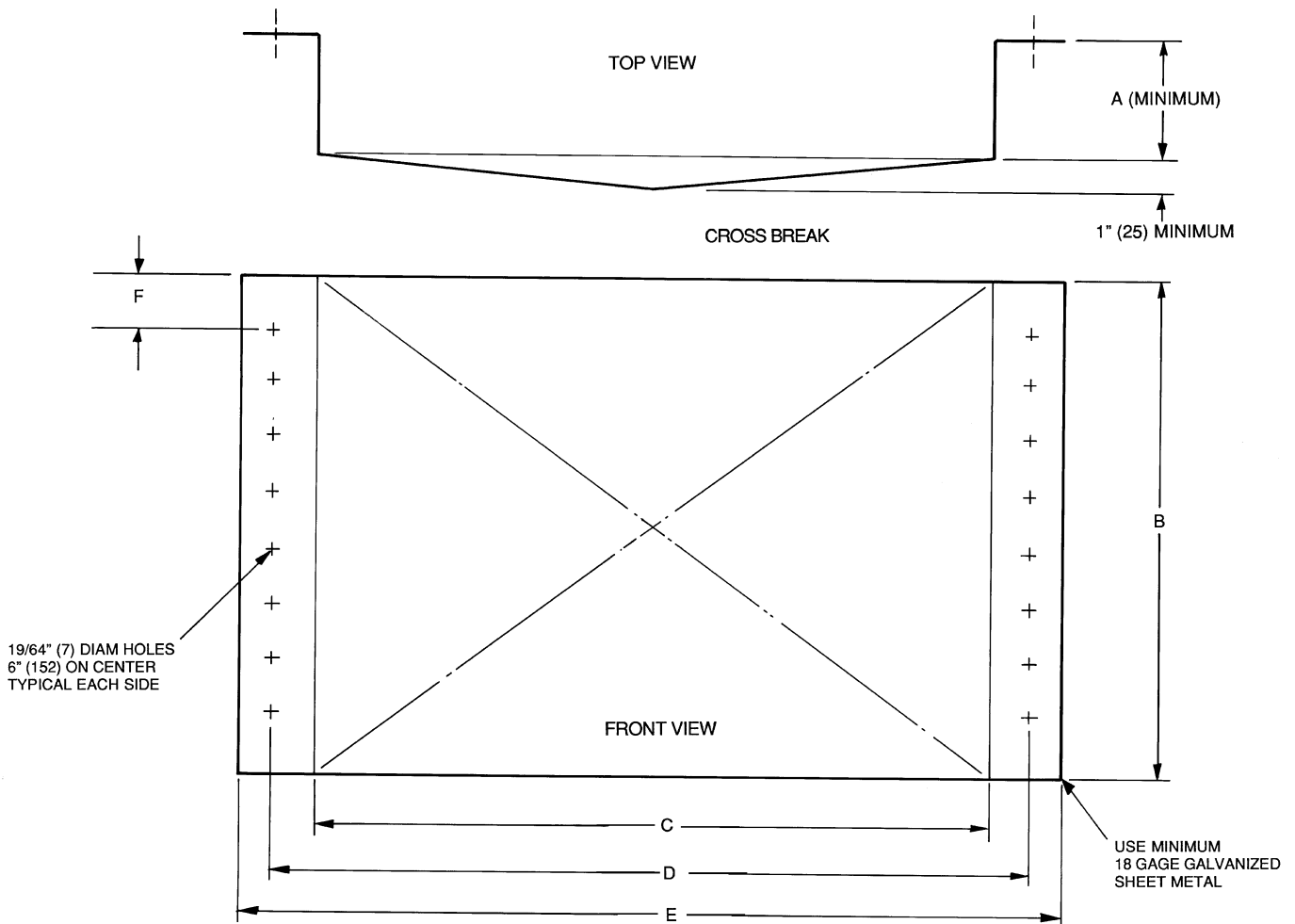
Fig. 35 — Motormaster® I Control Sensor Location

CONTROLS INSTALLATION

Constant Volume (CV) Units — The 48FJ and 50FJX,FJY,FW units may be used in applications with additional control features, options, or accessories. Refer to the appropriate accessory installation instructions for more information on installing that accessory. Control options and accessories available for CV units are:

- thermostats
- differential enthalpy sensor
- modulating power exhaust
- Motormaster® I control
- 115-v convenience outlet

CONTROL WIRING — Install a Carrier-approved accessory 24-v thermostat assembly according to the installation instructions shipped with the accessory. Locate thermostat assembly to sense average temperature. Route thermostat cable or equivalent leads of colored wire from subbase terminals to terminal board (P1). The terminal board (P1) is located on the constant volume control board on units with no economizer and on the economizer board on units with the economizer option.



NOTES:

1. Dimensions shown in () are in millimeters
2. Two baffles are required per unit.

UNIT SIZES	DIMENSIONS											
	A		B		C		D		E		F	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
078-104	10	254	31	787	108	2743	109	2781	111	2832	1	25

Fig. 37 — Wind Baffle Mounting Details

Total wire lengths should not exceed the following limits: 50 ft (4.6 m) of 18 AWG, 80 ft (7.4 m) of 16 AWG or 125 ft (11.6 m) of 14 AWG. See Fig. 38 for field wiring connections between the thermostat and the unit 24-v terminal block. Once wire length from unit to thermostat is determined, the length should be doubled to obtain total wire length required. Voltage drop is dependent on length of current path.

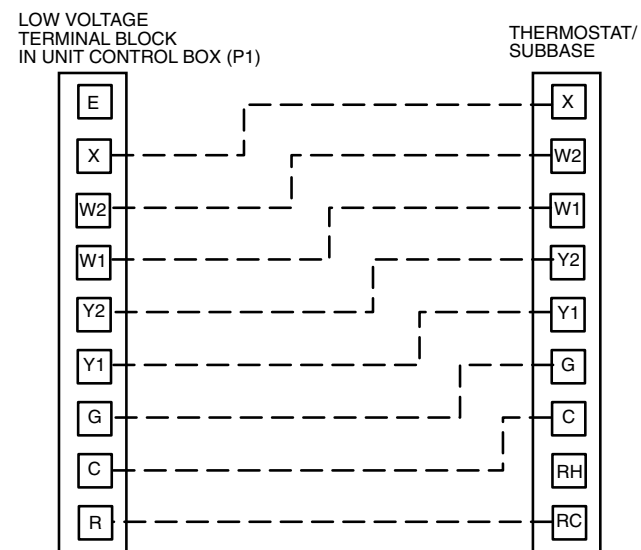
NOTE: Connections between thermostat and unit control terminal board are shown in Fig. 38. Connections at W1 and W2 are used only when an external staged heating device (field supplied and installed) is used.

There are no required 115-v field wiring connections, therefore no provisions have been made in the unit for running 115-v wiring. If any of the field-installed options requiring 115-v connections are desired, the unit must be modified in the field for 115-v wiring.

Variable Air Volume Units — The 48FK and 50FKX, FKY, FY units may be used in applications with additional control features, options, or accessories. Refer to the appropriate accessory installation instructions for more information on installing that accessory. Control options and accessories available for VAV units are:

- smoke control modes
- differential enthalpy sensor
- modulating power exhaust
- Motormaster® I control
- space temperature reset
- night setback thermostat (field-supplied device)
- single step demand limit (field-supplied hardware)
- two-step demand limit
- inlet guide vanes
- remote panel
- variable frequency drive
- variable frequency drive remote display kit

CONTROL WIRING, VARIABLE AIR VOLUME UNITS — A switch or timeclock (field supplied) must be wired in to control when unit will go into and out of Occupied mode. Connect switch or timeclock between terminals 1 and 2 on terminal block 4 in unit control box. See Fig. 39. The circuit potential is 24 v.



NOTE: On Cooling Only units, terminals W1 and W2 are not used unless an external heating device is installed.

Fig. 38 — Field Control Thermostat Wiring (Constant Volume Units)

Variable air volume units equipped with warm-up heat (all 48FK and 50FKX, FKY, FY units equipped with a field-installed, externally located heating device) require that room terminals be controlled to go fully open when unit goes into the Heating mode. Heating interlock relay (HIR) is provided for this function. The relay is located in the unit control box. When unit goes into Heating mode, interlock relay is energized providing switch closure or opening (depending on how field power source is set up) to open the room terminals. Field connections for interlock relays are terminals 3 and 4 (for normally open contacts) and terminals 3 and 7 (for normally closed contacts) terminal block 4. See Fig. 40. Note that a field-supplied power source is required.

There are no required 115-volt field wiring connections, therefore no provisions have been made in the unit for running 115-volt wiring. If any of the field-installed options requiring 115-volt connections are desired, the unit must be modified in the field for 115-volt wiring. Options requiring 24-volt or 115-volt control wiring are shown in Fig. 41-44.

Night Setback Thermostat — Wire field-supplied thermostat (suitable for 24-v circuit) between terminals 1 and 2 on terminal block 4. This thermostat is used to bypass the timeclock occupied/unoccupied switch and is used to operate unit during unoccupied times at more economical temperatures. (See Fig. 39.)

Space Temperature Reset Accessory (50DJ900021) — Consists of a thermistor (T10) and a reset board with a potentiometer (P7) that is used to set space temperature at which reset starts. Mount reset board in unit control box or other convenient place. Wire thermistor in series with P7 and connect to terminals 12 and 15 on terminal block 4 in unit control box. If there is a long run to conditioned space, it is necessary to splice additional wire to thermistor. The reset board has 2 pressure connectors for field wiring. (See Fig. 41).

Single-Step Demand Limit Potentiometer — Potentiometer is a field-supplied, 3-wire potentiometer with a resistance of 5-K to 20-K ohms. Connect 3 wires from potentiometer to terminals 8, 9 and 10 (through field switch SW) on terminal block 4 in unit control box, as shown in Fig. 42.

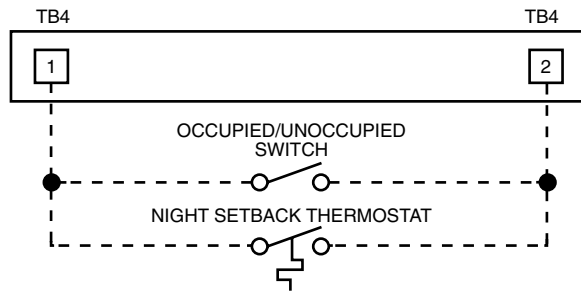
Accessory 2-Step Demand Limit (Fig. 43) — Install the 2-step demand limit module in unit control box as close as possible to the processor board. Mount using four no. 8 x 3/4-in. long screws.

24-Volt Connection — The 2-step demand limit module is equipped with a connector for hookup to processor board. Prior to hookup, plugs and wires running between terminals 1, 2 and 3 on J3 of the processor board and terminals 1, 2 and 3 on terminal block 3 in unit control box must be removed. After removing these plugs, attach connector from demand limit module to terminals 1, 2 and 3 on processor board. The 115-volt wiring for field-controlled input signals must be completed before demand limit board will operate.

115-Volt Connection — Field-controlled input signals to the accessory 2-step demand limit module. Connect field input signals to terminal strips INT1 and INT2 located on the module (see Fig. 43). These are pressure-type terminals. The terminals will accept up to 12-gage wire. See Fig. 44 for wiring details.

Variable Frequency Drive (VFD) — The VFD factory-installed option is available only on 48FK, FP and 50FKX, FKY, FY, FB, FPX, FPY units. The VFD is factory-wired and is factory-configured with the proper program and jumpers for each unit.

Refer to the separate Controls and Troubleshooting manuals for instructions on adjusting set points and servicing the VFD.



NOTES:

1. Occupied/Unoccupied switch closes when occupied.
2. Night setback thermostat closes when in night setback.

Fig. 39 — Occupied/Unoccupied Switch with Night Setback Thermostat

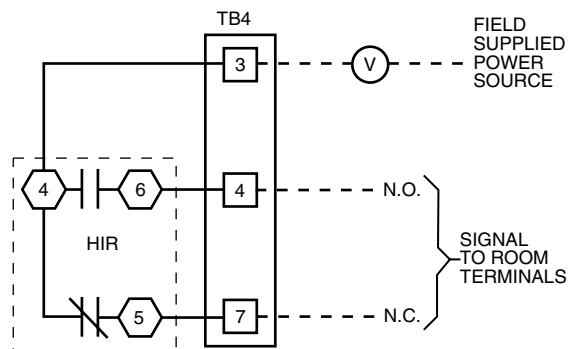


Fig. 40 — Heat Interlock Relay (VAV Units)

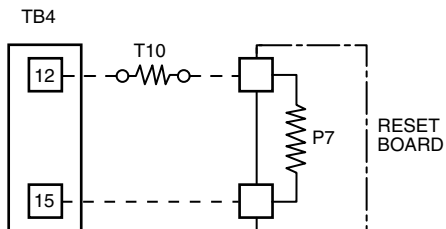


Fig. 41 — Accessory Reset Board

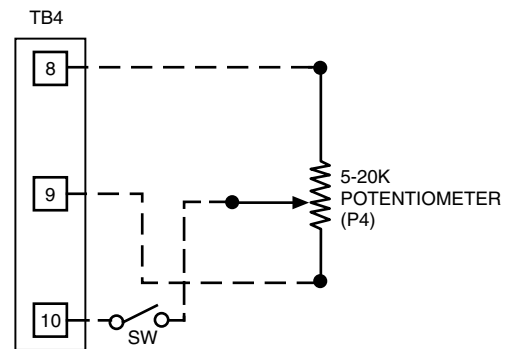


Fig. 42 — Single-Step Demand Limit

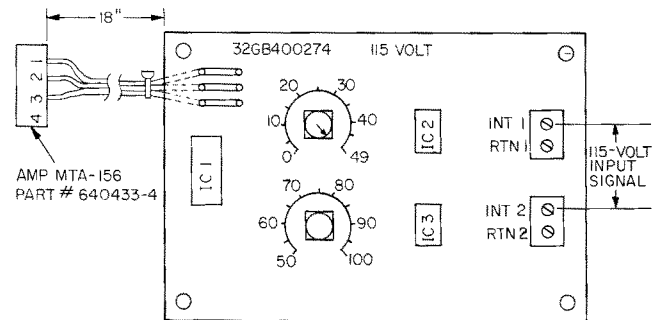
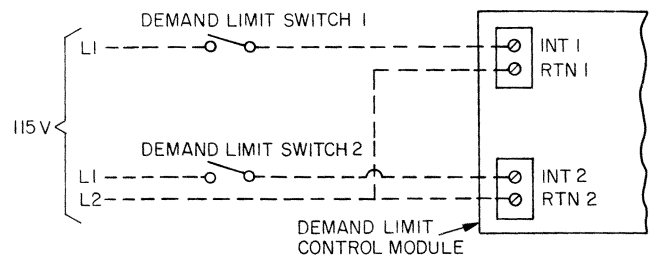


Fig. 43 — Two-Step Demand Limit Module



NOTES:

1. Demand limit switches are field supplied and wired.
2. Demand limit control module terminal blocks will accept up to 12-gage wire.
3. --- is field wiring.

Fig. 44 — 115-V Field Wiring to Accessory 2-Step Demand Limit Control Module

PIC Control Wiring (48FP and 50FB,FPX,FPY) —

The recommended types of control wiring for all unit devices are shown below:

MANUFACTURER	PART NO.	
	Regular Wiring	Plenum Wiring
Alpha	1895	—
American	A21451	A48301
Belden	8205	884421
Columbia	D6451	—
Manhattan	M13402	M64430
Quabik	6130	—

SENSORS — Sensors should be wired using single twisted pairs of 20 AWG (American Wire Gauge) conductor cable rated for the application, except for the T-56 accessory sensor which requires 3-conductor cable.

NOTE: Humidity and CO₂ sensors must be powered from isolated 24-v power supplies.

HUMIDITY CONTROL AND HOT WATER AND STEAM VALVES — These devices require 20 AWG twisted pair conductor cables rated for the application for the 4 to 20 mA signal.

SPACE TEMPERATURE SENSOR (T-55) — The space temperature sensor (P/N CEC0121448-01) is shipped standard with every unit, and is located in the main control box. Space temperature sensor wires are to be connected to terminals in the unit main control box. The space temperature sensor includes a terminal block (TB1), a jumper between pins E2 and E3, and an RJ11 female connector. The RJ11 connector is used to tap into the Carrier Comfort Network (CCN) at the sensor. See RJ11 Plug Wiring section on page 34 to connect the RJ11 connector to the CCN. A 3-lead cable must run from the RJ11 connector to the unit for communication through the sensor.

⚠ CAUTION

Jumper **MUST** be in place between pins E2 and E3 or inaccurate readings could result.

To connect the space temperature sensor (Fig. 45):

1. Connect 1 wire of the twisted pair to terminal T1 (T-55) and connect the other wire to terminal T2 on terminal block 1 (TB1) located on the cover of the space temperature sensor using a 20 AWG twisted pair conductor cable rated for the application.
2. Connect the other ends of the wires to terminals 1 and 2 of TB2 located in the unit main control box.

NOTE: This sensor should be installed for all applications. For VAV applications, it is used to control heating and cooling during unoccupied periods. For DAV (digital air volume) applications, it is used to maintain control of the space during linkage failures with the TSM (terminal system manager).

NOTE: Either the T-55 or T-56 sensor must be connected for CV (constant volume) applications to function properly.

SPACE TEMPERATURE SENSOR (T-56) (CV [constant volume] Applications Only) — Space temperature sensor (P/N CEC0121503-01) wires are to be connected to terminals in the unit main control box. The space temperature sensor includes a terminal block (TB1), a jumper between pins E2 and E3, and an RJ11 female connector. The RJ11 connector is used to tap into the CCN at the sensor. See RJ11 Plug Wiring section on page 34 to connect the RJ11 connector to the CCN.

⚠ CAUTION

Jumper **MUST** be in place between pins E2 and E3 or inaccurate readings could result.

To connect the space temperature sensor (Fig. 45):

1. Connect one wire of the 3-conductor cable to terminal TH, one wire to terminal COM, and the other wire to terminal SW on terminal block 1 (TB1) located on the cover of the space temperature sensor using a 20 AWG twisted 3-conductor cable rated for the application.
2. Connect the other ends of the wires to terminals 1, 2, and 7 on TB2 located in the unit main control box. The wire from terminal SW **MUST** be connected to terminal 7.

NOTE: Either the T-55 or the T-56 sensor must be connected for CV applications to function properly.

SPACE TEMPERATURE AVERAGING — Applications that require averaging using multiple space temperature sensors can be satisfied using either 4 or 9 sensors as shown in Fig. 46.

NOTE: Only Carrier sensors may be used for standard T-55 space averaging. Sensors must be used in multiples of 1, 4, and 9 only, with total sensors wiring not to exceed 1000 ft.

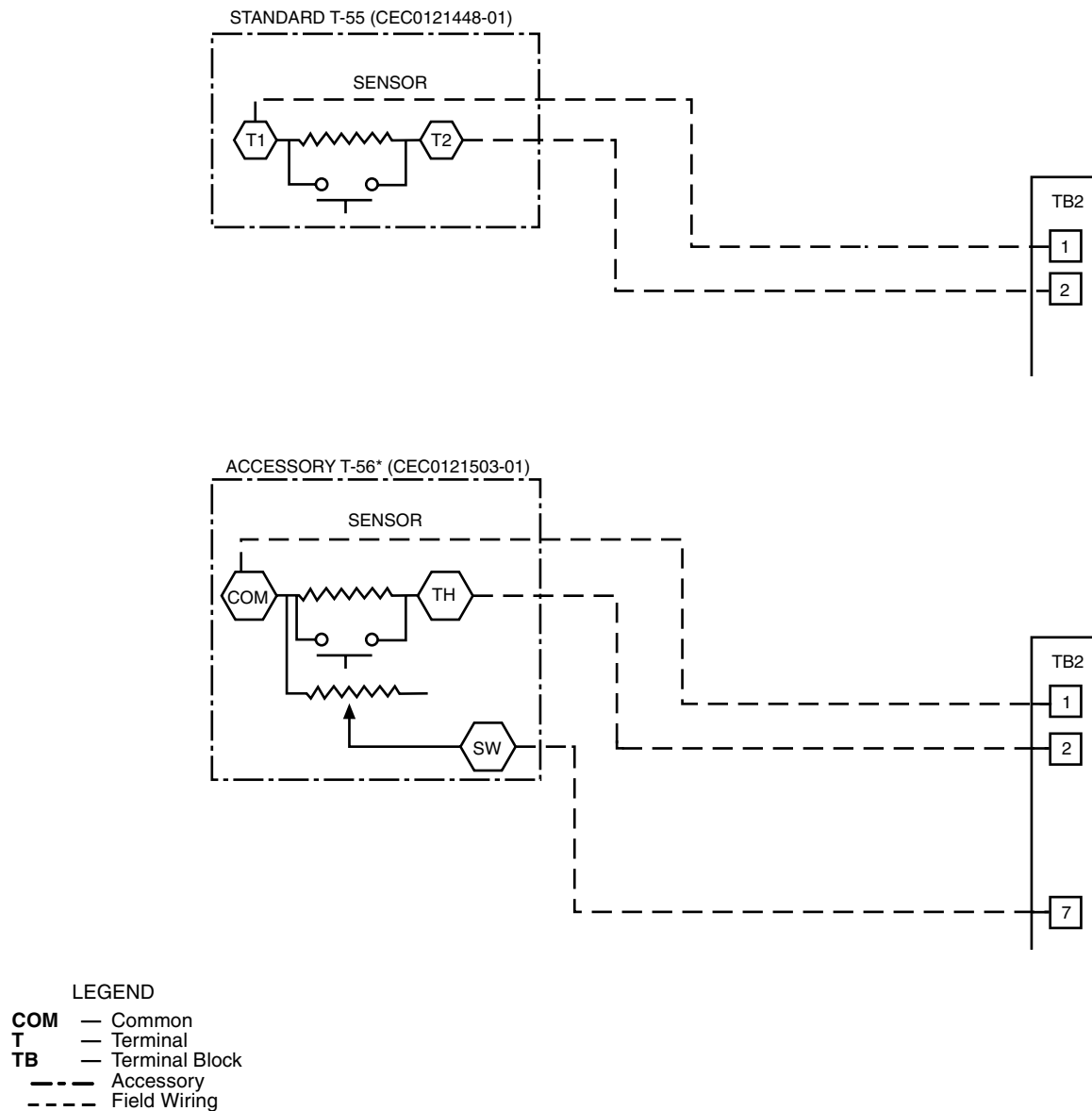
NOTE: Do not use T-56 sensors for space temperature averaging because the 5 degree offset function will not work in a multiple sensor application.

HEAT INTERLOCK RELAY (VAV Units Only) — 48FK and 50FKX,FKY,FY units equipped with a field-supplied, externally located heating device using optimal start (morning warm-up) and/or occupied heating require that room terminals be controlled to the fully open position when the unit goes into Heating mode. The HIR1 (Heat Interlock Relay) function is provided for this control. When the unit goes into Heating mode, the HIR is energized to provide switch closure or opening (depending on how the field-supplied power source is set up) to open the room terminals. The field connections for the HIR1 are at TB2. See Table 6.

OPTION AND ACCESSORY CONTROL WIRING — The 48FP and 50FB,FPX,FPY units may be used in applications with additional control features, options, or accessories. Refer to the Controls and Troubleshooting manual for more information concerning installation and configuration of

options and accessories. Figures 47-60 contain wiring information on the following features:

- heat interlock relay (Fig. 47)
- differential enthalpy sensor (Fig. 48)
- remote start (Fig. 49)
- accessory humidity control (Fig. 50)
- smoke control (Fig. 51)
- indoor air quality (Fig. 52)
- outdoor airflow control (Fig. 53)
- timed discrete output (Fig. 54)
- humidifier (Fig. 55)
- hydronic heating (Fig. 56)
- freezestat (Fig. 57)
- remote supply-air temperature/space temperature offset (Fig. 58)
- refrigerant transducer/thermistor (Fig. 59)
- CCN Building Supervisor (Fig. 60)



*Constant volume applications only.

Fig. 45 — Space Temperature Sensor Wiring

Table 6 — Field Connections for HIR1

HEAT INTERLOCK RELAY	TERMINALS
Normally Closed	8 and 10
Normally Open	8 and 9

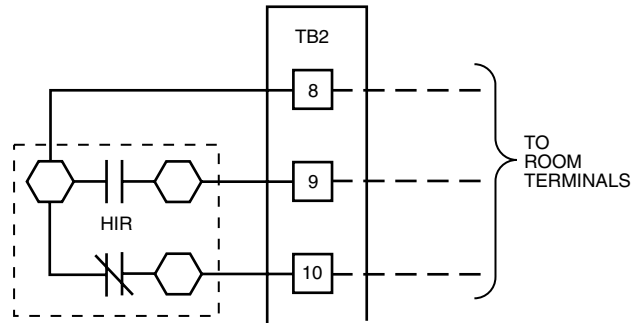
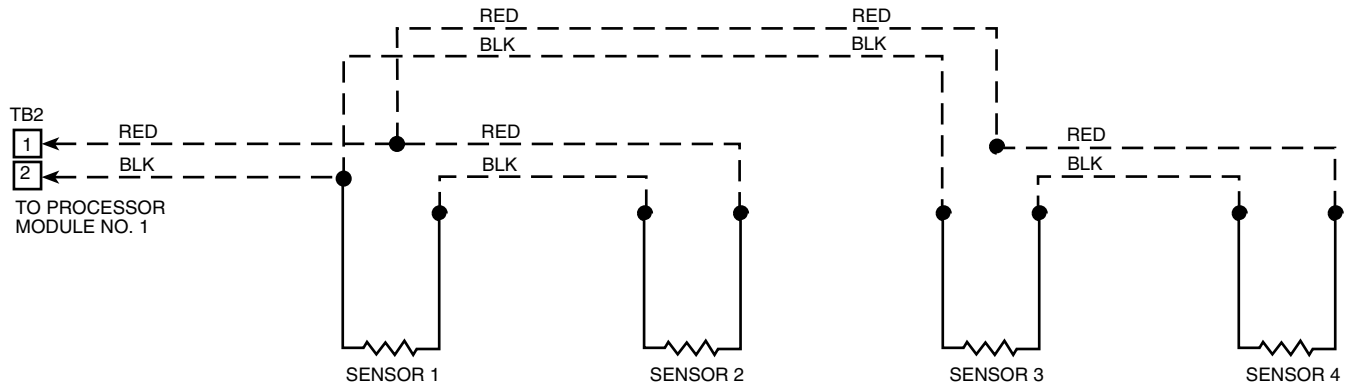
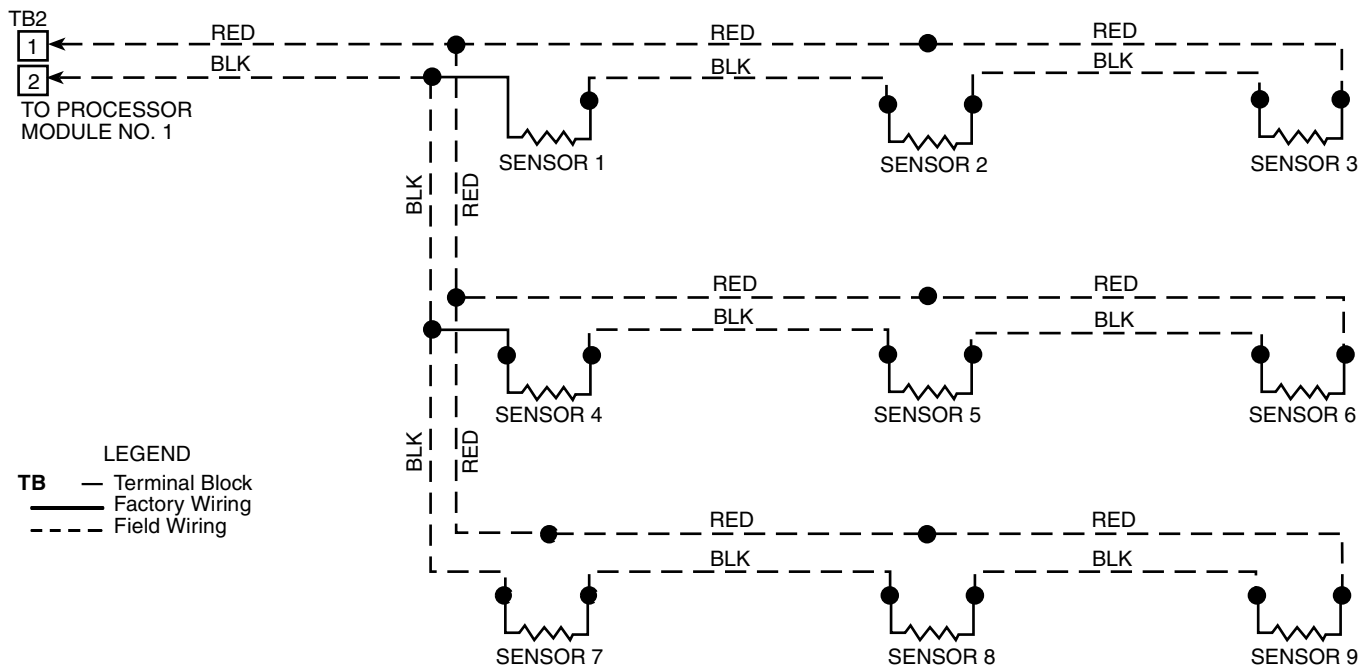


