



Product Data

48HJD/HJF Single-Package Rooftop Units Electric Cooling/Gas Heating

13 to 20 Nominal Tons

Quality Assurance



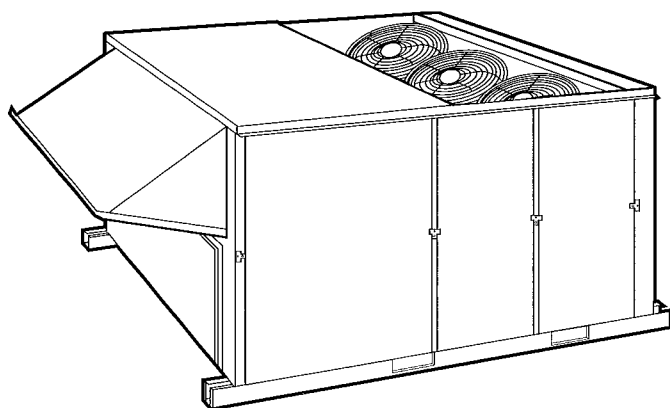
Approvals:

ISO 9002

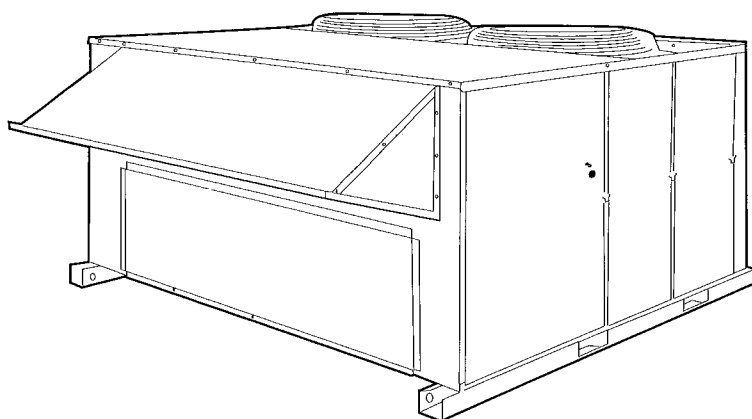
EN 29002

BS5750 PART 2

ANSI/ASQC Q92



(48HJ015,017)



(48HJ025)

High-performance, single-package rooftop products with the following industry-leading premium features:

- Cooling EERs up to 10.5
- Serviceable semi-hermetic compressors
- Service valves and full refrigeration system safeties
- High-static capable oversized fan motors (standard)
- Variable-pitch belt drive fan motors (standard)
- TEMP system compatible Apollo electronic controls (optional)
- exclusive integrated gas control board with diagnostics

Features/Benefits

Industry-leading cooling EERs

The 48HJ015 (13 tons) and 017 (15 tons) units provide leading ARI (Air Conditioning and Refrigeration Institute) certified cooling EERs (Energy Efficiency Ratios) of 10.5 and 10.3, respectively. The fully-rated 20-ton 48HJ025 has an EER of 9.3. These exceptionally high ratings assure minimum operating costs and will qualify for attractive utility rebates in many areas.

Semi-hermetic compressors

All three 48HJ units use the Carlyle 06D semi-hermetic compressors. These serviceable compressors are highly regarded, preferred by owners and users, and offered exclusively on the Carrier high-efficiency 13 to 20 ton HJ units.

Two 06D semi-hermetic compressors on independent refrigeration circuits are offered on the 48HJ017 and 025 units for 2 steps of capacity control and redundancy. A single 06D semi-hermetic compressor with unloading capability and TXV (Thermostatic Expansion Valve) refrigerant control is offered on the 48HJ015. All compressors have service valves and a full complement of safety

devices, including high- and low-pressure switches, overtemperature protection, an electronic cooling lockout device, and crankcase heaters

Oversized fan motors and variable-pitch belt drives

The 48HJ units have oversized evaporator-fan motors and variable-pitch belt drives supplied standard from the factory. A 5 hp motor is provided standard on the 48HJ017 (15-ton unit), and a 10 hp motor is standard on the 48HJ025 (20-ton unit).

Easy installation

The 48HJ 13 to 20 ton rooftop units are perfect for vertical supply and return roof curb mount installation on new construction, retrofit, and replacement applications. The unique industry-leading compact size and weight are favored by designers, contractors, owners, and users.

The compact physical size and weight are not only advantages in terms of minimizing required roof structures on new construction and retrofit jobs, but also make the 48HJ the perfect replacement unit for any of the original Carrier 48DP, DR 012-020 units installed in the late 1970s and early 1980s to meet the upgraded job requirements of the 1990s.

The new 48HJ units can be easily converted to horizontal supply and return with Carrier's new fan-performance-boosting, horizontal, high-static regain adapter (part no. 50DP900211). This vertical-to-horizontal supply/return adapter is not only fully factory assembled with a built-in insulated transition duct, it improves fan performance by as much as 0.6 in. wg of static.

Designed with the service technician in mind, the combustion section viewport is located on the unit side panel and allows full visibility of flame operation at a safe distance from flue gases.

Efficient operation, dependable performance

All compressors are equipped with crankcase heaters, calibrated circuit breakers for overcurrent protection, and Cycle-LOC™ compressor protection. Solid-state Cycle-LOC circuit prevents compressor short cycling by shutting off compressor if any safety device trips.

Aerodynamically-designed condenser fan orifice increases airflow, reduces turbulence, and dampens sound level while minimizing operating costs.

Weather-resistant Carrier cabinet is coated with pre-painted polyester finish to ensure long life and good looks.

Condenser fans are direct driven, permanently lubricated and positioned for quiet, efficient vertical discharge.

Computer-designed coils feature staggered copper tubes for increased operating efficiency. Fins are ripple edged for strength and double waved for higher efficiency.

Safety is assured with the redundant gas valve.

Turbo-tubular™ heat exchangers optimize heat transfer for improved efficiency. The tubular design permits hot gases to make multiple passes across the path of the supply air. The extra thick Alumagard™ heat exchanger coating provides corrosion resistance and ensures long life performance.

The induced draft combustion system eliminates the unsightly appearance of flue stacks, and diminishes the effects of winds on heating operation. The heat exchanger operates under negative pressure, and if any leakage should occur, the flue gases are drawn outside and will not enter the supply air.

During the heating mode, the evaporator-fan relay automatically starts the evaporator fan after the heat exchanger warms up. This prevents cold air from entering the supply air when the conditioned space is calling for heat.

The system utilizes a flame rectification sensor which quickly senses flame and ignites burners almost instantaneously. Since the sensor is quick to react to any flame outage or system failure, fast shutdown is a certainty.

Heating safety controls assure dependability. Limit switches shut off gas valve if excessive temperatures should develop. Hall effect switch shuts down main gas valve in case of insufficient combustion air. A rollout switch deenergizes the gas valve on flame rollout.

Manual outdoor-air damper can be preset to provide up to 25% outdoor air for year-round ventilation. Units equipped with optional or accessory economizer have a thermostatically controlled, fully modulating damper which admits up to 100% outdoor air and provides low-cost cooling. Temperature control governs economizer cooling operation in mild weather.

Integrated gas unit controller (IGC)

All ignition components are contained in the compact IGC which is easily accessible for servicing. The IGC control board, designed and manufactured exclusively for Carrier rooftop units, provides built-in diagnostic capability. An LED (light-emitting diode) simplifies troubleshooting by providing visual fault notification and system status confirmation.

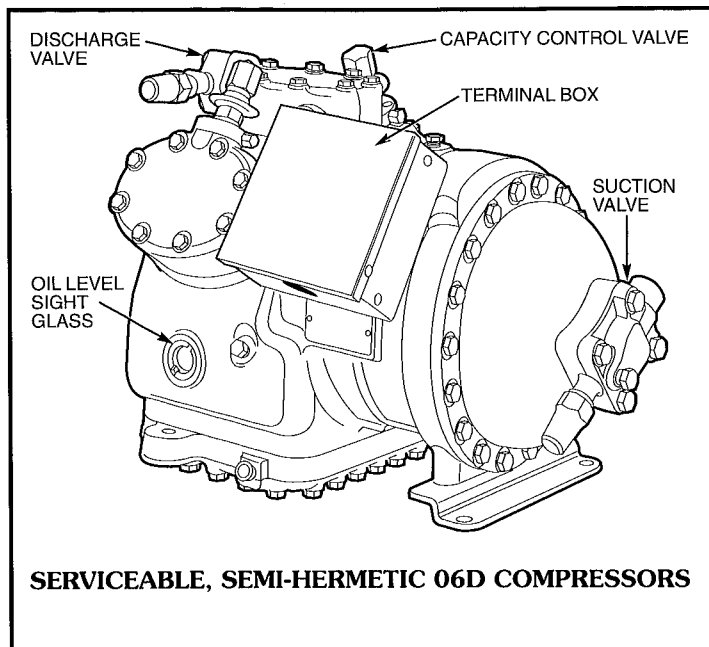
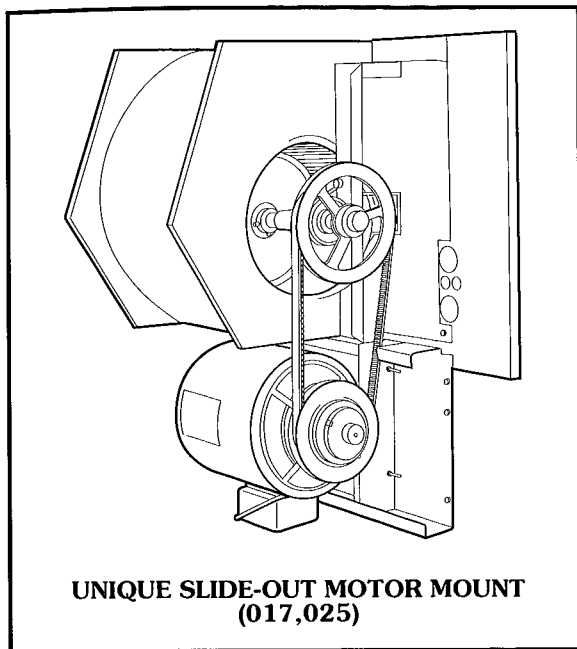
The IGC also contains an exclusive anti-cycle protection for gas heat operation. After 4 continuous cycles on the unit high-temperature limit switch, the gas heat operation is disabled, and an error code is issued. This feature greatly improves reliability of the rooftop unit.

The IGC also contains burner control logic for accurate and dependable gas ignition. The LED is visible without removing the unit control box access panel. This LED fault-notification system reduces service person troubleshooting time and minimizes service costs. The IGC also maximizes heating efficiency by controlling evaporator-fan on and off delays.

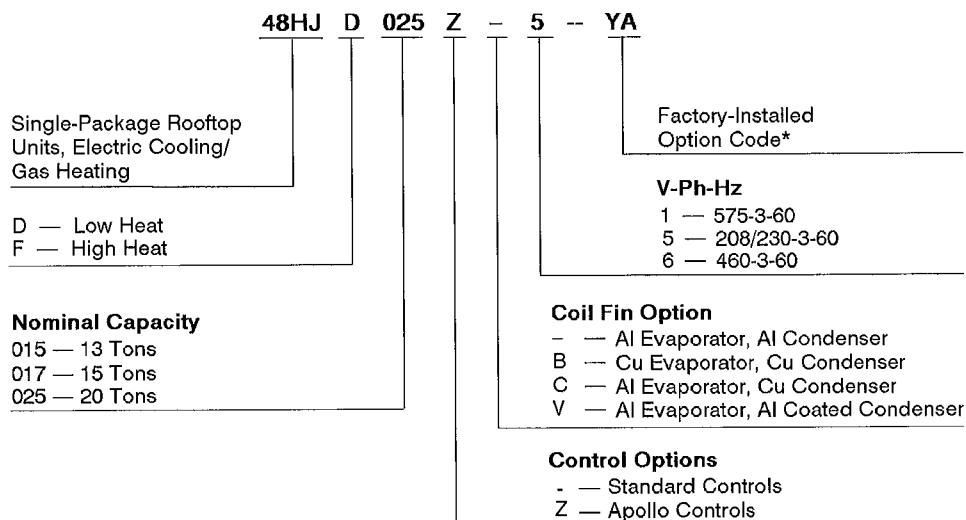
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Features/Benefits (cont)



Model number nomenclature



Al — Aluminum
Cu — Copper

*Refer to 48HJ price pages for 48HJ factory-installed option table or contact your local representative

ARI* capacity ratings



COOLING CAPACITIES AND EFFICIENCIES

UNIT 48	TOTAL kW	NET COOLING CAPACITY (BTUH)	STANDARD CFM	IPLV	EER
HJD/F015	13.91	146,000	3750	12.8	10.5
HJD/F017	18.05	186,000	5200	10.5	10.3
HJD/F025	25.29	234,000	6000	9.3	9.3

LEGEND

EER — Energy Efficiency Ratio

IPLV — Integrated Part-Load Value

*Air Conditioning and Refrigeration Institute



NOTE

Rated in accordance with ARI Standard 360-96.

Ratings are net values, reflecting the effects of circulating fan heat. Ratings are based on

Cooling Standard: 80 F db, 67 F wb indoor entering air temperature and 95 F db air entering outdoor unit.

IPLV Standard: 80 F db, 67 F wb indoor entering-air temperature and 80 F db outdoor entering air temperature

HEATING CAPACITIES AND EFFICIENCIES

UNIT 48	HEATING INPUT (Btuh)	OUTPUT CAPACITY (Btuh)	TEMPERATURE RISE (F)	AGA STEADY STATE EFFICIENCY (%)	MINIMUM HEATING CFM
HJD015	230,000	186,300	15-45	81	3800
HJF015	300,000	243,000	30-60	81	3800
HJD017	275,000	222,750	15-45	81	4750
HDF017	360,000	291,600	20-50	81	5450
HJD025	275,000	222,750	15-45	81	4750
HJF025	360,000	291,600	20-50	81	5450

AGA — American Gas Association

NOTE Minimum allowable temperature of mixed air entering the heat exchanger during first stage heating is 45 F. There is no minimum mixed-air temperature limitation during second-stage heating.