Fig. 47 — Heat Interlock Relay Wiring (PIC Units)



SPACE TEMPERATURE AVERAGING — 4 SENSOR APPLICATION



SPACE TEMPERATURE AVERAGING — 9 SENSOR APPLICATION

Fig. 46 — Space Temperature Sensor Averaging

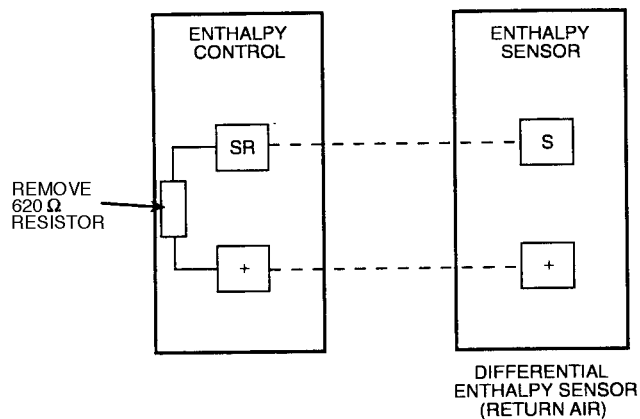


Fig. 48 — Differential Enthalpy Sensor

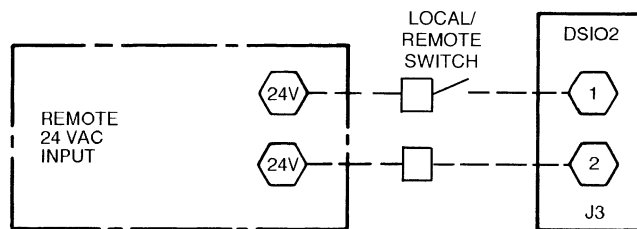


Fig. 49 — Remote Start

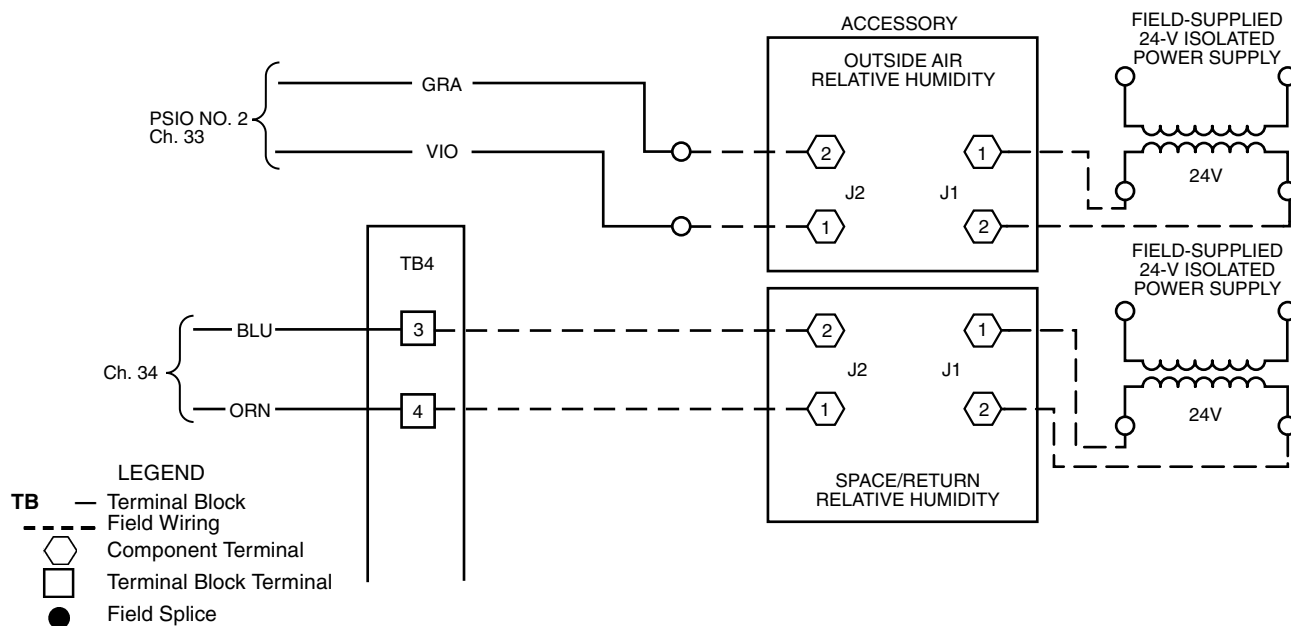


Fig. 50 — Accessory Humidity Control

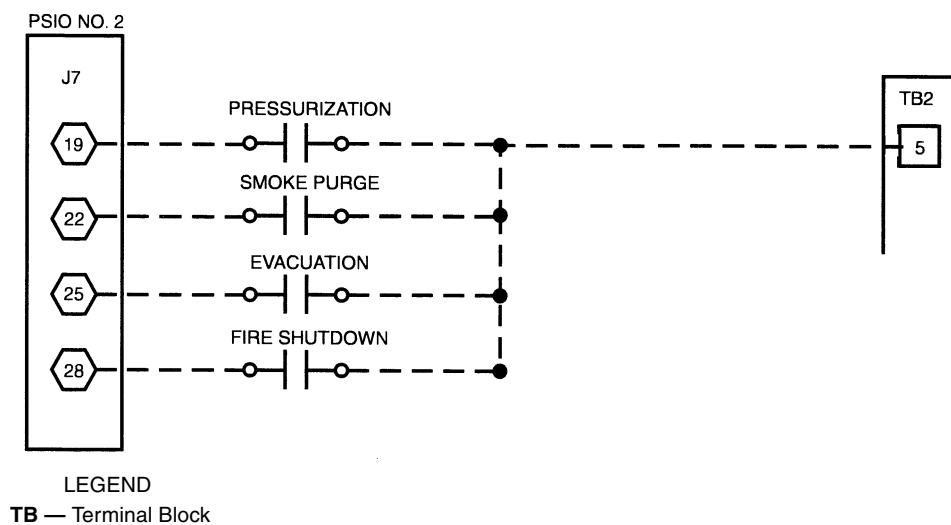


Fig. 51 — Fire/Smoke Control

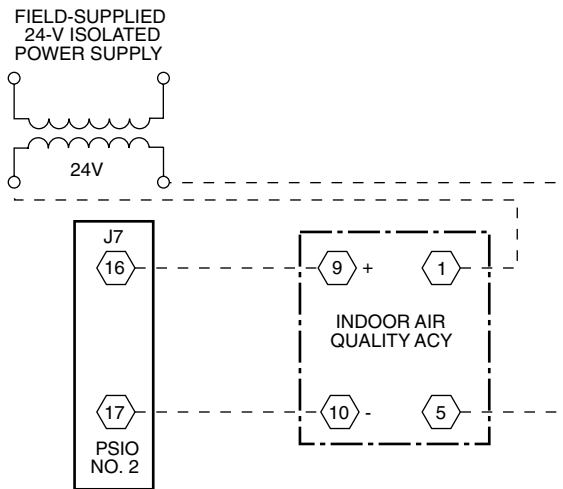


Fig. 52 — Indoor-Air Quality

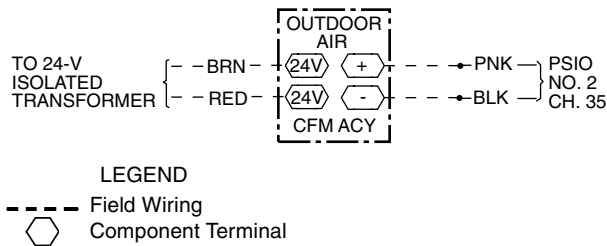


Fig. 53 — Outdoor Airflow Control

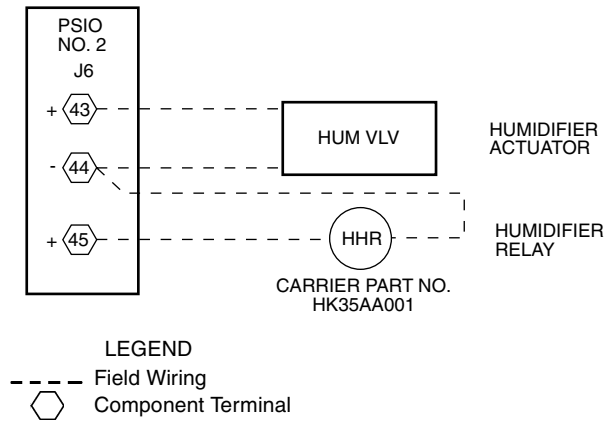


Fig. 55 — Humidifier

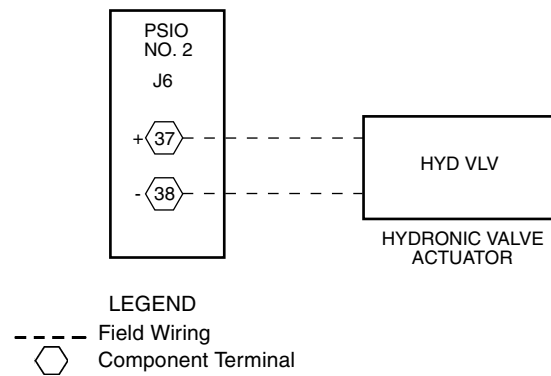


Fig. 56 — Hydronic Heating

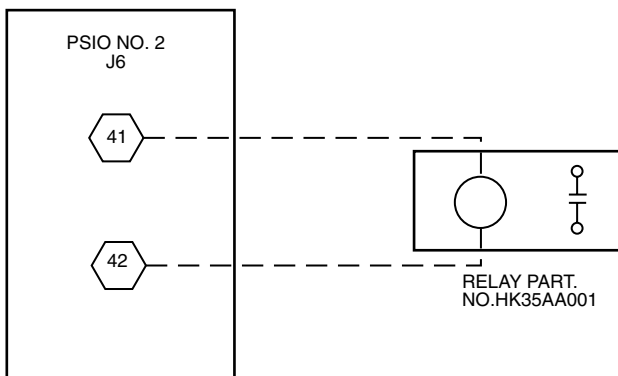


Fig. 54 — Timed Discrete Output

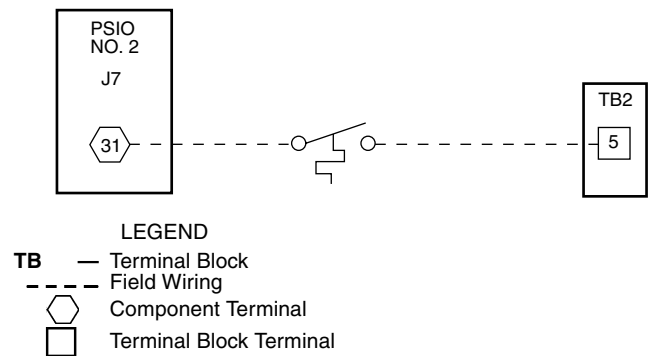
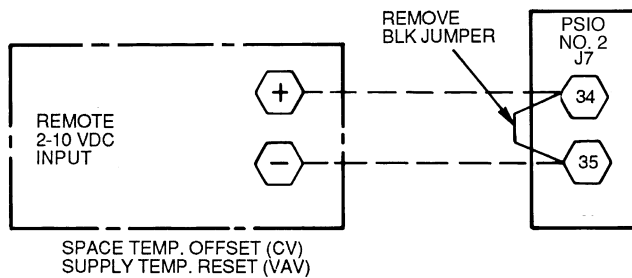


Fig. 57 — Freezestat



LEGEND

CV — Constant Volume

VAV — Variable Air Volume

Fig. 58 — Remote Supply-Air Temperature Reset/Space Temperature Offset

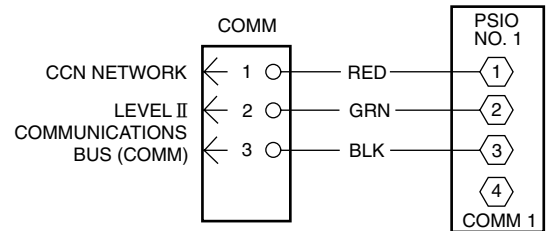
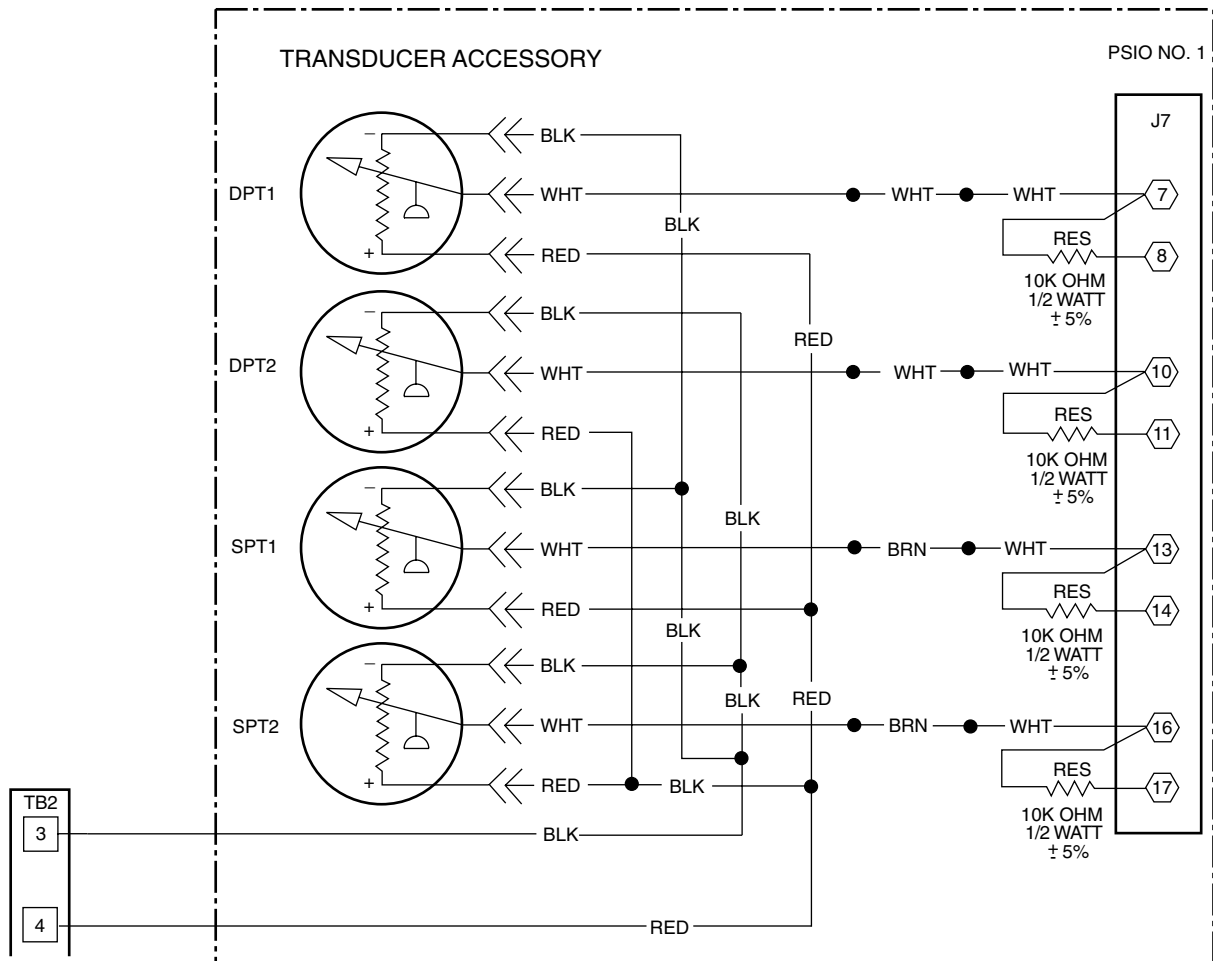


Fig. 60 — CCN Building Supervisor



LEGEND

DPT — Discharge Pressure Transducer

SPT — Suction Pressure Transducer

TB — Terminal Block

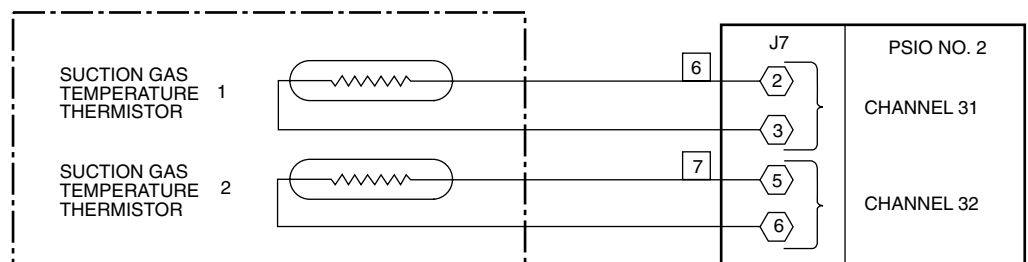


Fig. 59 — Transducer/Thermistor

Carrier Comfort Network Interface — The 48FP and 50FB, FPX,FPY units can be connected to the CCN if desired. The communication bus wiring is supplied and installed in the field. It consists of shielded, 3-conductor cable with drain wire.

The system elements are connected to the communication bus in a daisy chain arrangement. The positive pin of each system element communication connector must be wired to the positive pins of the system element on either side of it, the negative pins must be wired to the negative pins, and the signal pins must be wired to signal ground pins. Wiring connections for CCN should be made at the 4-pin plug (COMM) located at the bottom right side of the fuse bracket in the main control box. Consult CCN Contractor's Manual for further information.

NOTE: Conductors and drain wire must be 20 AWG minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon, or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of -20 C to 60 C is required. See Table 7 for cables that meet the requirements.

Table 7 — CCN Connection Approved Shielded Cables

MANUFACTURER	CABLE PART NO.
Alpha	2413 or 5463
American	A22503
Belden	8772
Columbia	02525

IMPORTANT: When connecting the CCN communication bus to a system element, use a color coding system for the entire network to simplify installation and checkout.

The following color code is recommended:

SIGNAL TYPE	CCN BUS CONDUCTOR INSULATION COLOR	COMM1 PLUG PIN NO.
+	RED	1
GROUND	WHITE	2
-	BLACK	3

NOTE: If a cable with a different color scheme is selected, a similar color code should be adopted for the entire network.

At each system element, the shields of its communication bus cables must be tied together. If the communication bus is entirely within one building, the resulting continuous field must be connected to a ground at one point only. If the communication bus cable exits from one building and enters another, the shields must be connected to grounds at the lightning suppressor in each building where the cable enters or exits the building (one point per building only).

To connect the unit to the network:

1. Turn off power to the control box.
2. Cut the CCN wire and strip the ends of the red (+), white (ground) and black (-) conductors. (If a different network color scheme is used, substitute appropriate colors.)
3. Remove the 4-pin female plug from the fuse and control circuit breaker bracket in the main control box, and connect the wires as follows:
 - a. Insert and secure the red (+) wire to terminal 1 of the 4-pin plug.

- b. Insert and secure the white (ground) wire to terminal 2 of the 4-pin plug.
 - c. Insert and secure the black (-) wire to terminal 3 of the 4-pin plug.
4. Insert the plug into the existing 4-pin mating connector on the fuse or control circuit breaker bracket in the main control box.

IMPORTANT: A shorted CCN bus cable will prevent some routines from running and may prevent unit from starting. If abnormal conditions occur, unplug the connector. If conditions return to normal, check CCN connector, and run new cable if necessary. A short in one section of the bus can cause problems with all system elements on the bus.

RJ11 PLUG WIRING — Units on the CCN can be monitored from the space at the sensor through the RJ11 connector, if desired. To wire the RJ11 connector into the CCN (Fig. 61):

IMPORTANT: The cable selected for the RJ11 connector wiring **MUST** be identical to the CCN communication bus wire used for the entire network. Refer to Table 7 for acceptable wiring.

1. Cut the CCN wire and strip ends of the red (+), white (ground), and black (-) conductors. (If another wire color scheme is used, strip ends of appropriate wires.)
2. Insert and secure the red (+) wire to pin J2 of the space temperature sensor terminal block (TB1).
3. Insert and secure the white (ground) wire to pin J3 of the space temperature sensor TB1.
4. Insert and secure the black (-) wire to pin J5 of the space temperature sensor TB1.
5. Connect the other end of the communication bus cable to the remainder of the CCN communication bus at the COMM1 plug located on the fuse and control circuit breaker bracket in the unit main control box.

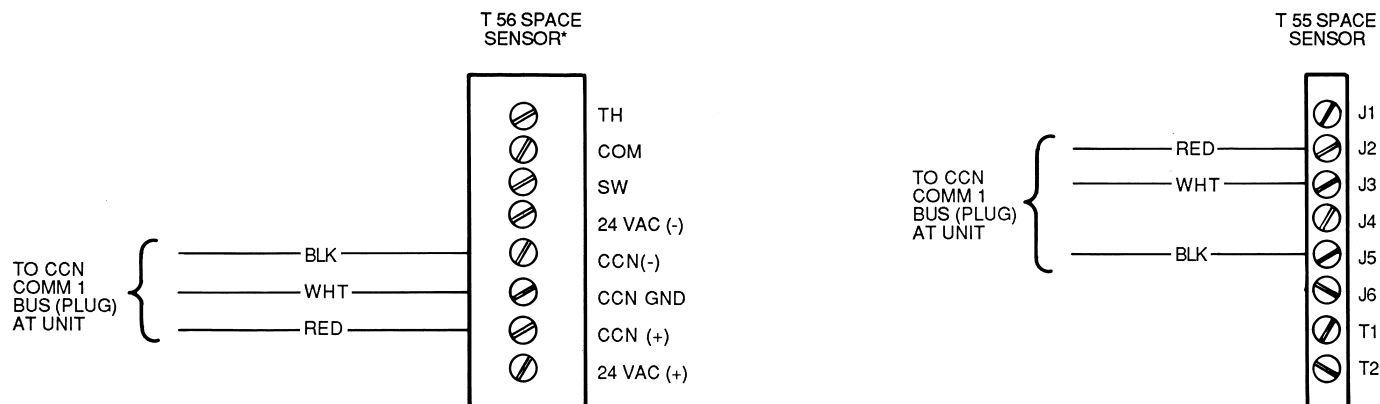
Smoke Control Modes — Rooftop units can be used for aid in building smoke control in the event of a building fire. The available functions include: Fire Shutdown, Pressurization, Evacuation, and Smoke Purge. These functions are enhanced when multiple rooftop units are used to zone a building. See Table 8.

FIRE SHUTDOWN — Fire Shutdown mode terminates all unit operation (cooling, heating, supply fan, and power exhaust). This mode prevents recirculation of contaminated air back into the space. The mode will not allow admission into the space of unsuitable outside air.

PRESSURIZATION — Pressurization mode is intended to keep smoke out of a zone. The factory-installed optional economizer is required for this function. Pressurization is accomplished by the following:

- opening the economizer (option)
- running the supply fan (optional inlet guide vanes open or optional VFD at normal duct static pressure set point)
- closing the power exhaust dampers (if installed as option or accessory)
- shutting off the power exhaust fans (if installed as option)

This allows the space to be overpressurized relative to adjacent zones and prevents or slows entry of smoke into this space from adjacent zones.



*Constant volume applications only.

Fig. 61 — Space Sensor to Communication Bus Wiring

EVACUATION — Evacuation mode removes smoke or undesirable air from interior spaces without reintroducing unsuitable air. The factory-installed optional economizer with optional power exhaust is required for this function. Evacuation is accomplished by the following:

- turning the supply fan off
- opening the economizer (option required)
- running the exhaust fans (option required)
- opening the exhaust dampers

SMOKE PURGE — Smoke Purge mode removes smoke from the interior spaces and replaces it with fresh outside air. The factory-installed optional economizer with optional power exhaust are required for this function. Smoke purge is accomplished by the following:

- turning supply fan on
- opening the economizer (option required)
- running the exhaust fans (option required)
- opening the exhaust dampers

Table 8 — Smoke Control Modes

FUNCTION	MODE			
	Fire Shutdown	Pressurization	Evacuation*	Smoke Purge*
Supply Fan	Off	On	Off	On
IGV/VFD†	—	Open/On	—	Open/On
Economizer	Closed	Open	Open	Open
Return Air Damper	Open	Closed	Closed	Closed
Exhaust Fans	Off	Off	On	On
Exhaust Damper	Closed	Closed	Open	Open

*Power exhaust option required for this mode.

†Applicable to VAV and PIC units with appropriate options.

SMOKE CONTROL INSTALLATION — Implementation of the various Smoke Control Modes on these units requires the installer to modify the unit wiring to add contacts (via either manual switches or relays) that will selectively interrupt and override standard factory control sequences. See Tables 9-14 and Fig. 62-66 for more information.

**Table 9 — Smoke Control Switches — Constant Volume Units
(48FJ and 50FJX,FJY,FW)**

SMOKE CONTROL MODE	FIRE SHUTDOWN	PRESSURIZATION	EVACUATION (Non-Modulating Power Exhaust)	EVACUATION (Modulating Power Exhaust)	SMOKE PURGE
SWITCHES USED	SW-1	SW-1	SW-1	SW-1	SW-1
	SW-2*	SW-2*	SW-2*	SW-2*	SW-2*
		SW-3	SW-3	SW-3	SW-3
		SW-4	SW-4	SW-4	SW-4
		SW-5A/B	SW-6	SW-6	SW-5A/B
		SW-6	SW-7	SW-7	SW-8
				SW-8	
				SW-9	

*On 48FJ units only. Not required on 50FJX,FJY,FW units. Required ONLY if Fire Shutdown PLUS a second Smoke Control mode will be configured. If Fire Shutdown is the only mode to be configured, SW-1 is only switch required. If Fire Shutdown AND (Pressurization and/or Evacuation and/or Smoke Purge) modes will be configured, then SW-1 AND SW-2 are required to implement Fire Shutdown mode.

NOTE: All switches are shown in “as installed” (power OFF or de-energized) position. In these positions, none of these modes will be activated and normal unit operation is permitted by the base unit controls. To initiate any mode, all switches listed under this mode in the table must be energized, causing the contact position to change to energized position. Switches may be manually or electrically operated.

**Table 10 — Smoke Control Switch Functions — Constant Volume Units
(48FJ and 50FJX,FJY,FW)**

SWITCH NUMBER	CONFIGURATION	VOLTAGE	FUNCTION
SW-1	N.C.	115	Disconnect 115-v Control Power
SW-2*	N.C.	24	Disconnect 24-v Control Power to Gas Heat Control
SW-3	N.O.	24	Supply Power to Economizer Motor
SW-4	N.C.	24	Opens Economizer Dampers to Wide-Open
SW-5A/B	A: N.C. B: N.O.	115	A: Prevent Backfeed through K3 B: Energize IFC
SW-6	N.C.	115	Isolate IFC and PEC, for Separate Operation
SW-7	N.O.	115	Energize Power Exhaust
SW-8	N.O.	24	Force Power Exhaust Damper for Open
SW-9	N.C.	24	Prevent DPS Control from Reclosing Exhaust Damper Due to Low BP

LEGEND

BP — Building Pressure
DPS — Differential Pressure Switch
IFC — Indoor Fan Contactor
N.C. — Normally Closed
N.O. — Normally Open
PEC — Power Exhaust Contactor

*On 48FJ units only. Not required on 50FJX,FJY,FW units. Required ONLY if Fire Shutdown PLUS a second Smoke Control mode will be configured. If Fire Shutdown is the only mode to be configured, SW-1 is only switch required. If Fire Shutdown AND (Pressurization and/or Evacuation and/or Smoke Purge) modes will be configured, then SW-1 AND SW-2 are required to implement Fire Shutdown mode.

NOTE: Contact a Carrier representative for special considerations when a field-supplied externally located heating device is used on a 50 series unit.