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Physical data



UNIT SIZE 48	HJD/F015		HJD/F017	HJD/F025
	208/230, 460 V	575 V		
OPERATING WT (lb)				
AI/AI*	1650		2050	2250
Unit AI/Cu*	1800		2200	2400
Cu/Cu*	1930		2330	2530
Economizer	110		110	110
Roof Curb†	200		200	200
COMPRESSOR			Semi-Hermetic	
Model Number (Qty)	06D 328 (1)		06D 818 (2)	06D 824 (2)
Cylinders	6		4	6
REFRIGERANT TYPE			R-22	
Expansion Device	TXV		Acutrol™ Feed Device	
Charge (lb)				
System 1	22.50		14 25	17.50
System 2	—		15.00	17.00
CONDENSER COIL				
Rows	3/8-in Enhanced Copper Tubes, Aluminum Lanced or Copper Plate Fins			
Fins/in.	3		4	4
Total Face Area (sq ft)	15		15	15
	22.2		22.2	22.2
CONDENSER FAN			Propeller Type, Direct Drive	
Nominal Cfm	10,500		10,500	14,200
Number...Diameter (in.)	3 22		3 22	2 30
Motor Hp (1075 Rpm)	1/2		1/2	1...1075
Watts Input (Total)	1090		1090	3400
EVAPORATOR COIL				
Rows	3/8-in Enhanced Copper Tubes, Aluminum or Copper Plate Fins			
Fins/in.	2		3	4
Total Face Area (sq ft)	17		15	15
	17.9		17.9	17.9
EVAPORATOR FAN			Centrifugal, Adjustable Pitch Belt Drive	
Quantity...Size (in.)	2 10 x 10	2 10 x 10	2 12 x 12	2 12 x 12
Nominal Cfm	5000	5000	6000	8000
Fan Rpm Range	862-1132	1201-1462	737-885	983-1180
Maximum Allowable Rpm	1550	1550	1550	1550
Motor Pulley Pitch Diameter (in.)	3 1/4.1	4 3/5.3	3 7/4.7	4.9/5.9
Fan Pulley Pitch Diameter (in.)	6 0	6 4	9.4	8 6
Belt, Quantity...Type...Length (in.)	1. BX 42	1 B 45	1. .BX...48	2 BX 50
Speed Change per Full Turn of Movable Pulley Flange (rpm)	54	52	36	39
Movable Pulley Maximum Full Turns	6**	5	6**	6**
Factory Setting	3	3 1/2	3	3
Factory Speed Setting (Rpm)	1024	1279	826	1101
Motor Hp (Service Factor)	3.7 (1 15)	3 (1 15)	5 (1 15)	10 (1 15)
Motor Frame Size	56H	56H	184T	215T
Pulley Center Line Distance (in.)	13.5-15.5	13.5-15.5	13.3-14.8	14.6-15.4
Fan Shaft Diameter (in.)	1 3/16	1 3/16	1 7/16	1 7/16
FURNACE SECTION				
Rollout Switch Cutout Temp (F)††	190		190	190
Burner Orifice Diameter (in. ...drill size)				
Natural Gas	0 1405 28/0 136 29		0 1405 28/0 136 29	0 1405. 28/0.136 29
Gas Input (Btuh) Stage 1	172,000/225,000		206,000/270,000	206,000/270,000
Stage 2	230,000/300,000		275,000/360,000	275,000/360,000
Thermostat Heat Anticipator Setting				
208/230,575 v Stage 1	0.98		0.98	0.98
Stage 2	0.44		0.44	0.44
460 v Stage 1	0.80		0.80	0.80
Stage 2	0.44		0.44	0.44
Efficiency (Steady State) (%)	81		81	81
Temperature Rise Range (F)	15-45/30-60		15-45/20-50	15 45/20-50
Manifold Pressure (in. wg)				
Natural Gas	3.3		3.3	3.3
Field Gas Connection Size (in.)	3/4		3/4	3/4
Gas Valve Quantity	1		1	1
HIGH-PRESSURE SWITCH				
Cutout (psig)			426	
Reset (psig)			320	
LOW-PRESSURE SWITCH				
Cutout (psig)			7	
Reset (psig)			22	
AIR INLET SCREENS			Cleanable	
Economizer, Quantity...Size (in.)			2 . 20 x 25 x 1	
			1 20 x 20 x 1	
RETURN-AIR FILTERS (TYPE)			10% Efficient — 2-in. Throwaway Fiberglass	
Quantity... Size (in.)			4 .20 x 20 x 2	
			4 16 x 20 x 2	

LEGEND

AI — Aluminum
Cu — Copper
TXV — Thermostatic Expansion Valve

*Evaporator coil fin material/condenser coil fin material

†Weight of 14 in. roof curb

**Pulley cannot be run at 0 or 1/2 turns open

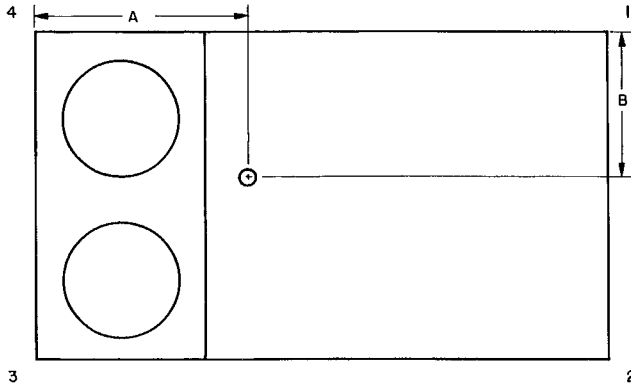
††Rollout switch lockout is manually reset by interrupting power to unit or resetting thermostat

Physical data (cont)

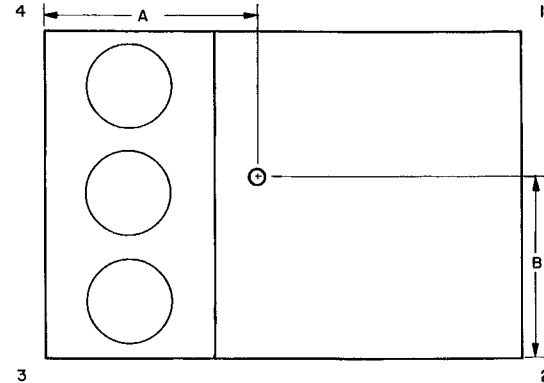


WEIGHT DISTRIBUTION AND CENTER OF GRAVITY

UNIT 48HJ D/F	WEIGHT OF CORNER								DIMENSIONS			
	1		2		3		4		A		B	
	Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg	ft-in.	mm	ft-in.	mm
015	358	162	370	168	384	174	538	244	4-0	1219	3-2	965
017	485	220	516	234	519	235	529	240	3-6 ⁵ / ₈	1083	3-7 ³ / ₈	1102
025	527	239	545	247	578	262	600	272	3-4	1016	3-7 ³ / ₈	1102



48HJ025



48HJ015,017

Options and accessories

ITEM	OPTION*	ACCESSORY†
Apollo Communicating Controls	X	
Integrated Economizer With Hood	X	X
Two-Position Damper With Hood		X
Barometric Relief Damper		X
Roof Curbs (Horizontal and Vertical)		X
Horizontal Adapter		X
Remote Control Panel		X
Thermostat and Subbase		X
Electronic Programmable Thermostat		X
Time Guard® II Circuit		X
Motormaster® Head Pressure Control		X
25 F Low-Ambient Kit**		X
-20 F Low-Ambient Kit**		X
Winter Start Time-Delay Relay Kit		X
Power Exhaust		X
Pressure Operated Unloader		X
Differential Enthalpy Sensor		X
LP (Liquid Propane) Conversion Kit		X

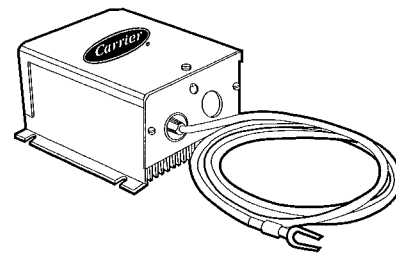
*Factory installed

†Field installed.

**Consists of a combination of accessory kits. See price pages for more details or contact your local Carrier representative.

HEAD PRESSURE CONTROL

The 48HJ015-025 standard units are designed to operate at outdoor temperatures down to 35 F. With accessory Motormaster control (condenser-fan speed modulation), units can operate at lower outdoor temperatures. The head pressure controls, which mount in the condenser section, modulate the condenser-fan motor to maintain correct condensing temperature. Refer to unit price pages or contact your local Carrier representative for complete information on low outdoor-ambient operation accessories.



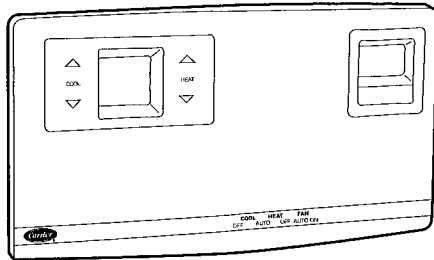
TIME GUARD II CONTROL

Time Guard II Control automatically prevents compressor from restarting for at least 5 minutes after a shutdown. Accessory prevents short cycling of compressor if thermostat is rapidly changed. Time Guard II device mounts in the control compartment of unit.

Options and accessories (cont)

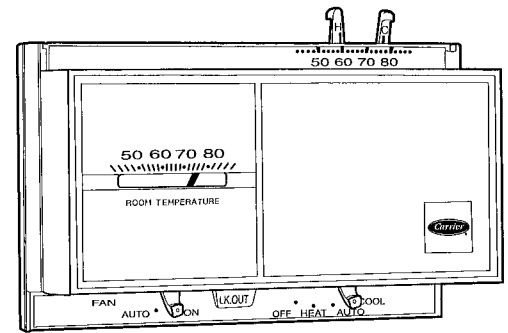


ELECTRONIC PROGRAMMABLE THERMOSTAT



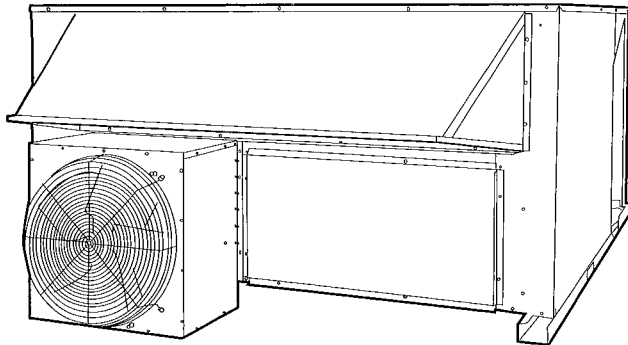
Electronic programmable thermostat provides efficient temperature control by allowing you to program heating and cooling setbacks and set-ups with provisions for weekends and holidays. Accessory remote sensing package is also available to provide tamperproof control in high-traffic areas. Used in conjunction with factory-installed Apollo communicating control, this thermostat provides a 5-minute re-cycle timer between modes of operation for short-cycle protection.

THERMOSTAT



Zone thermostat (24 v) provides one- or 2-stage cooling for control of unit. Matching subbases are available with or without tamperproof switches and automatic changeover.

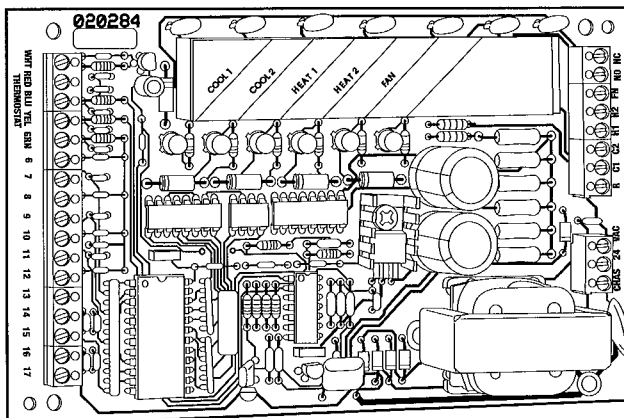
POWER EXHAUST



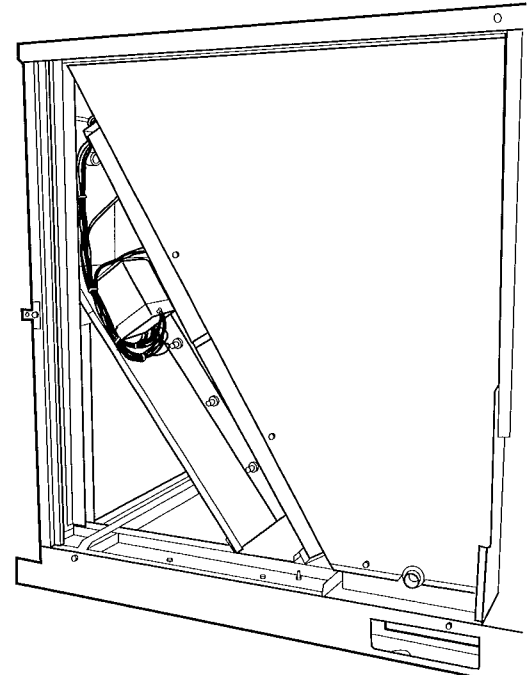
When used with accessory/optional economizer, the power exhaust accessory helps to relieve building over-pressurization.

NOTE: Power exhaust and barometric relief accessories cannot be used with factory pre-assembled, high-static, horizontal adapter.

FACTORY-INSTALLED APOLLO COMMUNICATING CONTROLS



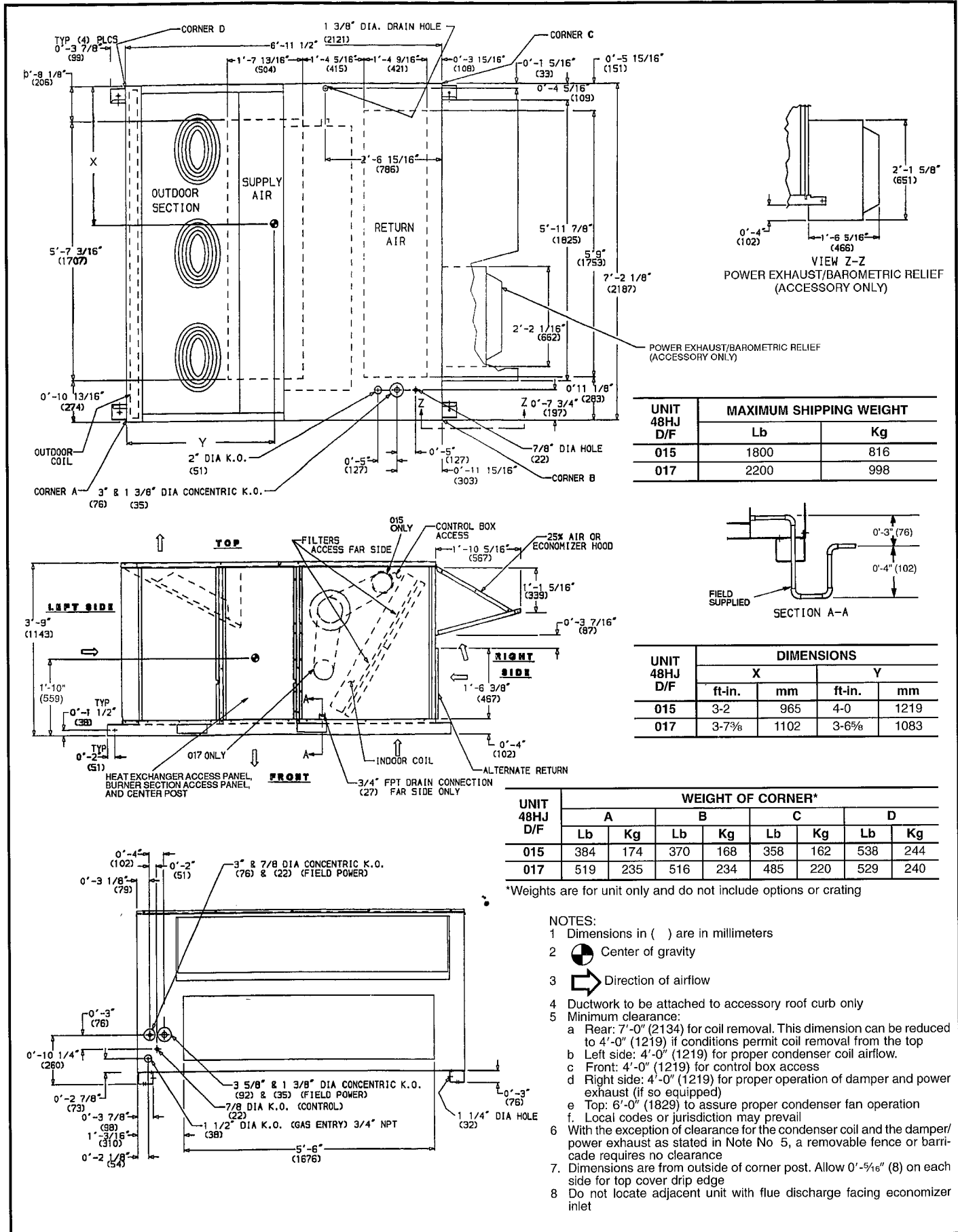
INTEGRATED ECONOMIZER

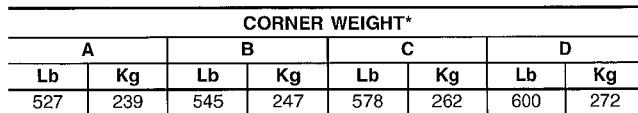


Units equipped with economizer have a thermostatically controlled, fully modulating damper which admits up to 100% outdoor air and provides low-cost cooling. Temperature control governs economizer cooling change-over to provide lowest cost operation in mild weather.