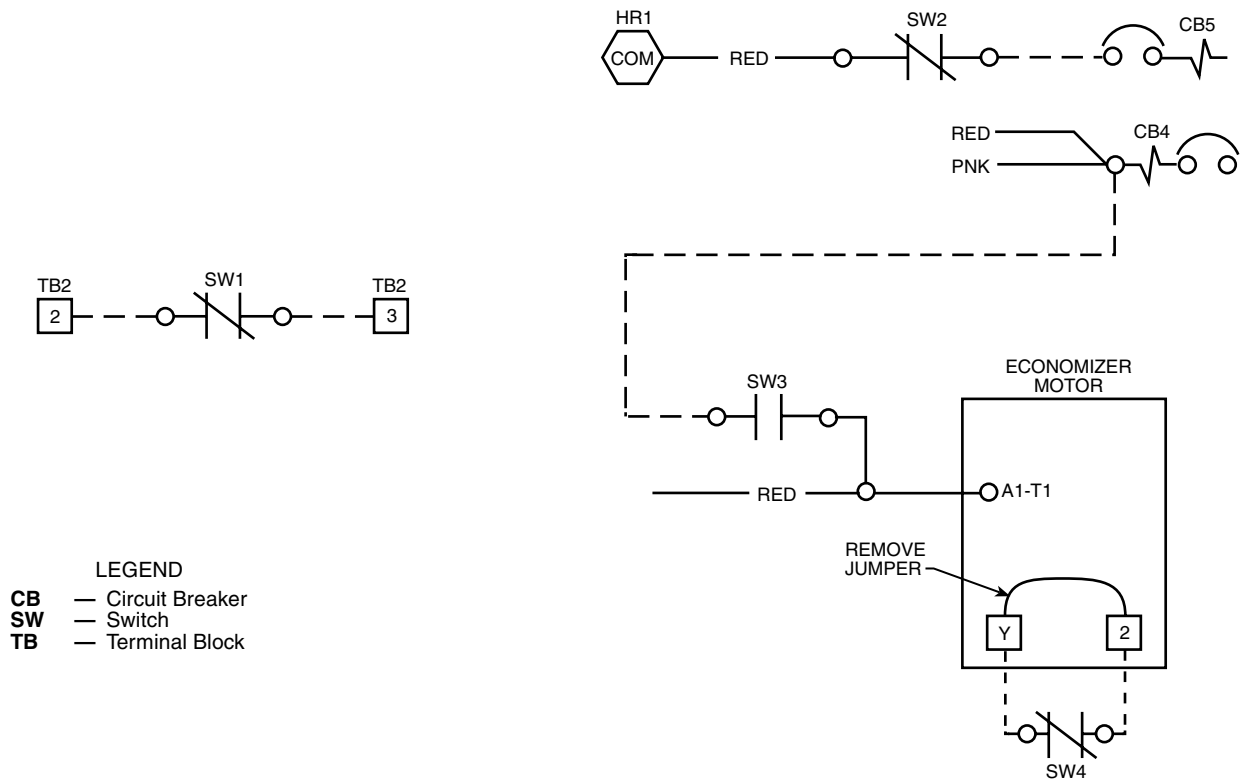


Fig. 62 — Constant Volume Smoke Control Wiring (SW-1 Through SW-4)

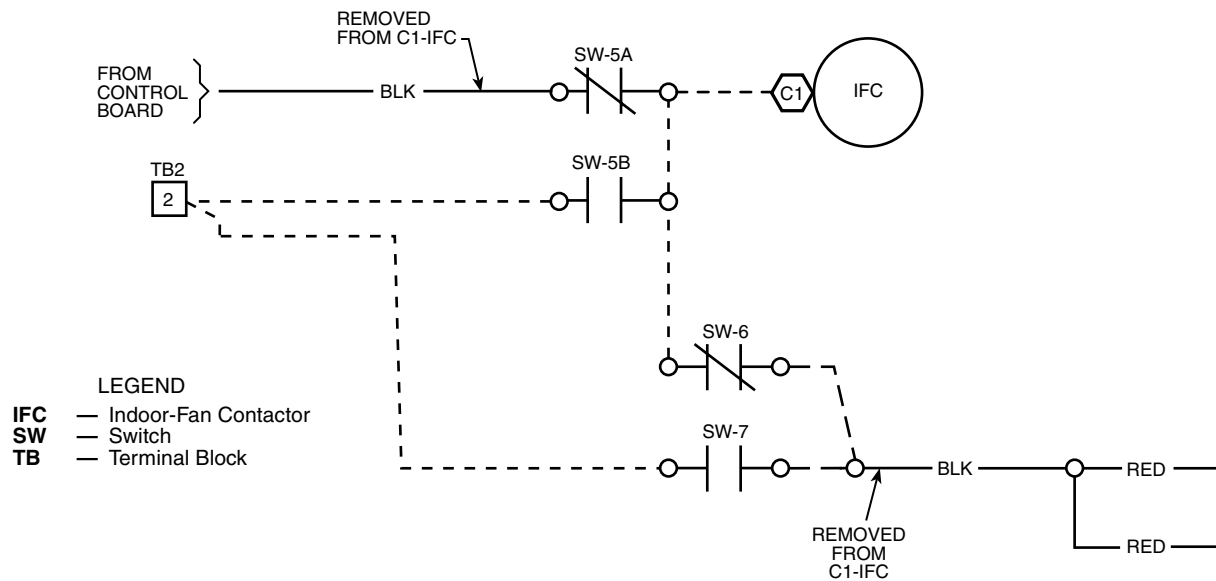


Fig. 63 — Constant Volume Units with Non-Modulating Power Exhaust, Smoke Control Wiring (SW-5 Through SW-7)

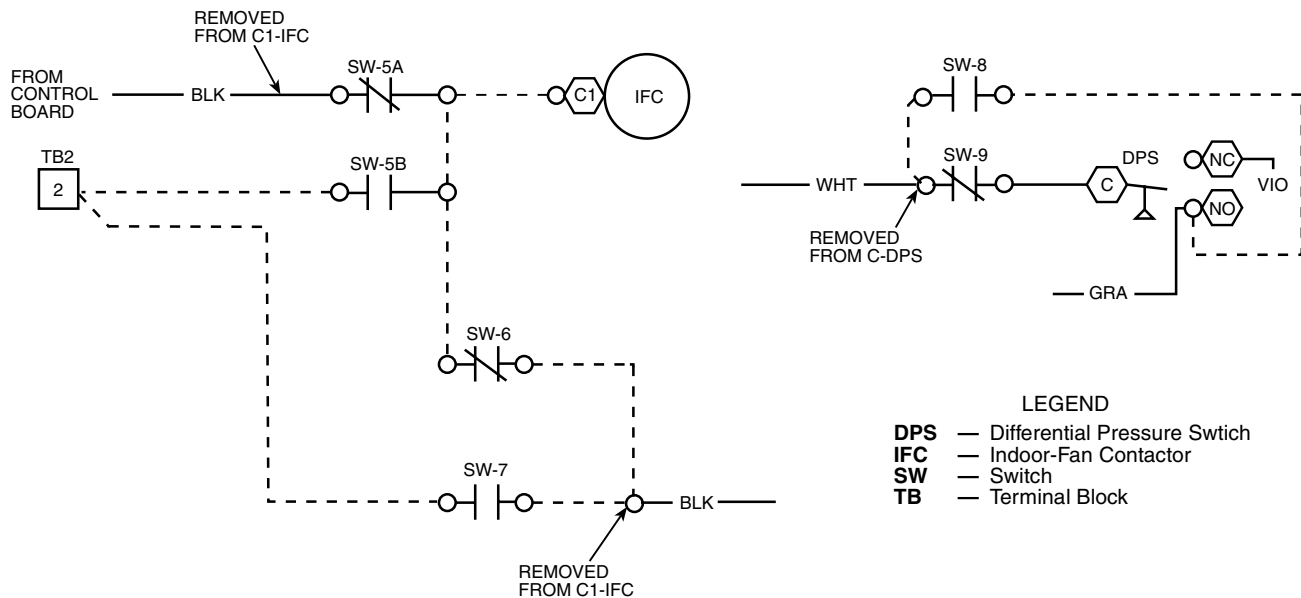


Fig. 64 — Constant Volume Units with Modulating Power Exhaust, Smoke Control Wiring (SW-5 Through SW-9)

Table 11 — Smoke Control Switches — Variable Air Volume Units (48FK and 50FKX,FKY,FY)

SMOKE CONTROL MODE	FIRE SHUTDOWN	PRESSURIZATION	EVACUATION (Modulating Power Exhaust)	SMOKE PURGE
SWITCHES USED	SW-1	SW-1	SW-1	SW-1
	SW-2	SW-2	SW-2	SW-2
		SW-4	SW-3	SW-3
		SW-5	SW-5	SW-4
		SW-6	SW-6	SW-9A/B
		SW-9A/B	SW-7	
			SW-8	

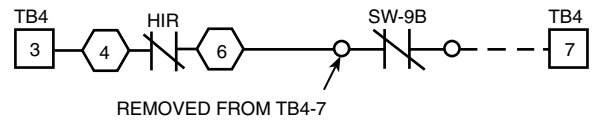
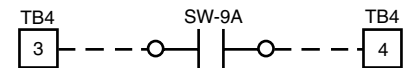
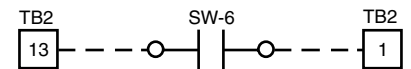
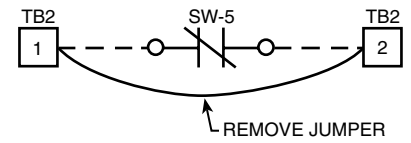
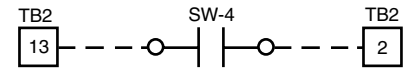
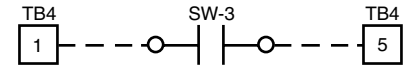
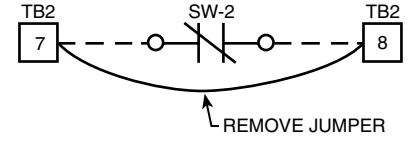
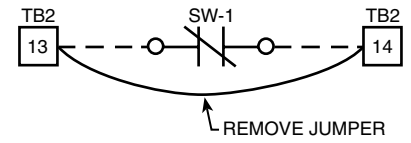
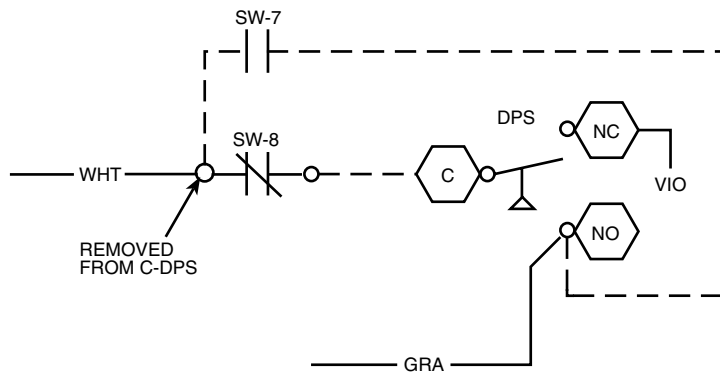
NOTE: All switches are shown in "as installed" (power OFF or deenergized) position. In these positions, none of these modes will be activated and normal unit operation is permitted by the base unit controls. To initiate any mode, all switches listed under this mode in the table must be energized, causing the contact position to change to energized position. Switches may be manually or electrically operated.

Table 12 — Smoke Control Switch Functions — Variable Air Volume Units (48FK and 50FKX,FKY,FY)

SWITCH NUMBER	CONFIGURATION	VOLTAGE	FUNCTION
SW-1	N.C.	115	Deenergize 115-v (OFC, Comp, IFC, Electric Heaters)
SW-2	N.C.	115	Deenergize TRAN7 (Process Board)
SW-3	N.O.	24	Energize EOR (Open Economizer Outside Air Dampers)
SW-4	N.O.	115	Energize IFC and CR-3 (IGV/VFD)
SW-5	N.C.	115	Isolate IFC and PEC for Separate Operation
SW-6	N.O.	115	Energize PEC (Power Exhaust)
SW-7	N.O.	24	Open PED at DPS
SW-8	N.C.	24	Block Auto-Close at DPS (Due to Low BP)
SW-9A/B	A: N.O. B: N.C.	115 max	Signal Room Terminals to Open (HIR1)

LEGEND

BP — Building Pressure
DPS — Differential Pressure Switch
EOR — Economizer Open Relay
HIR — Heat Interlock Relay
IFC — Indoor-Fan Contactor
IGV — Inlet Guide Vane
N.C. — Normally Closed
N.O. — Normally Open
PEC — Power Exhaust Contactor
PED — Power Exhaust Damper
OFC — Outdoor-Fan Contactor
VFD — Variable Frequency Drive



LEGEND

DPS — Differential Pressure Switch

HIR — Heat Interlock Relay

SW — Switch

TB — Terminal Block

Fig. 65 — Variable Air Volume Units, Smoke Control Wiring

**Table 13 — Smoke Control Switches — PIC Control Units
(48FP and 50FB,FPX,FPY)**

SMOKE CONTROL MODE	FIRE SHUTDOWN	BUILDING PRESSURIZATION	EVACUATION (Modulating Power Exhaust)	SMOKE PURGE
SWITCHES USED	SW-1	SW-2	SW-3	SW-4
		SW-5A/B		SW-5A/B

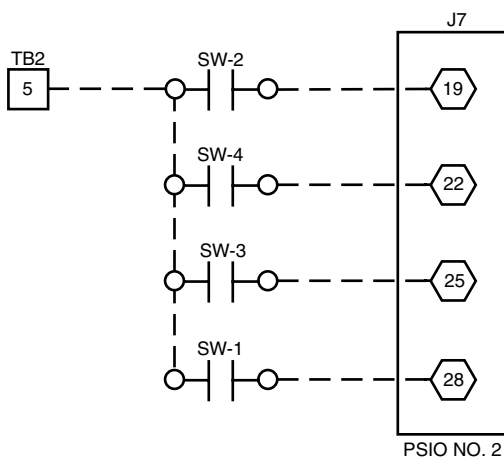
NOTE: All switches are shown in “as installed” (power OFF or deenergized) position. In these positions, none of these modes will be activated and normal unit operation is permitted by the base unit controls. To initiate any mode, all switches listed under this mode in the table must be energized, causing the contact position to change to energized position. Switches may be manually or electrically operated.

**Table 14 — Smoke Control Switch Functions — PIC Control Units
(48FP and 50FB,FPX,FPY)**

SWITCH NUMBER	SWITCH CONFIGURATION	VOLTAGE	FUNCTION
SW-1	N.O.	24	Activate Fire Shutdown Mode
SW-2	N.O.	24	Activate Pressurization Mode
SW-3	N.O.	24	Activate Evacuation Mode
SW-4	N.O.	24	Activate Smoke Purge Mode
SW-5 A/B	A: N.O. B: N.C.	115	Signal Room Terminals to Open (HIR1)

LEGEND

HIR — Heat Interlock Relay
N.C. — Normally Closed
N.O. — Normally Open
PIC — Product Integrated Controls



LEGEND
HIR — Heat Interlock Relay
SW — Switch
TB — Terminal Block

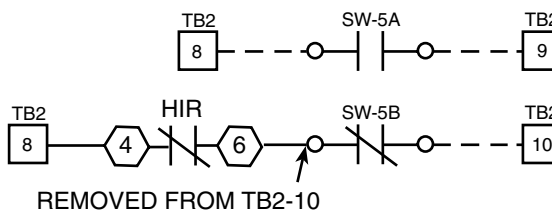


Fig. 66 — PIC Units, Smoke Control Wiring

PRE-START-UP

IMPORTANT: Before beginning Pre-Start-Up or Start-Up, review Start-Up Checklist at the end of this publication. The Checklist assures proper start-up of a unit and provides a record of unit condition, application requirements, system information, and operation at initial start-up.

Do not attempt to start the air-conditioning system until following checks have been completed.

System Check

1. Check the outside air hoods to ensure the hoods are fully opened and secure, with filters in place.
2. Check the supply fan suspension brackets. Shipping spacers should be removed and sleds levelled to specification.
3. Check compressor suspension. Snubber washers can be moved with finger pressure.
4. Electrical power source must agree with unit nameplate.
5. Check tightness of all electrical connections.

⚠ CAUTION

Failure to open discharge service valve prior to starting compressor can result in damage to or failure of the compressor.

6. Check caps on suction line service ports. Make sure caps are tight.
7. Backseat (open) compressor suction and discharge shutoff valves. Close valves one turn to allow refrigerant pressure to reach the test gages.
8. Oil should be visible in the compressor sight glasses. See Fig. 67. All units are factory charged with oil. Adjust the oil level as required. No oil should be removed unless the crankcase heater has been energized for at least 24 hours. Refer to Oil Charge section on page 62 for Carrier-approved oils.
9. Perform leak test. Be sure there are no refrigerant leaks. All units are shipped with a complete operating charge of R-22 and should be under sufficient pressure for leak testing after installation. If there is no system pressure, add refrigerant until a pressure is observed and check for leaks. After leaks are repaired, remove and recover refrigerant from system. For leak testing procedures, see GTAC 2, Module 5, Charging, Recovery, Recycling and Reclamation section. Do not use the system compressors to remove refrigerant from the system.
10. *Crankcase heaters must be firmly locked into compressors, and must be on for 24 hours prior to start-up.*

⚠ CAUTION

Crankcase heaters on all units are wired into the control circuit, so they are always operable as long as the main power supply disconnect is on (closed) and compressor is not running, even if any safety device is open. Compressor heaters must be on for 24 hours prior to the start-up of any compressor.

11. Check supply fan belts, sheaves, and bearings. Check the lubrication of the fan and motor bearings. Check bearing and bearing set screws for tightness.

Check sheave alignment and belt tension. Hand turn fan to ensure fan wheel does not rub on housing. The fan shaft and motor shaft must turn freely before power is applied to the unit.

12. Check exhaust fan belts, sheaves, and bearings. Check the lubrication of the fan and motor bearings. Check bearing and bearing set screws for tightness. Check sheave alignment and belt tension. Hand turn fans to ensure fan wheels do not rub on housing.
13. Check economizer linkage. Economizer dampers should be fully closed. Linkage should permit full and free travel.
14. Check that the correct return air filters are installed in the filter tracks. Do not operate unit without return air filters.
15. Check that all access doors on the air handler section have been closed and secured.
16. Check rotation of outdoor fans during first start-up check. Fan rotation is clockwise as viewed from top of unit. Fan motors are 3-phase. If fan is not turning clockwise, reverse 2 of the power wires. For supply fan and exhaust fan, check rotation per label on fan housing.

25% Outdoor-Air Damper — On units without economizer, be sure 25% outdoor-air damper is set at the desired position. Also, be sure hood is installed properly.

Economizer Inlet Screens — Check that they are in place before operating the unit.

Economizer Dampers — With no power to the unit, the economizer outdoor-air dampers should be fully closed. Check by opening the access door marked FILTER SECTION. On units with economizer, be sure economizer minimum position is set at the desired setting. Be sure hood is installed properly.

Compressor Oil — Check that compressor oil is visible in the sight glass of the compressor. All units are factory charged with oil. Observe oil level closely at start-up. If oil level is below the sight glass and cannot be seen, add oil until the level is approximately as shown in Fig. 67. See Oil Charge section on page 62 for information on adding or removing oil.

If oil charge is above sight glass, do not remove any oil until the compressor crankcase heater has been on for at least 24 hours. When additional oil or a complete charge is needed, use only Carrier-approved compressor oil.

Do not reuse drained oil and do not use any oil that has been exposed to the atmosphere.

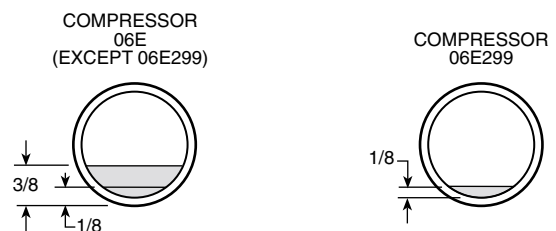


Fig. 67 — Operating Oil Levels (Sight Glass)

Gas Manifold Pressure — Check pressure to ensure it matches the pressure stamped on the valve body. See Gas Valve Adjustment section on page 64 for more details.

Evaporator-Fan Belts, Pulleys, and Sheaves — Belts, pulleys, and sheaves are factory installed. All pulleys are nonadjustable.

See Tables 1A and 1B for fan shaft center distance ranges and shaft sizes when making selections for field-supplied drives.

Factory-installed drives are fixed-speed and are non-adjustable. Refer to Tables 1A and 1B for factory-supplied wheel speeds and drive set data.

If different wheel speeds are required for an application, Carrier recommends that the installer contact the nearest Browning dealer. The Browning dealer can develop the required information for the fan drive set.

Observe the maximum wheel speed and unit airflow limits for the specific unit size and fan type.

See Tables 15-24 for supply fan performance. See Table 25 for component pressure drops.

Check rotation of wheel with arrow on the fan housing. Check fan speed with a strobe-type tachometer, or use this formula:

$$\text{Fan Rpm} = \frac{\text{motor rpm} \times \text{motor sheave pitch diameter (in.)}}{\text{fan sheave pitch diameter (in.)}}$$

(Obtain motor rpm from the fan motor nameplate and read sheave pitch diameters marked on the fan and motor sheaves.)

EXAMPLE:

Nameplate motor rpm 1750
Motor sheave pitch diameter (in.) 5.3
Fan sheave pitch diameter (in.) 16.1

$$\text{Fan Rpm} = \frac{1750 \times 5.3}{16.1} = 576 \text{ Rpm}$$

The maximum allowable fan speed for the supply air fan is 680 rpm. The maximum allowable fan speed for the power exhaust fan is 925 rpm.

Excessive fan speed may result in condensate carryover from the evaporator coil, fan motor overload, or wheel failure. See Table 26 for Cooling Airflow Operating Ranges. See Table 27 for Heating Airflow Operating Ranges.

Table 15 — Fan Performance — 48FJD,FKD,FPD078 Units (Low Heat)

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		0.2		0.4		0.6		0.8		1.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
078	14,000	231	2.78	260	3.48	288	4.24	313	5.05	338	5.89
	16,000	257	3.94	282	4.68	307	5.52	331	6.40	353	7.32
	18,000	284	5.42	305	6.20	328	7.10	350	8.05	371	9.05
	20,000	311	7.26	330	8.08	350	9.02	370	10.04	390	11.12
	22,000	339	9.50	355	10.35	373	11.34	392	12.42	410	13.56
	24,000	367	12.18	382	13.07	398	14.09	414	15.22	431	16.41
	26,000	396	15.33	409	16.26	423	17.32	438	18.49	454	19.73
	28,000	424	19.00	436	19.98	449	21.07	463	22.27	477	23.56
	30,000	453	23.23	464	24.24	476	25.37	488	26.61	501	27.95

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		1.2		1.4		1.6		1.8		2.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
078	14,000	361	6.77	384	7.67	405	8.61	426	9.57	446	10.56
	16,000	375	8.27	396	9.26	416	10.27	436	11.31	455	12.37
	18,000	391	10.08	411	11.14	429	12.22	448	13.33	466	14.47
	20,000	409	12.22	427	13.36	445	14.52	462	15.70	479	16.92
	22,000	428	14.73	445	15.95	462	17.19	478	18.45	495	19.74
	24,000	448	17.66	464	18.95	480	20.26	496	21.61	511	22.97
	26,000	469	21.05	485	22.40	500	23.79	515	25.21	529	26.64
	28,000	491	24.92	506	26.35	520	27.79	534	29.30	548	30.80
	30,000	515	29.35	528	30.82	542	32.34	555	33.91	568	35.50

LEGEND

Bhp — Brake Horsepower

 VAV units only

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. See Component Pressure Drop table before using Fan Performance tables.

3. Conversion — Bhp to kilowatts:

$$\text{Kilowatts} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Physical Data in Table 1A for motor efficiency.

Table 15 — Fan Performance — 48FJD,FKD,FPD078 Units (Low Heat (cont))

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		2.2		2.4		2.6		2.8		3.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
078	14,000	466	11.56	485	12.59	503	13.63	521	14.69	538	15.76
	16,000	473	13.45	491	14.56	509	15.69	526	16.83	543	17.99
	18,000	483	15.64	500	16.82	517	18.02	534	19.25	550	20.49
	20,000	496	18.16	512	19.41	528	20.69	544	22.00	559	23.31
	22,000	510	21.05	526	22.38	541	23.74	556	25.12	570	26.51
	24,000	526	24.36	541	25.76	555	27.20	569	28.65	583	30.12
	26,000	543	28.11	558	29.60	571	31.10	585	32.63	598	34.17
	28,000	562	32.35	575	33.91	588	35.50	601	37.10	614	38.73
	30,000	581	37.11	594	38.74	607	40.41	619	42.10	631	43.80

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		3.2		3.4		3.6		3.8		4.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
078	14,000	555	16.85	571	17.95	587	19.06	603	20.19	618	21.32
	16,000	559	19.17	575	20.37	591	21.57	606	22.79	621	24.02
	18,000	565	21.76	581	23.04	596	24.33	611	25.64	625	26.96
	20,000	574	24.64	589	26.01	603	27.40	618	28.79	632	30.19
	22,000	585	27.92	599	29.36	613	30.81	626	32.28	640	33.78
	24,000	597	31.61	611	33.12	624	34.65	637	36.19	650	37.75
	26,000	611	35.75	624	37.32	637	38.93	650	40.54	662	42.18
	28,000	627	40.36	639	42.03	652	43.70	664	45.40	676	47.10
	30,000	644	45.51	656	47.25	667	49.00	679	50.76	—	—

Table 16 — Fan Performance — 48FJD,FKD,FPD088 Units (Low Heat)

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		0.2		0.4		0.6		0.8		1.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
088	16,000	257	3.94	282	4.68	307	5.52	331	6.40	353	7.32
	18,000	284	5.42	305	6.20	328	7.10	350	8.05	371	9.05
	20,000	311	7.26	330	8.08	350	9.02	370	10.04	390	11.12
	22,000	339	9.50	355	10.35	373	11.34	392	12.42	410	13.56
	24,000	367	12.18	382	13.07	398	14.09	414	15.22	431	16.41
	26,000	396	15.33	409	16.26	423	17.32	438	18.49	454	19.73
	28,000	424	19.00	436	19.98	449	21.07	463	22.27	477	23.56
	30,000	453	23.23	464	24.24	476	25.37	488	26.61	501	27.95
	32,000	482	28.05	492	29.11	503	30.29	514	31.55	526	32.92
	34,000	511	33.51	520	34.62	530	35.83	541	37.13	552	38.54

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		1.2		1.4		1.6		1.8		2.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
088	16,000	375	8.27	396	9.26	416	10.27	436	11.31	455	12.37
	18,000	391	10.08	411	11.14	429	12.22	448	13.33	466	14.47
	20,000	409	12.22	427	13.36	445	14.52	462	15.70	479	16.92
	22,000	428	14.73	445	15.95	462	17.19	478	18.45	495	19.74
	24,000	448	17.66	464	18.95	480	20.26	496	21.61	511	22.97
	26,000	469	21.05	485	22.40	500	23.79	515	25.21	529	26.64
	28,000	491	24.92	506	26.35	520	27.79	534	29.30	548	30.80
	30,000	515	29.35	528	30.82	542	32.34	555	33.91	568	35.50
	32,000	539	34.37	551	35.89	564	37.46	576	39.08	589	40.75
	34,000	563	40.03	575	41.58	587	43.21	599	44.89	610	46.60

Table 16 — Fan Performance — 48FJD,FKD,FPD088 Units (Low Heat) (cont)

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		2.2		2.4		2.6		2.8		3.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
088	16,000	473	13.45	491	14.56	509	15.69	526	16.83	543	17.99
	18,000	483	15.64	500	16.82	517	18.02	534	19.25	550	20.49
	20,000	496	18.16	512	19.41	528	20.69	544	22.00	559	23.31
	22,000	510	21.05	526	22.38	541	23.74	556	25.12	570	26.51
	24,000	526	24.36	541	25.76	555	27.20	569	28.65	583	30.12
	26,000	543	28.11	558	29.60	571	31.10	585	32.63	598	34.17
	28,000	562	32.35	575	33.91	588	35.50	601	37.10	614	38.73
	30,000	581	37.11	594	38.74	607	40.41	619	42.10	631	43.80
	32,000	601	42.43	614	44.15	626	45.88	638	47.64	650	49.42
	34,000	622	48.36	634	50.14	646	51.95	657	53.78	669	55.64

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		3.2		3.4		3.6		3.8		4.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
088	16,000	559	19.17	575	20.36	591	21.57	606	22.79	621	24.02
	18,000	565	21.76	581	23.04	596	24.33	611	25.64	625	26.96
	20,000	574	24.64	589	26.01	603	27.40	618	28.79	632	30.19
	22,000	585	27.92	599	29.36	613	30.81	626	32.28	640	33.78
	24,000	597	31.61	611	33.12	624	34.65	637	36.19	650	37.75
	26,000	611	35.75	624	37.32	637	38.93	650	40.54	662	42.18
	28,000	627	40.36	639	42.03	652	43.70	664	45.40	676	47.10
	30,000	644	45.51	656	47.25	667	49.00	679	50.76	—	—
	32,000	661	51.22	673	53.03	—	—	—	—	—	—
	34,000	680	57.51	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower
 VAV units only

3. Conversion — Bhp to kilowatts:

$$\text{Kilowatts} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Physical Data in Table 1A for motor efficiency.

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. See Component Pressure Drop table before using Fan Performance tables.

Table 17 — Fan Performance — 48FJD,FKD,FPD104 Units (Low Heat)

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		0.2		0.4		0.6		0.8		1.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
104	20,000	311	7.26	330	8.08	350	9.02	370	10.04	390	11.12
	22,000	339	9.50	355	10.35	373	11.34	392	12.42	410	13.56
	24,000	367	12.18	382	13.07	398	14.09	414	15.22	431	16.41
	26,000	396	15.33	409	16.26	423	17.32	438	18.49	454	19.73
	28,000	424	19.00	436	19.98	449	21.07	463	22.27	477	23.56
	30,000	453	23.23	464	24.24	476	25.37	488	26.61	501	27.95
	32,000	482	28.05	492	29.11	503	30.29	514	31.55	526	32.92
	34,000	511	33.51	520	34.62	530	35.83	541	37.13	552	38.54
	36,000	540	39.65	549	40.80	558	42.04	568	43.39	578	44.83
	38,000	569	46.50	577	47.69	586	48.99	595	50.36	604	51.85
	40,000	598	54.09	606	55.35	614	56.69	622	58.11	631	59.61

Table 17 — Fan Performance — 48FJD,FKD,FPD104 Units (Low Heat) (cont)

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		1.2		1.4		1.6		1.8		2.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
104	20,000	409	12.22	427	13.36	445	14.52	462	15.70	479	16.92
	22,000	428	14.73	445	15.95	462	17.19	478	18.45	495	19.74
	24,000	448	17.66	464	18.95	480	20.26	496	21.61	511	22.97
	26,000	469	21.05	485	22.40	500	23.79	515	25.21	529	26.64
	28,000	491	24.92	506	26.35	520	27.79	534	29.30	548	30.80
	30,000	515	29.35	528	30.82	542	32.34	555	33.91	568	35.50
	32,000	539	34.37	551	35.89	564	37.46	576	39.08	589	40.75
	34,000	563	40.03	575	41.58	587	43.21	599	44.89	610	46.60
	36,000	588	46.35	599	47.96	610	49.63	622	51.34	633	53.11
	38,000	614	53.41	624	55.04	635	56.75	645	58.52	656	60.34
	40,000	640	61.21	650	62.89	660	64.63	—	—	—	—

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		2.2		2.4		2.6		2.8		3.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
104	20,000	496	18.16	512	19.41	528	20.69	544	22.00	559	23.32
	22,000	510	21.05	526	22.38	541	23.74	556	25.12	570	26.51
	24,000	526	24.36	541	25.76	555	27.20	569	28.65	583	30.12
	26,000	543	28.11	558	29.60	571	31.10	585	32.63	598	34.17
	28,000	562	32.35	575	33.91	588	35.50	601	37.10	614	38.73
	30,000	581	37.11	594	38.74	607	40.41	619	42.10	631	43.80
	32,000	601	42.43	614	44.15	626	45.88	638	47.64	650	49.42
	34,000	622	48.36	634	50.14	646	51.95	657	53.78	669	55.64
	36,000	644	54.93	655	56.79	666	58.66	677	60.56	—	—
	38,000	666	62.20	677	64.10	—	—	—	—	—	—
	40,000	—	—	—	—	—	—	—	—	—	—

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		3.2		3.4		3.6		3.8		4.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
104	20,000	574	24.65	589	26.01	603	27.40	618	28.79	632	30.19
	22,000	585	27.92	599	29.36	613	30.81	626	32.28	640	33.78
	24,000	597	31.61	611	33.12	624	34.65	637	36.19	650	37.75
	26,000	611	35.75	624	37.32	637	38.93	650	40.54	662	42.18
	28,000	627	40.36	639	42.03	652	43.70	664	45.40	676	47.10
	30,000	644	45.51	656	47.25	667	49.00	679	50.76	—	—
	32,000	661	51.22	673	53.03	—	—	—	—	—	—
	34,000	680	57.51	—	—	—	—	—	—	—	—
	36,000	—	—	—	—	—	—	—	—	—	—
	38,000	—	—	—	—	—	—	—	—	—	—
	40,000	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

 VAV units only

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. See Component Pressure Drop table before using Fan Performance tables.

3. Conversion — Bhp to kilowatts:

$$\text{Kilowatts} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Physical Data in Table 1A for motor efficiency.

Table 18 — Fan Performance — 48FJE,FKE,FPE078 Units (High Heat)

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		0.2		0.4		0.6		0.8		1.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
078	14,000	247	3.16	276	3.90	302	4.68	328	5.52	352	6.40
	16,000	275	4.47	300	5.29	324	6.16	347	7.07	369	8.02
	18,000	303	6.12	326	7.03	348	7.98	369	8.97	389	10.00
	20,000	332	8.17	353	9.16	373	10.20	392	11.27	411	12.37
	22,000	361	10.65	380	11.73	399	12.85	417	14.00	434	15.19
	24,000	390	13.60	408	14.77	425	15.98	442	17.21	458	18.48
	26,000	420	17.08	436	18.34	452	19.63	468	20.95	484	22.30
	28,000	450	21.12	465	22.46	480	23.85	495	25.25	509	26.69
	30,000	480	25.75	494	27.20	508	28.66	522	30.17	536	31.68

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		1.2		1.4		1.6		1.8		2.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
078	14,000	375	7.32	397	8.26	419	9.24	440	10.23	460	11.24
	16,000	391	9.02	412	10.04	432	11.10	451	12.18	470	13.28
	18,000	409	11.07	429	12.17	447	13.30	466	14.47	484	15.65
	20,000	430	13.52	448	14.70	465	15.90	482	17.14	499	18.41
	22,000	451	16.41	468	17.66	485	18.94	501	20.25	517	21.60
	24,000	475	19.79	490	21.11	506	22.48	521	23.85	536	25.27
	26,000	499	23.68	513	25.09	528	26.53	542	28.00	556	29.49
	28,000	524	28.15	538	29.64	551	31.16	565	32.70	578	34.27
	30,000	549	33.24	562	34.80	576	36.41	588	38.02	601	39.67

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		2.2		2.4		2.6		2.8		3.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
078	14,000	479	12.27	497	13.31	516	14.37	533	15.45	550	16.53
	16,000	489	14.41	507	15.55	524	16.71	541	17.88	558	19.07
	18,000	501	16.86	518	18.10	535	19.35	551	20.62	567	21.90
	20,000	516	19.70	532	21.01	548	22.35	563	23.70	578	25.07
	22,000	532	22.96	548	24.36	563	25.77	577	27.21	592	28.67
	24,000	551	26.72	565	28.19	579	29.67	593	31.19	607	32.73
	26,000	570	31.00	584	32.54	598	34.12	611	35.70	624	37.31
	28,000	591	35.86	604	37.48	617	39.12	630	40.79	643	42.48
	30,000	614	41.34	626	43.03	638	44.76	650	46.49	662	48.26

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		3.2		3.4		3.6		3.8		4.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
078	14,000	567	17.63	583	18.74	599	19.86	614	20.99	629	22.13
	16,000	574	20.27	590	21.49	605	22.71	620	23.95	635	25.19
	18,000	583	23.20	598	24.51	613	25.83	628	27.17	642	28.52
	20,000	593	26.46	608	27.87	623	29.30	637	30.73	651	32.18
	22,000	606	30.14	620	31.63	634	33.15	648	34.67	661	36.22
	24,000	621	34.29	634	35.86	648	37.46	661	39.06	674	40.69
	26,000	637	38.95	650	40.61	663	42.28	675	43.97	—	—
	28,000	655	44.18	667	45.91	680	47.67	—	—	—	—
	30,000	674	50.03	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

 VAV units only

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. See Component Pressure Drop table before using Fan Performance tables.

3. Conversion — Bhp to kilowatts:

$$\text{Kilowatts} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Physical Data in Table 1A for motor efficiency.

Table 19 — Fan Performance — 48FJE,FKE,FPE088 Units (High Heat)

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		0.2		0.4		0.6		0.8		1.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
088	16,000	275	4.47	300	5.29	324	6.16	347	7.07	369	8.02
	18,000	303	6.12	326	7.03	348	7.98	369	8.97	389	10.00
	20,000	332	8.17	353	9.16	373	10.20	392	11.27	411	12.37
	22,000	361	10.65	380	11.73	399	12.85	417	14.00	434	15.19
	24,000	390	13.60	408	14.77	425	15.98	442	17.21	458	18.48
	26,000	420	17.08	436	18.34	452	19.63	468	20.95	484	22.30
	28,000	450	21.12	465	22.46	480	23.85	495	25.25	509	26.69
	30,000	480	25.75	494	27.20	508	28.66	522	30.17	536	31.68
	32,000	510	31.06	523	32.59	537	34.14	550	35.72	563	37.33
	34,000	540	37.06	553	38.66	565	40.31	578	41.97	590	43.67

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		1.2		1.4		1.6		1.8		2.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
088	16,000	391	9.02	412	10.04	432	11.10	451	12.18	470	13.28
	18,000	409	11.07	429	12.17	447	13.30	466	14.47	484	15.65
	20,000	430	13.52	448	14.70	465	15.90	482	17.14	499	18.41
	22,000	451	16.41	468	17.66	485	18.94	501	20.25	517	21.60
	24,000	475	19.79	490	21.11	506	22.48	521	23.85	536	25.27
	26,000	499	23.68	513	25.09	528	26.53	542	28.00	556	29.49
	28,000	524	28.15	538	29.64	551	31.16	565	32.70	578	34.27
	30,000	549	33.24	562	34.80	576	36.41	588	38.02	601	39.67
	32,000	575	38.97	588	40.63	600	42.29	613	44.01	625	45.74
	34,000	602	45.39	614	47.13	626	48.89	638	50.68	649	52.49

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		2.2		2.4		2.6		2.8		3.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
088	16,000	489	14.41	507	15.55	524	16.71	541	17.88	558	19.07
	18,000	501	16.86	518	18.10	535	19.35	551	20.62	567	21.90
	20,000	516	19.70	532	21.01	548	22.35	563	23.70	578	25.07
	22,000	532	22.96	548	24.36	563	25.77	577	27.21	592	28.67
	24,000	551	26.72	565	28.19	579	29.67	593	31.19	607	32.73
	26,000	570	31.00	584	32.54	598	34.12	611	35.70	624	37.31
	28,000	591	35.86	604	37.48	617	39.12	630	40.79	643	42.48
	30,000	614	41.34	626	43.03	638	44.76	650	46.49	662	48.26
	32,000	637	47.48	648	49.25	660	51.05	672	52.85	—	—
	34,000	660	54.31	672	56.17	—	—	—	—	—	—

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		3.2		3.4		3.6		3.8		4.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
088	16,000	574	20.27	590	21.49	605	22.71	620	23.94	635	25.19
	18,000	583	23.20	598	24.51	613	25.83	628	27.17	642	28.52
	20,000	593	26.46	608	27.87	623	29.30	637	30.73	651	32.18
	22,000	606	30.14	620	31.63	634	33.15	648	34.67	661	36.22
	24,000	621	34.29	634	35.86	648	37.46	661	39.06	674	40.69
	26,000	637	38.95	650	40.61	663	42.28	675	43.97	—	—
	28,000	655	44.18	667	45.91	680	47.67	—	—	—	—
	30,000	674	50.03	—	—	—	—	—	—	—	—
	32,000	—	—	—	—	—	—	—	—	—	—
	34,000	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

 VAV units only

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. See Component Pressure Drop table before using Fan Performance tables.

3. Conversion — Bhp to kilowatts:

$$\text{Kilowatts} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Physical Data in Table 1A for motor efficiency.

Table 20 — Fan Performance — 48FJE,FKE,FPE104 Units (High Heat)

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		0.2		0.4		0.6		0.8		1.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
104	20,000	332	8.17	353	9.16	373	10.20	392	11.27	411	12.37
	22,000	361	10.65	380	11.73	399	12.85	417	14.00	434	15.19
	24,000	390	13.60	408	14.77	425	15.98	442	17.21	458	18.48
	26,000	420	17.08	436	18.34	452	19.63	468	20.95	484	22.30
	28,000	450	21.12	465	22.46	480	23.85	495	25.25	509	26.69
	30,000	480	25.75	494	27.20	508	28.66	522	30.17	536	31.68
	32,000	510	31.06	523	32.59	537	34.14	550	35.72	563	37.33
	34,000	540	37.06	553	38.66	565	40.31	578	41.97	590	43.67
	36,000	570	43.78	582	45.47	594	47.20	606	48.96	618	50.75

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		1.2		1.4		1.6		1.8		2.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
104	20,000	430	13.52	448	14.70	465	15.89	482	17.14	499	18.41
	22,000	451	16.41	468	17.66	485	18.94	501	20.25	517	21.60
	24,000	475	19.79	490	21.11	506	22.48	521	23.85	536	25.27
	26,000	499	23.68	513	25.09	528	26.53	542	28.00	556	29.49
	28,000	524	28.15	538	29.64	551	31.16	565	32.70	578	34.27
	30,000	549	33.24	562	34.80	576	36.41	588	38.02	601	39.67
	32,000	575	38.97	588	40.63	600	42.29	613	44.01	625	45.74
	34,000	602	45.39	614	47.13	626	48.89	638	50.68	649	52.49
	36,000	629	52.55	641	54.38	652	56.24	663	58.10	674	59.99

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		2.2		2.4		2.6		2.8		3.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
104	20,000	516	19.70	532	21.01	548	22.35	563	23.70	578	25.07
	22,000	532	22.96	548	24.36	563	25.77	577	27.21	592	28.67
	24,000	551	26.72	565	28.19	579	29.67	593	31.19	607	32.73
	26,000	570	31.00	584	32.54	598	34.12	611	35.70	624	37.31
	28,000	591	35.86	604	37.48	617	39.12	630	40.79	643	42.48
	30,000	614	41.34	626	43.03	638	44.76	650	46.49	662	48.26
	32,000	637	47.48	648	49.25	660	51.05	672	52.85	—	—
	34,000	660	54.31	672	56.17	—	—	—	—	—	—
	36,000	—	—	—	—	—	—	—	—	—	—

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		3.2		3.4		3.6		3.8		4.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
104	20,000	593	26.46	608	27.87	623	29.30	637	30.73	651	32.18
	22,000	606	30.14	620	31.63	634	33.15	648	34.67	661	36.22
	24,000	621	34.29	634	35.86	648	37.46	661	39.06	674	40.69
	26,000	637	38.95	650	40.61	663	42.28	675	43.97	—	—
	28,000	655	44.18	667	45.91	680	47.67	—	—	—	—
	30,000	674	50.03	—	—	—	—	—	—	—	—
	32,000	—	—	—	—	—	—	—	—	—	—
	34,000	—	—	—	—	—	—	—	—	—	—
	36,000	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

 VAV units only

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. See Component Pressure Drop table before using Fan Performance tables.

3. Conversion — Bhp to kilowatts:

$$\text{Kilowatts} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Physical Data in Table 1A for motor efficiency.

Table 21 — Fan Performance — 50FB,FJX,FJY,FKX,FKY,FPX,FPY,FW,FY078 Units

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		0.2		0.4		0.6		0.8		1.0	
		Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
078	14,000	211	2.35	243	3.06	272	3.80	299	4.59	325	5.43
	16,000	232	3.27	261	4.06	288	4.88	313	5.74	337	6.65
	18,000	253	4.42	281	5.31	305	6.21	329	7.14	351	8.11
	20,000	275	5.83	301	6.82	324	7.81	346	8.82	366	9.86
	22,000	298	7.53	321	8.62	343	9.70	364	10.80	383	11.92
	24,000	320	9.55	342	10.75	363	11.93	383	13.11	401	14.31
	26,000	343	11.91	364	13.22	384	14.50	402	15.78	420	17.07
	28,000	367	14.65	386	16.06	405	17.45	422	18.83	439	20.20
	30,000	390	17.78	408	19.31	426	20.80	443	22.28	459	23.75

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		1.2		1.4		1.6		1.8		2.0	
		Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
078	14,000	349	6.30	372	7.21	395	8.15	416	9.12	437	10.10
	16,000	360	7.59	381	8.57	402	9.58	423	10.62	442	11.68
	18,000	372	9.12	393	10.17	413	11.25	432	12.36	450	13.50
	20,000	386	10.94	406	12.05	425	13.20	443	14.38	460	15.58
	22,000	402	13.07	420	14.25	438	15.46	455	16.70	472	17.98
	24,000	419	15.54	436	16.79	453	18.07	470	19.38	486	20.72
	26,000	437	18.37	453	19.70	469	21.05	485	22.43	500	23.83
	28,000	455	21.59	471	23.00	486	24.43	501	25.89	516	27.36
	30,000	474	25.24	489	26.73	504	28.24	518	29.76	533	31.32

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		2.2		2.4		2.6		2.8		3.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
078	14,000	457	11.10	476	12.13	495	13.17	513	14.22	531	15.29
	16,000	462	12.77	480	13.88	498	15.00	516	16.15	533	17.31
	18,000	469	14.66	486	15.84	504	17.05	521	18.27	537	19.53
	20,000	478	16.82	495	18.07	511	19.35	527	20.65	543	21.98
	22,000	489	19.28	505	20.60	521	21.96	536	23.33	551	24.72
	24,000	501	22.08	517	23.48	532	24.89	547	26.34	561	27.80
	26,000	515	25.27	530	26.73	544	28.22	559	29.72	573	31.26
	28,000	530	28.86	544	30.38	558	31.94	572	33.51	585	35.11
	30,000	546	32.89	560	34.48	573	36.10	586	37.74	599	39.41

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		3.2		3.4		3.6		3.8		4.0	
		Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp	Rpm	Hp
078	14,000	548	16.38	564	17.47	581	18.58	596	19.71	612	20.84
	16,000	550	18.48	566	19.68	582	20.88	597	22.10	613	23.33
	18,000	553	20.78	569	22.06	585	23.36	600	24.66	615	25.99
	20,000	559	23.32	574	24.68	589	26.06	604	27.45	618	28.85
	22,000	566	26.14	581	27.57	596	29.04	610	30.51	624	31.99
	24,000	576	29.29	590	30.80	604	32.33	617	33.88	631	35.44
	26,000	586	32.81	600	34.39	613	35.99	627	37.61	640	39.24
	28,000	599	36.74	612	38.38	624	40.05	637	41.74	650	43.44
	30,000	612	41.11	624	42.81	637	44.54	649	46.29	661	48.06

LEGEND

Bhp — Brake Horsepower

 VAV units only

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. See Component Pressure Drop table before using Fan Performance tables.

3. Conversion — Bhp to kilowatts:

$$\text{Kilowatts} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Physical Data in Table 1B for motor efficiency.

Table 22 — Fan Performance — 50FB,FJX,FJY,FKX,FKY,FPX,FPY,FW,FY088 Units

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		0.2		0.4		0.6		0.8		1.0	
		Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
088	16,000	232	3.27	261	4.06	288	4.88	313	5.74	337	6.65
	18,000	253	4.42	281	5.31	305	6.21	329	7.14	351	8.11
	20,000	275	5.83	301	6.82	324	7.81	346	8.82	366	9.86
	22,000	298	7.53	321	8.62	343	9.70	364	10.80	383	11.92
	24,000	320	9.55	342	10.75	363	11.93	383	13.11	401	14.31
	26,000	343	11.91	364	13.22	384	14.50	402	15.78	420	17.07
	28,000	367	14.65	386	16.06	405	17.45	422	18.83	439	20.20
	30,000	390	17.78	408	19.31	426	20.80	443	22.28	459	23.75
	32,000	414	21.36	431	22.99	448	24.59	464	26.17	479	27.75
	34,000	437	25.39	454	27.13	470	28.84	485	30.53	500	32.20

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		1.2		1.4		1.6		1.8		2.0	
		Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
088	16,000	360	7.59	381	8.57	402	9.58	423	10.62	442	11.68
	18,000	372	9.12	393	10.17	413	11.25	432	12.36	450	13.50
	20,000	386	10.94	406	12.05	425	13.20	443	14.38	460	15.58
	22,000	402	13.07	420	14.25	438	15.46	455	16.70	472	17.98
	24,000	419	15.54	436	16.79	453	18.07	470	19.38	486	20.72
	26,000	437	18.37	453	19.70	469	21.05	485	22.43	500	23.83
	28,000	455	21.59	471	23.00	486	24.43	501	25.89	516	27.36
	30,000	474	25.24	489	26.73	504	28.24	518	29.76	533	31.32
	32,000	494	29.32	508	30.90	523	32.49	536	34.11	550	35.73
	34,000	514	33.87	528	35.55	542	37.23	555	38.92	568	40.63

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		2.2		2.4		2.6		2.8		3.0	
		Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
088	16,000	462	12.77	480	13.88	498	15.00	516	16.15	533	17.31
	18,000	469	14.66	486	15.84	504	17.05	521	18.27	537	19.53
	20,000	478	16.82	495	18.07	511	19.35	527	20.65	543	21.98
	22,000	489	19.28	505	20.60	521	21.96	536	23.33	551	24.72
	24,000	501	22.08	517	23.48	532	24.89	547	26.34	561	27.80
	26,000	515	25.27	530	26.73	544	28.22	559	29.72	573	31.26
	28,000	530	28.86	544	30.38	558	31.94	572	33.51	585	35.11
	30,000	546	32.89	560	34.48	573	36.10	586	37.74	599	39.41
	32,000	563	37.38	576	39.04	589	40.73	601	42.45	614	44.18
	34,000	581	42.36	593	44.10	605	45.87	618	47.64	630	49.45

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		3.2		3.4		3.6		3.8		4.0	
		Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
088	16,000	550	18.48	566	19.68	582	20.88	597	22.10	613	23.33
	18,000	553	20.78	569	22.06	585	23.36	600	24.66	615	25.99
	20,000	559	23.32	574	24.68	589	26.06	604	27.45	618	28.85
	22,000	566	26.14	581	27.57	596	29.04	610	30.51	624	31.99
	24,000	576	29.29	590	30.80	604	32.33	617	33.88	631	35.44
	26,000	586	32.81	600	34.39	613	35.99	627	37.61	640	39.24
	28,000	599	36.74	612	38.38	624	40.05	637	41.74	650	43.44
	30,000	612	41.11	624	42.81	637	44.54	649	46.29	661	48.06
	32,000	626	45.94	638	47.72	650	49.51	662	51.33	674	53.17
	34,000	641	51.27	653	53.12	665	54.98	676	56.87	—	—

LEGEND

Bhp — Brake Horsepower

 VAV units only

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. See Component Pressure Drop table before using Fan Performance tables.

3. Conversion — Bhp to kilowatts:

$$\text{Kilowatts} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Physical Data in Table 1B for motor efficiency.

Table 23 — Fan Performance — 50FB,FJX,FJY,FKX,FKY,FPX,FPY,FW,FY104 Units

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		0.2		0.4		0.6		0.8		1.0	
		Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
104	20,000	275	5.83	301	6.82	324	7.81	346	8.82	366	9.86
	22,000	298	7.53	321	8.62	343	9.70	364	10.80	383	11.92
	24,000	320	9.55	342	10.75	363	11.93	383	13.11	401	14.31
	26,000	343	11.91	364	13.22	384	14.50	402	15.78	420	17.07
	28,000	367	14.65	386	16.06	405	17.45	422	18.83	439	20.20
	30,000	390	17.78	408	19.31	426	20.80	443	22.28	459	23.75
	32,000	414	21.36	431	22.99	448	24.59	464	26.17	479	27.75
	34,000	437	25.39	454	27.13	470	28.84	485	30.53	500	32.20
	36,000	461	29.92	477	31.77	492	33.58	506	35.38	521	37.16
	38,000	485	34.96	500	36.91	514	38.85	528	40.74	542	42.63
	40,000	509	40.54	523	42.61	537	44.65	550	46.66	563	48.64

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		1.2		1.4		1.6		1.8		2.0	
		Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
104	20,000	386	10.94	406	12.05	425	13.20	443	14.38	460	15.58
	22,000	402	13.07	420	14.25	438	15.46	455	16.70	472	17.98
	24,000	419	15.54	436	16.79	453	18.07	470	19.38	486	20.72
	26,000	437	18.37	453	19.70	469	21.05	485	22.43	500	23.83
	28,000	455	21.59	471	23.00	486	24.43	501	25.89	516	27.36
	30,000	474	25.24	489	26.73	504	28.24	518	29.76	533	31.32
	32,000	494	29.32	508	30.90	523	32.49	536	34.11	550	35.73
	34,000	514	33.87	528	35.55	542	37.23	555	38.92	568	40.63
	36,000	534	38.93	548	40.69	561	42.47	574	44.25	586	46.03
	38,000	555	44.50	568	46.36	581	48.23	593	50.10	605	51.98
	40,000	576	50.62	589	52.59	601	54.56	613	56.52	625	58.49

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		2.2		2.4		2.6		2.8		3.0	
		Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
104	20,000	478	16.82	495	18.07	511	19.35	527	20.65	543	21.98
	22,000	489	19.28	505	20.60	521	21.96	536	23.33	551	24.72
	24,000	501	22.08	517	23.48	532	24.89	547	26.34	561	27.80
	26,000	515	25.27	530	26.73	544	28.22	559	29.72	573	31.26
	28,000	530	28.86	544	30.38	558	31.94	572	33.51	585	35.11
	30,000	546	32.89	560	34.48	573	36.10	586	37.74	599	39.41
	32,000	563	37.38	576	39.04	589	40.73	601	42.45	614	44.18
	34,000	581	42.36	593	44.10	605	45.87	618	47.64	630	49.45
	36,000	599	47.85	611	49.67	623	51.51	634	53.37	646	55.25
	38,000	617	53.87	629	55.77	640	57.71	652	59.63	663	61.59
	40,000	636	60.48	648	62.46	659	64.47	—	—	—	—

UNIT SIZE	AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
		3.2		3.4		3.6		3.8		4.0	
		Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
104	20,000	559	23.32	574	24.68	589	26.06	604	27.45	618	28.86
	22,000	566	26.14	581	27.57	596	29.04	610	30.51	624	31.99
	24,000	576	29.29	590	30.80	604	32.33	617	33.88	631	35.44
	26,000	586	32.81	600	34.39	613	35.99	627	37.61	640	39.24
	28,000	599	36.74	612	38.38	624	40.05	637	41.74	650	43.44
	30,000	612	41.11	624	42.81	637	44.54	649	46.29	661	48.06
	32,000	626	45.94	638	47.72	650	49.51	662	51.33	674	53.17
	34,000	641	51.27	653	53.12	665	54.98	676	56.87	—	—
	36,000	657	57.14	669	59.06	680	60.98	—	—	—	—
	38,000	674	63.54	—	—	—	—	—	—	—	—
	40,000	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

 VAV units only

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. See Component Pressure Drop table before using Fan Performance tables.

3. Conversion — Bhp to kilowatts:

$$\text{Kilowatts} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Physical Data in Table 1B for motor efficiency.

Table 24 — Fan Performance — Power Exhaust*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
16,000	610	5.7	640	6.3	675	7.0	710	7.6	750	8.5	780	9.2	810	9.7	840	10.5	875	11.3	910	12.3
18,000	680	8.3	720	9.2	740	9.7	770	10.2	800	11.0	830	11.6	860	12.3	880	13.3	—	—	—	—
20,000	750	11.4	780	12.2	810	12.7	830	13.4	860	14.0	880	14.7	920	15.6	—	—	—	—	—	—
22,000	820	14.6	850	15.5	870	16.5	900	17.2	925	17.6	—	—	—	—	—	—	—	—	—	—
24,000	890	18.8	915	19.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

*Power exhaust available on vertical return units only.

Table 25 — Component Pressure Drops (in. wg)

COMPONENT	CFM											
	15,000	18,000	20,000	22,000	24,000	26,000	28,000	30,000	34,000	36,000	38,000	40,000
ECONOMIZER	0.09	0.12	0.14	0.16	0.19	0.21	0.24	0.26	0.31	0.34	0.37	0.40
INLET GUIDE VANES*	0.04	0.05	0.06	0.08	0.10	0.11	0.13	0.15	0.20	0.22	0.24	0.27
POWER EXHAUST	0.09	0.13	0.15	0.18	0.22	0.26	0.30	0.34	0.44	0.49	0.55	0.61

*Available on variable air volume units only.

†Available on vertical return units only.