The Apollo direct digital controls are designed exclusively by Carrier, and are used to actively monitor all modes of operation as well as evaporator-fan status, filter status, supply-air temperature, outdoor-air temperature, and indoor-air quality. They are designed to work in conjunction with Carrier TEMP and VVT® system thermostats.

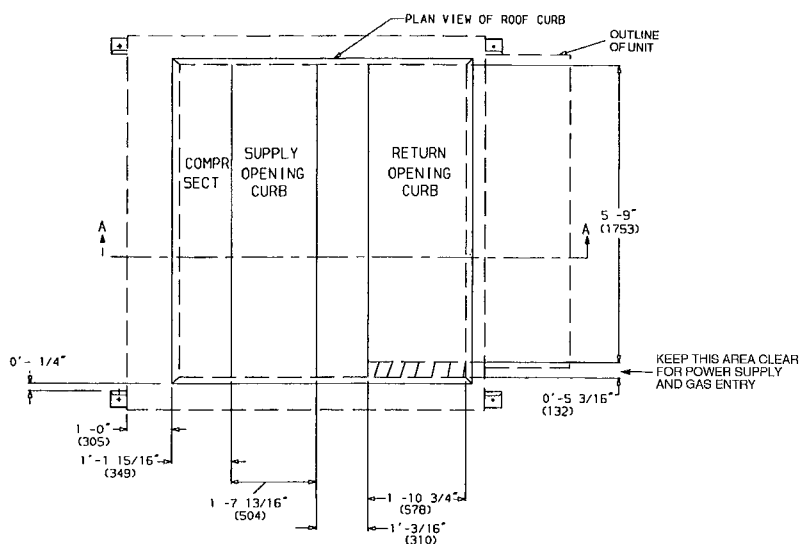
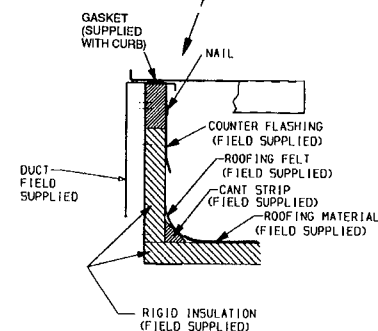
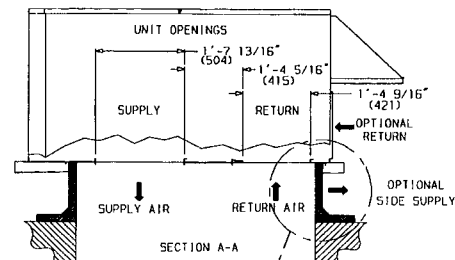
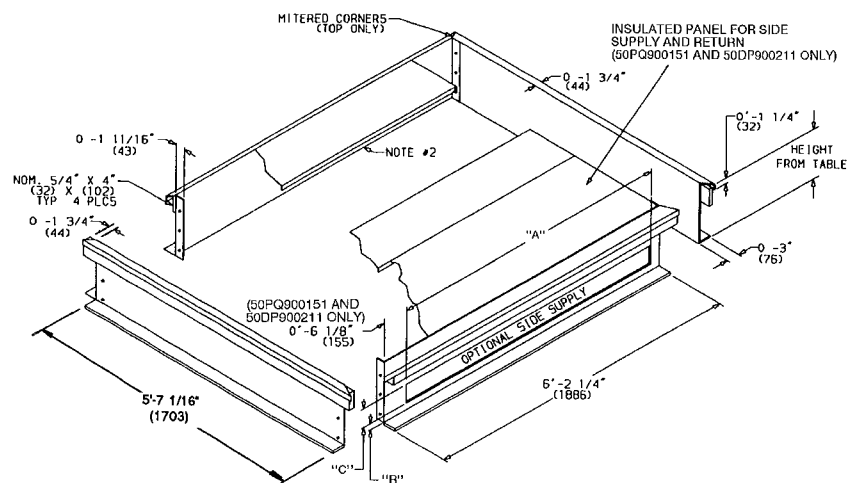
Base unit dimensions — 48HJ015,017





C

Accessory dimensions



ATTACH DUCT TO ROOF CURB

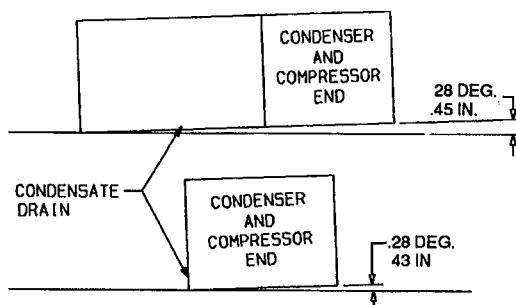
ACCESSORY PACKAGE NO.	CURB HEIGHT	DESCRIPTION	"A"	"B"	"C"
50PQ900221	1'-2" (305)	Standard Curb — 14" High	—	—	—
50PQ900141	2'-0" (610)	Standard Curb for Units Requiring High Installation	—	—	—
50PQ900151	2'-0" (610)	Horizontal Supply and Return Curb	5'-6" (1676)	0'-2 1/2" (64)	1'-6" (457)
50DP900211	1'-11" (584)	Pre-Assembled, High-Static, Horizontal Adapter	6'-2" (1880)	0'-6 1/4" (159)	1'-2 5/8" (371)

LEGEND

COMP SECT. — Compressor Section

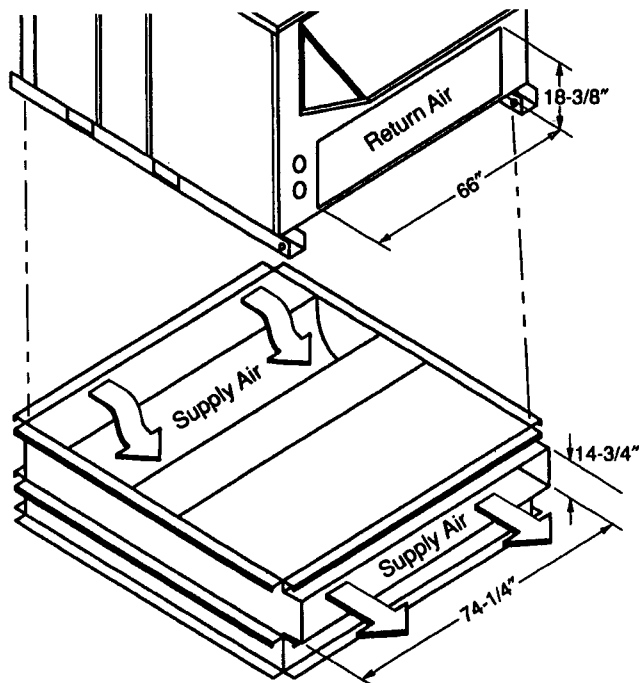
NOTES:

- 1 Roof curb accessory is shipped unassembled.
- 2 Insulated panels, 1/2-in thick neoprene-coated, 2 lb density
- 3 Dimensions in () are in millimeters
- 4 Direction of airflow.
- 5 Roof curb 16 gage steel
- 6 Attach all ductwork to roof curb
- 7 Field installation of sidewall is mandatory



NOTE To prevent the hazard of stagnant water build-up in the drain pan of the indoor-air section, unit can only be pitched as shown.

HORIZONTAL ADAPTER INSTALLATION



NOTES.

- 1 50DP900211 is a fully factory-preassembled horizontal adapter which includes an insulated high-static regain transition duct to substantially improve fan static performance
- 2 Power exhaust and barometric relief accessories cannot be used with factory pre-assembled, high-static, horizontal adapter

Selection procedure (with 48HJD025 example)

I Determine cooling and heating requirements at design conditions.

Given:

Required Cooling Capacity (TC) . . . 205,000 Btuh
 Sensible Heat Capacity (SHC) . . . 162,000 Btuh
 Required Heating Capacity 190,000 Btuh
 Condenser Entering Air Temp 95 F Summer
 Evaporator Entering Air Temp . . 80 F db, 67 F ewb
 Evaporator Air Quantity 8,000 cfm
 External Static Pressure 1.30 in. wg
 Electrical Characteristics (V-Ph-Hz) 460-3-60

Vertical discharge unit with optional economizer required.

II Select unit based on required cooling capacity.

Enter cooling capacity table for 48HJD025 on page 13 at condenser entering temperature 95 F, evaporator air entering at 8000 cfm and 67 F wb. The 48HJD025 unit will provide a total cooling capacity of 254,000 Btuh and a sensible heating capacity of 193,800 Btuh. For evaporator air temperatures other than 80 F edb, calculate sensible heat capacity correction, as required, using the formula in the notes following the Cooling Capacities tables.

NOTE: Unit ratings are gross capacities and do not include the effect of indoor fan motor heat. To calculate net capacities, see Step V.

III Select heating capacity of unit to provide design condition requirements.

In the Heating Capacities and Efficiencies table (page 4) note that the 48HJD025 will provide output capacity of 222,750 Btuh, which is adequate for the given application.

IV Determine fan speed and power requirements at design conditions.

Before entering the Fan Performance tables, calculate the total static pressure required based on unit components. From the given and the Accessory/FIOP Economizer Static Pressure table (page 19) (number derived through interpolation) find:

External static pressure	1.30 in. wg
Economizer static pressure	0.10 in. wg
Total static pressure	1.40 in. wg

Enter the Fan Performance table for 48HJD025 on page 17 at 8000 cfm and 1.40 in. wg external static pressure. The rpm is 1409 and the bhp is 6.84. The factory-installed 10 hp motor and drive are sufficient for this application.

V Determine net cooling capacity.

Cooling capacities are gross capacities and do not include indoor (evaporator) fan motor (IFM) heat. To determine input power to the motor, enter the Fan Performance table for the 48HJD025 on page 17 at 8000 cfm and 1.40 in. wg external static pressure. Input watts to the motor are 6297.

Determine net cooling capacity using the following formula:

$$\begin{aligned} \text{Net capacity} &= \text{Gross capacity} - \text{IFM heat} \\ &= 254,000 \text{ Btuh} - 6297 \left(3.412 \frac{\text{Btuh}}{\text{Watts}} \right) \\ &= 254,000 \text{ Btuh} - 21,485 \text{ Btuh} \\ &= 231,515 \text{ Btuh} \end{aligned}$$

$$\begin{aligned} \text{Net sensible capacity} &= 193,800 \text{ Btuh} - 21,485 \text{ Btuh} \\ &= 172,315 \text{ Btuh} \end{aligned}$$

The calculations show that a 48HJD025 unit is the correct selection for the given conditions.

COOLING CAPACITIES

48HJ015 (13 TONS)																
Temp (F) Air Entering Condenser (Edb)		Air Entering Evaporator — Cfm/BF														
		3750/0.06			4375/0.07			5000/0.08			5625/0.09			6250/0.10		
		Air Entering Evaporator — Ewb (F)														
		72	67	62	72	67	62	72	67	62	72	67	62	72	67	62
75	TC	177 0	164 0	150 0	181 0	167 0	154 0	184 0	169 0	157 0	185 0	172 0	160 0	186 0	173 0	162 0
	SHC	85 0	106 0	126 0	88 0	113 0	136 0	92.2	123 0	145 0	94 3	125 0	152 0	96 1	134 0	159 0
	kW	9.84	9 64	9 42	9.91	9 69	9 51	10 00	9.74	9 56	10 00	9.81	9.63	10 00	9 84	9 66
85	TC	172 0	157 0	143 0	175 0	161 0	147 0	177 0	165 0	150 0	180 0	166 0	153 0	180 0	167 0	155 0
	SHC	83.2	104 0	123 0	87 0	111 0	132 0	89 8	118 0	142 0	95 5	125 0	150 0	97 4	133 0	155 0
	kW	10.90	10 70	10 40	11 00	10 70	10 50	11 00	10 80	10 50	11 10	10 90	10 60	11 10	10 90	10 70
95	TC	165 0	150 0	135 0	168 0	154 0	139 0	170 0	157 0	142 0	172 0	159 0	146 0	175 0	160 0	149 0
	SHC	81 0	101 0	119 0	85 0	108 0	129 0	89 4	115 0	139 0	93 2	122 0	146 0	97 0	128 0	149 0
	kW	12 00	11 60	11 30	12 10	11 80	11 40	12 10	11 80	11 60	12 20	11 90	11 60	12 30	12 00	11 70
105	TC	158 0	143 0	126 0	160 0	146 0	129 0	164 0	149 0	134 0	164 0	151 0	140 0	165 0	152 0	143 0
	SHC	78 4	98 2	115 0	82 2	106 0	125 0	86 9	113 0	134 0	90 9	120 0	139 0	94 0	125 0	143 0
	kW	13 00	12 70	12 20	13 10	12 80	12 40	13 20	12 90	12 50	13 30	13 00	12 70	13 30	13 00	12 80
115	TC	149 0	134 0	113 0	153 0	138 0	119 0	155 0	140 0	125 0	155 0	142 0	132 0	157 0	143 0	136 0
	SHC	75 5	94 8	109 0	79 7	103 0	119 0	83 9	110 0	125 0	87 9	116 0	132 0	91 9	121 0	136 0
	kW	14 00	13 60	13 20	14 20	13 80	13 30	14 20	13 80	13 50	14 20	13 90	13 70	14 30	13 90	13 80
125	TC	141 0	123 0	102 0	144 0	127 0	109 0	146 0	131 0	116 0	148 0	133 0	122 0	148 0	134 0	129 0
	SHC	72 8	90 6	102 0	77 3	98 3	109 0	81 2	106 0	116 0	85 6	113 0	122 0	88 8	118 0	129 0
	kW	15 10	14 60	14 20	15 20	14 70	14 40	15 30	14 80	14 60	15 40	14 90	14 70	15 30	14 90	14 80

LEGEND

- BF** — Bypass Factor
Edb — Entering Dry-Bulb
Ewb — Entering Wet-Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTES:

- Direct interpolation is permissible. Do not extrapolate.
- The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{Sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

$$t_{lwb} = \text{Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil } (h_{lwb})$$

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where:

h_{ewb} = Enthalpy of air entering evaporator coil

- SHC is based on 80 F edb temperature of air entering evaporator coil. Below 80 F edb, subtract (corr factor x cfm) from SHC. Above 80 F edb, add (corr factor x cfm) to SHC.