Table 26 — Cooling Airflow Operating Range

UNIT	SIZE	MINIMUM CFM	MAXIMUM CFM	MINIMUM L/s	MAXIMUM L/s
48FK and 50FKX,FKY,FY	078	15,000	30,000	7,080	14,160
	088	17,000	34,000	8,030	16,050
	104	20,000	40,000	9,440	18,890
48FJ AND 50FJX,FJY,FW	078	21,000	30,000	9,910	14,160
	088	26,000	34,000	12,270	16,050
	104	30,000	40,000	14,160	18,875
48FP and 50FB,FPX,FPY	078	15,000	30,000	7,080	14,160
	088	17,000	34,000	8,030	16,050
	104	20,000	40,000	9,440	18,890

Table 27 — Heating Airflow Operating Range

UNIT	SIZE	MINIMUM CFM	MAXIMUM CFM*	MINIMUM L/s	MAXIMUM L/s*
48FJ	078	21,000	30,000/30,000	9,910	14,160/14,160
	088	26,000	34,000/34,000	12,270	16,050/16,050
	104	30,000	40,000/37,000	14,150	18,880/17,460
48FK,FP	078	15,000	30,000/30,000	7,080	14,160/14,160
	088	17,000	34,000/34,000	8,020	16,050/16,050
	104	20,000	40,000/37,000	9,440	18,880/17,460

*Low Heat/High Heat.

Manual Outdoor-Air Inlet Adjustments

MANUAL OUTDOOR-AIR DAMPER (Units Without Economizer Option) — All units except those equipped with a factory-installed economizer have a manual outdoor-air damper to provide ventilation air. This damper can be preset to admit up to 25% outdoor air into the return-air compartment. To adjust, loosen the blade limiter screws as shown in Fig. 68 and move the damper to the desired position. Then retighten the blade limiter screws to secure the damper. See Fig. 68. (To make this adjustment, it is necessary to remove the screens covering the hood opening and make adjustments from inside the hood.)

Economizer Settings

NOTE: The following text applies to CV units only (48FJ and 50FJX,FJY,FW). For economizer operation on VAV and PIC units, refer to the appropriate Controls and Troubleshooting literature.

ENTHALPY SENSOR (See Fig. 69) — This sensor is located behind the filters in the end, upper economizer hood. See Fig. 70. For maximum benefit of outdoor air, set enthalpy sensor control to the A setting. At this setting, when the relative humidity is 50%, and the outdoor air is below 74 F, the sensor's relay contacts will be closed. See Fig. 71 and 72.

NOTE: Enthalpy control setting dial is on the economizer motor.

MIXED-AIR THERMISTOR (MAT) — This control set point adjustment is on the top of the economizer motor. This motor is located in the return-air filter section, and is accessed by opening the access panel marked FILTER SECTION. See Fig. 73. Set MAT set point adjustment dial to the desired setting. The factory setting is 55 F $\pm$ 5 F (12.8 C $\pm$ 3 C); range is 40 to 90 F (4 to 32 C). The MAT is located on the filter rack.

DAMPER VENT POSITION — The position setting adjustment is located on the cover of the economizer motor. See Fig. 73. Adjust by setting the fan switch at ON position (continuous fan operation), and setting the system selector switch to OFF position. Then turn adjustment screw slowly until the dampers assume the desired vent position. Do not manually operate the damper motor; damage to the motor may result.

ECONOMIZER DAMPER LINKAGE ADJUSTMENT — When replacing economizer damper motors, or if the linkage has come loose, it is critical that the linkages be adjusted correctly. They are sensitive, and incorrect adjustment can cause the motor to stall.

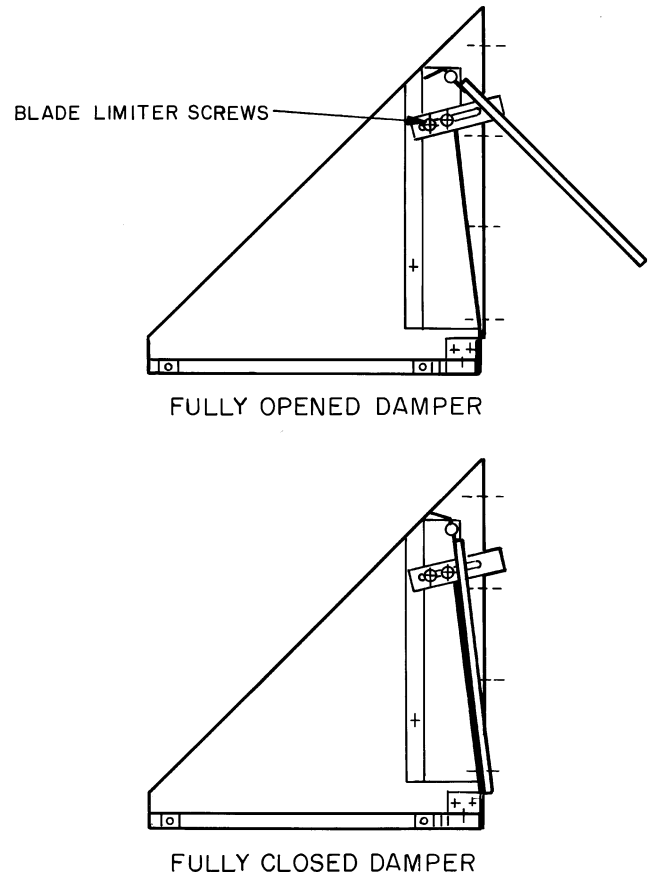


Fig. 68 — Outdoor-Air Damper Adjustments (Inside of Hood Shown)

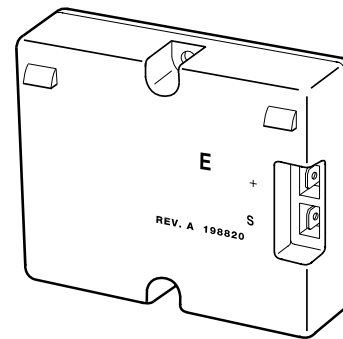


Fig. 69 — Enthalpy Sensor

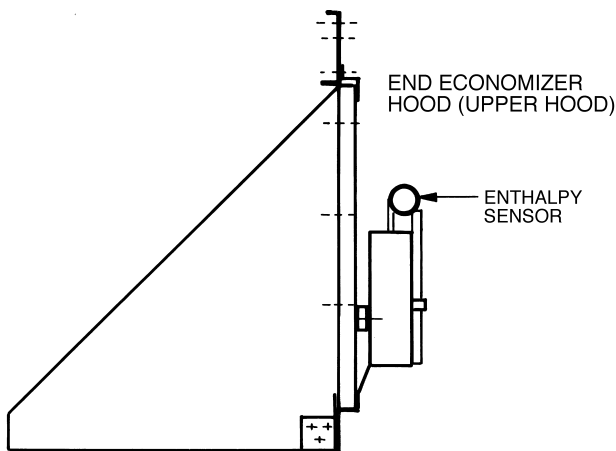
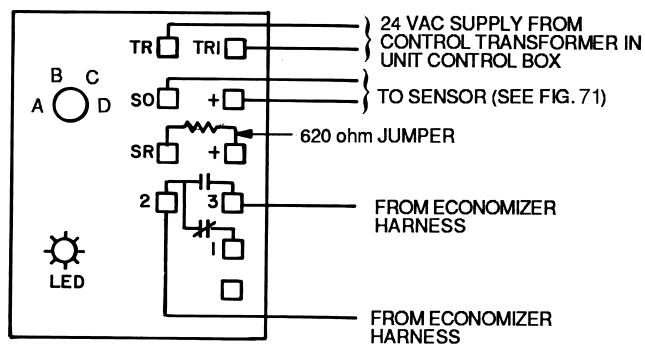


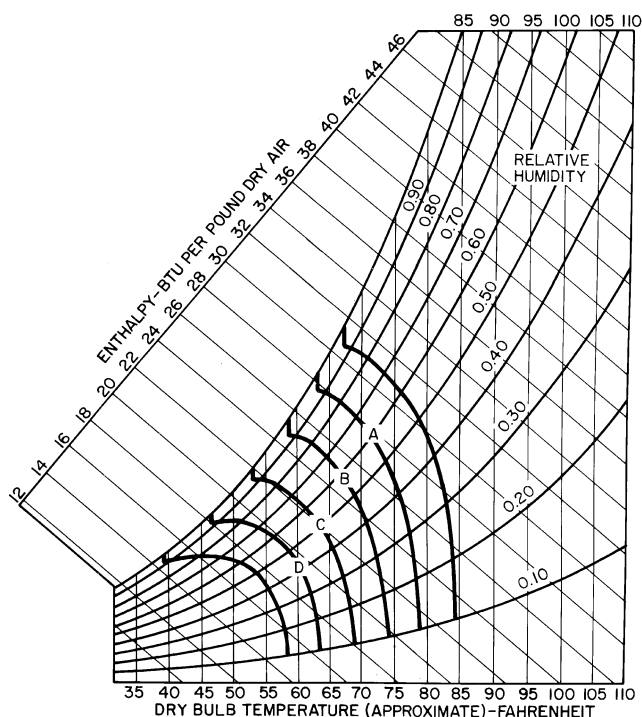
Fig. 70 — Enthalpy Sensor Location



NOTES:

1. Switches shown in high enthalpy state. Terminals 2 and 3 close on enthalpy decrease.
2. When standard economizer is used with accessory differential enthalpy sensor, set enthalpy control to "D" setting.

Fig. 72 — Wiring Connections for Solid-State Enthalpy Sensor (HH57AC077)



CONTROL CURVE	CONTROL POINT (approx Deg) AT 50% RH
A	73
B	68
C	63
D	58

LEGEND

RH — Relative Humidity

Fig. 71 — Psychrometric Chart for Enthalpy Control

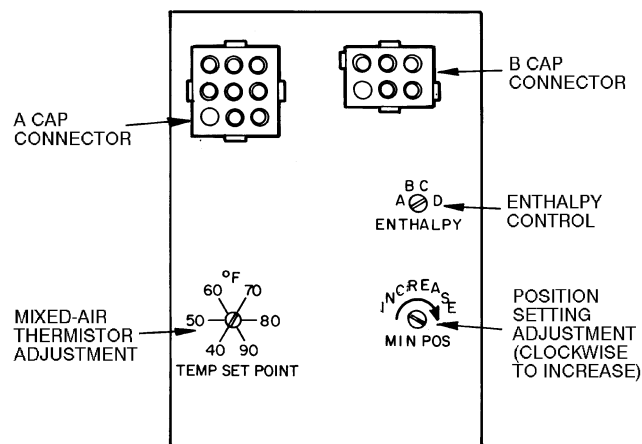


Fig. 73 — Mixed-Air Thermistor and Economizer Position Setting Adjustments (Top of Economizer Motor)

START-UP

For 48FJ and 50FJX,FJY,FW (constant volume) units, complete the Initial Check and Start-Up sections in this book.

For 48FK and 50FKX,FKY,FY (variable air volume) units, refer to the separate Controls and Troubleshooting provided with the unit for start-up and controls information.

For 48FP and 50FB,FPX,FPY (PIC) units, refer to the separate Controls and Troubleshooting provided with the unit for start-up and controls information.

Initial Check (Constant Volume Units)

IMPORTANT: Do not attempt to start unit, even momentarily, until all items on the Start-Up Checklist and the following steps have been completed.

1. Verify unit has been installed per the Installation section of this literature.
2. Certify that all auxiliary components (thermostats, sensors, controls, etc.) have been installed and wired to the control boxes per these instructions and the unit wiring label diagrams.
3. Verify that static pressure hoses (if applicable) are properly attached, routed, and free from pinches or crimps that may affect proper control operation.
4. Set any control configurations that are required (field-installed accessories, etc.).
5. Enter unit set points (if applicable).
6. Enter occupancy schedules (if applicable).
7. Verify that control time periods programmed meet current requirements.
8. Check all electrical connections to be sure they are tight.

General

1. Close the control circuit breaker (CCB), which will energize the control circuit and the crankcase heaters.
2. Complete Pre-Start-Up section items and Start-Up Checklist.

Operating Sequences — Base unit operating sequences are presented below. Refer to unit Controls and Troubleshooting literature for details on VAV and PIC controls operation.

COOLING, UNITS WITHOUT ECONOMIZER — Unit power ON, system selector switch set at COOL or AUTO., fan switch at AUTO., thermostat at setting below room temperature.

Y1 on the thermostat subbase closes, energizing indoor fan and return fan (if equipped) and energizing compressor no. 1 as first stage of cooling. If cooling load cannot be satisfied with only first-stage cooling, Y2 on the thermostat will close energizing compressor no. 2.

Size 078 — Condenser fan no. 1 is energized with compressor no. 1. Condenser fans no. 2 and no. 4 are energized with compressor no. 2. Condenser fans no. 3 and 5 are staged for head pressure control.

Size 088 and 104 — Condenser fans 1 and 3 are energized with circuit 1. Condenser fans 2 and 4 are energized with circuit 2. Condenser fans 5 and 6 are staged for head pressure control.

Check cooling effects at a setting below room temperature. Reset thermostat at a setting above room temperature. Compressor and indoor fan will shut off.

HEATING UNITS WITHOUT ECONOMIZER

48FJ Units — Refer to the Controls, Operation and Troubleshooting instructions for information on the control logic used by the unit controls for gas heat operation.

The 48FJD units have 2 gas heat sections. The 48FJE units have 3 gas heat sections. Each individual section operates in the same manner.

NOTE: The 48FJ units have 2 stages of heat.

When the PIC control calls for heating, power is sent to W on each IGC (integrated gas controller) board. An LED (light-emitting diode) on the IGC board will be on during normal operation. A check is made to ensure that the rollout switch and the limit switch are closed and the induced-draft motor is not running. The induced-draft motor is then energized, and when speed is proven with the hall effect sensor on the motor, the ignition activation period begins. The burners will ignite within 5 seconds.

If the burners do not light, there is a 22-second delay before another 5-second attempt. If the burners still do not light, this sequence is repeated for 15 minutes. After the 15 minutes have elapsed, if the burners have not been lit, heating is locked out. To reset the control, use the manual reset method found in the Controls Operation and Troubleshooting book.

When ignition occurs the IGC board will continue to monitor the condition of the rollout and limit switches, the hall effect sensor, and the flame sensor.

When additional heat is required, W2 closes and initiates power to the second stage of the main gas valve. When the thermostat is satisfied, W1 and W2 open and the gas valve closes, interrupting the flow of gas to the main burners. If the call for W1 lasted less than 1 minute, the heating cycle will not terminate until 1 minute after W1 became active.

An LED indicator is provided on the IGC to monitor operation. The IGC is located by removing the side panel and viewing the IGC through the view port located in the control box access panel. During normal operation, the LED is continuously on. See Table 28 for error codes.

Table 28 — IGC Control Board LED Alarms

INDICATION	ERROR MODE
ON	Normal Operation
OFF	Hardware Failure
1 FLASH	Fan ON/OFF Delay Modified
2 FLASHES	Limit Switch Fault
3 FLASHES	Flame Sense Fault
4 FLASHES	4 Consecutive Limit Switch Faults
5 FLASHES	Ignition Lockout Fault
6 FLASHES	Induced Draft Motor Fault
7 FLASHES	Rollout Switch Fault
8 FLASHES	Internal Control Fault

LEGEND

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

NOTES:

1. There is a 3-second pause between error code displays.
2. If more than one error code exists, all applicable error codes will be displayed in numerical sequence.
3. Error codes on the IGC will be lost if power to the unit is interrupted.

50FJX,FJY,FW Units With External Heating Device — Unit power ON, system selector switch at HEAT, fan switch at AUTO.; thermostat at setting above room temperature.

When W1 on the thermostat closes, the first stage of electric heat, indoor fan and return fan (if equipped) are energized. On a further drop in room temperature, W2 on the thermostat closes, energizing the second state of electric heat.

Reset thermostat to a setting below room temperature. Unit should shut off.

COOLING, UNITS WITH ECONOMIZER — With subbase switch set at COOL and fan switch set at AUTO., indoor fan are energized when Y1 on thermostat closes. If enthalpy is “good” (below setting on enthalpy switch), the economizer

outside air dampers will modulate open to satisfy the cooling requirement. If outside air alone will not meet the cooling requirements, Y2 on the thermostat will close, energizing compressor no. 1 to work in conjunction with the modulating economizer to meet the cooling requirement. While the unit is operating using outside air, compressor no. 2 cannot be energized.

If enthalpy is “not good” (above setting on enthalpy switch), the economizer outside air dampers move to the minimum (ventilation) position, and unit operates as described in Cooling, Units Without Economizer.

NOTE: If fan switch is ON and the room thermostat is satisfied, the outside air dampers move to the minimum position.

HEATING, UNITS WITH ECONOMIZER — Operation is the same as described in Heating, Units Without Economizer, except that the outside air dampers move from closed to the minimum ventilation position on a call for heating.

VENTILATION-AIR CIRCULATION (Continuous Fan) — Turn unit power on. Set system selector switch at OFF, HEAT, or COOL position, and set fan switch at ON position.

Evaporator-fan contactor is energized through the switch on the thermostat and the evaporator fan runs continuously. The damper moves to the minimum position.

AUTOMATIC CHANGEOVER USING AUTOMATIC CHANGEOVER THERMOSTAT — Turn unit power on. Set system selector switch at AUTO position.

When the temperature of the conditioned space rises to the cooling selector lever setting, unit automatically switches to Cooling mode. When the temperature of the conditioned space falls to the heating selector switch setting, unit automatically changes to Heating mode. The thermostat is interlocked so that cooling and heating systems do not operate at the same time. There is a deadband between Heating and Cooling modes.

POWER EXHAUST — The power exhaust assembly consists of two parallel and independent belt-drive forward curve fans. The fans, motors, and drives are located over the return air opening of the unit, in a plenum beneath the outside air intake plenum. The fans discharge horizontally out the back of the unit through individual barometric backdraft dampers with hoods. Operation is interlocked with economizer operation.

NON-MODULATING POWER EXHAUST (CV Units Only) — Operation of the non-modulating power exhaust is 2-stage, dictated by economizer position.

As the economizer actuator opens past 35% open, auxiliary switch DMS1 (in the economizer actuator) closes, energizing exhaust fan contactor PEC1. Fan motor no. 1 starts and runs. The power exhaust operates at 50% of available exhaust airflow.

As the economizer actuator opens further (to approximately 75% open), auxiliary switch DMS2 closes, energizing fan contactor PEC2. Fan motor no. 2 starts and runs. The power exhaust operates at 100% of available airflow.

DMS2 opens as damper closes below 65% open.

DMS1 opens as damper closes below 25% open.

MODULATING POWER EXHAUST (CV Units Only) — Fan no. 1 is equipped with a variable position discharge damper located in the outlet of the fan housing. This damper is controlled by an actuator (PEDM), based on signals from the building pressure differential pressure switch (DPS). Available range on the DPS is -0.50 to 0.50 in. wg, which is adjustable. Building pressure is sensed by a pick-up (field-supplied and -installed) located in the occupied space.

Operation of the Modulating Power Exhaust is a combination modulating/staged control, with fan no. 1 providing modulating control from 0 to 100% and fan no. 2 being staged On/Off according to damper position on fan no.1.

As the economizer actuator opens past 35% open, auxiliary switch DMS1 closes, energizing fan contactor PEC1. Fan motor no. 1 starts and runs.

The capacity of fan no. 1 is controlled by the position of the outlet damper. As building pressure increases above set point, the DPS will close its contact and drive the power exhaust damper motor (PEDM) open until set point is achieved. The DPS then opens its control contacts and PEDM maintains current position.

When space demand moves PEDM to 90% of full-open position, auxiliary switch PEDMS closes, energizing fan contactor PEC2. Fan motor no. 2 starts and runs. Increased exhaust airflow will lower space pressure, causing DPS to drive PEDM back toward its closed position, until set point is achieved.

If space pressure decreases until PEDM position is reduced to 10% of open position, PEDMS will open, deenergizing fan contactor PEC2 and shutting off fan no. 2.

Head Pressure Control — All units have a fan cycling thermostat which cycles no. 5 and 6 condenser fans. This switch opens at $70\text{ F} \pm 3\text{ F}$ and closes at $80\text{ F} \pm 3\text{ F}$. This allows the unit to operate down to 45 F outdoor ambient temperature.

NOTE: Accessory -20 F Low Ambient Kit is available, which allows mechanical cooling to -20 F outdoor ambient. See accessory installation instructions for mounting and operation details.

SERVICE

Service Access — All unit components can be reached through clearly labeled hinged access doors. These doors are not equipped with tiebacks, so if heavy duty servicing is needed, either remove them or prop them open to prevent accidental closure.

Each door is held closed with 3 latches. The latches are secured to the unit with a single $\frac{1}{4}$ -in.-20 x $\frac{1}{2}$ -in. long bolt. See Fig. 74.

To open, loosen the latch bolt using a $\frac{7}{16}$ -in. wrench. Pivot the latch so it is not in contact with the door. Open the door. To shut, reverse the above procedure.

NOTE: Disassembly of the top cover may be required under special service circumstances. It is very important that the orientation and position of the top cover be marked on the unit prior to disassembly. This will allow proper replacement of the top cover onto the unit and prevent rainwater from leaking into the unit.

IMPORTANT: After servicing is completed, make sure door is closed and relatched properly, and that the latches are tight. Failure to do this can result in water leakage into the indoor-air section of the unit.

COMPRESSORS — The oil pump end (compressor access) of each compressor is readily accessible from sides of unit as shown in Fig. 18. Access the motor end of the compressor through the condenser end of the unit or by removing compressor.

LIQUID SERVICE VALVES, FILTER DRIERS, AND SIGHT GLASSES — Access to these components is from the side of the unit as shown in Fig. 75.

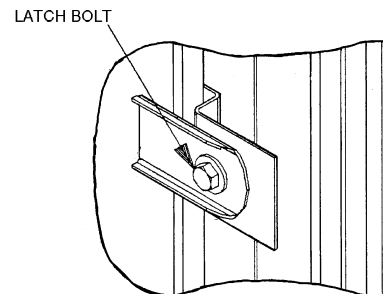


Fig. 74 — Door Latch

EVAPORATOR-FAN MOTORS, PULLEYS, AND BELTS — Access to these components is through the 2 doors labeled **FAN SECTION** on each side of the unit.

POWER EXHAUST MOTORS, PULLEYS, AND BELTS — Access to these components is through the door below the side economizer hoods on both sides of the unit. See Fig. 76.

RETURN AIR FILTERS — Access to these filters is through the door marked **FILTER SECTION** on the right side of the unit.

GAS HEAT SECTION — Access to the gas heat section is through the door labeled **HEAT SECTION** on the left side of the unit (when facing condenser end).

All gas system components are in the gas section.

MAIN BURNERS (48FJ,FK,FP Only) — At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames. Refer to Main Burners section on page 64.

FLUE GAS PASSAGEWAYS (48FJ,FK,FP Only) — The flue collector box and heat exchanger cells may be inspected by removing heat exchanger access panel (Fig. 8), flue box cover, and main burner assembly (Fig. 77). Refer to Main Burners section on page 64 for burner removal sequence. If cleaning is required, remove heat exchanger baffles and clean tubes with a wire brush.

Use caution with ceramic heat exchanger baffles. When installing retaining clip, be sure the center leg of the clip extends inward toward baffle. See Fig. 78.

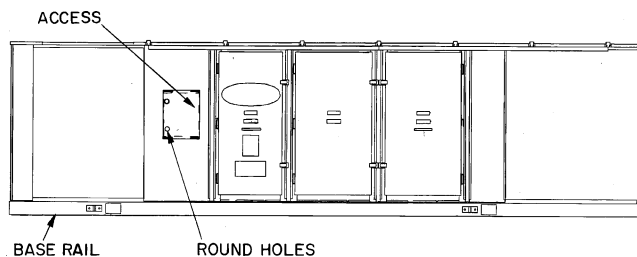


Fig. 75 — Typical Filter Drier and Liquid Service Valve Access

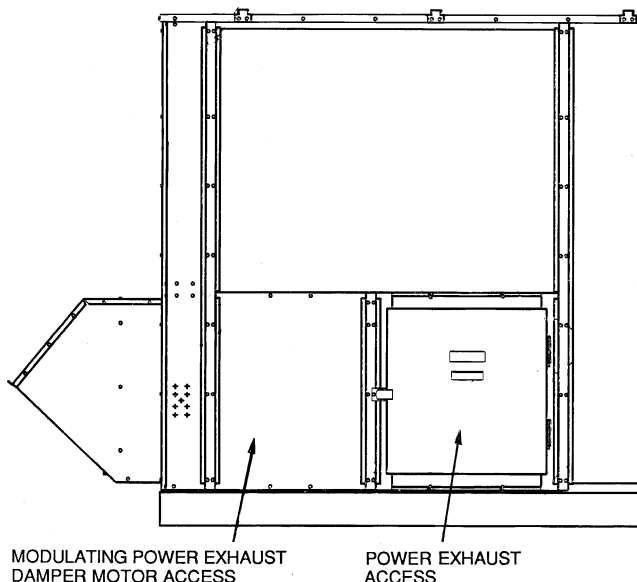


Fig. 76 — Modulating Power Exhaust Motor Access

COMBUSTION-AIR BLOWERS (48FJ,FK,FP Only) — 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 bi-monthly to determine proper cleaning frequency.

To inspect blower wheel, remove heat exchanger access panel. Shine a flashlight into opening to inspect wheel. If cleaning is required, remove motor and wheel assembly by removing screws holding motor mounting plate to top of combustion fan housing (Fig. 79). The motor and wheel assembly will slide up and out of the fan housing. Remove the blower wheel from the motor shaft and clean with a detergent or solvent. Replace motor and wheel assembly.

UNIT CONTROL BOX — Access to this component is through the doors marked **ELECTRICAL SECTION** on the condenser end of the unit (when facing the condenser coil).

ECONOMIZER DAMPER MOTOR — On units so equipped, the economizer motor is located in the mixing box section. Access to it is through the door labeled **FILTER SECTION** on the right hand side of the unit.

CONDENSER FANS AND FAN MOTORS — Remove the wire fan guard on top of the unit to gain access to the condenser fans and motors.

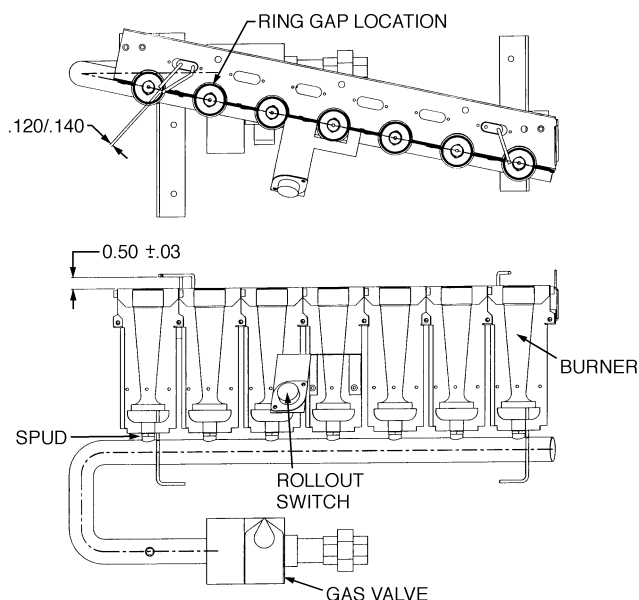
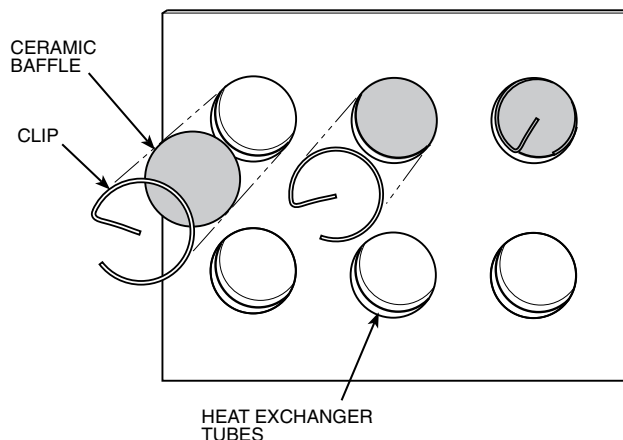


Fig. 77 — Burner Section Detail



NOTE: One baffle and clip will be in each upper tube of the heat exchanger.

Fig. 78 — Removing Heat Exchanger Ceramic Baffles and Clips

Adjustments

EVAPORATOR FAN AND POWER EXHAUST MOTOR PLATE — Adjust using a $\frac{15}{16}$ -in. wrench on the adjusting bolts:

1. Loosen holddown bolts. (See Fig. 80.)
2. Turn the adjusting bolts to move the motor mounting plate toward or away from the fan to loosen or tighten the belts. Make the same number of turns to each bolt.