BYPASS FACTOR (BF)	ENTERING AIR DRY-BULB TEMP (F)					
	79	78	77	76	75	under 75
	81	82	83	84	85	over 85
Correction Factor						
.05	1.04	2.07	3.11	4.14	5.18	Use formula shown below
.10	.98	1.96	2.94	3.92	4.90	
.20	.87	1.74	2.62	3.49	4.36	
.30	.76	1.53	2.29	3.05	3.82	

Interpolation is permissible

$$\text{Correction Factor} = 1.10 \times (1 - \text{BF}) \times (\text{edb} - 80)$$

COOLING CAPACITIES (cont)

48HJ017 (15 TONS)																
Temp (F) Air Entering Condenser (Edb)		Air Entering Evaporator — Cfm/BF														
		4500/0.03			5250/0.03			6000/0.04			6750/0.05			7500/0.05		
		Air Entering Evaporator — Ewb (F)														
		72	67	62	72	67	62	72	67	62	72	67	62	72	67	62
75	TC	224 0	206 0	186.2	230 0	212 0	191 8	234 0	216 0	196 4	236 0	218 0	200 0	238 0	220 0	204 0
	SHC	108 0	133 2	156 2	113 2	143 0	171 4	117 8	152 0	182 8	122 8	160 8	194 2	127 8	168 4	204 0
	kW	12 94	12.62	12 26	13 06	12 74	12 38	13 16	12 84	12 50	13 22	12.92	12.60	13 28	12.96	12 70
85	TC	216 0	196 2	177 0	220 0	202 0	182.6	224 0	206 0	186 8	226 0	210 0	190.6	228 0	212 0	196 2
	SHC	105 0	129 6	153 0	109 4	139 6	166 4	114 8	148 8	179 2	119 6	157 4	190.2	124 0	165 6	196 0
	kW	14 34	13.94	13 48	14 42	14 08	13 66	14 52	14 20	13 80	14 60	14.28	13.92	14 66	14 34	14.04
95	TC	206 0	186 4	167.6	210 0	191 6	172 6	214 0	195.6	177 0	216 0	198 4	182 6	216 0	200 0	187 6
	SHC	101.2	125.6	148 8	107 0	135.6	162 0	112 4	144.8	174 0	115 8	153 4	182 2	120 4	161 6	187 6
	kW	15.64	15 16	14.70	15 82	15.34	14 90	15 96	15 46	15.02	15 94	15 56	15 20	16 02	15 62	15 34
105	TC	194 6	176 4	156 8	198 4	181 4	163 0	200 0	184 8	168 2	202 0	187 2	174 0	204 0	188 8	179 0
	SHC	97 4	121 8	143 6	102 0	131 0	157.6	106 8	140.6	168 2	111.8	149 0	174 0	116 4	157 2	178 8
	kW	16 92	16 38	15 84	17.02	16 54	16 02	17.12	16 70	16 22	17 22	16 80	16.44	17 28	16 86	16.60
115	TC	183 0	166 4	149 0	186 4	170 8	154 0	188 6	173 4	160 0	190 8	175 4	165 4	192 2	177 0	169 6
	SHC	92.6	117 6	140 0	97 6	127 0	152 4	102 6	136 0	160 0	107.6	144 2	165.2	112.4	151 8	169 4
	kW	18.02	17.48	16 86	18.18	17 66	17 04	18.30	17 80	17 34	18.40	17 88	17 58	18 48	17 98	17 74
125	TC	171.2	155 8	139 4	172 6	159 0	145 4	176 2	161 4	151 4	178 2	163 4	156 2	178 8	164 8	159 6
	SHC	88 6	113 0	135 4	92 2	121 6	145.2	98 0	129 8	151 2	103 0	138 0	155 8	106 8	145 4	159 6
	kW	19 08	18 42	17 84	19.16	18 60	18 12	19 38	18 74	18 40	19 50	18.90	18 64	19.54	18 98	18 82

48HJ025 (20 TONS)																
Temp (F) Air Entering Condenser (Edb)		Air Entering Evaporator — Cfm/BF														
		6000/0.03			7000/0.04			8000/0.05			9000/0.05			10,000/0.06		
		Air Entering Evaporator — Ewb (F)														
		72	67	62	72	67	62	72	67	62	72	67	62	72	67	62
75	TC	290.0	264 0	242 0	300 0	272 0	250.0	304 0	278.0	256.0	306 0	284 0	260 0	308.0	286 0	266 0
	SHC	142 6	176 2	208 0	151 4	189 4	228 0	159.0	202 0	244 0	166 4	214 0	258.0	176 2	228 0	266 0
	KW	17 12	16.56	16 08	17.36	16 76	16 28	17 46	16 90	16 46	17.52	17 08	16 58	17.54	17 14	16 68
85	TC	280 0	254 0	228 0	286 0	262 0	236 0	292 0	266.0	244 0	296 0	272.0	250 0	302 0	274 0	258 0
	SHC	139 2	172.0	202.0	147.0	185 8	222 0	154 8	198 0	238 0	162.2	212 0	250 0	170.6	224 0	258 0
	KW	18 78	18 16	17 52	18.98	18.38	17 76	19.12	18 50	17.98	19 26	18 70	18 16	19 42	18.80	18 34
95	TC	268 0	242 0	214 0	274 0	250 0	222.0	280 0	254 0	230 0	284 0	258 0	240.0	286 0	262 0	246 0
	SHC	135.0	167.2	196 0	142 8	180.8	214.0	150 8	193 8	228 0	158.6	206.0	240.0	165 2	218.0	246 0
	KW	20 40	19 68	18 96	20 60	19 94	19 24	20.80	20 20	19 48	21 00	20 40	19 72	21 00	20.40	19.94
105	TC	256 0	226 0	199.6	260 0	234 0	208.0	264 0	238.0	218 0	268 0	242 0	228 0	272 0	246.0	236 0
	SHC	130 2	161.2	189.0	139 6	174 8	206.0	146.4	188 0	218 0	154.2	200 0	228 0	161.4	212.0	234.0
	KW	22 00	21.20	20 40	22.20	21 40	20 80	22.40	21 60	21.00	22 60	21 80	21 20	22 60	22.00	21 60
115	TC	240 0	210 0	185 0	246 0	218 0	194.8	252 0	222 0	206 0	256.0	226 0	214.0	256 0	230 0	222 0
	SHC	125 6	154 6	181 2	133 8	168 6	194 6	141 8	181 6	206 0	149.8	194.4	214 0	157 0	206.0	222 0
	KW	23.60	22 60	21 80	23 80	23 00	22 20	24.00	23 20	22 60	24 20	23.40	22 80	24 20	23 40	23.00
125	TC	224 0	193 8	170.4	230.0	199 2	181.0	236 0	204 0	192 4	238.0	210 0	200 0	240.0	214.0	208 0
	SHC	119 8	148.2	170 4	128.4	161.8	181 0	136 8	174 8	192 4	144 4	188.0	200 0	152.0	199 4	208 0
	KW	25 00	24.20	23 40	25 40	24.40	23 80	25 60	24 60	24 20	25 80	24.80	24 40	25 80	24.80	24 80

LEGEND

BF — Bypass Factor
Edb — Entering Dry-Bulb
Ewb — Entering Wet-Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTES

- Direct interpolation is permissible. Do not extrapolate.
- The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{Sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

$$t_{lwb} = \text{Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h}_{lwb}\text{)}$$

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where

h_{ewb} = Enthalpy of air entering evaporator coil

- SHC is based on 80 F edb temperature of air entering evaporator coil. Below 80 F edb, subtract (corr factor x cfm) from SHC. Above 80 F edb, add (corr factor x cfm) to SHC.

BYPASS FACTOR (BF)	ENTERING AIR DRY-BULB TEMP (F)					
	79	78	77	76	75	under 75
	81	82	83	84	85	over 85
.05	1.04	2.07	3.11	4.14	5.18	Use formula shown below
.10	.98	1.96	2.94	3.92	4.90	
.20	.87	1.74	2.62	3.49	4.36	
.30	.76	1.53	2.29	3.05	3.82	

Interpolation is permissible

Correction Factor = $1.10 \times (1 - \text{BF}) \times (\text{edb} - 80)$.

Performance data (cont)



FAN PERFORMANCE

48HJ015 (13 TONS) — STANDARD MOTOR (BELT DRIVE) — 208/230, 460-V UNIT															
Airflow (Cfm)	External Static Pressure (in. wg)														
	0.2			0.4			0.6			0.8			1.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	741	510	0.58	854	715	0.82	952	921	1.05	1041	1130	1.29	1124	1344	1.53
4000	773	647	0.74	882	859	0.98	978	1071	1.22	1064	1285	1.46	1145	1502	1.71
4250	806	796	0.91	912	1015	1.16	1004	1233	1.40	1089	1452	1.65	1167	1674	1.91
4500	839	958	1.09	942	1183	1.35	1032	1407	1.60	1114	1632	1.86	1191	1859	2.12
4750	873	1134	1.29	972	1365	1.56	1060	1595	1.82	1140	1825	2.08	1215	2056	2.34
5000	908	1323	1.51	1003	1560	1.78	1089	1796	2.05	1167	2032	2.32	1241	2268	2.58
5250	942	1527	1.74	1035	1769	2.02	1118	2011	2.29	1195	2252	2.57	1267	2494	2.84
5500	978	1745	1.99	1067	1992	2.27	1148	2240	2.55	1223	2487	2.83	1293	2733	3.11
5750	1013	1978	2.25	1099	2230	2.54	1179	2484	2.83	1252	2736	3.12	1321	2988	3.40
6000	1049	2227	2.54	1132	2483	2.83	1210	2742	3.12	1282	2999	3.42	1349	3257	3.71
6250	1085	2491	2.84	1166	2751	3.13	1241	3015	3.44	1312	3279	3.74	1378	3541	4.03

48HJ015 (13 TONS) — STANDARD MOTOR (BELT DRIVE) — 208/230, 460-V UNIT (cont)															
Airflow (Cfm)	External Static Pressure (in. wg)														
	1.2			1.4			1.6			1.8			2.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	1203	1562	1.78	1277	1784	2.03	1349	2010	2.29	1417	2240	2.55	1483	2473	2.82
4000	1222	1724	1.96	1294	1950	2.22	1364	2180	2.48	1431	2413	2.75	1495	2650	3.02
4250	1242	1900	2.16	1313	2129	2.43	1381	2362	2.69	1446	2599	2.96	1509	2839	3.23
4500	1264	2089	2.38	1333	2322	2.65	1399	2558	2.91	1463	2799	3.19	1525	3042	3.47
4750	1286	2290	2.61	1354	2528	2.88	1419	2769	3.15	1482	3012	3.43	1542	3259	3.71
5000	1310	2507	2.86	1376	2748	3.13	1440	2992	3.41	1501	3240	3.69	1560	3489	3.98
5250	1335	2737	3.12	1399	2983	3.40	1461	3230	3.68	1522	3481	3.97	—	—	—
5500	1360	2981	3.40	1423	3231	3.68	1484	3483	3.97	1543	3737	4.26	—	—	—
5750	1386	3241	3.69	1448	3495	3.98	1508	3750	4.27	—	—	—	—	—	—
6000	1413	3514	4.00	1474	3773	4.30	1532	4032	4.59	—	—	—	—	—	—
6250	1440	3803	4.33	1500	4066	4.63	1558	4330	4.93	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower Input to Fan
FIOP — Factory-Installed Option
Watts — Input Watts to Motor

NOTES.

- Boldface** indicates field-supplied drive required.
- indicates field-supplied motor and drive required
- Factory shipped motor drive range is 862 to 1132 rpm. Other rpms require a field-supplied drive

- Static pressure losses (i.e., economizer) must be added to external static pressure before entering Fan Performance table. See Accessory/FIOP Economizer Static Pressure table for more information.
- Interpolation is permissible. Do not extrapolate.
- Maximum continuous bhp is 4.25 and the maximum continuous watts are 3775. Extensive motor and drive testing on these units ensures that the full horsepower range of the motor can be utilized with confidence. Using your fan motors up to the watts rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.

FAN PERFORMANCE (cont)

48HJ015 (13 TONS) — STANDARD MOTOR (BELT DRIVE) — 575-V UNIT

Airflow (Cfm)	External Static Pressure (in. wg)														
	0.2			0.4			0.6			0.8			1.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	741	510	0.58	854	715	0.82	952	921	1.05	1041	1030	1.29	1124	1344	1.53
4000	773	647	0.74	882	859	0.98	978	1071	1.22	1064	1285	1.46	1145	1502	1.71
4250	806	796	0.91	912	1015	1.16	1004	1233	1.40	1089	1452	1.65	1167	1674	1.91
4500	839	958	1.09	942	1183	1.35	1032	1407	1.60	1114	1632	1.86	1191	1859	2.12
4750	873	1134	1.29	972	1365	1.56	1060	1595	1.82	1140	1825	2.08	1215	2056	2.34
5000	908	1323	1.51	1003	1560	1.78	1089	1796	2.05	1167	2032	2.32	1241	2268	2.58
5250	942	1527	1.74	1035	1769	2.02	1118	2011	2.29	1195	2252	2.57	1267	2494	2.84
5500	978	1745	1.99	1067	1992	2.27	1148	2240	2.55	1223	2487	2.83	1293	2733	3.11
5750	1013	1978	2.25	1099	2230	2.54	1179	2484	2.83	1252	2736	3.12	1321	2988	3.40
6000	1049	2227	2.54	1132	2483	2.83	1210	2742	3.12	1282	2999	3.42	1349	3257	3.71
6250	1085	2491	2.84	1166	2751	3.13	1241	3015	3.44	1312	3279	3.74	1378	3541	4.03

48HJ015 (13 TONS) — STANDARD MOTOR (BELT DRIVE) — 575-V UNIT (cont)

Airflow (Cfm)	External Static Pressure (in. wg)														
	1.2			1.4			1.6			1.8			2.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
3750	1203	1562	1.78	1277	1784	2.03	1349	2010	2.29	1417	2240	2.55	1483	2473	2.82
4000	1222	1724	1.96	1294	1950	2.22	1364	2180	2.48	1431	2413	2.75	1495	2650	3.02
4250	1242	1900	2.16	1313	2129	2.43	1381	2362	2.69	1446	2599	2.96	1509	2839	3.23
4500	1264	2089	2.38	1333	2322	2.65	1399	2558	2.91	1463	2799	3.19	1525	3042	3.47
4750	1286	2290	2.61	1354	2528	2.88	1419	2769	3.15	1482	3012	3.43	1542	3259	3.71
5000	1310	2507	2.86	1376	2748	3.13	1440	2992	3.41	1501	3240	3.69	1560	3489	3.98
5250	1335	2737	3.12	1399	2983	3.40	1461	3230	3.68	1522	3481	3.97	—	—	—
5500	1360	2981	3.40	1423	3231	3.68	1484	3483	3.97	1543	3737	4.26	—	—	—
5750	1386	3241	3.69	1448	3495	3.98	1508	3750	4.27	—	—	—	—	—	—
6000	1413	3514	4.00	1474	3773	4.30	1532	4032	4.59	—	—	—	—	—	—
6250	1440	3803	4.33	1500	4066	4.63	1556	4330	4.93	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower Input to Fan
FIOF — Factory-Installed Option
Watts — Input Watts to Motor

NOTES:

- Boldface** indicates field-supplied drive required
- Field-supplied motor and drive required.**
- Factory shipped motor drive range is 1201 to 1462 rpm. Other rpms require a field-supplied drive.
- Static pressure losses (i.e., economizer) must be added to external static pressure before entering Fan Performance table. See Accessory/FIOF Economizer Static Pressure table for more information.
- Interpolation is permissible. Do not extrapolate.
- Maximum continuous bhp is 3.45 and the maximum continuous watts are 3065. Extensive motor and drive testing on these units ensures that the full horsepower range of the motor can be utilized with confidence. Using your fan motors up to the watts rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.

Performance data (cont)



FAN PERFORMANCE (cont)

48HJ017 (15 TONS) — STANDARD MOTOR (BELT DRIVE)															
Airflow (Cfm)	External Static Pressure (in. wg)														
	0.2			0.4			0.6			0.8			1.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
4500	630	805	0.9	741	1059	1.2	846	1341	1.5	945	1653	1.9	1039	1993	2.2
4800	659	943	1.1	765	1208	1.4	865	1497	1.7	961	1816	2.0	1052	2163	2.4
5100	688	1094	1.2	789	1371	1.5	885	1668	1.9	977	1993	2.2	1064	2345	2.6
5400	717	1262	1.4	814	1550	1.7	907	1856	2.1	994	2187	2.4	1079	2546	2.8
5700	748	1450	1.6	842	1752	2.0	930	2067	2.3	1015	2406	2.7	1096	2770	3.1
6000	776	1648	1.8	867	1963	2.2	952	2289	2.6	1034	2635	2.9	1112	3004	3.4
6300	804	1861	2.1	892	2190	2.5	975	2526	2.8	1053	2880	3.2	1129	3256	3.6
6600	835	2103	2.4	919	2445	2.7	1000	2793	3.1	1076	3156	3.5	1149	3540	4.0
6900	863	2356	2.6	946	2712	3.0	1024	3072	3.4	1098	3445	3.9	1169	3835	4.3
7200	892	2628	2.9	972	2998	3.4	1049	3371	3.8	1120	3754	4.2	1189	4152	4.6
7500	923	2933	3.3	1001	3318	3.7	1076	3704	4.1	1146	4098	4.6	1213	4506	5.0

48HJ017 (15 TONS) — STANDARD MOTOR (BELT DRIVE) (cont)															
Airflow (Cfm)	External Static Pressure (in. wg)														
	1.2			1.4			1.6			1.8			2.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
4500	1128	2355	2.6	1211	2734	3.1	1289	3127	3.5	1363	3531	4.0	1433	3944	4.4
4800	1138	2533	2.8	1219	2921	3.3	1297	3325	3.7	1370	3742	4.2	1440	4170	4.7
5100	1148	2722	3.0	1228	3119	3.5	1305	3532	4.0	1377	3961	4.4	1447	4400	4.9
5400	1160	2928	3.3	1238	3332	3.7	1313	3755	4.2	1385	4192	4.7	1454	4643	5.2
5700	1175	3158	3.5	1251	3569	4.0	1324	3999	4.5	1395	4445	5.0	1462	4906	5.5
6000	1188	3398	3.8	1262	3814	4.3	1334	4250	4.8	1403	4704	5.3	1470	5173	5.8
6300	1203	3654	4.1	1275	4075	4.6	1344	4517	5.1	1412	4976	5.6	1478	5453	6.1
6400	1221	3944	4.4	1290	4370	4.9	1358	4817	5.4	1424	5283	5.6	1489	5765	6.5
6900	1238	4245	4.8	1305	4676	5.2	1371	5128	5.7	1436	5598	6.3	1499	6087	6.8
7200	1256	4569	5.1	1322	5006	5.6	1386	5463	6.1	1449	5938	6.6	1509	6420	7.2
7500	1278	4930	5.5	1341	5373	6.0	1403	5835	6.5	1465	6316	7.1	1515	6733	7.5

LEGEND

Bhp — Brake Horsepower Input to Fan
FIOF — Factory-Installed Option
Watts — Input Watts to Motor

NOTES.

- Boldface** indicates field-supplied drive required
- Field-supplied motor and drive required.**
- Factory shipped motor drive range is 737 to 885 rpm Other rpms require a field-supplied drive.

- Static pressure losses (i.e., economizer) must be added to external static pressure before entering Fan Performance table See Accessory/FIOF Economizer Static Pressure table for more information
- Interpolation is permissible Do not extrapolate
- Maximum continuous bhp is 5.9 and the maximum continuous watts are 5180 Extensive motor and drive testing on these units ensures that the full horsepower range of the motor can be utilized with confidence. Using your fan motors up to the watts rating shown will not result in nuisance tripping or premature motor failure Unit warranty will not be affected

FAN PERFORMANCE (cont)

48HJ025 (20 TONS) — STANDARD MOTOR (BELT DRIVE)

Airflow (Cfm)	External Static Pressure (in. wg)														
	0.2			0.4			0.6			0.8			1.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
6000	800	1732	1.88	891	2047	2.22	975	2376	2.58	1055	2728	2.96	1133	3104	3.37
6500	853	2134	2.32	939	2471	2.68	1018	2819	3.06	1094	3185	3.46	1167	3573	3.88
7000	907	2596	2.82	989	2957	3.21	1064	3324	3.61	1136	3707	4.02	1205	4107	4.46
7500	962	3123	3.39	1039	3507	3.81	1111	3895	4.23	1179	4295	4.66	1245	4710	5.11
8000	1017	3717	4.04	1091	4126	4.48	1160	4536	4.93	1225	4954	5.38	1287	5386	5.85
8500	1072	4385	4.76	1143	4818	5.23	1209	5250	5.70	1271	5688	6.18	1332	6137	6.66
9000	1128	5129	5.57	1196	5587	6.07	1260	6042	6.56	1323	6501	7.06	1377	6968	7.57
9500	1185	5955	6.47	1250	6437	6.99	1311	6915	7.51	1369	7395	8.03	1424	7881	8.56
10000	1241	6865	7.45	1304	7372	8.00	1363	7873	8.65	1419	8376	9.09	1472	8882	9.64

48HJ025 (20 TONS) — STANDARD MOTOR (BELT DRIVE)

Airflow (Cfm)	External Static Pressure (in. wg)														
	1.2			1.4			1.6			1.8			2.0		
	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp	Rpm	Watts	Bhp
6000	1208	3504	3.80	1282	3926	4.26	1353	4368	4.74	1421	4826	5.24	1488	5299	5.75
6500	1239	3983	4.32	1308	4415	4.79	1376	4866	5.28	1442	5337	5.79	1507	5823	6.32
7000	1273	4529	4.92	1339	4970	5.40	1403	5432	5.90	1467	5911	6.42	1520	6339	6.88
7500	1309	5143	5.58	1372	5597	6.08	1434	6067	6.59	1494	6558	7.12	1548	7014	7.62
8000	1349	5833	6.33	1409	6297	6.84	1467	6779	7.36	1529	7313	7.94	—	—	—
8500	1390	6600	7.17	1447	7077	7.68	1504	7571	8.22	—	—	—	—	—	—
9000	1433	7446	8.08	1488	7938	8.62	—	—	—	—	—	—	—	—	—
9500	1478	8378	9.10	—	—	—	—	—	—	—	—	—	—	—	—
10000	1524	9396	10.20	—	—	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower Input to Fan
FIOP — Factory-Installed Option
Watts — Input Watts to Motor

NOTES

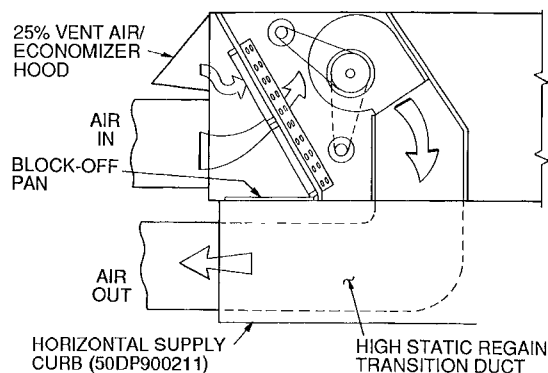
- Boldface** indicates field-supplied drive required.
- Factory shipped motor drive range is 983 to 1180 rpm. Other rpms require a field-supplied drive.
- Static pressure losses (i.e., economizer) must be added to external static pressure before entering Fan Performance table. See Accessory/FIOP Economizer Static Pressure table for more information.

- Interpolation is permissible. Do not extrapolate.
- Maximum continuous bhp is 10.2 for 208/230 and 575-v units and 11.8 for 460-v units. The maximum continuous watts are 9510 for the 208/230 and 575-v units and 11,000 for the 460-v units. Extensive motor and drive testing on these units ensures that the full horsepower range of the motor can be utilized with confidence. Using your fan motors up to the watts rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
- Deduct 0.2 in. wg static pressure for high heat units at or above 9000 cfm. Deduct 0.3 in. wg static pressure for high heat units at or above 10,000 cfm.

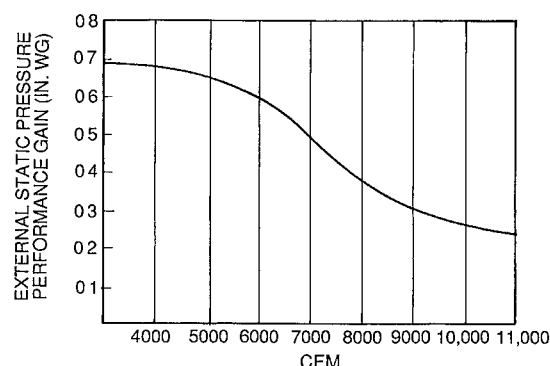
Performance data (cont)



HORIZONTAL SUPPLY/RETURN FAN PERFORMANCE WITH 50DP900211 HIGH STATIC REGAIN ADAPTERS

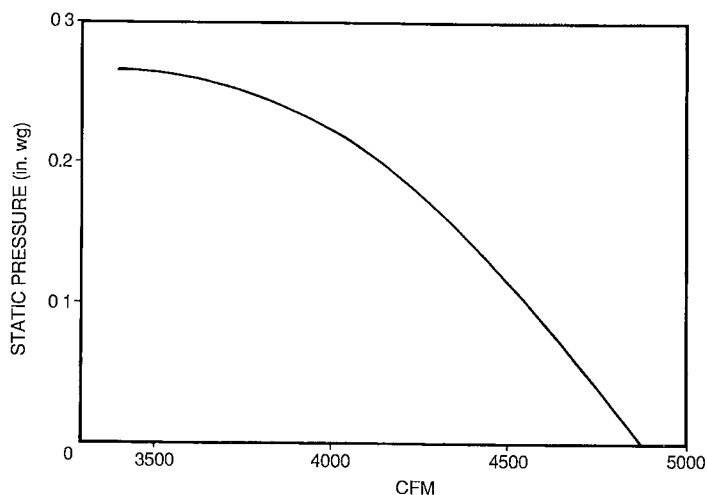


NOTE The 50DP900211 high static regain adapter accessory may be used to provide horizontal supply/return.



NOTE: The 50DP900211 horizontal supply/return adapter accessory improves 48HJ fan performance by increasing external static pressure by amount shown above

FAN PERFORMANCE USING ACCESSORY POWER EXHAUST



ALTITUDE COMPENSATION*

ELEVATION (Ft)	NATURAL GAS Orifice Size†	
	Lo Heat	High Heat
0-2,000	28	29
2,000	29	29
3,000	29	30
4,000	29	30
5,000	30	30
6,000	30	30
7,000	31	31
8,000	31	31
9,000	31	31
10,000	32	32

*As the height above sea level increases, there is less oxygen per cubic ft of air. Therefore, heat input rate should be reduced at higher altitudes

†Orifices available through your Carrier distributor

ALTITUDE DERATING FACTOR*

ELEVATION (Ft)	MAXIMUM HEATING VALUE (Btu/ft ³)
0-2,000	1,100
2,001-3,000	1,050
3,001-4,000	1,000
4,001-5,000	950
5,001-6,000	900

*Derating of the unit is not required unless the heating value of the gas exceeds the values listed in the table above, or if the elevation exceeds 6000 ft. Derating conditions must be 4% per thousand ft above sea level. For example, at 4000 ft, if the heating value of the gas exceeds 1000 Btu/ft³, the unit will require a 16% derating. For elevations above 6000 ft, the same formula applies. For example, at 7000 ft, the unit will require a 28% derating of the maximum heating value per the National Fuel Gas Code



AIR QUANTITY LIMITS

UNIT 48HJ	MINIMUM CFM	MAXIMUM CFM
015	3800	6,250
017	4750	7,500
025	5500	10,000

ACCESSORY/FIOP ECONOMIZER STATIC PRESSURE (in. wg)

UNIT 48HJ	UNIT VOLTAGE	CFM	ECONOMIZER PRESSURE DROP
015, 017	All	3,750	.03
		4,000	.03
		5,000	.05
		6,000	.07
		7,500	.10
025	All	6,000	.07
		7,200	.09
		9,000	.11
		10,000	.12

LEGEND

Bhp — Brake Horsepower
FIOP — Factory-Installed Option

NOTES:

1. The factory-assembled horizontal adapter substantially improves fan performance. See graph on page 18.

2. The static pressure must be added to external static pressure. The sum and the evaporator entering-air cfm should then be used in conjunction with the Fan Performance table to determine blower rpm, bhp, and watts.

FAN RPM AT MOTOR PULLEY SETTINGS* (Factory-Supplied Drives)

UNIT 48HJ	MOTOR PULLEY TURNS OPEN												
	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
015 (208/230,460 v)	†	†	1132	1105	1078	1051	1024	997	970	943	916	889	862
015 (575 v)	1462	1436	1410	1384	1358	1332	1305	1279	1253	1227	1201	—	—
017	†	†	885	870	855	840	826	811	796	781	766	751	737
025	†	†	1180	1160	1141	1121	1101	1082	1062	1043	1023	1003	983

*Approximate fan rpm shown

†Due to belt and pulley size, pulley cannot be set to this number of turns open

NOTE: To run units at speeds not listed, field-supplied drives are required.

EVAPORATOR-FAN MOTOR PERFORMANCE

UNIT 48HJ	UNIT VOLTAGE	MAXIMUM ACCEPTABLE CONTINUOUS BHP*	MAXIMUM ACCEPTABLE OPERATING WATTS	MAXIMUM AMP DRAW
015	208/230	4.25	3,775	10.5
	460			4.8
	575	3.45	3,065	3.9
017	208/230	5.90	5,180	15.8
	460			7.9
	575			6.0
025	208/230	10.20	9,510	28.0
	460	11.80	11,000	14.6
	575	10.20	9,510	13.0

LEGEND

Bhp — Brake Horsepower

*Extensive motor and electrical testing on these units ensures that the full horsepower range of the motors can be utilized with confidence. Using your fan motors up to the horsepower ratings shown in this table will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.