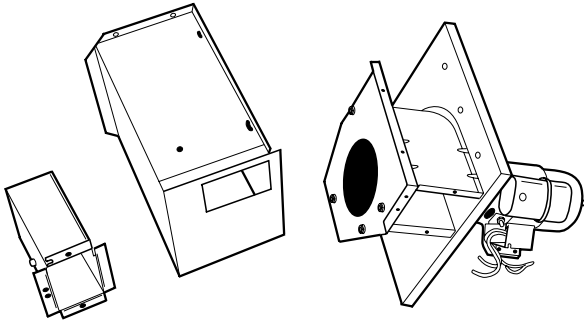


Fig. 79 — Combustion Blower Removal

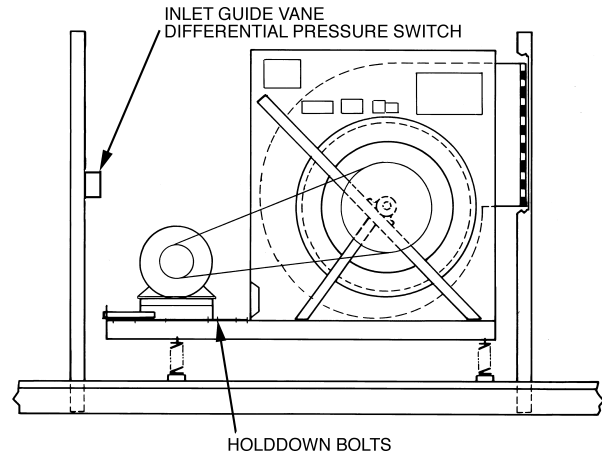


Fig. 80 — Motor Plate Adjustment

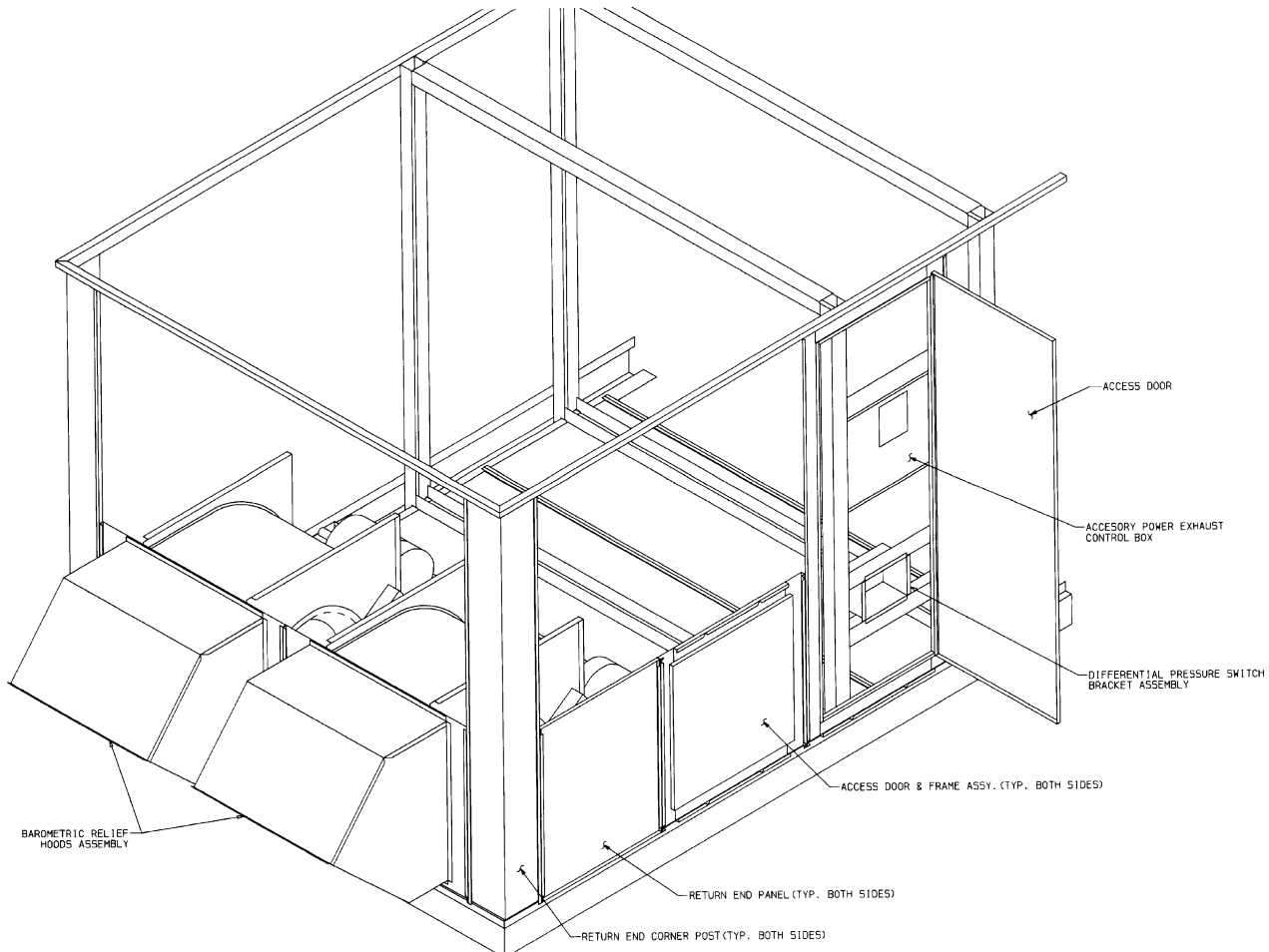


Fig. 81 — Power Exhaust Detail

3. Retighten holddown bolts.

MODULATING POWER EXHAUST DIFFERENTIAL PRESSURE SWITCH — The differential pressure switch is mounted below the auxiliary control box next to the access door labeled FILTER SECTION. See Fig. 81.

INLET GUIDE VANE DIFFERENTIAL PRESSURE SWITCH (Units With Optional Inlet Guide Vanes and Static Pressure Control) — The inlet guide vane differential pressure switch is mounted on an upright located behind the evaporator-fan motor. See Fig. 80.

INLET GUIDE VANE MOTOR AND LINKAGE (Units with Optional Inlet Guide Vanes) — Check linkage arm connected to inlet guide vane motor and inlet guide vanes. See Fig. 82. Make sure inlet guide vanes open and close correctly on both sides of fan, and that linkage arms open and close inlet guide vanes.

SWITCH ADJUSTMENT — Units with an optional economizer have an auxiliary switch located on the economizer damper motor. If other than the factory setting is desired, follow the steps below:

⚠ CAUTION

Do not turn motor shaft by hand or with a wrench. Damage to the gear train will result.

1. Remove top cover from motor to gain access to motor terminals and cam adjustments.
2. Disconnect controller from motor. Connect RED, WHITE, and BLUE terminals on the 135-ohm manual potentiometer to corresponding RED, WHITE, and BLUE terminals on the motor. Connect 24-vac power to Terminals 1 and 2. See Fig. 83.
3. Adjust the 135-ohm potentiometer so that the motor shaft turns to the position where auxiliary equipment is to be switched.
4. Adjust auxiliary cam by inserting a $\frac{1}{8}$ -in. straight blade screwdriver into slot on cam and moving TOP of screwdriver to the right or left. See Fig. 84.
5. To close auxiliary switch RED and BLUE contacts as the motor travels open (energizing the power exhaust motor), the switch differential can only be 10 degrees on both switches. To adjust either cam, perform the following steps:
 - a. If RED and BLUE contacts are open, rotate the cam counterclockwise until the contacts close.
 - b. If the RED and BLUE contacts are closed, rotate the cam clockwise until the contacts open.

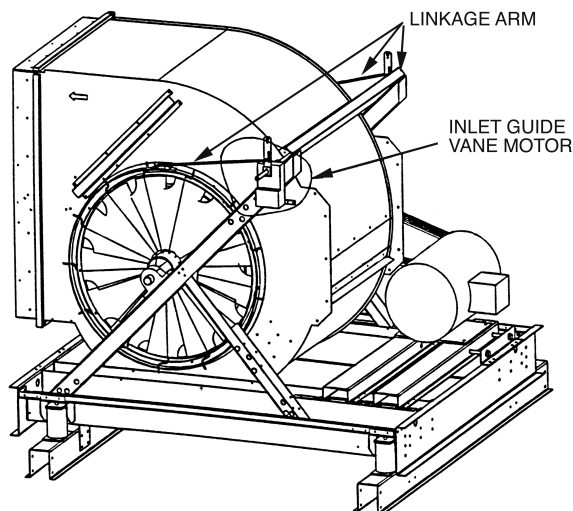


Fig. 82 — Inlet Guide Vane Motor

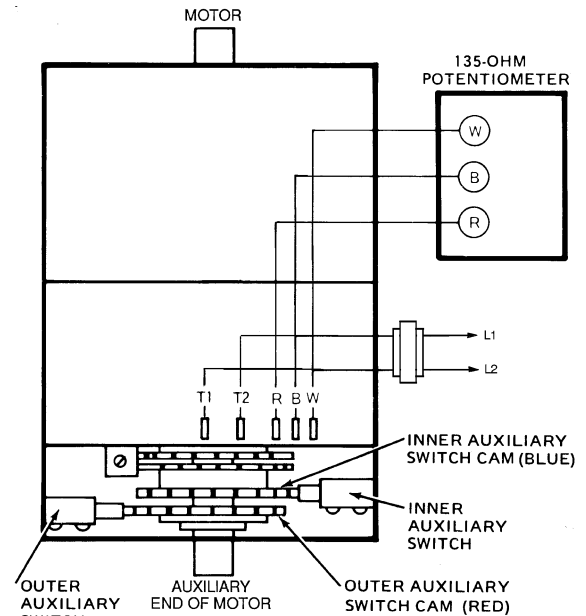


Fig. 83 — Auxiliary Switch Stroke Adjustment

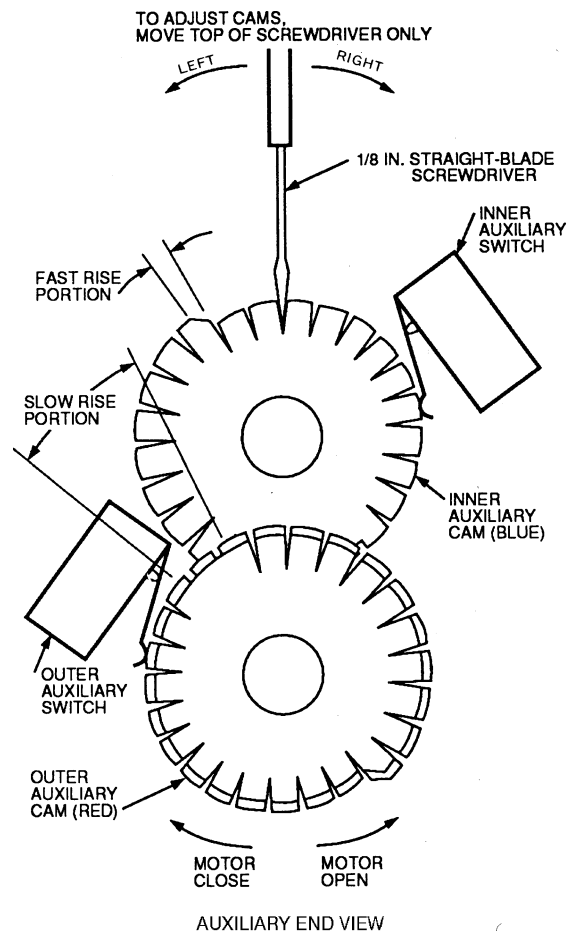


Fig. 84 — Auxiliary Switch Adjustment

- The auxiliary switch is set as follows:

UNIT	SWITCH	CONTROLS	ECON OPEN (Switch Closes)
CONSTANT VOLUME UNITS	Switch 1	1st Stage PE or MPE	35%
	Switch 2	2nd Stage PE	75%

LEGEND

ECON — Economizer
MPE — Modulating Power Exhaust
PE — Power Exhaust

BELT INSTALLATION AND TENSIONING

IMPORTANT: When installing or replacing belts, always use a complete set of new, matched belts to prevent potential vibration problems. Mixing belts often results in premature breakage of the new belts.

- Turn off unit power.
- Adjust motor plate so belts can be installed without stretching over the grooves of the pulley. (Forcing the belts can result in uneven belt stretching and a mismatched set of belts.)
- Before tensioning the belts, equalize belt slack so that it is on the same side of the belt for all belts. Failure to do so may result in uneven belt stretching.
- Tighten belts using the motor plate adjusting bolts.
- Adjust until proper belt tension ($\frac{1}{2}$ -in. [13 mm] deflection with one finger) is obtained. Be sure to adjust both adjusting bolts the same number of turns.

NOTE: Check the tension at least twice during the first day of operation, as there is normally a rapid decrease in tension until the belts have run in. Check tension periodically thereafter and keep it at the recommended tension.

With the correct belt tension, belts may slip and squeal momentarily on start-up. This slippage is normal and disappears after wheel reaches operating speed. Excessive belt tension shortens belt life and may cause bearing and shaft damage.

PULLEY ALIGNMENT — For proper belt life, the motor and fan pulleys must be properly aligned. To check, first turn off unit power. Place a straightedge against the motor and fan pulleys. See Fig. 85. If the pulleys are properly aligned, the straightedge should be parallel to the belts.

If they are not parallel, check that the motor shaft and fan shaft are parallel. If they are not, adjust the motor plate adjusting bolts until they are

After verifying that the shafts are parallel, loosen the setscrews on the motor pulley. Move pulley on the shaft until the pulleys are parallel. To move the sheave on the shaft, loosen the belts. If necessary, blower sheave can also be moved on the shaft.

INSTALLING REPLACEMENT MOTOR PULLEY (Evaporator Fan Only) — To install a field-supplied replacement pulley:

- Turn off unit power.
- Loosen belts using motor adjusting bolts until belts can be removed without stretching them over the grooves of the pulley.
- Remove belts.
- Loosen setscrews on motor pulley.
- Slide pulley off motor shaft. Make sure setscrews on new pulley are loose.
- Slide new pulley onto fan shaft and align it with the fan pulley as described in Pulley Alignment section above.

- Tighten setscrews.
- Install belts and tension properly as described in Pulley Alignment section above.

CONDENSER FAN ADJUSTMENT

- Turn off unit power.
- Remove fan guard and loosen fan hub setscrew.
- See Fig. 86 and adjust fan height using a straight edge laid across the fan deck.
- Tighten setscrew and replace rubber hubcap to prevent hub from rusting to the motor shaft. Fill hub recess with Permagum if hub has no rubber hubcap.
- Replace fan guard.

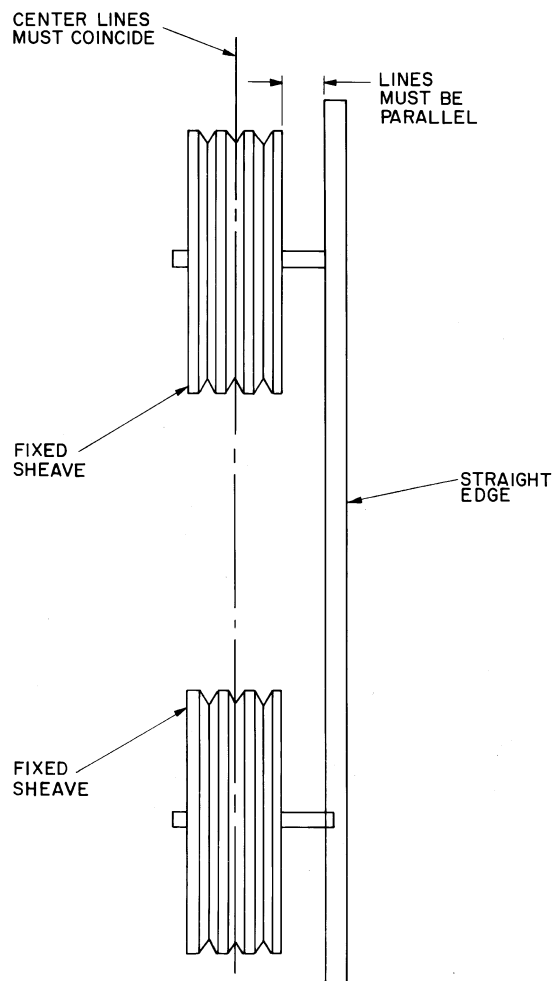


Fig. 85 — Pulley Alignment

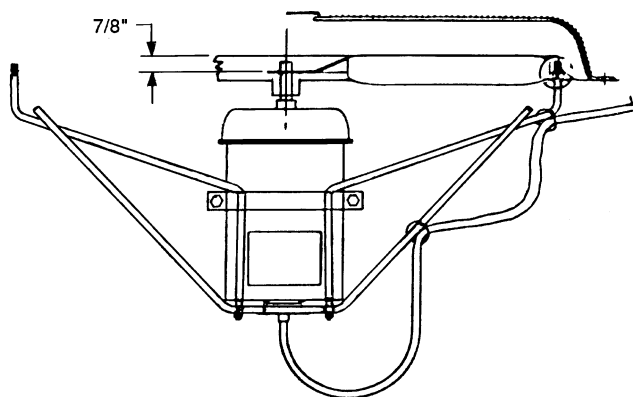


Fig. 86 — Condenser-Fan Adjustment

25% OUTDOOR-AIR DAMPER — Access to adjust the damper is through the hoods. Remove filters to gain access into unit to adjust linkage arms.

Cleaning — Inspect unit at the beginning of each heating and cooling season and during each season as operating conditions may require.

Clean evaporator coil with a stiff bristle brush (not wire), vacuum cleaner, or compressed air.

Check and clean condensate drain annually at the start of the cooling season.

Replace return-air filters at the start of each heating and cooling season or as often as necessary during each season, depending on operating conditions. See Tables 1A and 1B for filter types, quantities, and sizes.

1. Remove economizer outdoor-air filters from the hoods by removing the filter retainers.
2. Clean filters with steam or hot water and mild detergent.
3. Reinstall filters in hoods after cleaning. Never replace cleanable filters with throwaway filters.

Condenser Coil Maintenance and Cleaning —

Routine cleaning of condenser coil surfaces is essential to maintain proper operation of the unit. Elimination of contamination and removal of harmful residue will greatly increase the life of the coil and extend the life of the unit. The following maintenance and cleaning procedures are recommended as part of the routine maintenance activities to extend the life of the coil.

REMOVE SURFACE LOADED FIBERS — Surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft brush may be used. The cleaning tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges bent over) if the tool is applied across the fins.

NOTE: Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

PERIODIC CLEAN WATER RINSE — A periodic clean water rinse is very beneficial for coils that are applied in coastal or industrial environments. However, it is very important that the water rinse is made with very low velocity water stream to avoid damaging the fin edges. Monthly cleaning is recommended.

ROUTINE CLEANING OF COIL SURFACES — Monthly cleaning with *Enviro-Shield*[™] coil cleaner is essential to extend the life of coils. It is recommended that all coils, including standard aluminum, precoated, copper/copper, or E-coated coils are cleaned with *Enviro-Shield* coil cleaner. Coil cleaning should be part of the regularly scheduled maintenance procedures of the unit to ensure long life of the coil. Failure to clean the coils may result in reduced durability of the coil in the environment.

Enviro-Shield coil cleaner is non-flammable, hypoallergenic, non-bacterial, USDA accepted biodegradable and 100% ecologically safe agent that will not harm the coil or surrounding components such as electrical wiring, painted metal surfaces, or insulation. Use of non-recommended coil cleaners is strongly discouraged since coil and unit durability could be affected.

The following field-supplied equipment is required for coil cleaning:

- 2½ gallon garden sprayer
- water rinse with low velocity spray nozzle
- *Enviro-Shield* coil cleaner

Perform the following procedure to clean the coil:

NOTE: Wear proper eye protection such as safety glasses during mixing and application.

1. Remove all surface loaded fibers and dirt with a vacuum cleaner.
2. Thoroughly immerse finned surfaces with clean water using a low velocity water stream from a garden hose being careful not to bend fins.
3. Mix *Enviro-Shield* coil cleaner in a 2½ gallon garden sprayer according to the instructions included with the *Enviro-Shield* coil cleaner. The optimum solution temperature is 100 F.

⚠ CAUTION

DO NOT USE water with temperature in excess of 130 F. Enzymes in coil cleaner will be destroyed and coil cleaner will not be effective.

4. Thoroughly apply *Enviro-Shield* Coil Cleaner solution to all coil surfaces including finned area, tube sheets, and coil headers. Hold garden sprayer nozzle close to finned areas and apply cleaner with a vertical, up-and-down motion. Avoid spraying in horizontal pattern to minimize potential for fin damage. Ensure cleaner thoroughly penetrates deep into finned areas. Interior and exterior finned areas must be thoroughly cleaned.
5. Allow finned surfaces to remain wet with cleaning solution for 10 minutes. Ensure surfaces are not allowed to dry before rinsing. Reapply cleaner as needed to ensure 10-minute saturation is achieved.
6. Thoroughly rinse all surfaces with low velocity clean water using downward rinsing motion of water spray nozzle. Protect fins from damage from the spray nozzle.

⚠ CAUTION

Harsh chemical, household bleach, or acid cleaners should not be used to clean condenser or evaporator coils. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion at the fin/tube interface where dissimilar materials are in contact. If there is dirt below the surface of the coil, use the *Enviro-Shield* coil cleaner to clean the coil.

High velocity water from a pressure washer or garden hose, or compressed air should never be used to clean a coil. The force of the water or air jet will bend the fin edges and increase airside pressure drop. Reduced unit performance or nuisance unit shutdown may occur.

Lubrication

COMPRESSORS — Each compressor is correctly charged at the factory. Refer to 06E Compressor Service Manual if additional information regarding compressor lubrication system is required. See Compressor Oil section on page 41.

FAN SHAFT BEARINGS — Lubricate fan shaft bearings at least once a year with suitable bearing grease. Extended grease lines are provided on pulley side of blower. Typical lubricants are given below:

MANUFACTURER	LUBRICANT
Texaco	Regal AFB-2*
Mobil	Mobilplex EP No. 1
Sunoco	Prestige 42
Texaco	Multifak 2

*Preferred lubricant because it contains rust and oxidation inhibitors.

INLET GUIDE VANE BEARINGS (Units With Optional Inlet Guide Vanes) — These bearings are oil impregnated. Lubricate annually with a few drops of nondetergent SAE 20 oil.

FAN MOTOR BEARINGS — The condenser- and evaporator-fan motors have sealed bearings so no field lubrication is required.

DOOR HINGES — All door hinges should be lubricated at least once a year.

Refrigerant Feed Components — Each refrigerant circuit (2 per unit) has all the necessary refrigerant controls.

Thermostatic Expansion Valve (TXV) — Each circuit has 2 TXVs on which superheat may be adjusted if absolutely necessary.

The TXV is set to maintain 10 to 13 F superheat leaving the evaporator coil. It controls the flow of refrigerant to the evaporator coils.

Compressor Discharge Service Valve — Each compressor has one.

Compressor Suction Service Valve — Each compressor has one.

Protective Devices

COMPRESSOR PROTECTION

Overcurrent — Each compressor has one manual reset, calibrated trip, magnetic circuit breaker. Do not bypass connections or increase the size of the circuit breaker to correct trouble. Determine the cause and correct it before resetting the breaker.

Crankcase Heater — Each compressor has a crankcase heater to prevent absorption of liquid refrigerant by oil in the crankcase when the compressor is idle. Since 115-v power for the crankcase heaters is drawn from the unit control circuit, main unit power must be on for the heaters to be energized.

IMPORTANT: After a prolonged shutdown or service job, energize the crankcase heaters for 24 hours before starting the compressor.

Compressor Lockout — If any of the safeties high-pressure, or low-pressure) trip, or if there is a loss of power to the compressors, the compressors will be locked out. To reset 48FJ and 50FJX,FJY,FW units, manually move the thermostat setting. To reset 48FK,FP and 50FB,FKX,FKY,FPX,FPY,FY units, consult the controls and troubleshooting literature for the appropriate unit for details. See Fig. 87.

EVAPORATOR-FAN MOTOR PROTECTION — A manual reset, calibrated trip, magnetic circuit breaker protects against overcurrent. Do not bypass connections or increase the size of the breaker to correct trouble. Determine the cause and correct it before resetting the breaker.

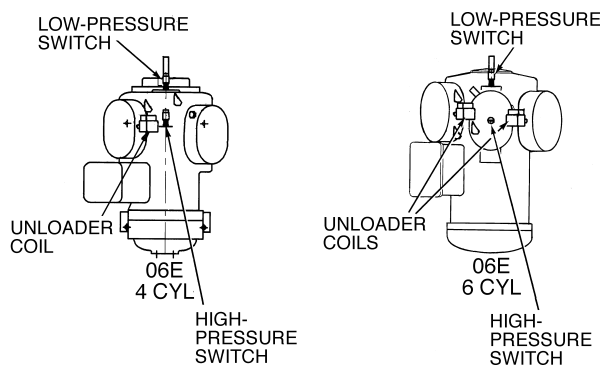


Fig. 87 — Typical Compressor High- and Low-Pressure Switch Locations

CONDENSER-FAN MOTOR PROTECTION — Each condenser-fan motor is internally protected against over-temperature. They are also protected against a severe overcurrent condition by manual reset, calibrated trip, magnetic circuit breakers on a common circuit. As with the circuit breakers, do not bypass connections or increase breaker size to correct trouble. Determine the cause and correct it before resetting the breaker.

HIGH- AND LOW-PRESSURE SWITCHES — See Fig. 87 for compressor mounting locations. Settings for these switches are shown in Table 29. If either switch trips, that refrigerant circuit will be automatically locked out by the controls. To reset, interrupt control power.

Table 29 — Pressure Switch Settings (psig)

SWITCH	CUTOUT	CUT-IN
High	426 ± 7	320 ± 20
Low	27 ± 4	67 ± 7

Relief Devices — All units have relief devices to protect against damage from excessive pressures (i.e., fire). These devices protect the high and low side.

Refrigeration Circuits

LEAK TESTING — Units are shipped with a full operating charge of R-22 (see Tables 1A and 1B). If there is no pressure in the system, introduce enough nitrogen to search for the leak. Repair the leak using good refrigeration practices. After leaks are repaired, system must be evacuated and dehydrated using methods described in GTAC II, Module 4, System Dehydration.

REFRIGERANT CHARGE (Refer to Tables 1A and 1B) — At the liquid line connection point on each circuit is a factory-installed liquid line service valve. On each valve is a 1/4-in. Schrader connection for charging liquid refrigerant.

All units are shipped with a complete operating charge of R-22. See unit nameplate and Tables 1A and 1B for amount of charge. When adding a complete charge, evacuate system using standard evacuating procedures and weigh in the specified amount of charge. See Fig. 88-91.

Charging with Unit Off and Evacuated — Close liquid line service valve before charging. Weigh in charge shown in Tables 1A and 1B. Open liquid line service valve; start unit and allow it to run several minutes fully loaded. Check for a clear sight glass. Be sure clear condition is liquid and not vapor. Complete charging the unit.

Charging with Unit Running — If charge is to be added while unit is operating, it is necessary to have all condenser fans and compressors operating. It may be necessary to block condenser coils at low-ambient temperatures to raise condensing pressure to approximately 280 psig (1931 kPag) to turn all condenser fans on. Do not totally block a coil to do this. Partially block all coils in uniform pattern. Charge vapor into compressor low-side service port located above oil pump crankshaft housing. Charge each circuit until sight glass shows clear liquid.

Oil Charge — All units are factory charged with oil. Acceptable oil level for each compressor is shown in Fig. 67, page 41).

When additional oil or a complete charge is required, use only Carrier-approved compressor oil.

Approved oils are:

Petroleum Specialties, Inc. — Cryol 150A (factory oil charge)
 Texaco, Inc. — Capella WF-32-150
 Witco Chemical Co. — Suniso 3GS

Do not reuse drained oil, and do not use any oil that has been exposed to atmosphere.

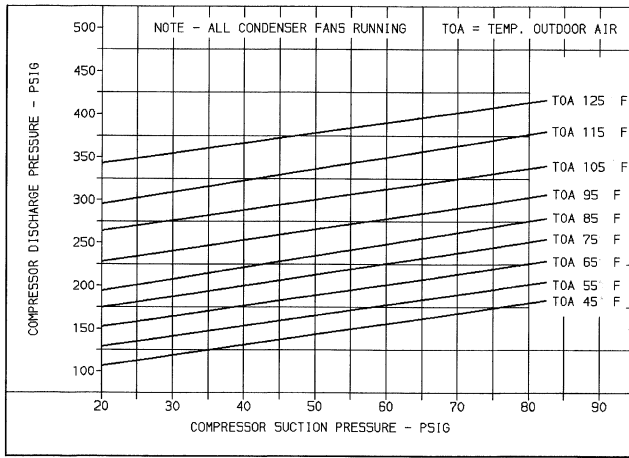


Fig. 88 — Charging Chart, 078 Units; Circuit 1, All Condenser Fans Running

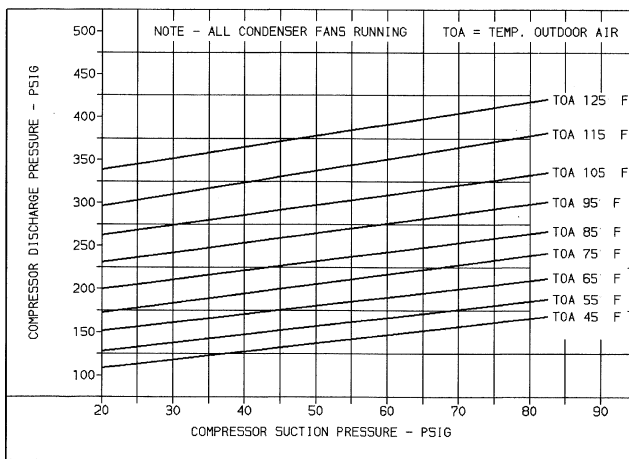


Fig. 89 — Charging Chart, 078 Units; Circuit 2, All Condenser Fans Running

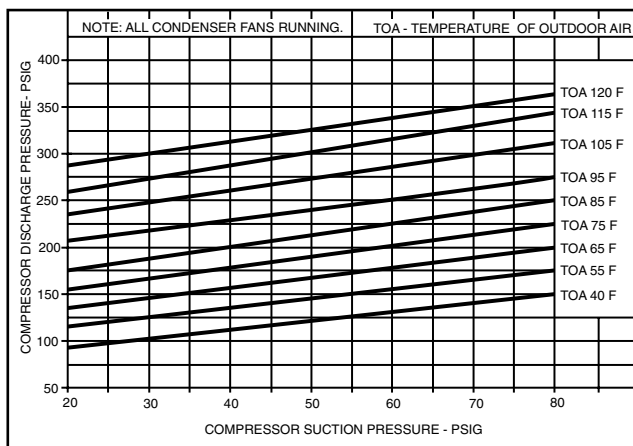


Fig. 90 — Charging Chart, 088 Units; All Condenser Fans Running

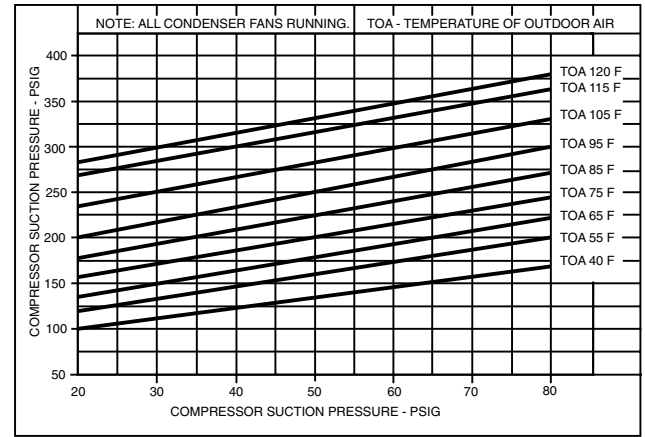


Fig. 91 — Charging Chart, 104 Units; All Condenser Fans Running

ADD OIL — Close suction shutoff valve and pump down crankcase to 2 psig (14 kPa). (Low-pressure cutout must be jumped.) Wait a few minutes and repeat until pressure remains steady at 2 psig (14 kPa). Remove oil fill plug above the oil level sight glass, add oil through plug hole, and replace plug. Run compressor for 20 minutes and check oil level.

REMOVE OIL — Pump down compressor to 2 psig (14 kPag). Loosen the 1/4-in. (6.4-mm) pipe plug at the compressor base and allow the oil to seep out past the threads of the plug.

NOTE: The crankcase will be slightly pressurized. Do not remove the plug, or the entire oil charge will be lost.

Small amounts of oil can be removed through the oil pump discharge connection while the compressor is running.

Moisture/Liquid Indicator — A clear flow of liquid refrigerant indicates sufficient charge in the system. Bubbles indicate undercharged system or the presence of non-condensables. Moisture in the system measured in parts per million (ppm) changes the color of the indicator:

Green — moisture below 45 ppm (dry)
 Chartreuse — 45 to 130 ppm (caution!)
 Yellow — moisture above 130 ppm (wet)

Change filter driers at the first sign of moisture in the system. See Carrier Charging Handbook for more information.

IMPORTANT: Unit must be in operation at least 12 hours before moisture indicator can give an accurate reading. With unit running, indicating element must be in contact with liquid refrigerant to give a true reading.

Filter Driers — These units use sealed type filter driers, one in each refrigeration circuit. The filter driers are located in the condenser sections, accessible from the right side of the unit.

Replace the filter cores whenever the moisture/liquid indicator shows moisture in the system.

Liquid Line Service Valve — Located immediately ahead of the filter drier, this valve has a 1/4-in. flare connection for field charging. With the liquid circuit shut, the compressor can be used to pump the refrigerant down into the high side. The refrigerant can then be stored there by closing the compressor discharge valve.

Gas Heat (48FJ,FK,FP Only)

LIMIT SWITCHES — The maximum supply-air temperature is controlled by a limit switch located in the gas section. The limit is designed to trip at 100 F above the maximum temperature rise shown in Table 1.

When the limit trips, 2 flashes occur on the IGC board. The gas valve is deenergized. After cooling, the system will reset and fires gas again. If four trips occur, the system shuts down into Lockout and 4 flashes occur on the IGC board. The system must then be manually reset by power down and power up of the unit.

ROLLOUT SWITCH — This switch senses any flame or excessive heat in the main burner compartment and deenergizes the gas valve. If this occurs, the gas heating system is locked out (7 flashes on IGC board) until the rollout switch is reset manually. Reset rollout switch manually by powering down and powering up of the unit.

When the rollout switch trips, it usually indicates a flue blockage. Inspect the unit for any obstruction in the flue system, for holes in the flue box, a defective hall effect sensor, a defective inducer motor, or a loose combustion blower.

Gas Valve Adjustment (48FJ,FK,FP Only)

NATURAL GAS — The gas valve opens and closes in response to the PIC control or limit control.

When power is supplied to valve terminals D1 and C2, the main valve opens to its preset position.

The regular factory setting is stamped on the valve body (3.3 in. wg).

To adjust regulator:

1. Set thermostat at setting for no call for heat.
2. Turn main gas valve to OFF position.
3. Remove 1/8-in. pipe plug from manifold or gas valve pressure tap connection. Install a suitable pressure-measuring device.
4. Set main gas valve to ON position.
5. Set thermostat at setting to call for heat.
6. Remove screw cap covering regulator adjustment screw (see Fig. 92).
7. Turn adjustment screw clockwise to increase pressure or counterclockwise to decrease pressure.
8. Once desired pressure is established, set thermostat setting for no call for heat, turn off main gas valve, remove pressure-measuring device, and replace 1/8-in. pipe plug and screw cap.

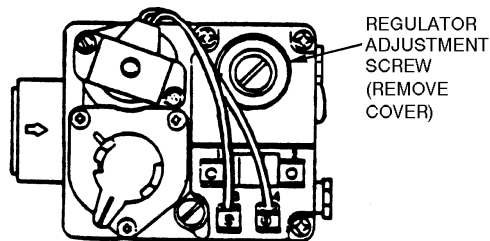


Fig. 92 — Gas Valve

Main Burners (48FJ,FK,FP Only) — For all applications, main burners are factory set and should require no adjustment.

MAIN BURNER REMOVAL AND REPLACEMENT

1. Shut off (field-supplied) manual main gas valve.
2. Shut off power to unit.

3. Remove gas section access door, door frame, and corner post.
4. Disconnect gas piping from gas valve inlet.
5. Remove wires from gas valve.
6. Remove wires from rollout switch.
7. Remove sensor wire and ignitor cable from IGC board.
8. Remove 2 screws securing manifold bracket to basepan.
9. Remove 2 screws that hold the burner support plate flange to the vestibule plate.
10. Lift burner assembly out of unit.
11. Replace burner assembly. Reinstall by reversing steps 1 to 10.

Compressor Removal — Access to the oil pump end of the compressor is from the side of the unit. Access to the motor end of the compressor is from the inside of the unit or by removing compressor. All compressors can be removed from the side of the unit.

IMPORTANT: All compressor mounting hardware and support brackets removed during servicing must be reinstalled prior to start-up.

1. Disconnect power to unit; lockout power to compressor.
2. Close suction and discharge service valves.
3. Relieve refrigerant pressure into a refrigerant recovery system.
4. Remove:
 - a. Fan-cycling pressure switch (FCPS)
 - b. High-pressure switch
 - c. Low-pressure switch
5. Disconnect power wires at terminal box and disconnect conduit.
6. Disconnect wires from crankcase heater.
7. Disconnect service valves from compressor.
8. Remove 4 large locknuts securing compressor to the spring assemblies.
9. Lift compressor off mounting bolts and remove.

Compressor Replacement — Perform the following:

1. Reverse procedure in Compressor Removal section to end of Step 4.
2. Reinstall service valves and safety switches, and tighten to torques as listed:

TORQUE	COMPRESSOR(S)
Tighten discharge valves to	
20-25 ft-lbs (27-34 N-m)	06E-250
80-90 ft-lbs (109-122 N-m)	06E-265,275,299
Tighten suction valves to	
80-90 ft-lbs (109-122 N-m)	06E-250
90-120 ft-lbs (122-163 N-m)	06E-265,275,299
Tighten the following fittings as specified	
120 in.-lbs (13.5 N-m)	High-Pressure Switch
120 in.-lbs (13.5 N-m)	Low-Pressure Switch

3. Leak-check and evacuate system, recover refrigerant.
4. Recharge system per pre-start-up and start-up sequences. Recheck oil levels.
5. Energize crankcase heater for 24 hours prior to restart of system.

TROUBLESHOOTING

The following Troubleshooting section applies to CV units (48FJ and 50FJX,FJY,FW) only. For expanded controls and troubleshooting on other units (VAV and PIC), refer to the Controls and Troubleshooting literature provided in the installation packet with the unit.

Economizer — The economizer control consists of an electronic control board mounted on the back of the cover plate of the economizer motor with the adjustments and electrical plugs accessible through the top of the cover. The economizer control is factory wired to the terminals on the motor. All potentiometers and adjustments are a part of the control board.

ECONOMIZER MOTOR CHECKOUT — The motor may be checked out separately from the control board. See Table 30 for motor checkout. To check out the motor, apply 24 VAC power to terminals T0 and T2 of the control board.

NOTE: The connections to motor terminals T1 and R must remain in place.

Table 30 — Economizer Motor Checkout

MOTOR TEST	PROCEDURE	EXPECTED RESULT AND RESPONSE
A	Remove wire connected to terminal W on the motor.	Motor drives open. If not, replace the motor.
B	Remove wire connected to terminal B on the motor, leaving W wire disconnected (Test A).	Motor drives closed. If not, replace the motor.

CONTROL BOARD CHECKOUT — To check out the control board motor, conduct the following 4 tests.

Test 1:

1. Apply 24 VAC power to terminals T0 and T2 of control board.
2. Remove mixed air sensor connected between terminals S1 and S2.
3. Remove outdoor-air enthalpy sensor between terminals ++ and SO.
4. Refer to Table 31.

Table 31 — Economizer Control Board Checkout, Test 1

MOTOR TEST	PROCEDURE	EXPECTED RESULT AND RESPONSE
A	Turn minimum position potentiometer fully counterclockwise.	Motor drives closed. If not, check minimum position jumper between terminals Z and Y, and check terminal W and T1 connections to motor
B	Turn minimum position potentiometer fully clockwise.	Motor drives open. If not, check terminal B and R connections to the motor.

Test 2:

1. Apply 24 VAC power to terminals T0 and T2 of the control board.
2. Apply 24 v between terminals 1 and T2, and jumper terminal T0 to terminal 1.
3. Remove the mixed-air sensor connected between terminals S1 and S2, and replace it with a 5490-ohm resistor.

4. Remove outdoor-air enthalpy sensor between terminals ++ and SO, and replace it with a 1.2 kOhm resistor.
5. Turn the minimum position potentiometer fully counterclockwise.
6. Refer to Table 32.

Table 32 — Economizer Control Board Checkout, Test 2

MOTOR TEST	PROCEDURE	EXPECTED RESULT AND RESPONSE
A	Turn enthalpy set point potentiometer to the A position.	1. The relays energize. If not, check return enthalpy resistor. If resistor is o.k., control board is faulty. 2. Motor drives open. If relays energize, but motor does not drive open, the control board is faulty.
B	Turn enthalpy set point potentiometer to the D position.	1. The relays deenergize. If not, control board is faulty. 2. Motor drives closed. If relays deenergize by motor does not drive closed, the control board is faulty.

Test 3:

1. Apply 24 VAC power to terminals T0 and T2 of the control board.
2. Apply 24 v between terminals 1 and T2, and jumper terminal T0 to terminal 1.
3. Remove the mixed-air sensor connected between terminals S1 and S2, and replace it with a 5490-ohm resistor.
4. Remove outdoor-air enthalpy sensor between terminals ++ and SO, and replace it with a 1.2 kOhm resistor.
5. Turn the minimum position potentiometer fully counterclockwise.
6. Turn enthalpy set point potentiometer to the A setting.
7. Refer to Table 33.

Table 33 — Economizer Control Board Checkout, Test 3

MOTOR TEST	PROCEDURE	EXPECTED RESULT AND RESPONSE
A	Turn mixed-air potentiometer to the midpoint position.	Motor should drive to mid-stroke with the set point set between 60 and 70 F. If not, the control board is faulty.
B	Turn mixed-air potentiometer fully counterclockwise.	Motor drives open, If not, the control board is faulty.
C	Turn mixed-air potentiometer fully clockwise.	Motor drives closed. If not, the control board is faulty.

Test 4:

Refer to Table 34 for the correct procedure for test 4.

Unit Control Board Checkout — The following tools are required to perform the troubleshooting tasks detailed in this section:

- 1.5-v battery
- 2 sets of jumper wires with alligator clips
- Multimeter
- Toggle switch with 14-in. wires terminated with 1/4-in. spade connectors

⚠ DANGER

Read these instructions completely before attempting to troubleshoot the control board. Failure to follow the steps precisely could result in damage to unit, personal injury, or death.

The control board checkout procedure consists of 2 parts: A basic check to verify availability of 24 and 115 v to the control board and a detailed check of each circuit within the board.

On size 104 units only, circuit 1 consists of compressors 1 and 3, and circuit 2 consists of compressors 2 and 4.

Table 34 — Economizer Control Board Checkout, Test 4

MOTOR TEST	PROCEDURE	EXPECTED RESULT AND RESPONSE
A (Outdoor Air Sensor)	1. Connect the enthalpy sensor terminal + to terminal + on the motor. 2. Connect the positive terminal of a DC milliammeter to terminal S of the sensor. 3. Connect the negative terminal of a DC milliammeter to terminal S_O of the enthalpy board.	Milliammeter reading should be between 3 and 24 mA if the sensor is operating correctly. If the reading is 0 mA, the sensor is either wired backward or is defective.
B (Indoor-Air Sensor)	1. Connect the enthalpy sensor terminal + to terminal + on the motor. 2. Connect the positive terminal of a DC milliammeter to terminal S of the sensor. 3. Connect the negative terminal of a DC milliammeter to terminal S_R of the enthalpy board.	Milliammeter reading should be between 3 and 24 mA if the sensor is operating correctly. If the reading is 0 mA, the sensor is either wired backward or is defective.

BASIC CHECK — Refer to Fig. 93 for control board component identification.

NOTE: All plugs (except P1) are labeled for easy identification. Plug P1 can be identified by its orange color.

1. Turn unit power off. Disconnect plug P1 from control board.

2. Turn unit power on and check voltage across Pin R and Pin C at plug P1. If voltage reads 18 to 30 v, skip to Step 5.
3. Turn unit power off. Disconnect plug P3.
4. Turn unit power on and measure voltage across wires on plug P3, Pins 1 and 2 (wires coming from the unit). If voltage reads 18 to 30 v, there is either a bad connection between plug P3 and control board, or the control board is defective. Verify the connection at this point and proceed to Step 5. If there is no voltage, check the circuit breaker and transformer in the 24-v control circuit of the unit.
5. Turn unit power off and disconnect plug P4 from the control board.
6. Switch scale on meter to read 115 v.
7. Turn unit power on and check voltage across Pin 6 on plug 4 and unit ground (wires coming from the unit). If voltage reads 104 to 122 v, there is adequate power available to the board. Verify connection at this point and proceed to Step 8. If there is no voltage, check the circuit breaker and transformer in the 115-v control circuit of the unit.
8. After verifying that 24-v and 115-v supply power is available to the control board, turn unit power off and reconnect plugs P1, P3, and P4. Proceed to Detailed Check section below.

DETAILED CHECK

NOTE: Plug P1 must be disconnected in order to perform any of the troubleshooting steps detailed in this section. To save time, reconnect plug P1 only after you have completed all of the required troubleshooting.

Symptom: Evaporator fan will not operate.

1. Turn unit power off and disconnect plug P1 from the control board.
2. Install a jumper across Pin R and Pin G at plug P1 on the control board.
3. Turn unit power on and check if the indoor (evaporator) fan contactor (IFC) coil has been pulled in. If the contactor has not been pulled in, check the voltage across the IFC coil. If there is voltage at this point, the IFC contactor is defective. If there is no voltage, proceed to Step 4.
4. Turn unit power off and disconnect plug P4 from the control board.
5. Turn unit power on and check for continuity across Pin 6 and Pin 3 at plug P4 on the control board. If there is no continuity, the board is defective. Replace control board. If there is continuity, then there is a bad connection between the board and plug P4. Correct the connection.
6. Turn unit power off. Reconnect plug P1 (if troubleshooting is complete) and plug P4.

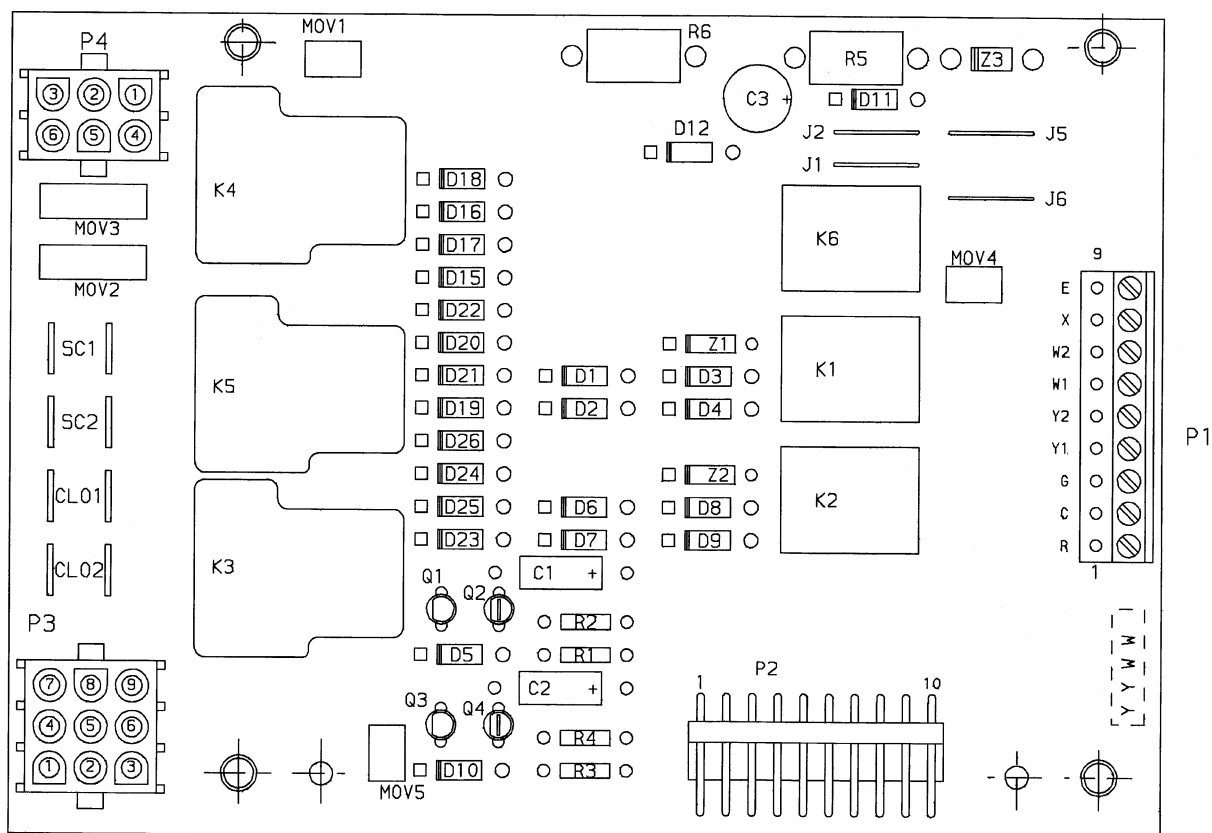


Fig. 93 — Control Board Component Arrangement

Symptom: Condenser fan no. 1 will not operate.

1. Turn unit power off. Disconnect plugs P1 and P3 from the control board.
2. Check for continuity between Pin 8 at plug P3 on the control board and Pin Y1 at plug P1 on the control board. If there is no continuity, the board is defective. If there is continuity, either the connection is bad between plug P3 and the control board or the problem is external to the board. Reconnect plug P1 (if troubleshooting is complete) and plug P3 to the board.

Symptom: Condenser fan no. 2-6 will not operate — Check operation of condenser fan no. 1. If fan no. 1 operates properly, the problem is external to the board.

Symptom: Circuit no. 1 will not operate.

1. Turn unit power off. Disconnect the 2 wires attached to the terminals marked SC1.
2. Check continuity between the 2 wires. If there is no continuity, the problem is external to the control board (possibly the pressure switches). If there is continuity, proceed to Step 3.
3. Reconnect the wires removed in Step 1.

4. With the unit power still off, disconnect plug P1 from control board. Install a jumper wire across Pin R and Pin Y1 at plug P1 on the control board.
5. Connect a voltmeter across the coil for circuit no. 1 contactor(s).
6. Energize unit and monitor the voltage for a few seconds.

IMPORTANT: Do not run compressor too long.

7. a. If proper voltage is indicated at the contactor, but contactor fails to close, replace contactor.
b. If voltage is indicated for a few seconds (i.e., the contactor momentarily pulls in and is then de-energized), the compressor lockout (CLO) logic has shut down the unit. This is an indication that the board is not sensing proper compressor current, or that one of the safeties has tripped. Proceed to Step 8 to verify compressor lockout logic operation.
c. If proper voltage is indicated at the contactor and contactor closes, the board is operating properly.

8. To verify compressor lockout logic:
 - a. Disconnect CLO sensor wires connected to CLO1 at the control board. Check wires for continuity. If there is no continuity, replace the sensor.
 - b. Connect the multimeter to read voltage between Pin X at plug P1 and ground.
 - c. Turn unit power on and check the multimeter. Within a few seconds the meter should indicate 24 v. If it does not, the control board is defective and must be replaced.
 - d. Turn unit power off. Use a toggle switch to connect a fresh 1.5-v battery to the terminals marked CLO1 as shown in Fig. 94.

⚠ CAUTION

The negative (–Ve) pole of the battery must be connected to the inner terminal, and the positive (+Ve) pole must be connected to the outer terminal as shown in Fig. 94.

- e. Turn unit power on and use the toggle switch to make and break the connection between the outer CLO1 terminal and the positive (+Ve) pole of the battery.
- f. If the multimeter shows 24 v when the battery is disconnected and no voltage when the battery is connected, the CLO logic is good. If the multimeter shows no change, the CLO logic is defective and the board must be replaced.

Symptom: Circuit no. 2 will not operate.

1. Be sure unit power is off. Disconnect the 2 wires attached to the terminals marked SC2.
2. Check continuity between the 2 wires. If there is no continuity, the problem is external to the control board (possibly the pressure switches). If there is continuity, proceed to Step 3.
3. Reconnect the wires removed in Step 1.
4. With unit power still off, disconnect plug P1 from the control board and install jumper wire across Pins R and Y2 at plug P1.
5. Connect a voltmeter across the coil for circuit no. 2 contactor(s).
6. Energize unit and monitor the voltage for a few seconds.

IMPORTANT: Do not run compressor too long.

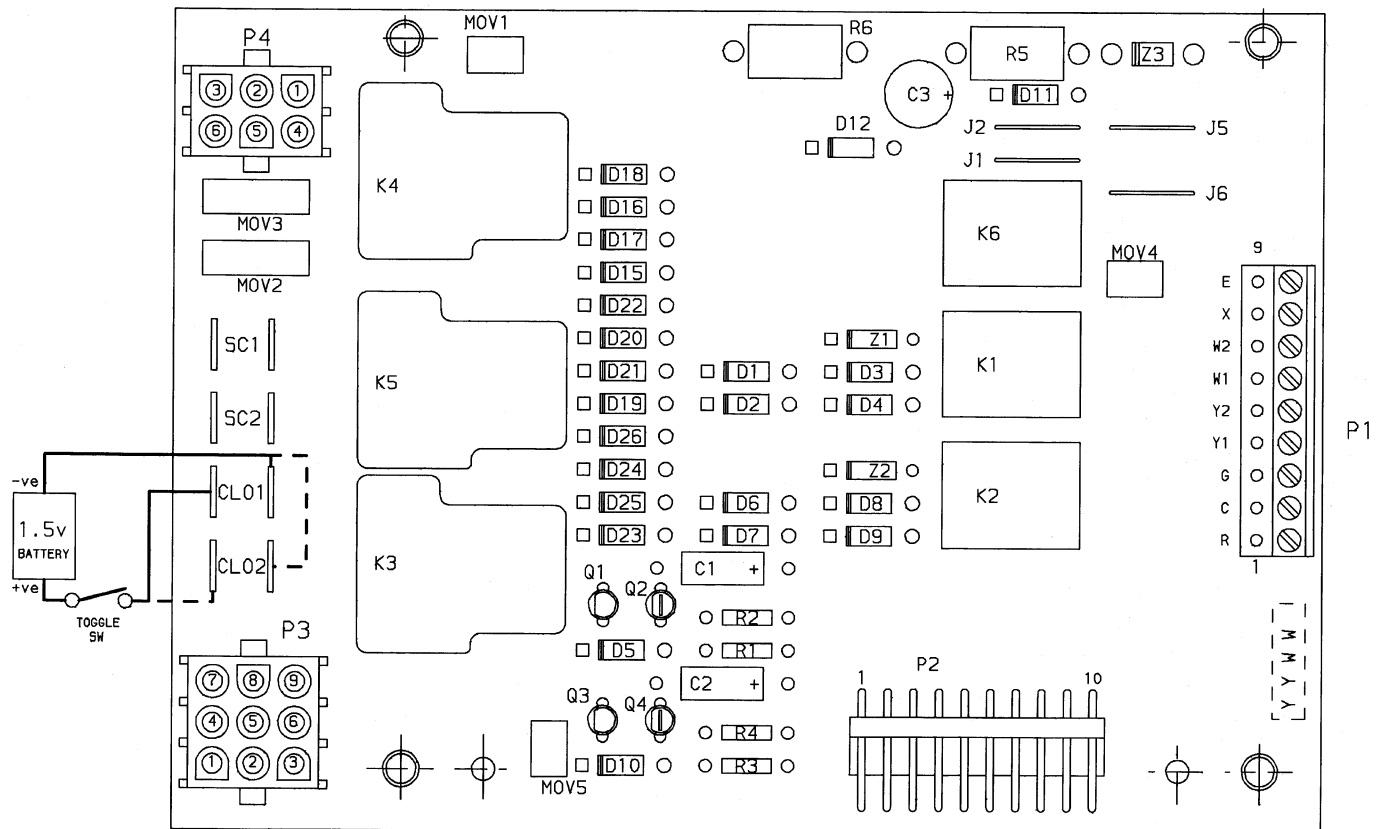
7.
 - a. If proper voltage is indicated at the contactor, but contactor fails to close, replace contactor.
 - b. If voltage is indicated for a few seconds (i.e., the contactor momentarily pulls in and is then deenergized), the Compressor Lockout (CLO) logic has shut down the unit. This is an indication that the board is not sensing proper compressor current, or that one of the safeties has tripped. Proceed to Step 8 to verify compressor lockout logic operation.
 - c. If proper voltage is indicated at the contactor and contactor closes, the board is operating properly.
8. To verify compressor lockout logic:
 - a. Disconnect CLO sensor wires connected to CLO2 at the control board. Check wires for continuity. If there is no continuity, replace the sensor.
 - b. Connect the multimeter to read voltage between Pin X on plug P1 and ground.
 - c. Turn unit power on and check the multimeter. Within a few seconds the meter should indicate 24 v. If it does not, the control board is defective and must be replaced.
 - d. Turn unit power off. Connect a fresh 1.5-v battery to terminals marked CLO2 as shown in Fig. 94.