Performance data (cont)



SOUND DATA (TOTAL UNIT)

UNIT 48HJ	SOUND RATING-BELS (60 Hz)	A-WEIGHTED (dB)	SOUND POWER (dB)							
			Octave Bands							
			63	125	250	500	1000	2000	4000	8000
015	8.8	87.3	87.1	89.9	86.4	84.0	82.7	79.0	73.9	68.6
017	8.9	88.0	95.7	88.9	87.2	85.2	91.9	79.5	72.7	66.0
025	9.5	94.1	90.6	87.2	89.9	86.2	85.8	81.0	75.6	69.6

Bels — Sound Levels (1 bel = 10 decibels)

Electrical data

UNIT 48HJ	NOMINAL VOLTAGE (3 Ph, 60 Hz)	VOLTAGE RANGE		COMPRESSOR				OFM			IFM			POWER EXHAUST		COMBUSTION FAN MOTOR	POWER SUPPLY		DISCONNECT SIZE	
				No. 1		No. 2														
		Min	Max	RLA	LRA	RLA	LRA	Qty	FLA (ea)	LRA (ea)	Hp	FLA	LRA	FLA	LRA	FLA	MCA	MOCP*	FLA	LRA
015	208/230	187	254	39.7	228	—	—	3	1.7	3.8	3.7	10.5/10.5	84.5/84.5	—	—	0.57	65/65	100/100	64/64	324/324
														4.6	18.8	0.57	70/70	100/100	70/70	343/343
	460	414	508	19.9	114	—	—	3	0.8	1.9	3.7	4.8	42.3	—	—	0.30	32	50	32	162
														2.3	6.0	0.30	34	50	34	168
	575	518	632	16.0	91	—	—	3	0.75	1.5	3	3.9	23.4	—	—	0.57	26	40	26	119
														2.1	4.8	0.57	28	40	29	124
017	208/230	187	254	28.2	160	28.2	160	3	1.7	24.8	5	15.8/15.8	105/91	—	—	0.57	84/84	110/100	90/90	499/485
														4.6	18.8	0.57	89/89	110/110	95/95	518/504
	460	414	508	14.1	80	14.1	80	3	0.8	10.8	5	7.9	46	—	—	0.30	42	50	45	238
														2.3	6.0	0.30	44	50	47	244
	575	518	632	11.3	64	11.3	64	3	0.75	8.4	5	6.0	37	—	—	0.57	34	40	36	190
														2.1	4.8	0.57	36	45	39	195
025	208/230	187	254	35.6	198	35.6	198	2	5.5	24.8	10	28.0/28.0	193/168	—	—	0.57	119/119	150/150	127/127	639/614
														4.6	18.8	0.57	124/124	150/150	133/133	657/632
	460	414	508	17.8	99	17.8	99	2	2.8	10.8	10	14.6	84	—	—	0.30	60	70	65	304
														2.3	6.0	0.30	63	80	67	310
	575	518	632	14.3	79	14.3	79	2	3.4	8.4	10	13.0	66	—	—	0.57	52	60	56	241
														2.1	4.8	0.57	54	60	59	246

LEGEND

FLA	—	Full Load Amps
HACR	—	Heating, Air Conditioning and Refrigeration
IFM	—	Indoor (Evaporator) Fan Motor
LRA	—	Locked Rotor Amps
MCA	—	Minimum Circuit Amps
MOCP	—	Maximum Overcurrent Protection
NEC	—	National Electrical Code
OFM	—	Outdoor (Condenser) Fan Motor
RLA	—	Rated Load Amps

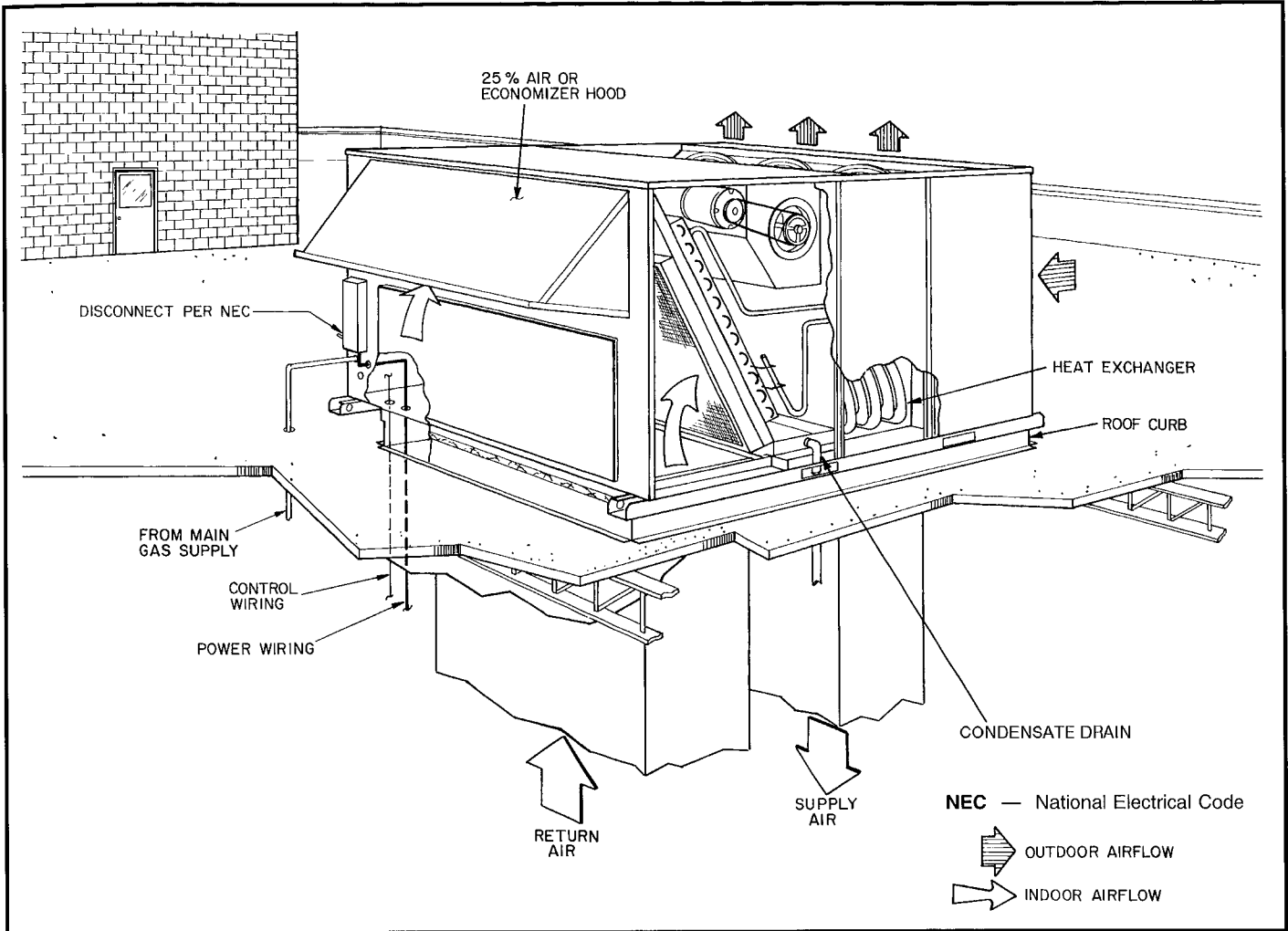
*This is the maximum size permissible; smaller fuse size may be used where conditions permit

NOTES: In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. The Canadian units may be fuse or circuit breaker.



;

Typical piping and wiring



Typical wiring schematic (48HJ025 shown)



LEGEND

BKR W/AT — Breaks with Amp Turns
BR — Burner Relay
C — Contactor, Compressor
CB — Circuit Breaker
CH — Crankcase Heater
CLO — Compressor Lockout
CLS — Compressor Lockout Switch
COMP — Compressor Motor
CR — Control Relay
CT — Current Transformer
DM — Damper Motor
DU — Dummy Terminal
EQUIP — Equipment
FPT — Freeze Protection Thermostat
FU — Fuse
GND — Ground
GVR — Gas Valve Relay
HPS — High-Pressure Switch
HS — Hall Effect Sensor
HV — High Voltage
IDM — Induced-Draft Motor
IFC — Indoor (Evaporator) Fan Contactor

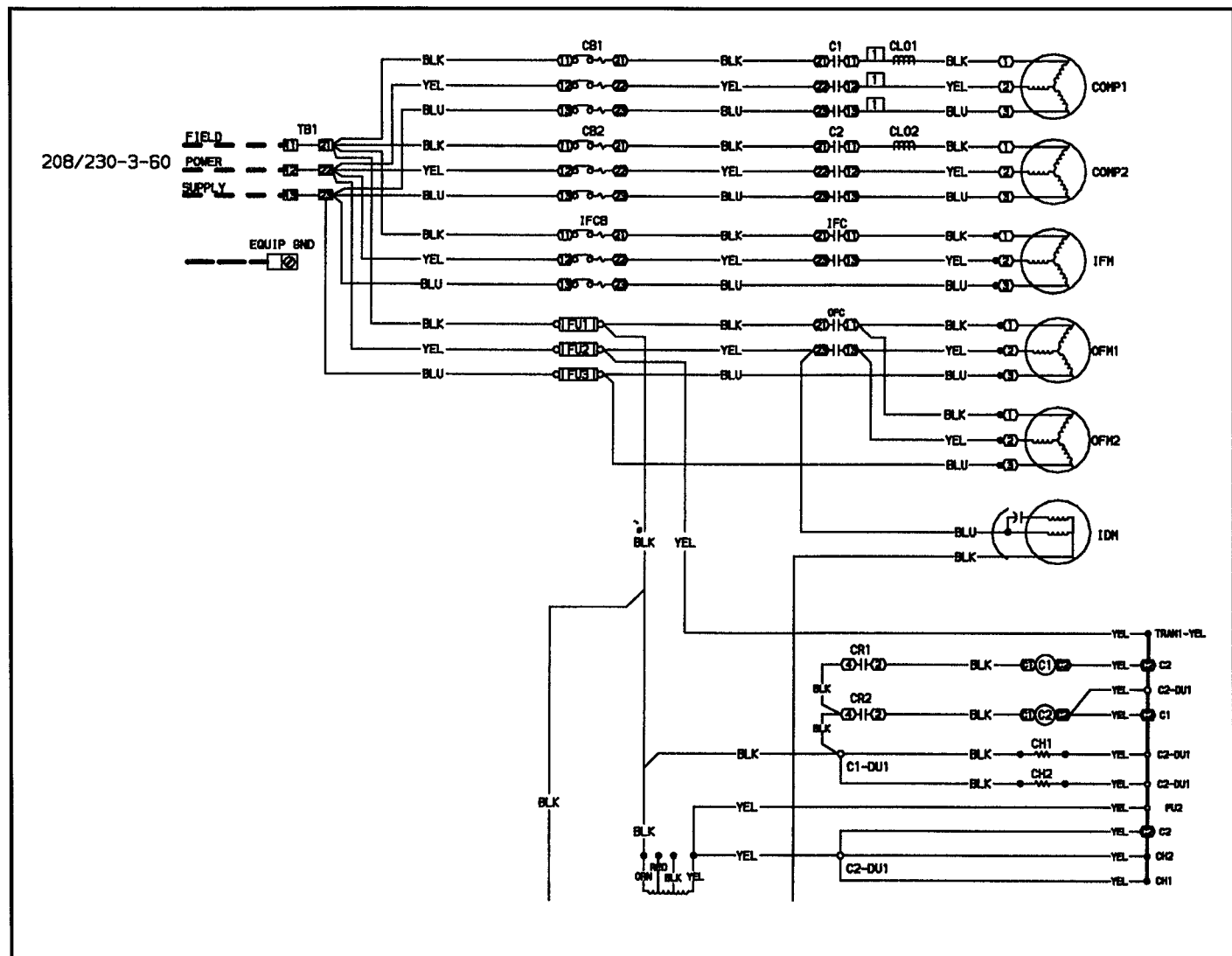
IFCB — Indoor (Evaporator) Fan Circuit Breaker
IFM — Indoor (Evaporator) Fan Motor
IGC — Integrated Gas Unit Controller
IP — Internal Protector
L — Light
LED — Light-Emitting Diode
LOR — Lockout Relay
LPS — Low-Pressure Switch
LS — Limit Switch
MAT — Mixed-Air Thermostat
MGV — Main Gas Valve
NEC — National Electrical Code
OAT — Outdoor-Air Thermostat
OFC — Outdoor (Condenser) Fan Contactor
OFM — Outdoor (Condenser) Fan Motor
PL — Plug Assembly
R — Relay
RS — Rollout Switch
SN — Sensor
SW — Switch
TB — Terminal Block
TRAN — Transformer

Terminal (Marked)
 Terminal (Unmarked)
 Terminal Block
 Splice
 Splice (Marked)
 Splice (Field Supplied)
 Factory Wiring
 Field Control Wiring
 Field Power Wiring
 Accessory or Optional Wiring
 To Indicate Common Potential Only, Not To Represent Wiring

NOTES:

- Compressor and fan motors thermally protected; 3-phase motors protected against primary single-phasing conditions.
- If any of the original wire furnished must be replaced, it must be replaced with type 90 C wire or its equivalent.
- Jumpers are omitted when unit is equipped with economizer.
- IFCB must trip amps is equal to or less than 140% full load amps, and CB1 and CB2 (156%)
- On 208/230-v unit, TRAN1 is factory wired to ORN lead for 230-v power supply. If unit is to run on 208-v power supply, TRAN1 must

- be rewired. Disconnect the BLK wire on TRAN1 and connect wire to 208-v RED wire. Insulate 230-v ORN wire
- The CLO locks out the compressor to prevent short cycling on compressor overload and safety devices. Before replacing CLO, check these devices.
- Number(s) indicates the line location of used contacts. A bracket over (2) numbers signifies a single-pole, double-throw contact. An underlined number signifies a normally-closed contact. A plain (no line) number signifies a normally-open contact.







Operating Sequence

Cooling, Units Without Economizer — When thermostat calls for cooling, terminals G and Y1 are energized. The indoor (evaporator) fan contactor (IFC) and compressor contactor no. 1 (C1) are energized and evaporator-fan motor (IFM), compressor no. 1 (017,025) or unloaded compressor (015), and condenser fan start. The condenser-fan motors run continuously while unit is cooling. If the thermostat calls for a second stage of cooling by energizing Y2, compressor contactor no. 2 (C2) is energized and compressor no. 2 starts (017,025), or compressor no. 1 runs fully loaded (015).

A freeze protection thermostat (FPT) is located on the evaporator coil. It detects frost build-up and locks out the compressors, allowing the coil to clear. Once frost has melted, the compressors can be reenergized by resetting the thermostat.

Heating, Units Without Economizer

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

When the thermostat calls for heating, power is sent to W on the IGC (integrated gas unit 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 limit switch are closed. 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 still have not lighted, heating is locked out. To reset the control, break 24-v power to the thermostat.

When ignition occurs the IGC board will continue to monitor the condition of the rollout and limit switches, the hall effect sensor, as well as the flame sensor. If the unit is controlled through a room thermostat set for fan auto, 45 seconds after ignition occurs, the indoor-fan motor will be energized. If for some reason the overtemperature limit opens prior to the start of the indoor fan blower, on the next attempt, the 45-second delay will be shortened to 5 seconds less than the time from initiation of heat to when the limit tripped. Gas will not be interrupted to the burners and heating will continue. Once modified, the fan on delay will not change back to 45 seconds unless power is reset to the control.

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. If the unit is controlled through a room thermostat set for fan auto, the indoor-fan motor will continue to operate for an additional 45 seconds then stop. If the overtemperature limit opens after the indoor motor is stopped within 10 minutes of W1 becoming inactive, on the next cycle the time will be extended by 15 seconds. The maximum delay is 3 minutes. Once modified, the fan off delay will not change back to 45 seconds unless power is reset to the control.

A 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.

The LED on the IGC board can be viewed without removing the control box cover. The IGC board is located to the left of the view port.

Cooling, Units With Economizer — Upon a call for cooling, when outdoor ambient is above the changeover control setting, the economizer damper moves to VENT position. The compressors and evaporator and condenser fans energize and operate as per Cooling, Units Without Economizer section.

Upon a first call for cooling, when outdoor ambient is below the changeover control setting, the evaporator fan starts and the economizer is fully open. The compressors remain off.

Upon a second-stage call for cooling, compressor no. 1 (017,025) or unloaded compressor (015) is energized and mechanical cooling is integrated with economizer cooling. If the outdoor-air temperature drops below 50 F, a cooling lockout switch prevents the compressors from running.