⚠ CAUTION

The negative (–Ve) pole of the battery must be connected to the inner terminal, and the positive (+Ve) pole must be connected to the outer terminal as shown in Fig. 94.

- e. Turn unit power on. Make and break the connection between the outer CLO2 terminal and the positive (+Ve) pole of the battery.
- f. If the multimeter shows 24 v when the battery is disconnected and no voltage when the battery is connected, the CLO logic is good. If the multimeter shows no change, the CLO logic is defective and the board must be replaced. Remove all jumpers and replace all plugs except plug P1. (Replace plug P1 only if no further troubleshooting is required.)

Unit Wiring — Refer to unit wiring diagrams provided with unit. See Fig. 96.



LEGEND
CLO — Compressor Lockout
P — Plug
SC — Safety Circuit

Fig. 94 — Compressor Lockout Connections

LEGEND FOR FIG. 95 AND 96

C	— Contactor	IFCB	— Indoor (Evaporator) Fan Circuit Breaker
CB	— Circuit Breaker	IFM	— Indoor (Evaporator) Fan Motor
CCB	— Control Circuit Breaker	IGC	— Integrated Gas Controller
CH	— Crankcase Heater	LPS	— Low-Pressure Switch
CHR	— Crankcase Heater Relay	LS	— Limit Switch
CLO	— Compressor Lockout	MAT	— Mixed Air Thermostat
COMP	— Compressor	MGV	— Main Gas Valve
CV	— Constant Volume	MTR	— Motor
DMS	— Damper Motor Switch	OFC	— Outdoor (Condenser) Fan Contactor
DPS	— Duct Pressure Switch	OFM	— Outdoor (Condenser) Fan Motor
DU	— Dummy	PCB	— Power Exhaust Circuit Breaker
ECON	— Economizer	PEC	— Power Exhaust Contactor
EQUIP	— Equipment	PEDM	— Power Exhaust Damper Motor
GND	— Ground	PEM	— Power Exhaust Motor
GVR	— Gas Valve Relay	P, PL	— Plug
HIR	— Heat Interlock Relay	TB	— Terminal Block
HPCT	— Head Pressure Control Thermostat	TDR	— Time-Delay Relay
HPS	— High-Pressure Switch	TRAN	— Transformer
HR	— Heat Relay	- - - -	Field Wiring
HS	— Hall Effect Sensor	————	Factory Wiring
IDM	— Induced Draft Motor		
IFC	— Indoor (Evaporator) Fan Contactor		

NOTES:

1. Circuit breaker must trip amps are equal to or less than 156% FLA for CB1 and CB2. All others are 140%.
2. If any of the original wire furnished must be replaced, it must be replaced with type 90° C wire or its equivalent.
3. Number(s) indicates the line location of contacts. A bracket over (2) numbers signifies single pole double throw contacts. An underlined number signifies a normally closed contact. Plain numbers (no lines), signifies a normally opened contact.
4. Condenser fan motors are thermally protected.
5. Three phase motors are protected under primary single phasing conditions.

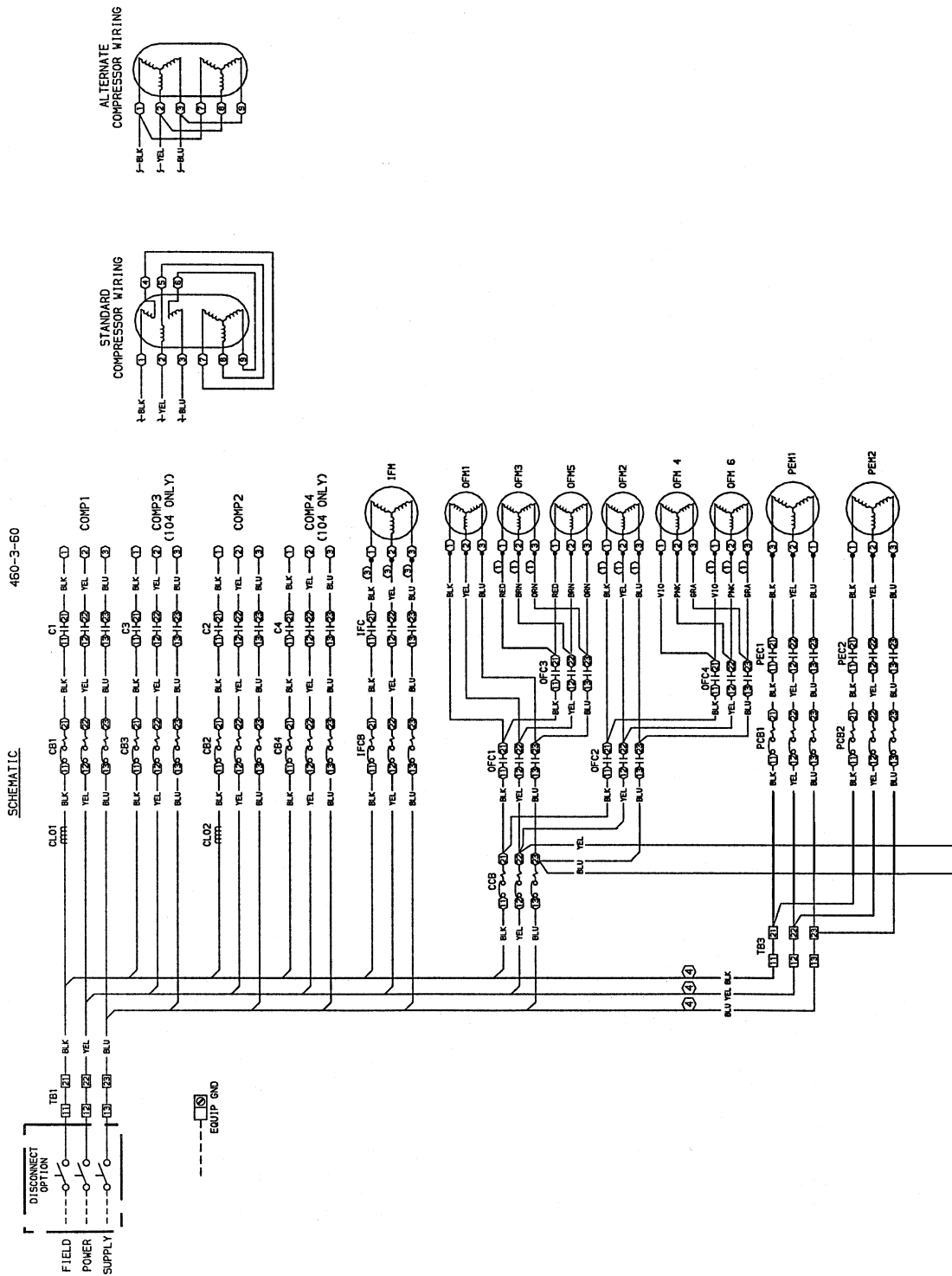


Fig. 95 — Typical Wiring Schematic

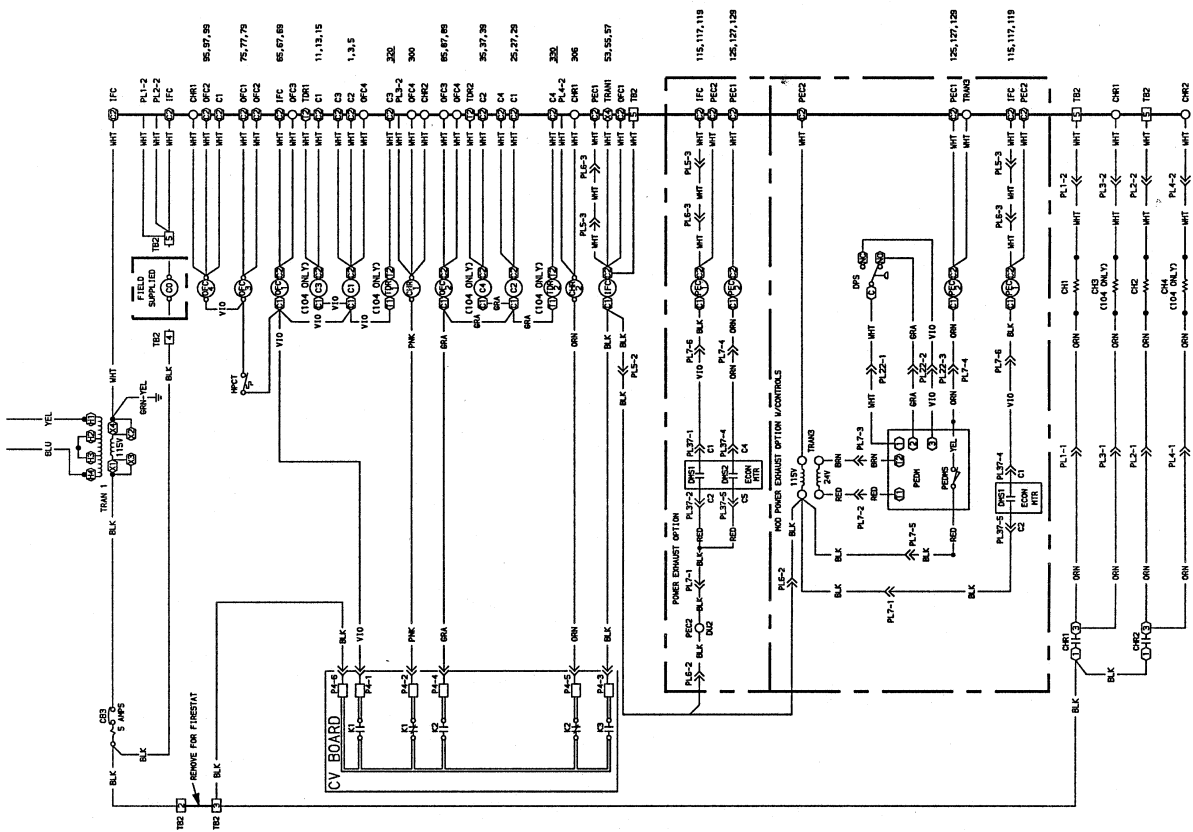


Fig. 95 — Typical Wiring Schematic (cont)

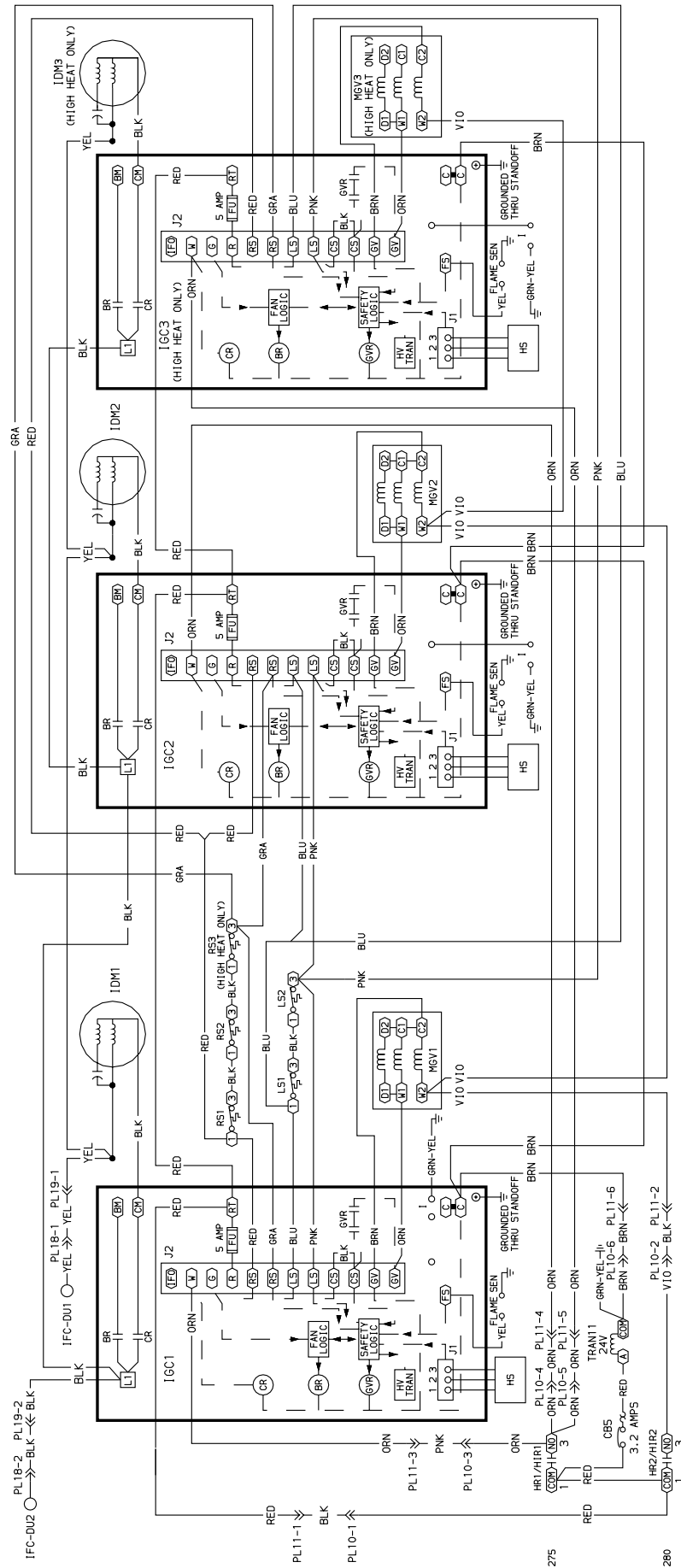


Fig. 96 — Typical Wiring Schematic — Gas Heat Section

TROUBLESHOOTING AND DIAGNOSTICS

PROBLEM	SOLUTION
COMPRESSOR DOES NOT RUN <u>Contactor Open</u> 1. Power off. 2. Fuses blown in field power circuit. 3. No control power. 4. Compressor circuit breaker tripped. 5. Safety device lockout circuit active. 6. Low-pressure switch open. 7. High-pressure switch open. 8. Loose electrical connections. 9. Compressor stuck.	1. Restore power. 2. After finding cause and correcting, replace with correct size fuse. 3. Check secondary fuse(s); replace with correct type and size. Replace transformer if primary windings receiving power. 4. Check for excessive compressor current draw. Reset breaker; replace if defective. 5. Reset lockout circuit at circuit breaker. 6. Check for refrigerant undercharge, obstruction of indoor airflow, or whether compressor suction shutoff valve is fully open. Make sure liquid line solenoid valve(s) is open. 7. Check for refrigerant overcharge, obstruction of outdoor airflow, air in system or whether compressor discharge valve is fully open. Be sure outdoor fans are operating correctly. 8. Tighten all connections. 9. See 06E compressor service literature.
<u>Contactor Closed</u> 1. Compressor leads loose. 2. Motor windings open. 3. Single phasing.	1. Check connections. 2. See 06E compressor service literature. 3. Check for blown fuse. Check for loose connection at compressor terminal.
COMPRESSOR STOPS ON HIGH-PRESSURE SWITCH <u>Outdoor Fan On</u> 1. High-pressure switch faulty. 2. Airflow restricted. 3. Air recirculating. 4. Noncondensables in system. 5. Refrigerant overcharge. 6. Line voltage incorrect. 7. Refrigerant system restrictions.	1. Replace switch. 2. Remove obstruction. 3. Clear airflow area. 4. Purge and recharge as required. 5. Purge as required. 6. Consult power company. 7. Check or replace filter drier, expansion valve, etc. Check that compressor discharge valve is fully open.
<u>Outdoor Fan Off</u> 1. Fan slips on shaft. 2. Motor not running. 3. Motor bearings stuck. 4. Motor overload open. 5. Motor burned out.	1. Tighten fan hub setscrews. 2. Check power and capacitor. 3. Replace bearings. 4. Check overload rating. Check for fan blade obstruction. 5. Replace motor.
COMPRESSOR CYCLES ON LOW-PRESSURE SWITCH <u>Indoor-Air Fan Running</u> 1. Filter drier plugged. 2. Expansion valve power head defective. 3. Low refrigerant charge.	1. Replace filter drier. 2. Replace power head. 3. Add charge. Check low-pressure switch setting.
<u>Airflow Restricted</u> 1. Coil iced up. 2. Coil dirty. 3. Air filters dirty. 4. Dampers closed.	1. Check refrigerant charge. 2. Clean coil fins. 3. Clean or replace filters. 4. Check damper operation and position.
<u>Indoor-Air Fan Stopped</u> 1. Electrical connections loose. 2. Fan relay defective. 3. Motor overload open. 4. Motor defective. 5. Fan belt broken or slipping.	1. Tighten all connections. 2. Replace relay. 3. Power supply. 4. Replace motor. 5. Replace or tighten belt.

LEGEND

PSIO — Processor Module
VFD — Variable Frequency Drive

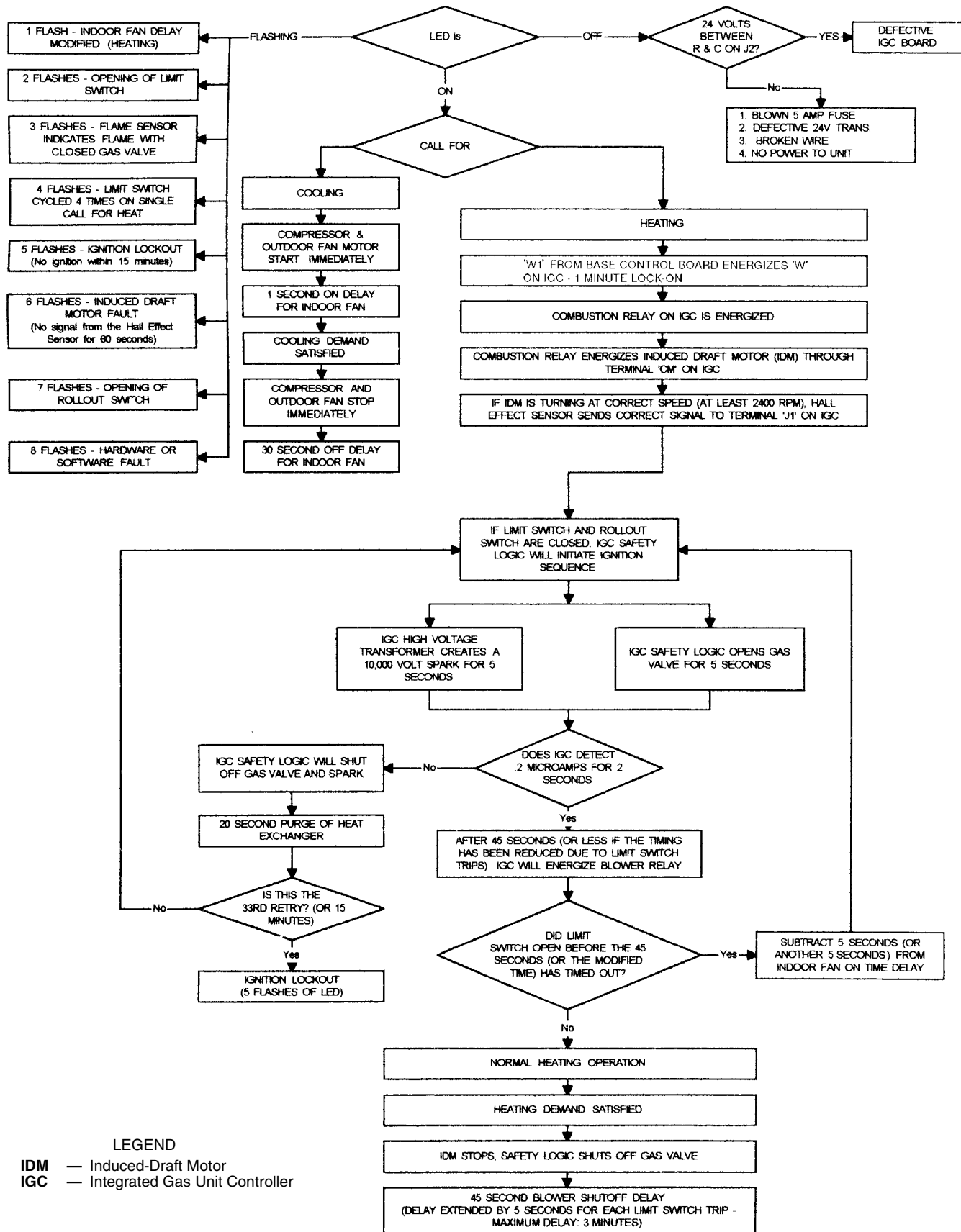
TROUBLESHOOTING AND DIAGNOSTICS (cont)

PROBLEM	SOLUTION
COMPRESSOR RUNNING BUT COOLING INSUFFICIENT Suction Pressure Low 1. Refrigerant charge low. 2. Head pressure low. 3. Air filters dirty. 4. Expansion valve power head defective. 5. Indoor coil partially iced. 6. Indoor airflow restricted.	1. Add refrigerant. 2. Check refrigerant charge. 3. Clean or replace filters. 4. Replace power head. 5. Check low-pressure setting. 6. Remove obstruction.
Suction Pressure High 1. Unloaders not functioning. 2. Compressor valve defective. 3. Heat load excessive.	1. Check unloader adjustments. Check unloader setting. 2. See 06E compressor service literature. 3. Check for open doors or windows in vicinity of fan coil.
UNIT OPERATES TOO LONG OR CONTINUOUSLY 1. Low refrigerant charge. 2. Control contacts fused. 3. Air in system. 4. Partially plugged expansion valve or filter drier.	1. Add refrigerant 2. Replace control. 3. Purge and evacuate system. 4. Clean or replace.
SYSTEM IS NOISY 1. Piping vibration. 2. Compressor noisy.	1. Support piping as required. 2. Check valve plates for valve noise. Replace compressor if bearings are worn.
COMPRESSOR LOSES OIL 1. Leak in system. 2. Crankcase heaters not energized during shutdown.	1. Repair leak. 2. Check wiring and relays. Check heater and replace if defective.
FROSTED SUCTION LINE Expansion valve admitting excess refrigerant.	Adjust expansion valve.
HOT LIQUID LINE 1. Shortage of refrigerant due to leak. 2. Expansion valve opens too wide.	1. Repair leak and recharge. 2. Adjust expansion valve.
FROSTED LIQUID LINE Restricted filter drier.	Remove restriction or replace.
CONTACTOR OPEN 1. Power off. 2. Fuses blown in field power circuit. 3. No control power.	1. Restore power. 2. After finding cause and correcting, replace with correct fuses. 3. Check secondary fuses. Replace with correct type and size. Replace transformer if primary windings are receiving power.
CONTACTOR CLOSED 1. VFD overload function tripped. 2. Motor leads loose. 3. Motor windings open. 4. Single phasing. 5. Belts broken or thrown. 6. Fan status switch contacts defective.	1. Refer to separate VFD technical manual for troubleshooting instructions. 2. Check connections at motor lead junction box. 3. Check motor windings. 4. Check for blown fuse. Check for loose connections at motor junction box. 5. Check belts. Replace as complete set if necessary. 6. Check for input signal at PSIO no. 1, channel 12. Replace switch if defective.

LEGEND

PSIO — Processor Module
VFD — Variable Frequency Drive

TROUBLESHOOTING AND DIAGNOSTICS (cont)



NOTE: Thermostat Fan Switch in the "AUTO" position or sensor-equipped unit.

Fig. 97 — IGC Control (Heating and Cooling)

START-UP CHECKLIST

MODEL NO.: _____

SERIAL NO.: _____

DATE: _____

TECHNICIAN: _____

PRE-START-UP:

- ☐ VERIFY THAT UNIT IS LEVEL
- ☐ VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT
- ☐ LOOSEN ALL SHIPPING HOLDDOWN BOLTS AND REMOVE SHIPPING BRACKETS PER INSTRUCTIONS
- ☐ VERIFY THAT COMPRESSOR SUSPENSION SPRINGS HAVE BEEN LOOSENEED PER INSTRUCTIONS
- ☐ VERIFY OPENING OF ECONOMIZER HOODS
- ☐ VERIFY INSTALLATION OF EXHAUST HOODS
- ☐ VERIFY THAT CONDENSATE CONNECTIONS ARE INSTALLED PER INSTRUCTIONS
- ☐ VERIFY THAT POWER SUPPLY MATCHES UNIT DATA PLATE
- ☐ VERIFY THAT ALL ELECTRICAL CONNECTIONS AND TERMINALS ARE TIGHT
- ☐ CHECK THAT INDOOR-AIR FILTERS ARE CLEAN AND IN PLACE
- ☐ CHECK FAN WHEEL AND PROPELLER FOR LOCATION IN HOUSING/ORIFICE, AND VERIFY SET SCREWS ARE TIGHT
- ☐ CHECK GAS PIPING FOR LEAKS
- ☐ VERIFY THAT FAN SHEAVES ARE ALIGNED AND BELTS ARE PROPERLY TENSIONED
- ☐ OPEN SUCTION, DISCHARGE, AND LIQUID LINE SERVICE VALVES
- ☐ CHECK COMPRESSOR OIL LEVEL SIGHT GLASS AND VERIFY PROPER LEVEL
- ☐ VERIFY THAT CRANKCASE HEATERS HAVE BEEN ENERGIZED FOR 24 HOURS
- ☐ CHECK VOLTAGE IMBALANCE

LINE-TO-LINE VOLTS: AB _____ AC _____ BC _____ V

$(AB + AC + BC)/3 = \text{AVERAGE VOLTAGE} = \text{_____ V}$

MAXIMUM DEVIATION FROM AVERAGE VOLTAGE = _____ V

VOLTAGE IMBALANCE = $100 \times (\text{MAX DEVIATION})/(\text{AVERAGE VOLTAGE}) = \text{_____ \%}$

IF OVER 2% VOLTAGE IMBALANCE, DO NOT ATTEMPT TO START SYSTEM!
CALL LOCAL POWER COMPANY FOR ASSISTANCE.

START-UP

CHECK EVAPORATOR FAN SPEED AND RECORD. _____

CHECK CONDENSER FAN SPEED AND RECORD. _____

AFTER AT LEAST 10 MINUTES RUNNING TIME, RECORD THE FOLLOWING MEASUREMENTS:

	COMP 1	COMP 2	COMP 3 (Size 104 only)	COMP 4 (Size 104 only)
OIL PRESSURE	_____	_____	_____	_____
SUCTION PRESSURE	_____	_____	_____	_____
SUCTION LINE TEMP	_____	_____	_____	_____
DISCHARGE PRESSURE	_____	_____	_____	_____
DISCHARGE LINE TEMP	_____	_____	_____	_____
ENTERING CONDENSER AIR TEMP	_____	_____	_____	_____
LEAVING CONDENSER AIR TEMP	_____	_____	_____	_____
EVAP ENTERING AIR DB TEMP	_____	_____	_____	_____
EVAP ENTERING AIR WB TEMP	_____	_____	_____	_____
EVAP LEAVING AIR DB TEMP	_____	_____	_____	_____
EVAP LEAVING AIR WB TEMP	_____	_____	_____	_____
COMPRESSOR AMPS (L1)	_____	_____	_____	_____
COMPRESSOR AMPS (L2)	_____	_____	_____	_____
COMPRESSOR AMPS (L3)	_____	_____	_____	_____

ELECTRICAL

SUPPLY FAN AMPS _____ EXHAUST FAN AMPS _____

TEMPERATURES

OUTDOOR-AIR TEMPERATURE _____ F DB (Dry-Bulb)

RETURN-AIR TEMPERATURE _____ F DB _____ F WB (Wet-Bulb)

COOLING SUPPLY AIR _____ F

GAS HEAT SUPPLY AIR _____ F

PRESSURES

GAS INLET PRESSURE _____ IN. WG

REFRIGERANT SUCTION CIRCUIT NO. 1 _____ PSIG CIRCUIT NO. 2 _____ PSIG

REFRIGERANT DISCHARGE CIRCUIT NO. 1 _____ PSIG CIRCUIT NO. 2 _____ PSIG

GAS MANIFOLD PRESSURE VALVE NO. 1 _____ IN. WG VALVE NO. 2 _____ IN. WG

☐ VERIFY REFRIGERANT CHARGE USING CHARGING CHARTS ON PAGE 63

GENERAL

☐ ECONOMIZER MINIMUM VENT AND CHANGEOVER SETTINGS TO JOB REQUIREMENTS

CHECK THE COMPRESSOR OIL LEVEL SIGHT GLASSES; ARE THE SIGHT GLASSES SHOWING OIL LEVEL PER INSTRUCTIONS ON PAGE 41. (Y/N) _____