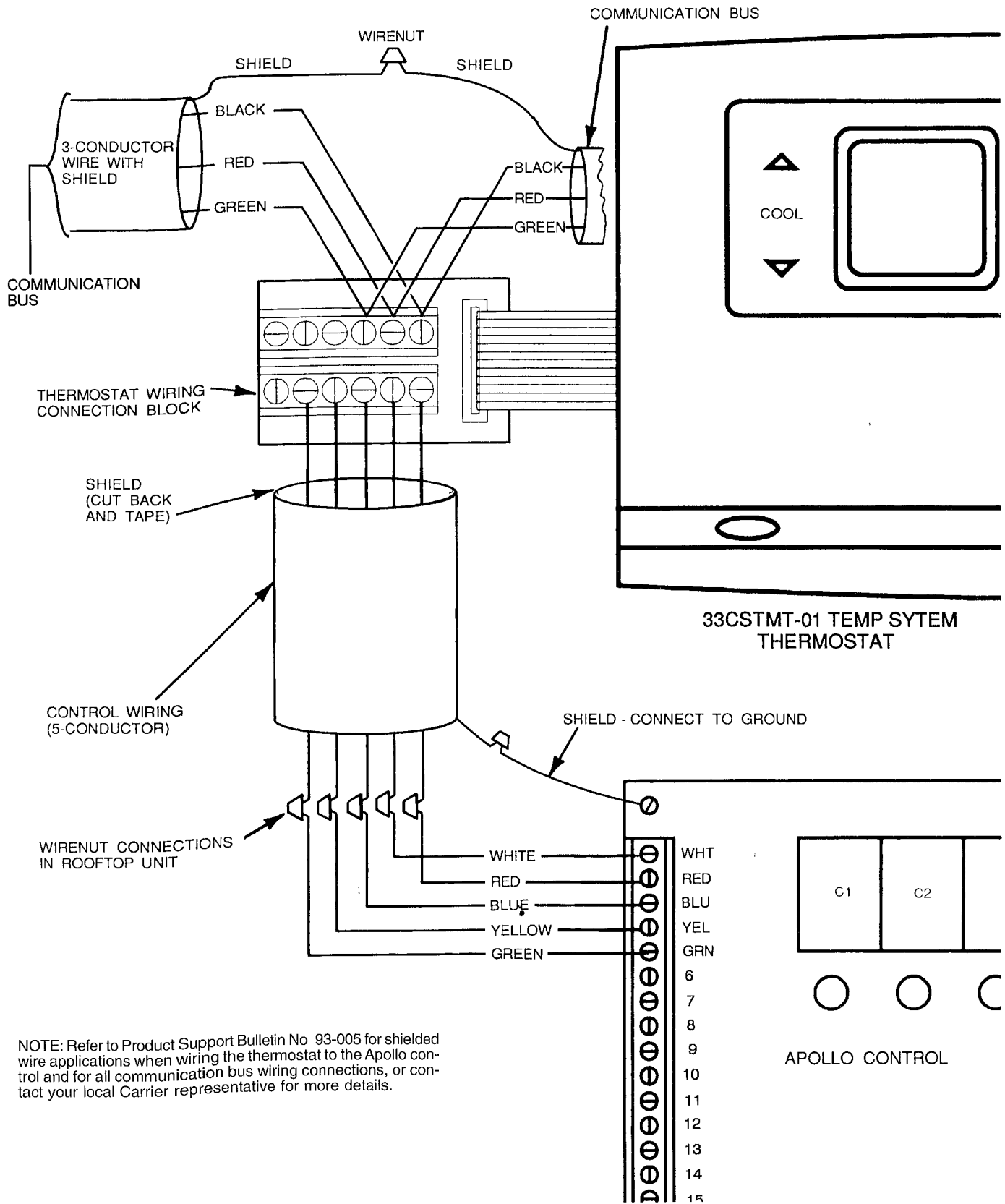
When supply-air temperature drops below a fixed set point, the economizer damper modulates to maintain the temperature at the fixed set point.

Heating, Units With Economizer — Outdoor-air damper stays at VENT position while evaporator fan is operating. Refer to Heating, Units Without Economizer section for heating sequence of operation.

Controls (cont)

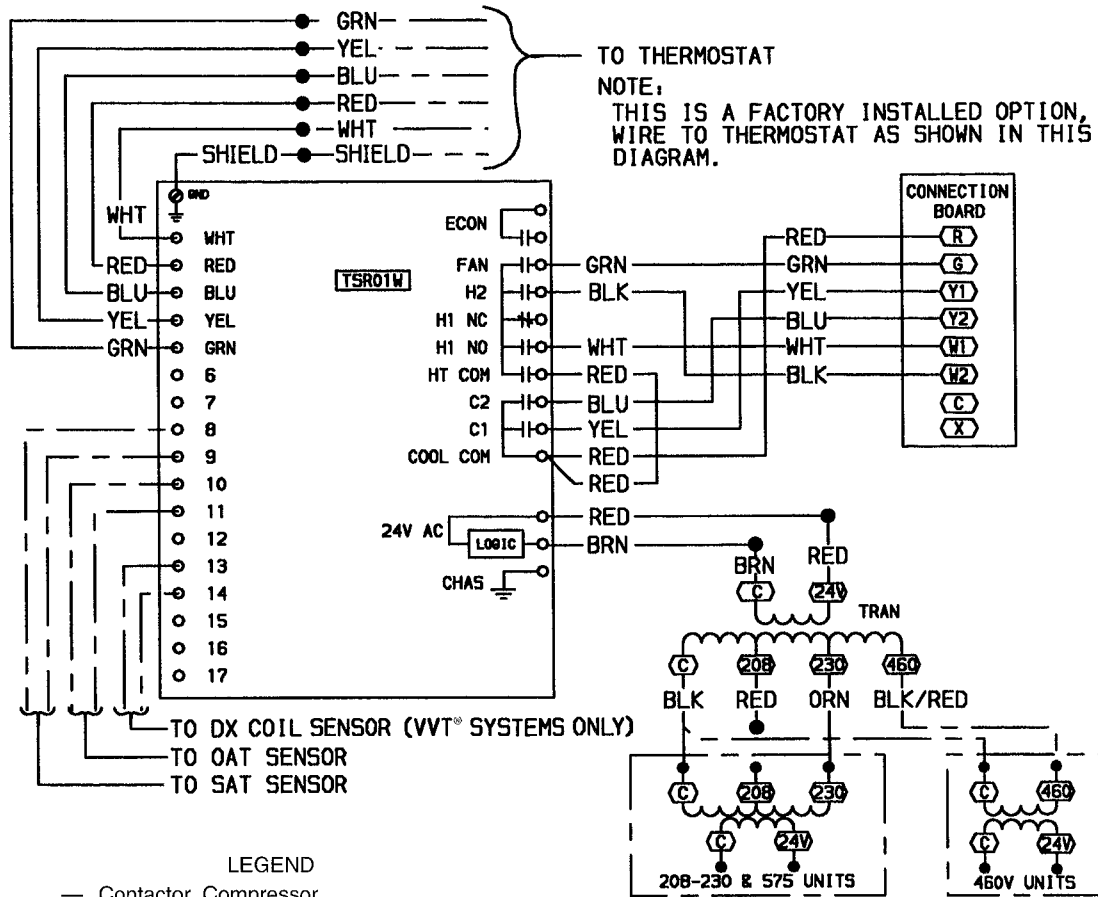


THERMOSTAT AND APOLLO COMMUNICATING CONTROL WIRING



NOTE: Refer to Product Support Bulletin No. 93-005 for shielded wire applications when wiring the thermostat to the Apollo control and for all communication bus wiring connections, or contact your local Carrier representative for more details.

APOLLO COMMUNICATING CONTROL WIRING SCHEMATIC



Controls (cont)



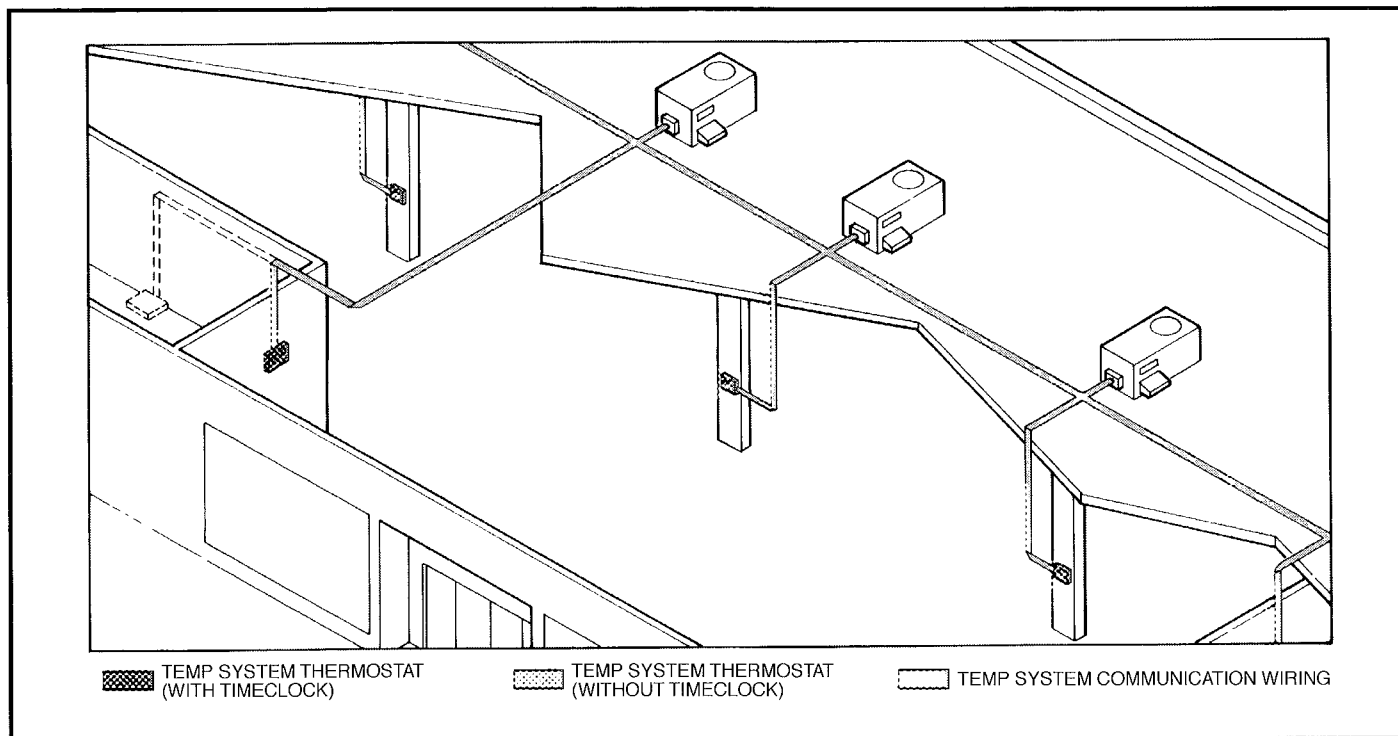
TEMP Systems

A TEMP System is a network of communicating Carrier TEMP System Thermostats and rooftop, factory-mounted, direct digital controls, each serving its own zone and heating/cooling unit. Networking allows your building manager to easily access each of your systems from a single location... whether they are in the same building or located throughout town.

The TEMP System's inherently flexible, modular base design supports the *exact* number of independent, single zone systems you require...no more, no less, no compromises.

Ideal for department stores, small office buildings, fast food chains, schools, and hotels, a TEMP System is a cost-effective way to maintain comfortable building environments.

NOTE: Unit temperature rise must not be exceeded for proper unit operation.

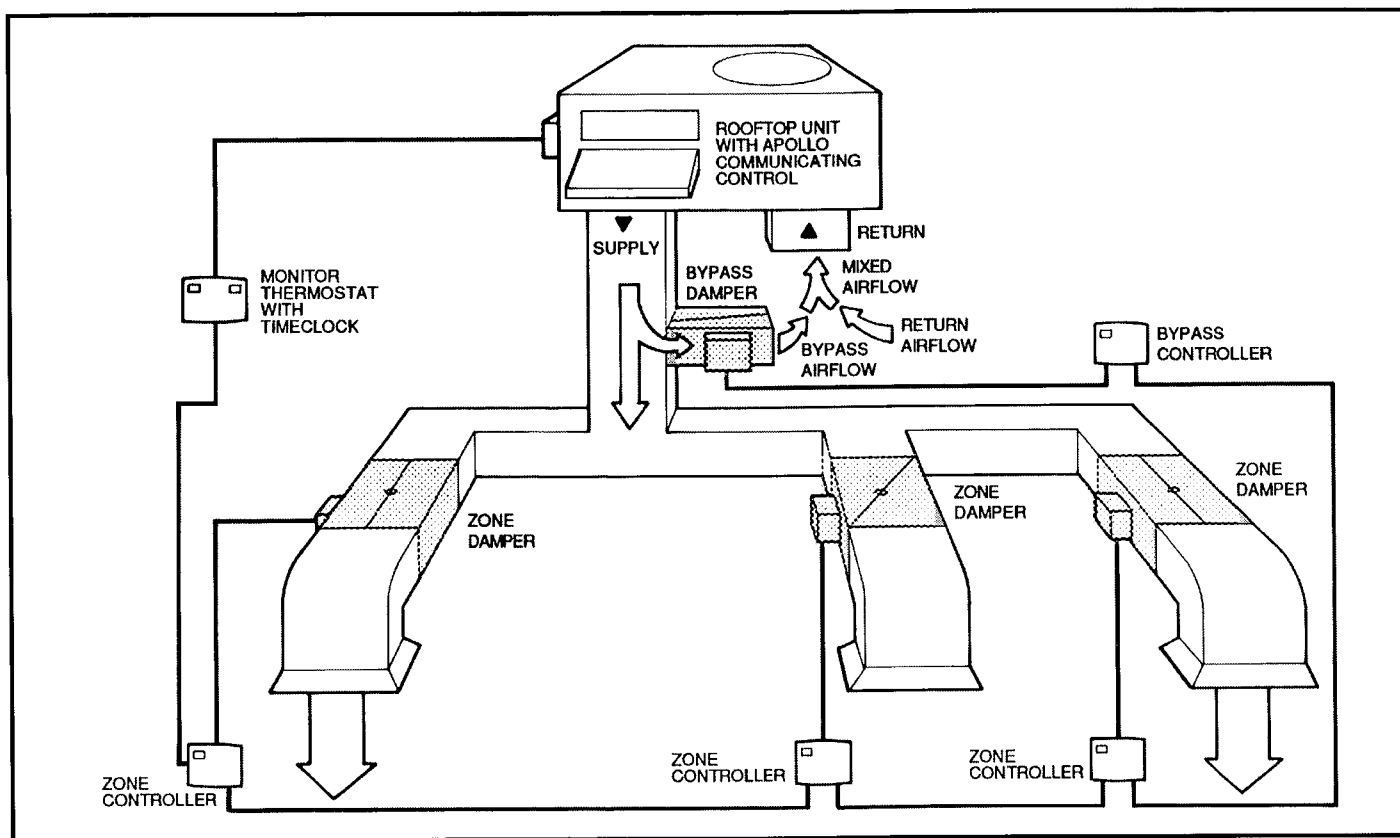


Variable Volume/Variable Temperature VVT® Systems

VVT Systems are dedicated to total building comfort. Carrier thermostats, zone dampers, and HVAC (heating, ventilating, and air conditioning) equipment with factory-mounted Apollo direct digital controls continually monitor and adjust their operation to ensure uninterrupted and personalized comfort for all occupants.

Through the use of Carrier's communicating electronic Apollo controls, VVT Systems are able to provide the comfort of a multiple zone system while using the installation, operating, and maintenance economics of single zone equipment.. virtually putting an end to the cost vs. comfort compromise.

NOTE: Unit temperature rise must not be exceeded for proper unit operation



Application data



Ductwork — Ductwork should be attached to the curb on all units. Interior installation may proceed before unit is set in place on roof. If ductwork will be attached to the unit, do not drill in condensate drain pan area — leaks may result. See figures below for information on field-installed concentric ductwork when applicable.

Thru-the-curb service connections — Roof curb connections allow field power wires, control wires, and gas supply to enter through the roof curb opening.

Thermostat — Use of 2-stage cooling thermostat is required for all units.

Heating-to-cooling changeover — All units are automatic changeover from heating to cooling when automatic changeover thermostat and subbase are used.

Airflow — Units are draw-thru on cooling and blow-thru on heating.

Maximum airflow — To minimize the possibility of condensate blow-off from evaporator, airflow through units should not exceed 500 cfm/ton.

Minimum airflow — The minimum airflow for cooling is 300 cfm/ton.

Minimum ambient cooling operation temperature — Units are designed to operate at outdoor temperatures down to 40 F. To operate at lower outdoor-air temperatures, see

unit price pages for appropriate accessory combinations for specific applications, or contact your local Carrier representative.

Maximum operating outdoor-air temperature — For cooling, this temperature is 125 F.

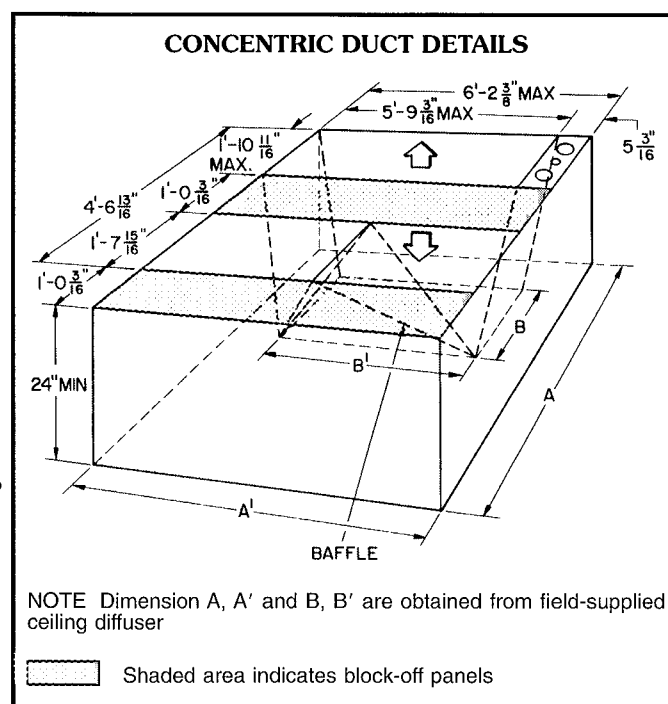
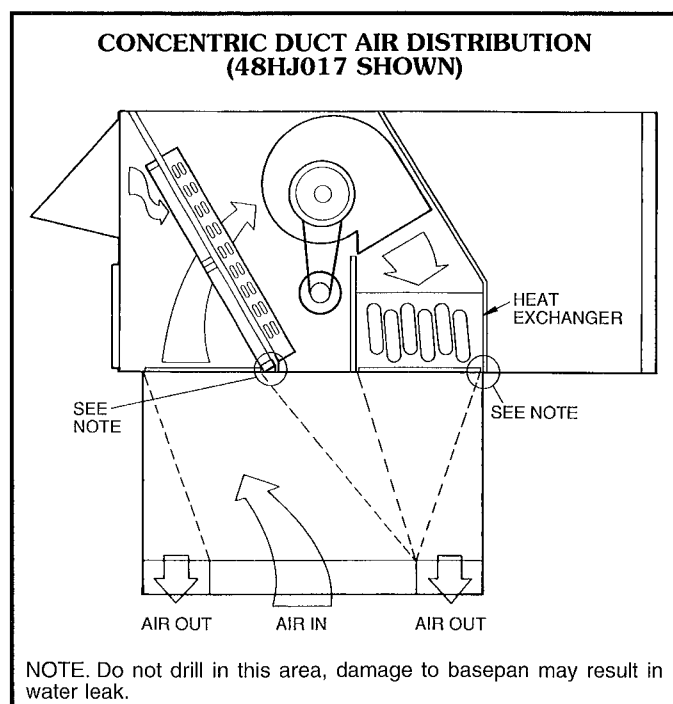
High altitude — A change to the gas orifice may be required at high altitudes. Refer to Altitude Compensation chart on page 18.

Minimum temperature — Air entering the heat exchanger in heating is 50 F continuous and 45 F intermittent.

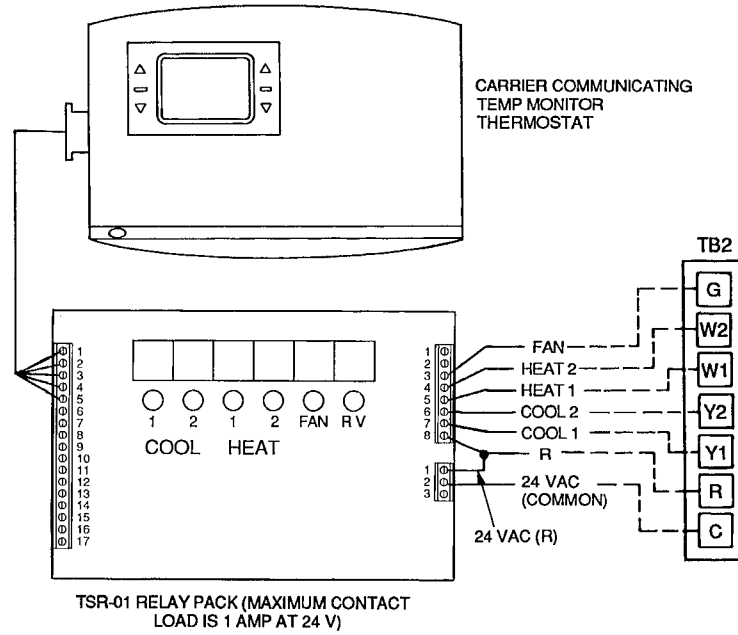
Internal unit design — Due to Carrier's internal unit design (draw-thru over the motor), air path, and specially designed motors, the full horsepower (maximum continuous bhp and watts) listed in the notes following each Fan Performance table can be utilized with extreme confidence.

Using Carrier motors with the values listed in the Fan Performance Data tables *will not* result in nuisance tripping or premature motor failure. The unit warranty will not be affected.

Apollo direct digital controls — The Apollo direct digital controls must be used with either a Carrier master or monitor thermostat. Refer to 48HJ price pages for part numbers, or contact your local representative.



TYPICAL FIELD THERMOSTAT WIRING



LEGEND

TB — Terminal Block

Guide specifications



Packaged Rooftop Electric Cooling Unit with Gas Heat — Constant Volume Application

HVAC Guide Specifications

Size Range: **13 to 20 Tons, Nominal (Cooling)**
230,000 to 360,000 Btuh, Nominal
(Input Heating)

Carrier Model Numbers: **48HJD**
48HJF

Part 1 — General

1.01 SYSTEM DESCRIPTION

- A. Unit is an outdoor, rooftop mounted, electrically controlled heating and cooling unit utilizing a reciprocating semi-hermetic compressor(s) for cooling duty and gas combustion for heating duty. Supply air shall be discharged downward or horizontally (with horizontal supply/return adapter assembly or horizontal roof curb), as shown on contract drawings. Standard unit shall include a manual outdoor-air inlet.

1.02 QUALITY ASSURANCE

- A. Unit shall be rated in accordance with ARI Standards 270 and 360 and designed in accordance with UL Standard 1995.
- B. Unit shall be designed to conform to ASHRAE 15.
- C. Unit shall be ETL-tested and certified in accordance with ANSI Z21.47 Standard as a total package.
- D. Unit shall be certified by ETL, Canada.
- E. Roof curb shall be designed to conform to NRCA Standards.
- F. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- G. Unit casing shall be capable of withstanding Federal test method Standard No. 141 (Method 6061) 500-hour salt spray test.
- H. Unit shall conform to ISO 9002 manufacturing quality standard.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Unit shall be stored and handled per manufacturer's recommendations

Part 2 — Products

2 01 EQUIPMENT (STANDARD)

A. General:

The 48HJ unit shall be a factory assembled, single-piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge (R-22), and special features required prior to field start-up.

B. Unit Cabinet:

- 1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a prepainted baked enamel finish.
- 2. Indoor blower compartment interior surfaces shall be insulated with a minimum 1/2-in thick

insulation coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the gas heat compartment.

- 3. Cabinet panels shall be easily removable for servicing.
- 4. Filters shall be accessible through an access panel
- 5. Holes shall be provided in the base rails for rigging shackles to facilitate overhead rigging.
- 6. Unit shall have a factory-installed internal condensate drain connection and a sloped condensate pan.

C. Fans:

- 1. Indoor blower (evaporator fan):
 - a. Fan shall be belt driven. Belt drive shall include an adjustable pulley.
 - b. Fan wheel shall be made from steel with a corrosion resistant finish. It shall be a dynamically balanced, double-inlet type with forward-curved blades.
- 2. Condenser fan shall be of the direct-driven propeller type, with corrosion-resistant blades riveted to corrosion-resistant steel supports. It shall be dynamically balanced and discharge air upwards.
- 3. Induced-draft blower shall be of the direct-driven, single inlet, forward-curved, centrifugal type. It shall be made from steel with a corrosion-resistant finish and shall be dynamically balanced.

D. Compressor(s):

- 1. The reciprocating semi-hermetic compressor(s) has factory-installed external spring vibration isolation.
- 2. Factory-installed crankcase heater prevents refrigerant dilution of oil.
- 3. The semi-hermetic compressor shall have unloading capability (015 only).
- 4. Shall be on independent circuits (017,025).

E. Coils:

- 1. Standard evaporator and condenser coils shall have copper or aluminum plate fins mechanically bonded to seamless copper tubes with all joints brazed.
- 2. Optional pre-coated fins shall be coated with a baked on black, organic, epoxy, phenolic coating.

F. Heating Section:

- 1. Induced-draft combustion type with energy saving direct-spark ignition system and redundant main gas valve.
- 2. The heat exchanger shall be of the tubular-section type constructed of a minimum of 20-gage steel coated with a nominal 1.2 mil aluminum-silicone alloy for corrosion resistance.
- 3. Burners shall be of the in-shot type constructed of aluminum-coated steel.
- 4. All gas piping shall enter the unit at a single location.

G. Refrigerant Components:

Refrigerant circuit components shall include:

1. Thermo-expansion device with filter drier (015).
2. Fixed expansion device with filter driers (017,025)
3. Service gage connection on suction, discharge, and liquid lines.
4. Suction and discharge service valves.

H. Filter Section:

Standard filter section shall consist of 2 sizes of factory-installed 2-in. thick throwaway fiberglass filters of commercially available sizes

I. Controls and Safeties:

1. Unit Controls:

- a. Economizer control (optional)
- b. Capacity control (2-step)
- c. Unit shall be complete with self-contained low-voltage control circuit.

2. Safeties:

- a. Unit shall incorporate a solid-state compressor lockout which provides reset capability at the space thermostat, should any of the following safety devices trip and shut off compressor:
 - 1) Compressor overtemperature, overcurrent
 - 2) Low-pressure switch.
 - 3) Freezestat (evaporator coil).
 - 4) High-pressure switch
- b. Supply-air thermostat shall be located in the unit.
- c. Heating section shall be provided with the following minimum protections:
 - 1) High-temperature limit switch.
 - 2) Induced-draft hall effect switch.
 - 3) Flame rollout switch (manual reset).
 - 4) Flame proving controls.
 - 5) Redundant gas valve(s).

J. Operating Characteristics:

1. Unit shall be capable of starting and running at 125 F ambient outdoor temperature, exceeding maximum load criteria of ARI Standard 360
2. Unit with standard controls will operate in cooling to 40 F
3. Unit provided with fan time delay to prevent cold air delivery

K. Electrical Requirements:

All unit power wiring shall enter unit cabinet at a single location.

L. Motors:

1. The compressor motors shall be of the refrigerant-cooled type with thermal and calibrated circuit breaker overload protection
2. All fan motors shall have permanently lubricated, sealed bearings and inherent automatic-reset thermal overload protection or manual reset calibrated circuit breakers.

M. Special Features:

Certain features are not applicable when the features designated * are specified. For assistance in amending the specifications, contact your local Carrier Sales Office.

1. Roof Curbs (Horizontal and Vertical):

- a. Formed of 18-gage galvanized steel with wood nailer strip and capable of supporting entire unit weight.
- b. Allows for installing and securing ductwork to curb prior to mounting unit on the curb
- c. Both horizontal and vertical supply/return curbs shall be available

2. Horizontal Adapter:

Includes factory-assembled adapter and duct and shall substantially improve evaporator-fan static performance.

* 3. Integrated Economizer:

- a. Integrated type capable of simultaneous economizer and compressor operation to provide cooling with outdoor air.
- b. Equipped with low-leakage dampers not to exceed 3% leakage, at 1.0 in. wg pressure differential.
- c. Capable of introducing up to 100% outdoor air.
- d. Equipped with dry-bulb temperature control to govern economizer changeover.

* 4. Two-Position Damper:

Two-position damper package shall include single blade damper and motor. Admits up to 25% outdoor air, and shall close upon unit shutoff

5. Accessory Compressor Cycle Delay:

Compressor shall be prevented from restarting for a minimum of 5 minutes after shutdown.

* 6. Thermostat and Subbase:

To provide staged heating and cooling in addition to automatic (or manual) changeover and fan control.

* 7. Barometric Relief Damper Package:

- a. Package shall include damper, seals, hardware, and hoods to relieve excess internal pressure.
- b. Damper shall close due to gravity upon unit shutdown.

* 8. Power Exhaust:

Package shall include an exhaust fan, motor, and damper for vertical flow units with economizer to control overpressurization of building.

* 9. Head Pressure Control Package:

Consists of an accessory outdoor-air package and a solid-state control with condenser coil temperature sensor for controlling condenser-fan motor speed to maintain condensing temperature between 90 F and 100 F at low outdoor ambient temperature

- 10. Low-Ambient Kits:
When used alone or in conjunction with head pressure control and/or winter start package, allow units to operate at lower outdoor ambient temperatures.
- * 11. Differential Enthalpy Sensor:
 - a. For use with economizer only.
 - b. Capable of comparing heat content (temperature and humidity) of outdoor air and indoor air and controlling economizer cut-in point at the most economical level
 - c. Two accessory enthalpy sensors are required for differential enthalpy control.
- * 12 Remote Control Panel:
Panel shall be a decorative, indoor, wall-mounted panel consisting of:
 - a Two-stage heat/2-stage cool thermostat.
 - b. Automatic changeover.
 - c System switch with HEAT-COOL-AUTO - OFF settings.
 - d. Fan switch with ON-AUTO. settings
 - e Ventilation control for remote variation of the amount of outdoor-air intake.
 - f Indicator lights for HEAT-COOL-FAN operation.
 - g Three unused indicator lights for field use.
- * 13 Electronic Programmable Thermostat:
Capable of using deluxe full-featured electronic thermostat.
- 14. Winter Start Time-Delay Relay:
When used in conjunction with accessory low-ambient and/or head pressure control kits, permits operation of 48HJ025 in cooling down to -20 F outdoor ambient.
- 15. Pressure Operated Unloader:
Adds an extra stage of unloading for increased efficiency at low loads.
- * 16 Direct Digital Controls:
 - a Shall be available as a factory-installed option.
 - b. Shall actively monitor all modes of operation, as well as evaporator-fan status, filter status, indoor-air quality, supply-air temperature, and outdoor-air temperature.
 - c Shall work with Carrier TEMP and VVT® systems.
 - d. Shall have built-in diagnostics for thermostat commands for both staged heating and cooling, evaporator-fan operation, and economizer operation
 - e. Shall be equipped with a 5-minute time delay between modes of operation
- 17. LP Conversion Kit:
Kit shall contain all the necessary hardware and instructions to convert a standard natural gas unit for use with liquified propane gas.

